

**UNIVERSITE MONTPELLIER II**  
**SCIENCES ET TECHNIQUES DU LANGUEDOC**

**T H E S E**

Pour obtenir le grade de

**DOCTEUR DE L'UNIVERSITE MONTPELLIER II**

***Discipline : Informatique***

***Formation Doctorale : Informatique***

***Ecole Doctorale : Information, Structure, Systemes***

présentée et soutenue publiquement

par

**Nik Nailah BINTI ABDULLAH**

le 10 Janvier 2006

**Titre :**

**Activity States: un cadre théorique pour l'analyse de la collaboration humaine concrète sur le Web**

**(Activity States: a theoretical framework for the analysis of actual human collaboration on the Web)**

**JURY**

Mme. Anne PRELLER	Professeur à l'Université Montpellier II	Présidente
M. Stefano A.CERRI	Professeur à l'Université Montpellier II	Directeur de Thèse
M. Michel LIQUIERE	Maître de Conférences à l'Université Montpellier II	Co-Directeur de Thèse
M. William J.CLANCEY	Chief Scientist, Human Centered Computing, Computational Division, NASA Research Center, Etats-Unis	Rapporteur
Mme. A.E SEGHROUCHNI	Professeur à l'Université Paris X	Rapporteur
M. Joost BREUKER	Professeur à l'Université d'Amsterdam, Les Pays Bas	Examineur

*Sometimes I can be the most frightening person to myself. If I do not stop myself from fantasizing, I can write and think of the most disgusting thing. At times, when I am writing the most disgusting thing, I sit back and reflect and feel angered by that disgusting thought. But it was only me, who had in the beginning wrote that very disgusting thing. This always roller coaster ride of fantasies, senses, touches and moral breaches of humanity sets me uneven in my role of gender and in my self concept. If I were not able to control my fantasies, I can evolve into something similar to madness. While writing a piece of story last night, I felt anger, I sweat, my heart pounded, I felt dizzy, I could not recognize the rationality behind that writing. I kept writing, as if..another spirit...yes another creature had delved into my sickening mind and taken over me. I pour the words into that. I have fear to know I am able to think of such sick things, but I am crossing my imagination. For I want to see ..clearly..can madness ever enter me? . I hate that writing, disgusting it was, distasteful it was. It full of sick humanity. Full of spite. I want to abandon that writing. It makes me angry and wonder to myself...perhaps too much imagination can make a normal human being sick. Sick in the mind and senses. It can drives us further into the woods of darkness where goblins and little green, slathering creatures lick us in every horrible, horrendous way. We are then covered in slimy green liquids, trapped in this sticky liquids that although had freed us from all sort of forbidden acts and allowing us to cross that boundary, had made us almost uncontrollable about humanity, cannot free ourselves from this uncontrollable act!!! That clear distinguishment between moral breaches and slight madness blurs like us being in a moving vehicle...blurs of trees, cars..swooning past us...and sways of consciousness begin to creep away. Swaying it, leaving dust of unbearable marks, big huge steps of deep scar in the ground. Far too unconscious to understand what those unbearable marks are. What frightening thought it is..Imagination, Fantasy..can burn our sanity.*

*Come and haunt me  
Come and chase the spirit out of me  
Light had been replaced with darkness  
Will had been replaced with dying consciousness  
Consciousness has been swept underground  
What remains  
Is the pure animalistic lust over the unforbidden*

*By Binti Abdullah, N.N, written on the 5<sup>th</sup> of August 2004.*

***For mom and dad with my most spiritual love***

## *Acknowledgments*

First of all, this is going to be a long acknowledgment, that will have some grammatical error due to mild stupidity. I would like first and foremost to say that this acknowledgment is a spiritual acknowledgment to my family, professors, friends and strangers.

My mom and dad, Abdullah Ahmad and Nik Noorul Aini, thank you for bringing me up and always supporting me in my own voyage of knowledge. It has always been my father who told me to do things based on the intentions of pleasing God and seeking knowledge. I hold on to his advices until today. Thank you to my mother who sacrifices, and just gives and gives her devotion and love to the family. My father went through bypass in 2001 and was diagnosed with cancer in 2003 and undergo treatment for several months, he also had to go for eye surgery in 2003. I thank my uncle Dr. Ghazali and my aunt Dr. Suraya for performing the bypass surgery on my father and my brother, Dr. Nik Aslan and sister Dr. Nik Nairan for curing my dad from cancer for now.... But at the same time I hate you..I really do hate you...my brother and sister for telling me that he has some years to live and the cancer might come back because of the surgery complications. I hate you for saying that people have to die and you have to accept, death was something you deal with everyday... not our father, I love him and he is a fighter, if you leave, my whole world will crumble and I am lost...My dad kept it as a secret from me, because he didn't want it to bother my studies. I was upset but he was so concern about me achieving my childhood dream of becoming a true scientist that he sacrificed that much pain. Not allowing me to share his pain, let me suffer for you... In 2004, when my mother broke the news to me, I cried, angry at first that he did not tell me, and I plunged further into depression that I thought if you were to leave me, I would leave with you too... ..I am sorry for my temperamental behavior since young, I am sorry for the pain I have caused you with my ups and downs.... I see the sadness in your eyes seeing me popping pills now and then in the morning. I see the sadness in your eyes..and I feel the sadness too.. and you keep telling me to be positive and keep hoping that I will be well soon, you taught me to be a fighter in all aspects of life. You taught me to be positive with what I have and turn it around. Then I would watch you under medication when you grew older...and so we go on our bonding of understanding the pain, the physical pain, and the emotional pain, our dreams to be together forever and...I love you my mom and dad. We used to joke how I would work hard so I could catch up with your age and we would all die together..me with my pain and you with your pain..our voyages together..in this emotional turmoil.. when we have breakfast in the morning, me watching you take your pills, and you watch me suffering from my mild sickness and also taking pills, it became so normal, and became a point of this special bonding that we share between a father and daughter. I am chasing time, counting the days and months, and nothing matter most than making sure you are in time to share my life fulfillment with me and me in time as well. You dad, you urged me to find God and seek knowledge everywhere in this world and travel for that and you are happiest when I know God, so I am doing that.

I thank my father and mother for blessing your daughter's impossible and idealistic dream, of finding herself a place where she can always learn and learn and do something meaningful for herself, for God and for the people. My love and obsession for science exceeds everything else in my life. I don't know what I am seeking, but I know I am seeking to know God, and myself, and that is through science. I hope to be re-united with my family in lifeafter. I thank my lovely aunt-mother, Nik Ruziah, my lovely uncle-father, Nik Kamaruddin, Harris and Tasha for your support and assuring me that you will follow me anywhere I go in this world..What more can I ask from my great families?

I thank my two wonderful, exceptional supervisors. Professors Stefano A.Cerri who is like a father to me, who cares about me, who goes all the way to shape me up as who I am today. He took me and gave me the chance to get better education, I cannot thank enough. Your kindness and generosity is so enormous I only wish you a good life here and then. To Dr. Michel Liquiere, I know we have conflicting believes from God to Logic Programming to Genetic Algorithms, but I cherish our grape picking days, picnics with your family and the fatherly and motherly care of your wife, Louise while I was sick. Your wife would care for me and I thank you for letting me into your family.

I thank all the members of the jury, Professor Anne Preller, my two supervisors, Professor Stefano A.Cerri and Dr.Michel Liquiere, Dr. William J. Clancey, Professor Amal El-Fallah Seghrouchni and Professor Joost Breuker for taking the time and agreeing to become the member of my jury for my oral defence.

I would like to thank Sylvain Degeilh, my best friend since I first arrived in France with not knowing a single French. Either I was stupid or crazy or stupid or crazy (notice the circular nature, can't be anything else than that!). Sylvain thought me French word by word. I remember the pain of coming to get a Masters and being admitted to a PhD program...till the end of this thesis. The pain of going to classes and not knowing anything, because you don't understand the language, at times you think you are really foolish, but you were just so desperate to learn, your foolishness kind of becomes a motivation. Sylvain watched me from my flunctuation moods, temperaments, sickness, and my laughter and tears, to my paralyzation, and hypertension. He witnessed it all. The moments when I am sick when I will lock myself in the bathroom and sit in the tub and talk to myself while crying and sobbing, Sylvain has been there, watching me as who I am and accepting me totally as who I am. Where can I find a friend like Sylvain? I hope our friendship will last a lifetime...Thanks for your care when I was sick from then until now...I thank Sylvain to come when I call on you to ask for help and tell you I cannot move because my mind is not right today, you would come to help me get dress to I am able to go to the lab. I thank Sylvain for taking me to the emergency room when I had my panic and social phobia attacks.

I thank Guta, my special soulmate and beautiful friend who has this beautiful and eccentric personality that I feel this special bond with you, we connect at a spiritual level and I hope our friendship will last a lifetime. You know me inside

out, like no other, and know when I am about to become sick, you can sense a week or two.... To my darling Patitta and to her wonderful boyfriend Xavier, thank you also for being there for me when my slight sickness comes in, I thank Patitta to help me sleep when my mind won't stop to rest. I thank you for trying all ways to help me sleep, that nice massage, the nice oil, the music, I am sorry I got you so worried and waking up in the morning to check up on me when I am not feeling well. I thank my lab friends, Jose Baez, Nicole (the receptionist), Elisabeth, Meghna, Maxim (I am sorry I send you my up and down crazy e-mails that at times you are lost at words and don't know what to reply back) Anfana Traore, Jonathan Touitou, Clement Jonquet, John Tranier, Christophe Crespelle, Dr. Syed Mohamad (thanks for observing my character and telling me to take care of myself), Azrin, Philippe Lemoisson, Tom Visser, my doctor, Dr. Bergier and my psychiatrist, Dr. Alymerac Olivier. I thank Jose Baez for listening to my inner turmoils and understanding my frenzied moods. I thank Tom for on days when I cannot see light, you would hold my arm and carry my bags and bring me home. I thank Nicole when I had my attacks, and you would get someone to bring me to the emergency. The emergency room is so common, in and out I go with my friends. I can never find friends who are always like that, on nights I cry and I walk and ask Patitta, to please come and get me and bring me to the emergency, because it is coming, and she would come in 5 minutes. How wonderful her friendship is to me...

I relate this story to show how rare and exceptional people in LIRMM are and I don't know if one can ever have and find sincere friends like them, and good and helpful professors, like Professors Stefano and Dr. Michel and how special my family is...to me..because they were the ones who stood behind me..always..

Finally, I thank Dr. William J. Clancey for opening the doors to more knowledge and thank you for making me find what I feel I am destined to do, doing what I am doing right now, all this in my thesis. Thank you for reading my long desperate e-mails, and reading my long incomprehensible thesis. Thank you for becoming my jury and supporting me until this far. Also thank you for sharing me your knowledge and guiding me through my thesis.

Last but not least, thank you ....to the kebab man at the Super Star Kebab for offering me tea when I am cold, thank you for your sweet smile when I am down, thank you to Emmanuel, the shop assistant at Elytis..thank you to all the strangers that smiles to me.

# List of contents

## Chapter 1

### Introduction:actual scenarios as a case study

1	NASA scenarios	13
1.1	HMP work practice	14
1.1.1.	Event 1	14
1.1.2.	Event 2	15
1.1.3.	Event 3	16
1.2	Analysis of the events	17
1.3	Statement of general problem	19
1.4	Summary of the HMP work practice events	21
1.5	The EleGI joint project – our case study	22
1.6	Research approach : Social Cognitive Theory (SCT)	23
1.7	Statement of contributions	25
1.8	Summary and outline of thesis	25

## Chapter 2

### Example

2	The Elegi joint project web communications	28
2.1	BuddySpace and FlashMeeting	29
2.2	The moment of “throwness”	36
2.3	Actual EleGI chats over the BuddySpace	37
2.4	Actual EleGI project meetings over the FlashMeeting	46
2.5	An overview of the complete CONSTEPS process	55
2.5.1.	The Big Picture of the CONSTEPS	57
2.6	Test-bed stage	63
2.6.1.	Answers from the participants from the test bed stage	65
2.7	Experiment 1.0-becoming a participant observer	69
2.8	Analysis of the two experiments	75

## Chapter 3

### Background

3 Introduction	77
3.1 Our approach to analyzing communications	78
3.2 History of CONSTEPS and Activity States Framework	81
3.3 Relating our communication approach to cognition process at the neural level.	82
3.4 Computer, thoughts and language: Winograd and Flores	84
3.4.1. Breakdown and recurrences	85
3.4.1.1. Breakdown and recurrences in daily activities	86
3.4.1.2. Readiness to hand for computer design: a moment of throwness and breakdown	88
3.4.2 Summary of the events	94
3.5 Summary of Winograd and Flores approach to designing tools	96
3.6 Language Action Perspectives (LAP)	97
3.7 Philosophical idea behind LAP	100
3.7.1. Basic concepts of LAP	101
3.7.2. Early tools for conversations	103
3.7.3. Migrating from LAP to workflow modeling processes	104
3.7.4. Several examples of LAP applications for facilitating communication	106
3.8 Speech acts	111
3.8.1. Modeling speech acts in conversations	112
3.8.2. Using the locutory, illocutory, and perlocutory acts for modeling speech acts for agent conversations	113
3.8.3. Components of illocutory acts	115
3.8.4. Conversations for speech acts to communication protocols	116
3.9 Analyzing communications from speech acts and commitment theory is not a complete analysis	117
3.10 What's wrong with speech acts?	120
3.11 Speech act theory-a cry for help	123

3.11.1. The problem of theoretical abstractions of speech act theory	123
3.11.2. The limited notion of context	125
3.12 Conversation analysis and discourse analysis	126
3.13 Basic components of Acl	129
3.13.1.A little bit of background of Acl's	129
3.13.2.Issues in Acl	130
3.13.2.1. Theories of Agency	131
3.13.2.2.Acl's semantics	132
3.14 Using Fipa-Acl as a formal guideline	133
3.15 Summary: People and tools	134

## **Chapter 4**

### **On Human Learning and Communication From Situated Cognition to Activity Theory**

4 Introduction	136
4.1 Knowing How and What (When?), Learning and Memory	137
4.2 The logical theories of learning and communication	139
4.2.1 Communications	139
4.3 The theory of logical types	141
4.4 Basis of learning	142
4.4.1 Learning Zero	145
4.4.2 Learning I	146
4.4.3 Learning II	149
4.5 A summary on the hierarchy of learning and communication	153
4.6 Related work to Bateson's hierarchy of learning and communication	157
4.7 Learning and Memory	165
4.8 Summary on Learning and Communication	175
to Learning and Memory	
4.9 Situated Cognition: for understanding the whole picture	182
4.9.1 Getting the “remembering” right: Contextualism	186
4.9.2 Looking into a transactional experience	189



4.10 Activity Theory	193
4.11 Overall picture of the theoretical integration	197
4.12 Where we are headed: Understanding the “transformations” when communicating	204
4.13 Transformation of the in-between the Stimulus-Response	206
4.14 Summary: the views from existing theories	211

## **Chapter 5**

### **CONSTEPS + Formulating the Activity States**

#### **A Participant Observers Approach**

5 Introduction	212
5.1 Some preliminaries on Fipa-Acl	213
5.1.1 Syntax of the Fipa-Acl	213
5.1.2 Formal Model of Fipa-Acl	214
5.2 What is information in our work?	215
5.3 Annotated sentences	217
5.3.1 Applying the narrator approach to analyzing sentences	220
5.4 Summary of the annotated sentences	249
5.5 Equational Logic	250
5.5.1 Formal definitions	251
5.5.2 Three Basic Properties of Equation	252
5.5.3 Interpretations	252
5.6 First step towards applying equational logic in the natural language conversations	252
5.6.1 Abstracting some models from the annotated sentences	254
5.6.2 Setting parameters and notations	256
5.6.3 Looking for properties in sentences	257
5.7 A simple model for asking questions or services	260
5.8 Applying the MD(n)'s and usnig equational logic systems on annotated sentences	261
5.9 Summary of Part A-I	263

5.10 Part A-II: Introduction to activity states	263
5.10.1 The categories of activity states	267
5.11 The controversy notion of “states” and “degrees”	269
:Manic Depressive Illness- a clue to the idea communication?	
of hierachy of learning and	
5.12 Abstracting the communications	276
5.12.1 Using the activity state for relating the ut to the CA	277
5.13 Applying activity states	277
5.14 Summary of Part A-II	287
5.15 Part B: The many hows, when will it ever end?	287
5.16 Trying to explain the articulation of predicates and observations	292
of the collaborators; the birth of the see-saw representation	
5.17 Activity States using the notion of see-saw	294
5.18 The Transformations: In-between Object-Subject	300
5.19 Bateson's Criteria of Mental Process	317
5.19.1 Criterion 1: A mind is an Aggregate of Interacting Parts or	318
components	
5.19.2 Criterion 2: The interaction between Parts of Mind is	319
Triggered by Differences	
5.19.3 Criterion 4: Mental Process Requires Circular )	320
(or more Complex Chains of Determination	
5.19.4 Criterion 5: In Mental Process, the Effects	323
of Differences Are to Be Regarded as Transforms (i.e., Coded	
Versions) of the Differences which Preceded them	
5.19.5 Criterion 6: The Description and	323
Classification of these Process of Transformation Disclose a	
Hierarchy of Logical Types Immanent in the phenomena	
5.20 What we understand about transformation:	325
in-between object and subject	
5.21 What we are learning from converting the conversations	327
another language	
5.22 Summary: Activities states based on see-saw notion	327

## **Chapter 6**

### **Preliminary findings on communication protocols**

6 Introduction	329
6.1 First paper: Preliminary Analysis On: The Induction of Communication Protocols	329
6.2 Second paper: Analysis and Synthesis of Learning Agent's Communicative behavior	342
6.3 Summary: preliminary findings on communication protocols and its relationship to the CONSTEPS	366

## **Chapter 7**

### **Conclusions**

7.1 Activity states framework: how it was developed	368
7.2 What this thesis is and what it is not; and why it is not	375
7.3 Perspectives and future directions	376

<b>References</b>	377
-------------------	-----

<b>Appendix</b>	387
-----------------	-----

<b>A</b> Fipa-Acl formal model	387
--------------------------------	-----

<b>B</b> Fipa-Acl semantics	396
-----------------------------	-----

<b>C</b> A sample of the actual recorded and transcribed conversations with their converted messages	398
---------------------------------------------------------------------------------------------------------	-----



## RESUME en francais

Ce travail est basé sur l'observation de conversations entre informaticiens sur Internet grâce à des outils de communication comme la messagerie instantanée et la vidéoconférence. L'objectif est de comprendre comment l'apprentissage et la communication peuvent s'influencer mutuellement: les personnes peuvent inférer le comportement communicatif de l'autre en interprétant dans le même temps comment leurs intentions apparaissent quand ils parlent et ont une activité. D'abord plusieurs conversations ont été enregistrées et étudiées (environ 50 000 mots échangés à chaque fois). Puis ces conversations ont été transcrites manuellement en messages formalisés pour un agent. L'analyse de ces messages et la compréhension des scénarios de communication ont requis une application étendue des théories existantes : (i) hiérarchie de l'apprentissage et de la communication (Bateson, 1972 et 1979), (ii) cognition située (Clancey, 1997) et (iii) théorie de l'activité (Leont'ev 1977 et 1978). Cependant, lors du processus d'analyse, un cadre de travail théorique innovant a émergé et a été appelé Etats d'Activité. Il fournit des règles pour la conversion des conversations dans un langage de communication entre agents (en conservant la sémantique). Les Etats d'Activité tentent aussi d'expliquer et de comprendre comment, par exemple, la façon de lire et de comprendre un texte peut être liée à l'activité que l'on peut avoir à un moment donné sur Internet. Cela influence directement la façon dont les gens vont formuler leurs intentions. Finalement, l'analyse des messages formalisés a ces remarques préliminaires: (i) les gens possèdent des règles internes (par exemple un système de règles combinatoires) (ii) les gens apprennent, rassemblent et adaptent leurs protocoles de communication au contexte dans lequel ils se trouvent (cela valide en quelque sorte certaines théories qui déjà le suggèrent). Pour conclure, les Etats d'activité sont appelés à être une approche prometteuse pour une meilleure compréhension du comportement humain de collaboration à distance via Internet.

## RESUME en anglais

The work was centered on observing actual computer scientists communicating on the web via social tools (instant messaging and video conferencing) in the context of a joint project. The objective has been to *understand* how learning and communication mutually influence one another; allowing people to infer each other's communicative behavior, at the same time understanding how *intentions arise* when people are *speaking* and *doing activities*. First, actual conversations have been recorded and observed (about 50,000 words exchanges). Then those conversations have been manually translated into formalized agent messages. The analysis of those formalized messages, and the comprehension of the communicative scenarios has required the extensive application of existing theories: (i) *hierarchy of learning and communication* (i.e. *logical theories of learning and communications*) (Bateson, 1972 & 1979); (ii) *situated cognition* (Clancey, 1997); and (iii) *activity theory* (Leont'ev 1977 & 1978). However, during this analytical process, an innovative theoretical framework has emerged that has been called Activity States. It provides guidelines on how to convert the actual conversations into agent communication messages (having equivalent semantics). The Activity State framework also attempts to understand and explain how the activity of reading (as an example), and comprehending the text that one reads, is in relationship to that person's activity on the web. All of this influences how people formulate his/her intentions. Finally, the analysis of the formalized messages enabled preliminary findings: (i) people have internal rules (e.g., a combinatorial rule system); and (ii) people learn, merge and adapt communication protocols in their situated context (in some ways validating some existing theories suggesting this). As a conclusion, our Activity States framework is claimed to be a promising approach for a better understanding of human collaborative behavior at a distance, over the Web.

**MOTS-CLES** : Apprentissage et Communication Humains, Cognition située, Théorie de l'activité, Langage de communication des agents, LAP, Fipa-Acl

## Chapter 1

### Introduction: actual scenarios as a case study

*“In scientific research you start from two beginnings, each of which has its own kind of authority: the observations cannot be denied, and the fundamentals must be fitted. You must achieve a sort of pincers maneuver. If you are surveying a piece of land, or mapping the stars, you have two bodies of knowledge, neither of which can be ignored. There are your own empirical measurements on the other hand and there is Euclidean geometry on the other. If these two cannot be made to fit together, then either the data are wrong or you have argued wrongly from them or you have made a major discovery leading to a revision of the whole geometry”*

*Gregory Bateson, Steps to an ecology of mind, 1972.*

#### 1. NASA scenarios

In this section, we review *actual communications scenarios* by (Clancey, 2001). These scenarios are illustrated as *events*. After illustrating these events, we shall move on to the analysis; combining both from the author (Clancey, 2001) as well as our own. At the end of the section, we assert why considering actual communications scenarios is important in designing a communication tool.

## 1.1 HMP work practice<sup>1</sup>

All the scenarios presented below were carried out during the NASA Haughton-Mars Project (Clancey, 2001). The NASA Haughton-Mars Project (HMP) is an interdisciplinary field research project centered on the scientific study of the Haughton impact structure and surrounding terrain, Devon Island, High Arctic. This is viewed as a terrestrial analog for Mars. The NASA HMP supports an exploration program aimed at developing new technologies, strategies, human factors experience, and field-based operational know-how key to planning the future exploration of the Moon, Mars and other planets by robots and humans (HMP, 2001)

We review three specific events that had occurred during the HMP. These events are scenarios of research collaborators and scientists who engage in a work practice. In particular, Clancey(2001)<sup>2</sup> studied the aspects of the *communication protocols* of these events.

The group members that were involved during those events are: a mission controller, a mission support, a commander, crew members and several outside experts and occasionally colleagues of the group members.

### 1.1.1 Event 1

The first event occurred in the year 1999. The group members had to learn how to use instruments to gather data in the crater to perform a survey of magnetic irregularities. The commander was in a regular communication with the outside experts, who advised on how particular instruments should be used.

We illustrate the possible sequences of events that occurred during this context in figure 1.1.

---

<sup>1</sup>Work practice is a concept that originates in social-technical systems, business anthropology, work systems design and management science. It is a *collective activity* of a group of people who collaborate and communicate, while performing these activities synchronously and asynchronously (Sierhuis et al, 2001). Work practices include for examples: conversations, mode of communication, informal assistance, impromptu meetings, and workarounds (Clancey, 2002).

<sup>2</sup>Other related analysis on communications may be referred to (Clancey, 2005).

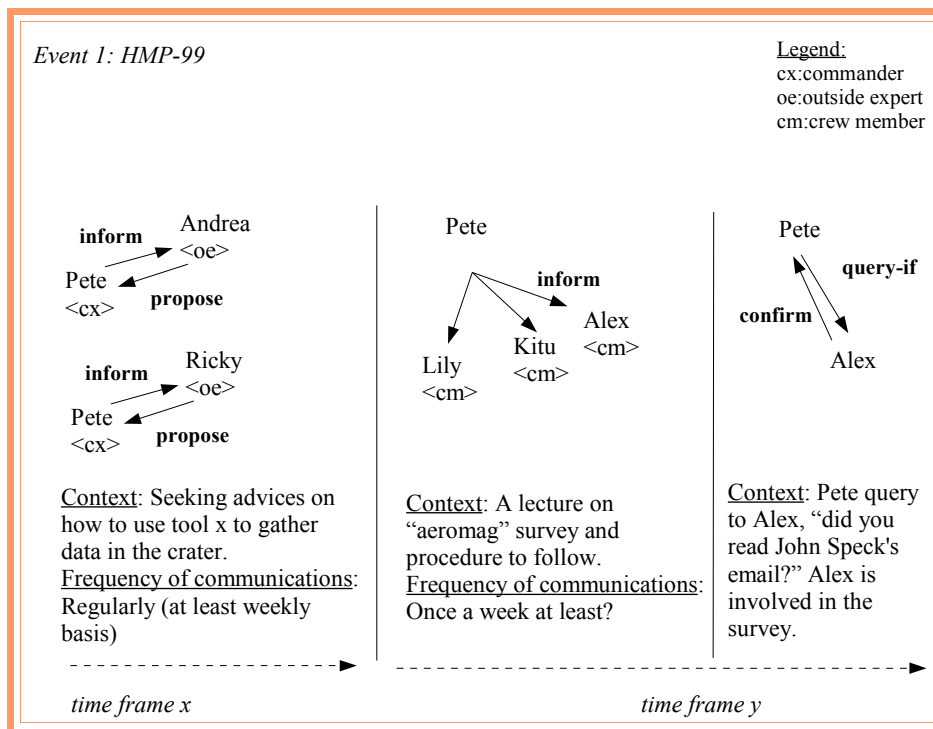


Figure 1.1.1 (a): Event 1 is on the instructions on using tools for gathering data in the crater.

Referring to figure 1.1.1(a), Pete is the commander. He engages periodically in conversations with two outside experts, Andrea and Ricky to seek advice on *how to use* certain *tools* for the *activity* of *gathering data* in the *crater*. The arrows between Pete and Andrea, between Pete and Ricky illustrate the exchange of messages (i.e. conversations). Whether these communications were made at the same moment, or separately, is unknown. The vertical lines, denotes the separation of the *context* of *activity*. The horizontal lines, denotes the time those events had taken place.

After some time, we present another event that had occurred in *time frame y*. During this time frame, two transitional states<sup>3</sup> took place. In the first phase, Pete gave a briefing to all his crew members, Lily, Kitu and Alex. He was giving a lecture (i.e. inform-all) on the "aeromag" survey and procedures to follow. After a while, Pete asked (i.e. query-if) Alex if he had read John Speck's e-mail since Alex was involved in the survey. However Alex answered (i.e. confirm), no that he has not read his e-mail yet.

### 1.1.2 Event 2

This event occurred in 2001. Again we present the possible sequences of events in figure 1.1.2(a) below.

<sup>3</sup>Transitional states is a notion used to represent the "movement states" of one person's activity to another activity.



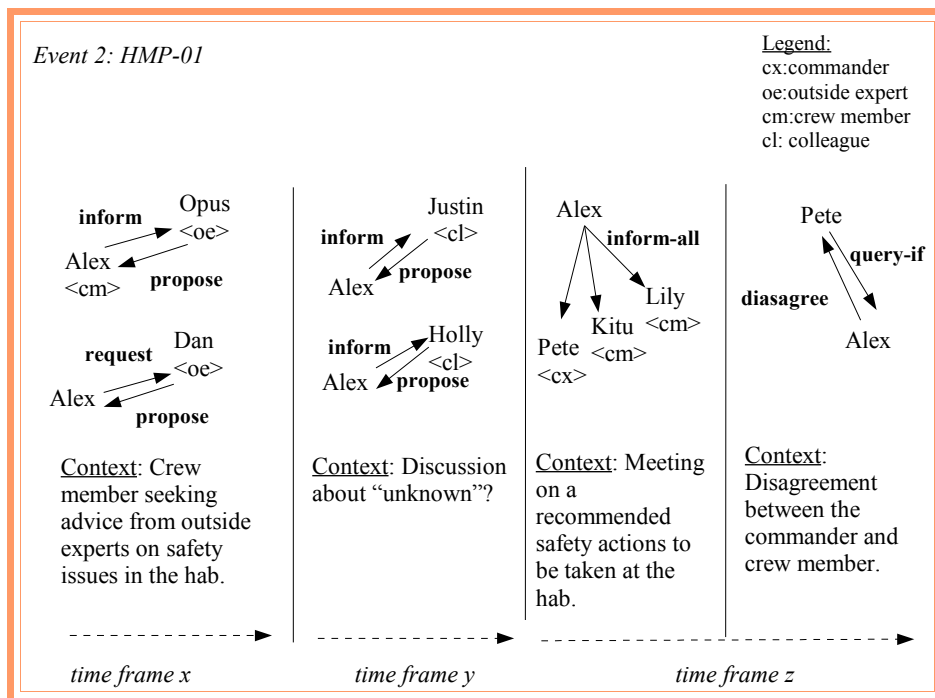


Figure 1.1.2(a): Event 2 on the safety issue at the hab.

Referring to figure 1.1.2(a), Alex the crew member was seeking advice from the outside experts on the safety issue in the hab. We assume that Alex queries about a certain issue from Opus and perhaps request Dan to inform him on how to tackle the safety issue. We do not know again, whether this communication had taken place together on the same day or had taken place after some period of time. In time frame y, Alex had a long private discussion with his colleagues, Justin and Holly. Here we make an assumption that this communication occurred after Alex had communicated with the outside experts. After returning from his private discussion with his colleagues, (i.e., refer to time frame z), Pete requested the group members to have a meeting on recommended safety actions to be taken at the hab. Pete confronted the group with facts and some recommended actions. Each of his reasoning was supported by claims of authoritative ruling that he had personally received (Clancey, 2001). After some time during time frame z, Pete (i.e. commander) tried to get clarifications and explore options, but Alex became defensive and claimed that the commander had no expertise in the matters at hand, and that they must follow the advice of outside experts. The moment was tense and very uncomfortable for all of them (Clancey, 2001).

### 1.1.3 Event 3

This event occurred in 2001 where Clancey (2001) conducted a simple experiment with outside experts to explore the boundaries of what is possible and permissible. The NASA paid the Canadian Artic Weather to provide forecasts specific to Haughton Crater. Furthermore, for a fee, the Canadian Artic Weather had to answer questions about weather and the forecasting process to one of the

group member. They were engaged in a distributed collaboration with mutual learning. This involves *non-operational, scientific advice*. The Canadian Arctic Weather is requested to also answer any questions on related issues of weather. The idea of this experiment is that a Mars crew is unlikely to be an expert in every area of human knowledge relevant to Mars science. The meteorology of Haughton is part of the scientific study of the crater, yet they have no trained meteorologist in the crew. For example, a photograph of cloud formation during changing weather conditions is useful to forecasters. During this process, the experts back on Earth (the Arctic Weather Service) are devoting more attention than usual and hence learning about the conditions on Devon Island. Figure 1.3.1(a) illustrates the possible sequences of events.

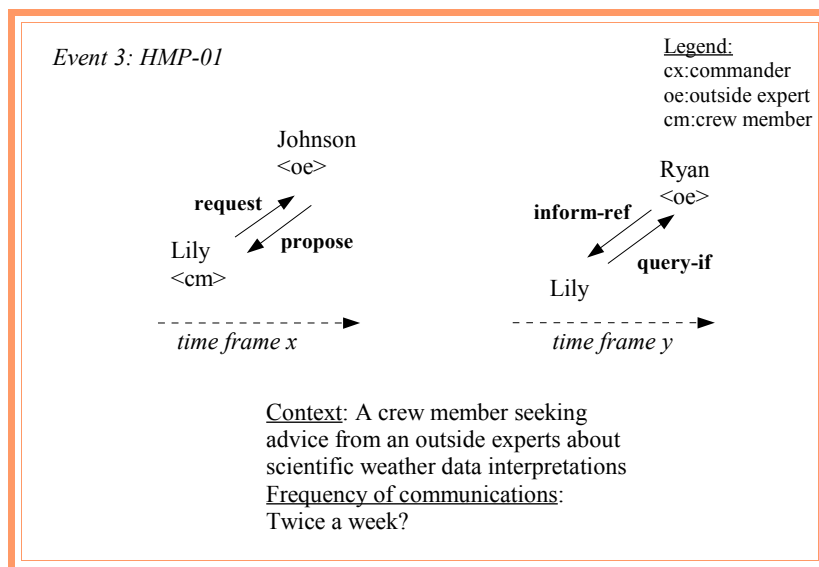


Figure 1.3.1(a): Event 3 seeking advices about scientific weather data interpretations.

Refer to the figure above, Lily, the crew member had consulted Johnson and Ryan, the outside experts from the Canadian Arctic Weather Service. It is unknown for how long the experiments were carried out. We also don't know how regularly the communication between the group member and the outside experts took place. Here, Lily was allowed to consult these expert independently, without asking permission from her commanders. This communication protocol proves not to be problematic.

## 1.2 Analysis of the events

This section will discuss the analysis of Clancey (2001) as well as our own. Clancey(2001) reviewed several opinions on the events, which we review below:

Event 1: There are two opinions on this matter.

*Case 1:* According to an experienced NASA mission controller, if the mission support had been in control, the crew member who had not read his e-mail yet would have received the outside experts' advice; the information would not have come up so haphazardly through the commander during the briefing. Hence, the mission controller claimed that *all communication should go through mission support*, which would then ensure that all members of the crew with a need to know would receive the appropriate information on a timely basis. The mission controller suggests that the mission support should be in control. This would have prevented the awkward situation that occurred during that briefing.

*Case 2:* On the other hand, the commander argues that the information was in fact presented efficiently and on a timely basis by *being communicated in a meeting*. This *enabled* the commander to *retain control over technical information* provided to the *remote team*. This contradicts the mission controller's perspective.

Looking from both perspectives, we summarize some points:

- In *case 1*: If the email of the outside experts goes through the mission support (who is in control of the communications between the commander and outside experts), then the mission support *evaluates* if the information should be communicated to a crew member. It will be communicated on a need to know basis. However, if this communication protocol takes place, the commander cannot retain control over technical issues. Then, if advice were to follow in this matter, we must consider several issues: (i) *what* is the *context* of defining "on a need to know basis"?; (ii) *who* are the *recipients* of the *e-mail*? And *how* they are *selected* on a need to know basis?
- In *case 2*: The outside experts communicate directly with the commander. Some questions that must be considered are : (i) does the commander forward the e-mail a day before a meeting is to be held?; (ii) Does the commander expect all the crew member to discuss the received e-mail during the meetings. Or are the crew members assumed to be aware of matters (without directly discussing the content of the e-mail); (ii) Does informing the crew members a priori of advice from the outside experts "change" their awareness of these advices? (what will the effects be after communicating this information?).

Event 2: This particular event showed that the communication that had taken place did not work well. Operations advice, whether it comes from mission support or direct e-mail with a colleague, should only be directed to the commander. An outsider should not be telling a crew member what his/her commander should do.

Event 3: This particular event showed that the communication worked very well for one of the members. Even if it violates the mission's controller hypothesis that only the commander should be communicating with outside experts directly.

Event 1,2, and 3 illustrates a scenarios of how people are *learning to communicate* and what people are *learning about defining communication protocols* in work practice. It also reveals the *context dependency* of outlining the communication protocols.

### 1.3 Statement of the general problem

The problems illustrated above are of interest to us and we claim why they are here. Primarily, from our generalist point of view, those events signify three major issues:

1. *Human learning and communications.*

Mission controller has an opinion A on matter X. Commander has an opinion B on matter X. Opinions are about an *unexpected event*. What must we do next, and how do we do it? Thus, bringing forth the interest of *understanding* how does one *discriminate* one *context* from *another*. The involved group members were “unable” to *discriminate/distinguish* the *context* that he/she is *situated in* at that moment of event. *They have learn that this is a context to discriminate*. This had *somehow* caused “a jump<sup>4</sup>” in their learning. Because, later, they had learned how to explore new solutions (and providing explanations) in those events. In doing so, they have compared several contexts of communications (from their experiences) as generalizing the context that he/she (or explaining their experiences) is currently situated in.

2. Tools “effecting” communications and *becoming a part of the context* of making up the *communication protocols*.

➤ Access to unbounded communications contributes to the possibility of *modifying* present communication protocols. The communication protocols have to be adapted from time to time when considering new “located” tools in the context of a work practice.

3. Tools facilitating (possibly improving) communications of people at work practice with the outside world.

The effects of tools when considering communication protocols cannot be underestimated. Preliminary, let us discuss point 1. The group members of the HMP work practice project had encountered an *unexpected event*. During this unexpected event, the group members become (indirectly) *aware* of the *potential pro* and *cons* of a tool (e.g, the e-mail system). “What should we do? What happened? Was it wrong to allow direct e-mail communication with crew member A with an outside expert? Should forwarded e-mails be constrained to particular people?”

This notion brings us to the idea of “breakdown” in system designing (Winograd et al, 1986). This notion originally came from (Heidegger, 1962). The author (Heidegger, 1962) recognized that everyday life is like the situation that

---

<sup>4</sup>This is relating to the ideas on hierarchy of learning and communication by (Bateson, 1972). We discuss this in Chapter 3.

had been described. Our interactions with other people and with the world we inhabit put us into a situation of “thrownness”. For example, the *objects* and *properties* are not inherent in the world, but *arise* only in an *event* of *breaking down* in which they become present-at hand. In the event of breakdown, people learn to *discriminate* that new *context* of *communications*. These two topics; (i) breakdown; in respect to (ii) learning is discussed in the coming section. In Chapter 2, we discuss the essence of the notion of breakdown.

Readers should refer again to event 1 and 2. In our own interpretation, the object (which is the e-mail program) and its properties (allowing one to send and receive emails from anyone in this world) became, *indirectly*, a *topic of discussion* among the group members. To illustrate the communication scenarios in respect to the tools used, we show figure 1.2.1 (a) below.

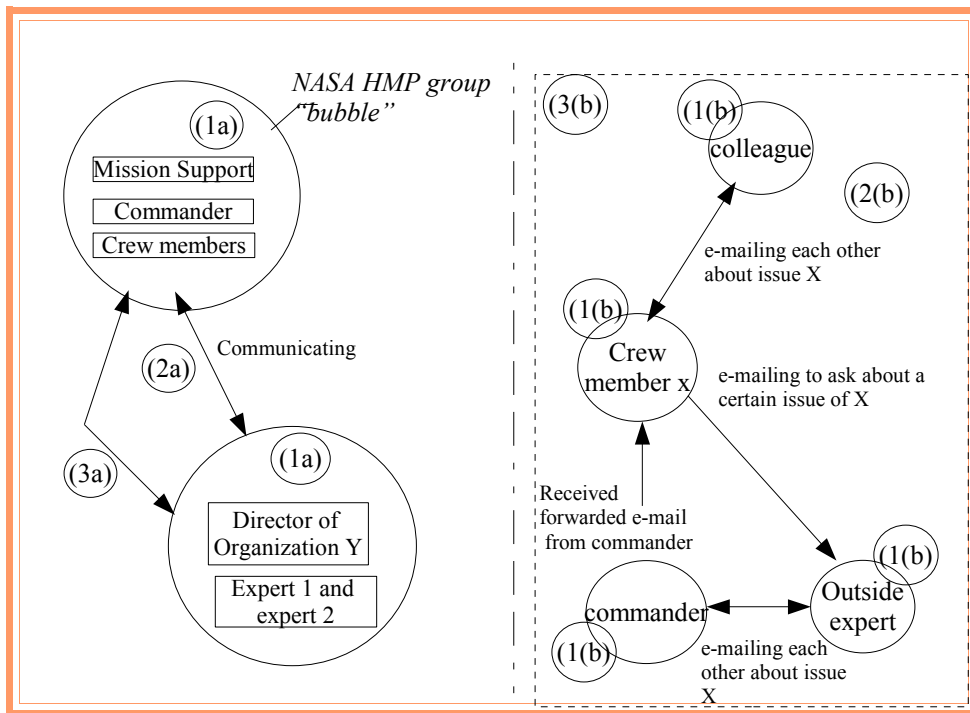


Figure 1.2.1(a): Communications taking place in work practice.

The left hand-side of the figure, denoted by A represents the *NASA HMP* group and organization *Y* as existing in their own "bubble". These organizations have their own *intentions*, *goals*, and *communication protocols*. The right hand side of the figure denoted by B represents the microscopic view of the communication that has taken place. What are the major concerns in the above figure 1.2.1 (a)?

- 1a) Class hierarchy exists in a work practice. Each of the members corresponding to this class hierarchy has also his/her own roles. A commander, for example, is in a higher class than crew members. A commander has a role to coordinate his crew members. This is represented by the circle labeled (1a) for the *NASA HMP* group in figure 1.2.1(a) Similarly it applies to organization *Y*.

2 a) Communication effectiveness or failure among the *internal groups* and *external groups* in most *new cases* is *difficult* to be *predicted*. An example, HMP group members belonging to the NASA organization will not know exactly how to "manage" communications with an external expert coming from another organization for the first time. This is due to the *unfamiliarity* with the *new context* they are engaged in. This is represented by the circle labeled with (2a) in figure 1.2.1.(a).

3a) Any sort of personal crisis among members of the work practice can interrupt or cause problem in decision making and this cannot happen for an important project such as the HMP.

Point (1a), (2a) and (3a), the right side of the diagram illustrates in general two organization that are collaborating yet “existing” in its very own bubble. The terminology we used as existing in its very own bubble is to illustrate that each organization has its own set of rules and procedures and roles to adhere to. On the other hand, the left hand side is giving a microscopic view of what is going on between the two organizations which we associate point (1a) to (3a) to (1b) to (3b) below.

1b) Each member of the crew of NASA HMP has her<sup>5</sup> own duties to carry out. She normally has a guideline that outlines her cooperative and collaborative duties to ensure that she will complete it successfully. As an example, the commander normally outlines the activities that the crew member must carry out for the day within the organization. Similarly it applies to organization Y.

2b) Members of the work practice may work with experts coming from an external society. There must be guidelines that specify what type of communication to use to share/exchange information, and *to whom* in which *operation*. This is represented by the circle labeled with (2b) in figure 4. In point 1b), we noted that the members of the work practice have guidelines on what they should do in an organization. The concerned members must also be provided with outlines on *what to communicate, with whom* and *when*.

3b) Professional relationships among members of the work practice and people from external society have to be maintained to ensure a good collaboration environment.

#### 1.4 Summary of the HMP work practice events

Let us summarize our view on those events. Firstly, readers notice, we have highlighted these keywords: *learning and communication, breakdown situation, ac-*

---

<sup>5</sup>We use she for he/her.

*tivities, contexts of communications, and communication protocols.* How do people *learn to communicate*? How do *people learn to handle breakdown* situations? At the same time, how are the learning and communication of one person taking shape with one another when this person is engaged in an activity (like the HMP example, using tools for conducting survey or reading and e-mailing procedures). After some time, people handle the *context of communications* as if they were *repeatable*. If we are to commit to this notion of *repeatable*, then we must ask ourselves, how are they in the beginning able to *recognize/conduct* a context as being context A? Hence, *knowing with what* and *with whom* to communicate (and applying a particular communication protocol) in their situated context.

With the presence of e-mail systems, it is important to design communication tools that “takes into presence” the *human communication protocols*. It is interesting to observe how access to an e-mail program, and possibly many more tools (video-conferencing, instant messaging) can affect work practice. Those tools can either increase/decrease effectiveness in the work. It also provides virtual joint project opportunities.

We are inspired by the actual events that had taken place during the HMP work practice. Thus, it has initiated us to look into a similar actual scenario. We have chosen a scenario of four computer scientist that are currently engaged in a joint project for the European Union project. In the next section, we briefly review the domain of our study.

## **1.5 The EleGI joint project- our case study**

We have mainly reviewed in the previous section the fundamentals of the thesis direction. In particular, we reviewed to readers the actual events that had taken place during work practice. We have discussed and emphasized on the importance of studying how people use tools for facilitating communications. Now, looking into this, we have selected similar actual scenarios. We looked into a particular context: computer scientists *collaborating online* to prepare a conceptual framework deliverable. This deliverable had to be submitted before a given deadline for the European Community under the Information Society Technologies (IST) program of the 6th Framework Programme for RTD - project EleGI (EleGI, 2004)<sup>6</sup>. The members of the collaboration are from these organizations 1) LIRMM (France) 2) Telindus (Belgium) 3) Open University (UK) and an external adviser on theories of conversations (i.e. currently attached to the University of Amsterdam, the Netherlands and LIRMM). All communications between collaborating members were carried out using *e-mails* and also *Buddyspace* (i.e. instant messaging), and *FlashMeeting* (i.e. Video-conferencing).

---

<sup>6</sup>The EleGI project, and the European Union are gratefully acknowledged as providing partial support for the activities carried out during the preparation of this thesis.

The members of Telindus are people coming from the industry, whereas the members from LIRMM are computer scientists specialized in the domain of agent technology. On the other hand, the computer scientists from the Open University are mostly concerned about designing social tools. Finally, the external adviser is a cognitive psychologist.

This is a particularly interesting scenario, as the tools had already some restrictions to use. This is discussed in Chapter 2. It differs from the HMP work practice. In the sense that this joint project is mostly carried out over the web communications. Scheduling meetings, brainstorming about how to design the deliverables, and sending them were mainly performed over the web. Thus, the group members relies almost everyday on web communications to move the project forward. Normally, the group members use e-mails, or forward e-mails to many recipients to inform new schedules. Other times, video conferencing is scheduled on a weekly basis (depending on upcoming deadlines). Sometimes, they do both, using chatting systems and also video-conferencing. On some rare occasions, one can find a seasoned “virtual” collaborator organizing his work on a video-conferencing, over the phone and chatting. This is being carried out occasionally simultaneously. They are always engaged in an *active activity* of *coordinating* their joint project (Clancey 2002, 2004b).

## 1.6 Research approach: Social Cognitive Theory (SCT)

Let us summarize from the beginning. We have begun our thesis with a rather detailed account of an actual scenario that had taken place the HMP work practice. Next, we moved on to highlight that *those scenarios* (Clancey, 2001) are *the statement of the general problem* in our work.

Looking into it had led us to look into a similar context of study. At the same time, trying to comprehend the problem at hand has become the central focus of this thesis. The *comprehension of how people learn to punctuate communication protocols* in the *first place*. Thus, in order to understand this notion or “punctuation” (which is discussed thoroughly in Chapter 4), we cannot ignore the necessity of starting from the bottom-up approach to protocol analysis (Ericsson et al, 1984). We want to *understand* how *learning* and *communication* in respect to the notion of breakdown can help us design tools to improve communications. But before we begin to understand this, we believe that we must understand *how people learn to formulate* their *intentions* in respect to using the *located tools* when engaged in *joint project activities*. Then, we must understand how people learn to overcome breakdown situations. Our argument for detailing our approach in such a way is discussed at the end of this chapter.

When we use the word formulate, we are referring to the “mechanism” constituting the *representation* that occurs in the brain (Clancey, 1997a) when one is



speaking and reading (perceiving). Using this terminology carries a lot of implicit meanings and understanding. It concerns the act of conceiving of what one is perceiving. It's not a simple representation that is occurring. It also concerns how the learning of *recognizing events* as being that *experience* and *categorizing* it as that *context of communications* when people are communicating. Studying from this point of view allows us to trace how people learn to communicate on daily basis and learn to seek new solutions or grounds, in adapting to new environments.

Hence, we have taken the social cognitive theoretical approach (SCT) to analyzing the communications (in particular the conversational structures). The SCT considers the role of personal factors (e.g., beliefs, attitudes, expectations, memory) in addition to the environmental and behavioral aspects of learning (Plucker, 1999). It is also known as the “triadic reciprocity model of causality”. Through feedback and reciprocity, a person's own reality is formed by the interaction of the environment and one's cognition. In addition, cognitions change over time as a function of maturation and experience (i.e., attention span, memory, ability to form symbols, reasoning skills) (Plucker, 1999). Through the understanding of the processes involved in one's construction of reality enables human behaviour to be understood, predicted, and changed.

Before readers begin to assume that we are about to speak about tools; we are not. *This thesis is not about designing tools (not just yet)*. It is about the *conversion steps (CONSTEPS<sup>7</sup>)* that uses formal model (Fipa-Acl, 2002) as a formal guideline to identify intentions in sentences. The CONSTEPS approach is introduced with an example in Chapter 2.

Therefore, the focus of the *thesis* is dealing only with the CONSTEPS that pre-processes the natural language conversations using an activity states framework into marked up agent communication language based on the existing theories of: (i) (Bateson, 1972); (ii) Situated Cognition (Clancey, 1997a); and (iii) Activity Theory (Leont'ev, 1977 & 1978). *Activity states* framework aim at providing explanations for how people comprehend texts and formulate actions situated in the context of their communications. These *activities* are taking place always in *respect* to *using* the *located tools*. Along the way, CONSTEPS have extended the semantics of the model we used (Fipa-Acl, 2002). But the conceptualization of the extended semantics is not discussed in this thesis (it requires another research writing)<sup>8</sup>.

## 1.7 Statement of contributions

---

<sup>7</sup>We would like to thank the examiner, Prof. William J.Clancey for suggesting and contributing his idea on this acronym for the conversation steps.

<sup>8</sup>We only provide a summary of the standard semantics in the Appendix.

We provide an “open framework” for the conversion of natural language conversation into marked up agent communication messages. Some of the contributions are:

- It contributes to the conceptual *modeling* of the *understanding* of *learning and communication* in respect to using located tools in a situated context of environment. The natural language conversations which have been pre-processed into formalized structures is a first step towards understanding how people punctuate communication protocols (Sack et al, 1974); by observing the placement, sequences and relationships among the structures.. Hopefully with this understanding, we can return to our first initiative to help computer designers design communication tools that improve joint project web communications.
- It's also a side contribution to the agent communication society. It provides a different view on how to tackle the current debate on modeling agent communications in multiagent systems, in particular the debate on the definition of semantics of the protocols for agents to communicate. One of the current issues is to model conversations when some of these agents are humans. This opens up the integration of pure agent communication with agent to human conversations. Our “open framework” of the activity states can be integrated in the current modeling of agent to human conversations (Sadek, 1997) by incorporating our view of how to look into actual communications for the modeling of human agent and artificial agent communications.

Ultimately, it is our wish that in future this one step shall allow us to give *comprehension* on how people induce communication protocols (or in Bateson's term, the “punctuation of events”<sup>9</sup> in (Bateson,1972) page 288 and 298.

## 1.8 Summary and outline of thesis

This chapter began with an introduction of actual events portraying *communication protocols problems*. Then, looking into those actual events inspired us to search for a similar scenario. We are motivated to study how people learn from a breakdown situation. We used to this help us understand the notion of *punctuation of events (i.e. communication protocols) by relating it to the hierarchy of learning and communication* by (Bateson, 1972 & 1979).

This is a thesis relating people to tools. We present existing theories for analyzing conversations (i.e. speech acts, conversation analysis, discourse analysis). Then we present our approach to analyzing conversations based on learning and memory.

---

<sup>9</sup>To summarize, the contexts of communication is referred as streams of events. The signals that mark those contexts are called “markers” for the punctuation of events. Then the question would be how does one punctuate these streams of events as being event 1; event 2 and so on, when communicating with another person? Or we may understand the term punctuated as: the ability to recognize a certain *communication protocol* goes through the *punctuation of context*, markers that *mark* them as certain *events* as an experience (having meanings) and are classified as “classes”. This is discussed in detail in Chapter 4.

We summarize the work that has been carried out in our work:

- Retrieved chat logs (7 months) on the instant messaging between two members.
- Transcribed recorded video conferencing of 3 meetings (in a month) among several group members. The meetings lasted on the average an hour each. The number of members involved varies, but normally a group consists of 5 people.
- Kept track of one subject's (the project coordinator) communications with other group members. This observation was carried out in order to know exactly how and when the subject had punctuated the communication protocols in the first place.
- Begun analyzing communication at the simplest type of interaction (i.e. 1-1 chat, then e-mail, then video-conferencing). It is simpler to keep track on one subjects communication process starting from the most simplest type of interaction: coordinating and then to collaboration. As an example, how the user starts to familiarize himself with the new system. Then, how he becomes a professional at handling meetings in a collaborative virtual environment.
- *Converted* the collected *conversations* into *formalized messages* using our formulated framework: *activity states*. This framework is introduced in Chapter 4.
- Applied existing theoretical foundations as well as own analysis on the formalized messages to analyze communication protocols. We have obtained some preliminary findings (Binti Abdullah et al 2005a, 2005b).

The rest of the thesis is organized as follows:

- Chapter 2 gives an example of the EleGI joint project scenarios. We introduce the notion of “thrownness” in this example Chapter 2.
- Chapter 3 introduces briefly our approach to communications, at the same time deals with the background work. This chapter also provides an argument for approaching the work in such a way.
- Chapter 4 introduces the three existing theories which we refer to. They are (i) hierarchy of learning and communication (Bateson, 1972); (ii) situated cognition (Clancey, 1997a); and (iii) activity theory (Leont'ev, 1977). We discuss why those particular theories are being considered in our activity states framework.

- Chapter 5 introduces the center of the thesis. The CONSTEPS framework using the *activity states*.
- Chapter 6 discusses some preliminary findings on communication protocols. Two published papers are introduced in this chapter reformatted for this dissertation (Binti Abdullah et al 2005a, 2005b).
- Chapter 7 concludes the thesis. We discuss the relationships between the *activity states* and the primitive findings we have obtained so far on communication protocols.

## CHAPTER 2

### Example

*“You boast about your consciousness, yet all you do is vacillate, because, though your mind works, your heart is darkened by depravity, and without pure heart there can be no full, right consciousness”*

*Fyodor Dostoevsky, Notes from Underground, 1993.*

### 2. The EleGI joint project web communications

On the web communications, we must always consider that people are communicating mediated by web communication tools. Those tools allow them to facilitate their activities. Thus, they are always in an “activity”, always adapting their thoughts and actions mediated by these tools. A person using web mediated tools normally multi-task their jobs. As an example, she may switch her attention from task A to B, vice versa or simultaneously on different communication tools (skype phone, chat messenger, reading e-mails, having a webcam chat while replying, sending images or files in pdf or words format to one another). We refer these occurrences as *web activities*. Our interest of the web activities is mainly focused on computer scientist collaborating online preparing a deliverable (an official proposal) to be submitted to the EU for project permission (recall Chapter 1 for the brief introduction of the case study).

The communication tools are used mainly as a mediator to achieve certain goals; such as arranging online FlashMeeting to discuss progress of project, to justify a proposal, and using BuddySpace as a media to invite the project

executive for a visit to France for an EleGI meeting. Going back to our main objective of the thesis, the CONSTEPS is a stepping stone for understanding how the collaboration process is taking place. In the next section, we introduce the tools that were used for facilitating the EleGI joint project. Then, we illustrate particular chat logs and transcribed meetings and explain why it is very complex to analyze these communications.

## 2.1 BuddySpace and FlashMeeting

The collaborators normally use an e-mail system (on a daily basis) to exchange opinions, and instant messaging (BuddySpace) to chat daily with one another. For meetings, they use video-conferencing (FlashMeeting). In this section, we show the two main communication tools: *BuddySpace* and *FlashMeeting*. We introduce the functions of the communication tools. E-mail was a very major importance during their collaboration, but was not analyzed. This was due that the side goal was to study the effectiveness and impact of these web communication tools<sup>10</sup> (BuddySpace and FlashMeeting) for web collaborations. We have analyzed actual web communications based on the recorded chat conversations and transcribed video-conferencing meetings. We have pre-processed, and at the same time converted all the conversations into marked-up agent communication messages (Fipa-Acl). Specifically, we have analyzed the recorded chats between Philippe Lemoisson, the project coordinator and Marc Eisenstadt, one of the EleGI executives, from 19/04/2004 until 28/09/2004. The recorded and transcribed meetings among the group members were analyzed on these dates; 17/09/2004, 22/09/2004 and 29/09/2004. We show a typical *BuddySpace* (Eisenstadt et al, 2002 & 2004) instant messaging environment and user interface in Figure 2.1 (a) and 2.1 (b):

---

<sup>10</sup>The BuddySpace and FlashMeeting are sometimes referred to as “social tool” defined by Stowe (2004) as a generation of software as being intentional from the start to guide human behaviors into new paths and patterns , to counter prevailing ways of interaction.

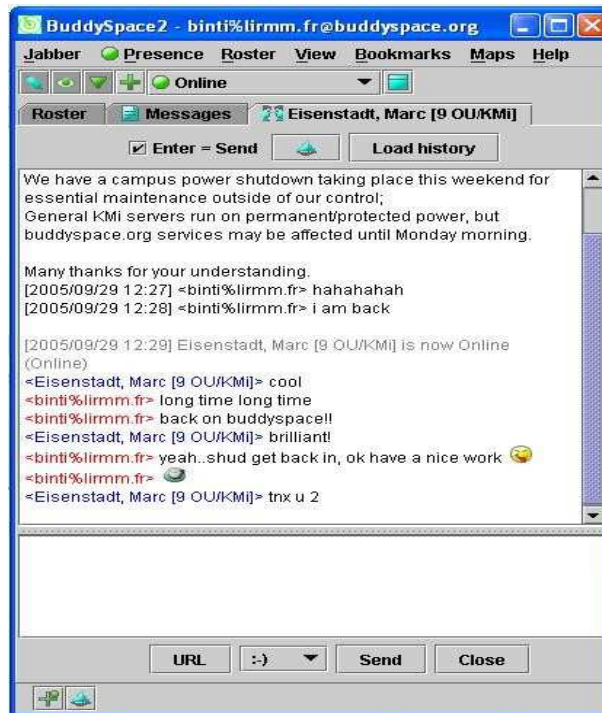


Figure 2.1 (a): The BuddySpace chatting user interface. Some chatting going on.



Figure 2.1 (b): The main view of BuddySpace instant messaging tool.

Figure 2.1(a) and 2.1 (b) illustrates the *BuddySpace* user interface. Sometimes during the joint project, it is regular that the communication extends to the students of the collaborators involved. Normally, they ask indirect questions about some of the concerns in the joint project for the student's own

personal interest. Figure 2.1 (b) shows the main view of the *BuddySpace* instant messaging tool. The users come from different institutions. For example, “Eisenstadt, Marc [9 OU/KMI]” represents that the user Eisenstadt is from the Open University (OU), Knowledge Media Institute (KMI). The number 9 denotes the institution in the EleGI project.

A typical *FlashMeeting* is illustrated by Figure 2.1 (c).



Figure 2.1 (c): The *FlashMeeting* among the group members.



Figure 2.1 (d): *FlashMeeting* features. Excerpted from (Cnm, 2005).

Figure 2.1(c) illustrates the typical scenario of the video conferencing meetings. The features of the *FlashMeeting* is explained in figure 2.1 (d).

Figure 2.1(d) illustrates the functions of *FlashMeeting*. *FlashMeeting* functions in this way: (i) The particular collaborator clicks on the large “broadcast” button to begin broadcasting both his image and sound to everyone else in the meeting. (ii) when the particular collaborator wants to terminate the broadcasting, the button has to be clicked again to stop. (iii) Only one person at the time can speak; if one



of the other collaborators has something very urgent to say, he can press the interrupt button. However, in our case, the collaborators rarely use the interrupt button. (iv) If a person clicks on the “broadcast” button when another person is already broadcasting, then that person will join the “queue”. If that particular person is the first in the queue, then when the broadcaster finishes that person automatically begins broadcasting. The hand button is used to indicate the position of the collaborators in the queue.

The *FlashMeeting* can be replayed by using *FlashMeeting Memo*. Below, is the typical user interface of the *FlashMeeting Memo* and its functions.

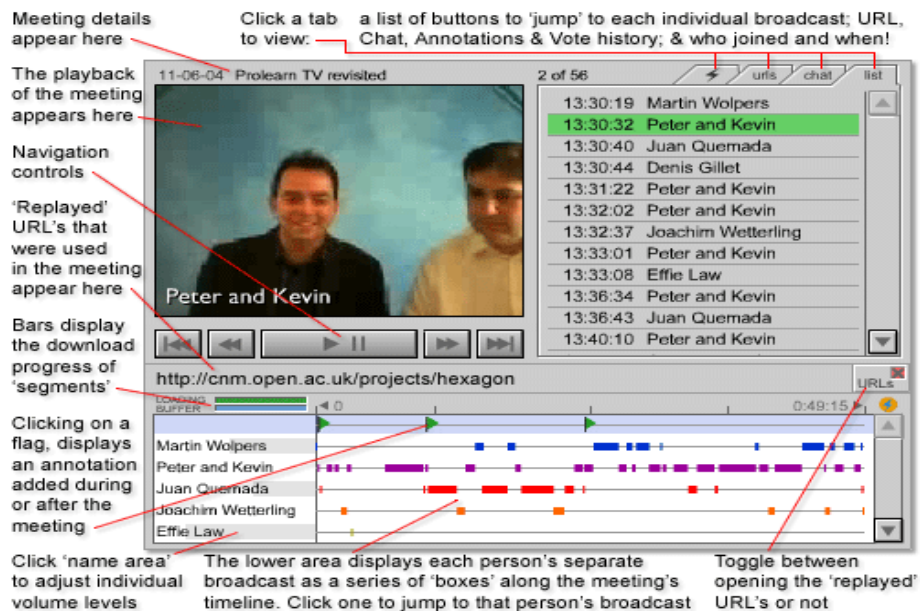


Figure 2.1 (e): FlashMeeting Memo features. Excerpted from (Cnm, 2005).

*FlashMeeting Memo* (Figure 2.1 (e)) has these features: (i) ability to view secure and private recording of the online meetings; (ii) navigation around each section to watch the whole meeting; (iii) see a list of participants and the time they joined; (iv) read “time-stamped” text chat written during the meeting; (v) see a list of URL's and the time they were sent. It provides the facility for us to replay the meetings for transcribing the actual conversations. It also provides the facility of seeing how the coordination and reaction of group members when someone is broadcasting. We show below the actual *FlashMeeting Memo* playback meetings.

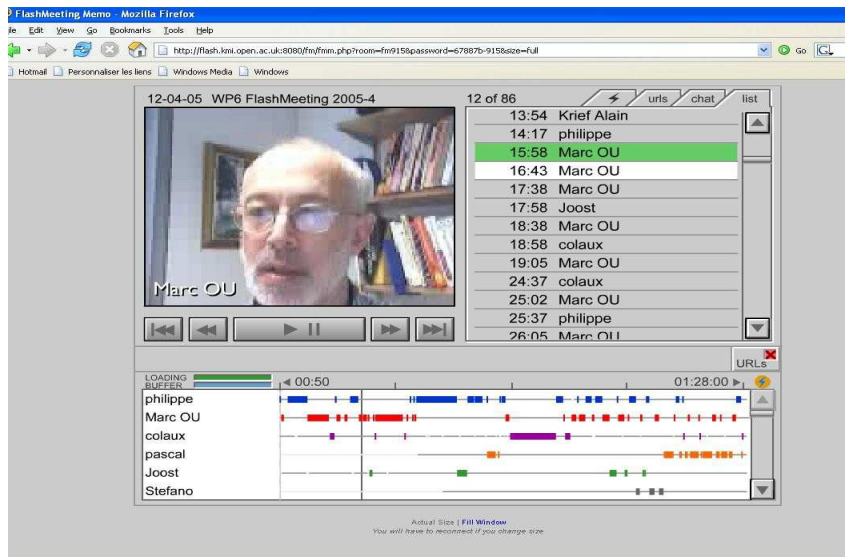


Figure 2.1(f): *FlashMeeting Memo* user interface. Marc is now speaking to the rest of the group.

Figure, 2.1(f), Marc Eisenstadt is broadcasting in a meeting. Another view of the *FlashMeeting Memo* function is show in figure 2.1(g).

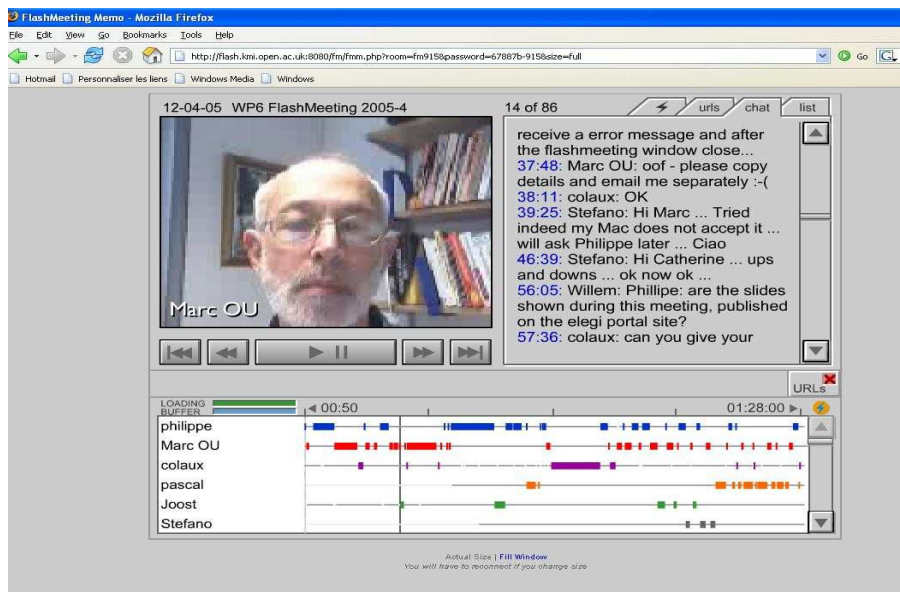
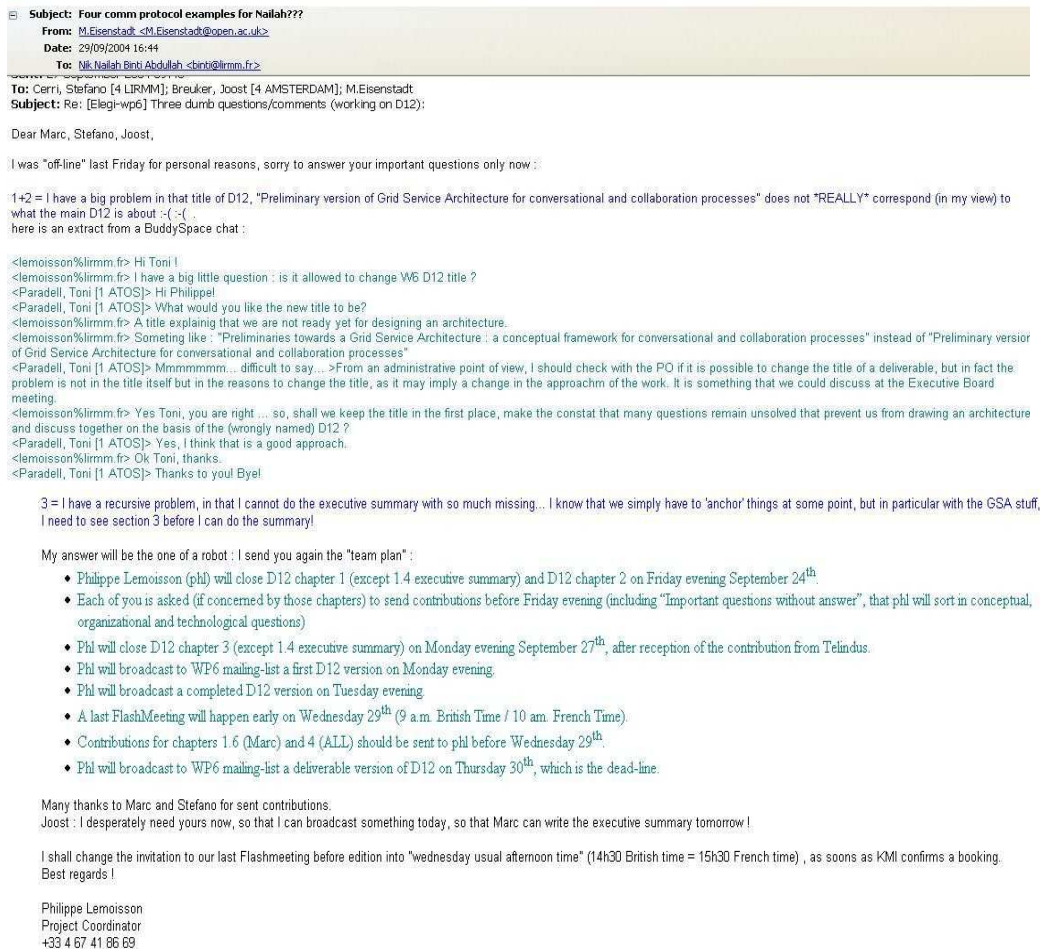


Figure 2.1 (g): *FlashMeeting Memo* user interface, later in a meeting.

Referring to Figure 2.1 (g), during the online meetings, the collaborators can also type chat messages. The text chat also allows us to capture the reaction of some of the collaborators during broadcasting. The collaborators may also send URL links to one another. For example, some of them (referring to Figure 2.1 (g)) are making side comments on the chat, while the broadcaster is speaking. These comments could be about the tool that they are using at that moment (in this example, they are discussing technical problems they had encountered). The subject is always changing, while some are complaining of the technical problems, about 10

minutes later, Williem is asking if the slides are on the portal (corresponding to what what had been discussed at the moment).

The collaborators also use a commercial e-mail system for sending and receiving e-mails (e.g. Microsoft Outlook, or Mozilla Thunderbird). The e-mails could be a composition of many things like a retrieval of chat logs, shown in Figure 2.1 (i).



Subject: Four comm protocol examples for Nailah???

From: M.Eisenstadt <M.Eisenstadt@open.ac.uk>  
Date: 29/09/2004 16:44  
To: Nik.Nailah Binti Abdullah <bnbt@lirmm.fr>

To: Cerri, Stefano [4 LIRMM]; Breuker, Joost [4 AMSTERDAM]; M.Eisenstadt  
Subject: Re: [Elegi-wp6] Three dumb questions/comments (working on D12):

Dear Marc, Stefano, Joost,

I was "off-line" last Friday for personal reasons, sorry to answer your important questions only now :

1+2 = I have a big problem in that title of D12, "Preliminary version of Grid Service Architecture for conversational and collaboration processes" does not \*REALLY\* correspond (in my view) to what the main D12 is about :-(-. here is an extract from a BuddySpace chat :

<lemoisson%lirmm.fr> Hi Toni !  
<lemoisson%lirmm.fr> I have a big little question : is it allowed to change W6 D12 title ?  
<Paradell, Toni [1 ATOS]> Hi Philippe!  
<Paradell, Toni [1 ATOS]> What would you like the new title to be?  
<lemoisson%lirmm.fr> A title explaining that we are not ready yet for designing an architecture.  
<lemoisson%lirmm.fr> Something like : "Preliminaries towards a Grid Service Architecture : a conceptual framework for conversational and collaboration processes" instead of "Preliminary version of Grid Service Architecture for conversational and collaboration processes"  
<Paradell, Toni [1 ATOS]> Mmmmmmm... difficult to say...>From an administrative point of view, I should check with the PO if it is possible to change the title of a deliverable, but in fact the problem is not in the title itself but in the reasons to change the title, as it may imply a change in the approach of the work. It is something that we could discuss at the Executive Board meeting.  
<lemoisson%lirmm.fr> Yes Toni, you are right ... so, shall we keep the title in the first place, make the constat that many questions remain unsolved that prevent us from drawing an architecture and discuss together on the basis of the (wrongly named) D12 ?  
<Paradell, Toni [1 ATOS]> Yes, I think that is a good approach.  
<lemoisson%lirmm.fr> Ok Toni, thanks.  
<Paradell, Toni [1 ATOS]> Thanks to you! Eyet

3 = I have a recursive problem, in that I cannot do the executive summary with so much missing... I know that we simply have to 'anchor' things at some point, but in particular with the GSA stuff, I need to see section 3 before I can do the summary!

My answer will be the one of a robot : I send you again the "team plan" :

- Philippe Lemoisson (phl) will close D12 chapter 1 (except 1.4 executive summary) and D12 chapter 2 on Friday evening September 24<sup>th</sup>.
- Each of you is asked (if concerned by those chapters) to send contributions before Friday evening (including "Important questions without answer", that phl will sort in conceptual, organizational and technological questions)
- Phl will close D12 chapter 3 (except 1.4 executive summary) on Monday evening September 27<sup>th</sup>, after reception of the contribution from Telindus.
- Phl will broadcast to WP6 mailing-list a first D12 version on Monday evening.
- Phl will broadcast a completed D12 version on Tuesday evening
- A last FlashMeeting will happen early on Wednesday 29<sup>th</sup> (9 a.m. British Time / 10 am. French Time).
- Contributions for chapters 1.6 (Marc) and 4 (ALL) should be sent to phl before Wednesday 29<sup>th</sup>.
- Phl will broadcast to WP6 mailing-list a deliverable version of D12 on Thursday 30<sup>th</sup>, which is the dead-line.

Many thanks to Marc and Stefano for sent contributions.  
Joost : I desperately need yours now, so that I can broadcast something today, so that Marc can write the executive summary tomorrow !

I shall change the invitation to our last Flashmeeting before edition into "wednesday usual afternoon time" (14h30 British time = 15h30 French time) , as soon as KMI confirms a booking.  
Best regards !

Philippe Lemoisson  
Project Coordinator  
+33 4 67 41 86 69

Figure 2.1 (h): An excerpt from the actual e-mail correspondence between the project coordinator with the project executives.

In Figure 2.1 (h), the project coordinator used an alternative communication approach to answering some of the urgent questions from the three project executives of the EleGI. Looking at Figure 2.1(h) again, the project coordinator used *BuddySpace* to reach a particular person for obtaining the desired answers as a medium to convey the concerns of those project executives. To give a clearer view, we resize that particular retrieved chat logs shown in Figure 2.1 (h) in Table 2.1 (i).

Table 2.1(i): Retrieving chat logs as e-mail composition for clarifying and answering certain situations.

<lemoisson%lirmm.fr> Hi Toni !  
<lemoisson%lirmm.fr> I have a big little question : is it allowed to change W6 D12 title ?  
<Paradell, Toni [1 ATOS]> Hi Philippe!  
<Paradell, Toni [1 ATOS]> What would you like the new title to be?  
<lemoisson%lirmm.fr> A title explaining that we are not ready yet for designing an architecture.  
<lemoisson%lirmm.fr> Something like : "Preliminaries towards a Grid Service Architecture : a conceptual framework for conversational and collaboration processes" instead of "Preliminary version of Grid Service Architecture for conversational and collaboration processes"  
<Paradell, Toni [1 ATOS]> Mmmmmmm... difficult to say... >From an administrative point of view, I should check with the PO if it is possible to change the title of a deliverable, but in fact the problem is not in the title itself but in the reasons to change the title, as it may imply a change in the approach of the work. It is something that we could discuss at the Executive Board meeting.  
<lemoisson%lirmm.fr> Yes Toni, you are right ... so, shall we keep the title in the first place, make the constant that many questions remain unsolved that prevent us from drawing an architecture, and discuss together on the basis of the (wrongly named) D12 ?  
<Paradell, Toni [1 ATOS]> Yes, I think that is a good approach.  
<lemoisson%lirmm.fr> Ok Toni, thanks.  
<Paradell, Toni [1 ATOS]> Thanks to you! Bye!

There were originally three main concerns from the project executives directed to the project coordinator. The question was brought up by Marc Eisenstadt particularly that in his opinion, the deliverables did not correspond with the main focus of the project. (we could not locate these issues in the chat logs). We assume that the concerned party (Marc Eisenstadt) had sent an e-mail to Philippe Lemoisson since he was not reachable by BuddySpace. In answering question 1 and 2, the project coordinator retrieved his chat logs with the concerned party. We assume from our analysis, in doing this, the project coordinator did not have to explain again how the question-answer scenario went between him and the concerned party. At the same time, this provides as a justification and evidence that those urgent questions had been given attention. We also make an assumption that perhaps with this procedure the issue raised cannot be dispute further as the instructions were very clear coming from Toni Paradell (a project executive at a higher level). This way of retrieving actual chat logs and re-pasting it in the e-mail avoids miscommunication or misinterpretation (for example the project coordinator could had instead merely re-phrased or summarized the brief meeting between him and Toni Paradell). Secondly, for answering the third question raised by the other collaborators, the project coordinator reasserts the primary team plan.

## 2.2 The moment of “thrownness”

Before, we illustrate how the project coordinator gets used to the web communications and how the project progresses, we properly illustrate the notion of “thrownness” adapted from Winograd et al (1986). Then we relate this “thrownness” situation to our own analysis of the EleGI scenario.

“Image that you are chairing a meeting of fifteen or so people, at which some important and controversial issue is to be decided: say, the decision to bring a new computer system into the organization. As the meeting goes on you must keep things going in a productive direction, *deciding whom to call on, when to cut a speaker off, when to call for an end of discussion* or a vote, and so forth. There are forcefully expressed differences of opinion, and if you don't take a strong role the discussion will quickly deteriorate into a shouting match dominated by the loudest, who will keep repeating their own fixed positions in hopes of wearing everyone else down” (Winograd et al, 1986, pp. 34-35).

Referring to the underlined word, we invert the idea on what appears as the moment of thrownness to the context as how people go with the flow by inducing communication protocols. If we were to relate this idea to Bateson (1972 & 1979) then we would have to go back how the levels of learning and communication (hierarchy of learning and communication by Bateson (1972)) that are changing that enable people to learn and to know how to handle the moment of “thrownness” if ever a similar moment was to re-occur. The notion of punctuation of events are like those illustrated above; an event that could be to decide whom to call on, or when to call for an end to a meeting. We continue illustrating several scenarios representing the moment of “thrownness”.

- *You cannot avoid acting.* At every moment, you are in position of authority, and your actions affect the situation. If you just sit there for a time, letting things go on in the direction they are going that in itself constitutes an action, with effects that you may or may not want. You are “thrown” into action independent of your will.
- *You cannot step back and reflect on your actions.* Anyone who has been in this kind of situation has afterwards felt “I should have said..” or “I shouldn't have let Joe get away with...” In the need to respond immediately to what people say and do, it is impossible to take time to analyze things explicitly and choose the best course of action. In fact, if you stop to do so you will miss some of what is going on, and implicitly choose to let it go on without interruption. You are thrown on what people loosely call your “instincts”, dealing with whatever comes up.

- *The effects of actions cannot be predicted.* Even if you had time to reflect, it is impossible to know how your actions will affect other people. If you decide to cut someone off in order to get to another topic, the group may object to your heavy-handedness that in itself becoming a topic of discussion (recall Chapter 1 on the NASA scenario). If you avoid calling on someone whose opinion you don't like, you may find that he shouts it out, or that a friend feels compelled to take up his point of view. Of course this doesn't imply things are total chaos, but simply that you cannot count on careful rational planning to find steps that will achieve your goals. You must, as the idiom goes, “flow with the situation”

These are just some of the examples which we excerpted from Winograd et al (1986) on the illustrations on the notion of “thrownness”. From here onwards, we move on to some primitive analysis of the actual EleGI joint project web communications. Let us reveal some moment of “thrownness”.

### **2.3 Actual EleGI chats over the BuddySpace**

In this section, we illustrate how the project coordinator slowly familiarizes himself with the new web communication environment. Then from here onwards, we illustrate how they progress from using the BuddySpace to having the first FlashMeeting. Next, we see how the project collaboration progresses (writing up deliverables and submitting it on time). We shall also demonstrate how the group members organize themselves to go on their first FlashMeeting.

Table 2.3 (a): Demonstrating online how to use a one to one chat.

```
[2004/03/09 11:03] <m.eisenstadt%open.ac.uk> Here you go: this is a more typical 'chat'
situation...
[2004/03/09 11:04] <m.eisenstadt%open.ac.uk> if you press the 'sailboat' icon at the top of this
window, you can 'float' the chat window separately...
[2004/03/09 11:04] <m.eisenstadt%open.ac.uk> But I suggest you urgently adjust the Preferences
(in the menu item: Jabber... Preferences... Alerts..)
[2004/03/09 11:04] <Lemoisson, Philippe> ok, it seems nice
[2004/03/09 11:04] <m.eisenstadt%open.ac.uk> ..in order to fix both the sound you want (you can
set your own)... and more importantly..
[2004/03/09 11:05] <Lemoisson, Philippe> the sound is ok
[2004/03/09 11:05] <m.eisenstadt%open.ac.uk> you probably want to UN-Select 'auto-popup new
messages'
[2004/03/09 11:05] <m.eisenstadt%open.ac.uk> (because when 'checked' it 'grabs control of your
mouse focus')
[2004/03/09 11:05] <Lemoisson, Philippe> eveything seems ok now
[2004/03/09 11:06] <m.eisenstadt%open.ac.uk> Note also that there is a little 'typing...' indicator at
the bottom...
[2004/03/09 11:06] <m.eisenstadt%open.ac.uk> next to the URL button..
[2004/03/09 11:06] <m.eisenstadt%open.ac.uk> so you can see when I'm about to reply..
[2004/03/09 11:06] <Lemoisson, Philippe> hum ...
[2004/03/09 11:08] <Lemoisson, Philippe> By the way, how is it that you are not "on line" in the
Roster
[2004/03/09 11:10] <m.eisenstadt%open.ac.uk> really?
[2004/03/09 11:10] <m.eisenstadt%open.ac.uk> oops... I don't know..
[2004/03/09 11:16] <m.eisenstadt%open.ac.uk> now YOU should up as offline ('red')
[2004/03/09 11:16] <m.eisenstadt%open.ac.uk> are you still there?
[2004/03/09 11:16] <m.eisenstadt%open.ac.uk> (and am I now 'green' in the Roster?)
```

This is an excerpt of the actual conversations at a part of the beginning stage. (The project executive sent a broadcasting message a-priori to welcome new EleGI members to the environment). The project coordinator firstly received an e-mail that contains instructions on how to install the BuddySpace. According to the project coordinator, he believes<sup>11</sup> that the e-mail was a generic instruction sent to interested people. Secondly, the project coordinator himself created the BuddySpace account by following the instructions. The project coordinator (Lemoisson, Philippe) was familiarizing himself with the chatting environment. He was getting familiar with the help of one of the project executives. The project executive (m.eisenstadt), happens to be the project leader of BuddySpace tool. M.eisenstadt went online to welcome the project coordinator to this new environment. Moment by moment, the project coordinator was getting himself familiarized with the new “social web” environment through the instructions by m.eisenstadt and perhaps through his own exploration. On the other hand, the m.eisenstadt might have been visualizing what the others might be visualizing and conceiving at the other end when explaining the functions of the tools. Referring to the Table 2.3(a), the flow of the conversations subjects cannot be predicted. This may likely be because what they are both conceiving at the same moment are not of the same thing (one being on the other side of the media, and the other one on another media). The project coordinator is coordinating himself to reading the instructions at the same time looking at the user interface and functions of the BuddySpace (exploration). Particularly, if readers analyze this

<sup>11</sup>We would like to thank Philippe Lemoisson, the project coordinator for his kind cooperation for allowing us to interview him to recall back how he first got on BuddySpace.

particular fragment from Table 2.3 (a) beginning at this moment demonstrated in Table 2.3(b):

Table 2.3(b). Distracted by the tool.

A moment of thrownness for the other party- the affects of actions cannot be predicted.

```
[2004/03/09 11:06] <m.eisenstadt%open.ac.uk> so you can see when I'm about to reply..
[2004/03/09 11:06] <Lemoisson, Philippe> hum ...
[2004/03/09 11:08] <Lemoisson, Philippe> By the way, how is it that you are not "on line" in the
Roster
[2004/03/09 11:10] <m.eisenstadt%open.ac.uk> really? oops... I don't know..
[2004/03/09 11:16] <m.eisenstadt%open.ac.uk> now YOU should up as offline ('red')
[2004/03/09 11:16] <m.eisenstadt%open.ac.uk> are you still there?
[2004/03/09 11:16] <m.eisenstadt%open.ac.uk> (and am I now 'green' in the Roster?)
```

The conversations subjects are *dynamic* and *situated* at what the individuals are actively focused at the moment. This short example, Table 2.3 (b) illustrates a moment of “thrownness” for both parties. For example, the project coordinator was following instructions and exploring the tools following the online instructions. However, he was distracted by a particular fact that “Marc Eisenstadt” is not online on the Rooster”, during his exploration. Interestingly, towards the end of the chat, they both ended up in a short tutorial on another solution on how to reach each other whenever this incident occurs. Also, the project coordinator briefly learned something new about the functions and representation of the tool.

We show in Table 2.3 (c).



Table 2.3 (c): From troubleshooting to a short tutorial.

[2004/03/09 11:16] <Lemoisson, Philippe> i am  
[2004/03/09 11:16] <m.eisenstadt%open.ac.uk> interesting...  
[2004/03/09 11:17] <m.eisenstadt%open.ac.uk> I can only reach you now by pressing the little 'eyeball' icon at the top ('show all users') which shows me the 'offline' users too... we will fix this.  
[2004/03/09 11:17] <Lemoisson, Philippe> and i am neither green nor red, but grey, from the beginning.  
[2004/03/09 11:17] <m.eisenstadt%open.ac.uk> ah, your OWN icon is different:  
[2004/03/09 11:17] <m.eisenstadt%open.ac.uk> (because you can be logged in multiple times with different 'resources')  
[2004/03/09 11:18] <Lemoisson, Philippe> I do not understand : I thought my status was global !  
[2004/03/09 11:19] <m.eisenstadt%open.ac.uk> it is: but there is no 'TRUE' view of your own presence!! That is because we allow multiple presence states: I can be in 'Do Not Disturb' mode for my KMi colleagues, but 'Online' for EleGI  
[2004/03/09 11:20] <m.eisenstadt%open.ac.uk> So we show 'grey' for yourself!  
[2004/03/09 11:20] <m.eisenstadt%open.ac.uk> (Because you KNOW your own state anyway!!)  
[2004/03/09 11:20] <Lemoisson, Philippe> Ok, I get aware of this new dimension  
[2004/03/09 11:21] <m.eisenstadt%open.ac.uk>  
[2004/03/09 11:21] <Lemoisson, Philippe>  
[2004/03/09 11:23] <Lemoisson, Philippe> Thanks a lot for this lesson n°1 !

Referring to Table 2.3 (c), the chat was initially about demonstrating to the project coordinator about a typical 1 to 1 chat environment. Then in an *unexpected event (in a moment of thrownness)*, the chat subject turns into troubleshooting the BuddySpace because of the presence problem that finally ended up in a short tutorial whereby m.eisenstadt did not anticipate for this to happen (of giving a short tutorial after), starting from his explanation on how he was able to reach the project coordinator by the “eyeball”. On the other hand, those events become a mark to denote a punctuation of events (Bateson, 1972). For example, starting from the 3<sup>rd</sup> line, m.eisenstadt started to give a short tutorial, here denotes a punctuation of events. We hypothesize that whenever, a similar situation of thrownness comes about, he may perhaps learn from this experience that if someone is new to this environment, he should include this instructions (multiple ways of reaching a person in case that this ever happens)<sup>12</sup>.

Now, we look into another scenario, when the project coordinator learns by observing how the project executive goes online to start a chat (during the beginning stage) he took up “e-manners”. We excerpt another chat logs to show this in Table 2.3 (d).

<sup>12</sup>We will show that in some cases, after several recurrences, the individual starts to learn to “punctuate the events”.

Table 2.3 (d): Learning e-manners.

```
[2004/03/19 13:45] <Lemoisson, Philippe [4 UM2/LIRMM]> Hello Marc,  
[2004/03/19 13:46] <Lemoisson, Philippe [4 UM2/LIRMM]> Once again, I forgot to change my  
"presence status" when going out, sorry !  
[2004/03/19 13:48] <Lemoisson, Philippe [4 UM2/LIRMM]> Now, I have activated a screen saver, so  
that it does not happen anymore !
```

Table 2.3 (d) illustrates an event that had taken place twice. The project coordinator left the computer without changing his presence (e.g., online, away or DND). The project executive sent messages to the project coordinator because he was shown as being “online”. Starting from those recurrence of events, the project coordinator became more aware and found a solution so that it won't happen anymore (and so maybe after this recurrence of patterns, he had learn to “punctuate the events”?).

At the beginning stage from when BuddySpace was installed, it took some months before one of the other project executives were able to go online because of technical problems. We show in Table 2.3 (e).

Table 2.3 (e) : Getting everyone using BuddySpace- constraint by technical problems.

```
[2004/04/19 10:00] <m.eisenstadt%open.ac.uk> is Stefano logged in now?  
[2004/04/19 10:00] <m.eisenstadt%open.ac.uk> (I don't see him in my roster)  
[2004/04/19 10:00] <Lemoisson, Philippe [4 UM2/LIRMM]> Stefano ... I can touch him  
[2004/04/19 10:00] <m.eisenstadt%open.ac.uk> aha  
[2004/04/19 10:00] <m.eisenstadt%open.ac.uk> but is he using BuddySpace?  
[2004/04/19 10:00] <m.eisenstadt%open.ac.uk> (so I can touch him too)  
[2004/04/19 10:01] <Lemoisson, Philippe [4 UM2/LIRMM]> He still has a problem with his machine*  
[2004/04/19 10:01] <m.eisenstadt%open.ac.uk>  
[2004/04/19 10:01] <m.eisenstadt%open.ac.uk> oh well... don't worry..
```

It was not a very easy task in the beginning to get the group members to become familiar with the web communication tools. Some prefer conventional way of phoning to speak about the project or simply using the e-mail system. But we noted, after a while, the group members started to become familiar with using the BuddySpace (and actually enjoy using it). It also became a daily routine to go online to ask urgent questions or just to say hi (sometimes complaining of work task).

Occasionally, while chatting, the subject of organizing the joint task sometimes turns (frequently) about troubleshooting the tool. We show in Table 2.3 (f).

Table 2.3 (f): Troubleshooting the tool.

```
[2004/04/19 11:03] <Lemoisson, Philippe [4 UM2/LIRMM]> buddy space was suddenly frozen
[2004/04/19 11:03] <m.eisenstadt%open.ac.uk> WHILE TRUE DO: <deposit money into account of
William Gates III>
[2004/04/19 11:04] <Lemoisson, Philippe [4 UM2/LIRMM]> ha
[2004/04/19 11:04] <m.eisenstadt%open.ac.uk> ah, buddyspace frozen... hmmm..
[2004/04/19 11:04] <m.eisenstadt%open.ac.uk> WHILE TRUE DO: <deposit money into account of
Bill Joy & Bill Gosling>
[2004/04/19 11:04] <m.eisenstadt%open.ac.uk> (i.e. that's a Java bug)
[2004/04/19 11:04] <m.eisenstadt%open.ac.uk> or rather Java Runtime Environment... nothing we
can do
[2004/04/19 11:05] <Lemoisson, Philippe [4 UM2/LIRMM]> anyway ,did the "Bill gates/ppt"
reach you ?
[2004/04/19 11:05] <m.eisenstadt%open.ac.uk> did you have an open 'dialog box' when the freeze
occurred?
[2004/04/19 11:05] <Lemoisson, Philippe [4 UM2/LIRMM]> Nothing, I had to kill the process with
Task manager !
[2004/04/19 11:07] <m.eisenstadt%open.ac.uk> aargh
[2004/04/19 11:07] <m.eisenstadt%open.ac.uk> you mean you weren't doing anything other than
typing to me?
[2004/04/19 11:07] <Lemoisson, Philippe [4 UM2/LIRMM]> sorry
[2004/04/19 11:08] <m.eisenstadt%open.ac.uk> (maybe you were opening powerpoint)?
[2004/04/19 11:08] <Lemoisson, Philippe [4 UM2/LIRMM]> of course I had many other processes
open
[2004/04/19 11:08] <m.eisenstadt%open.ac.uk> just trying to diagnose the process...
[2004/04/19 11:08] <m.eisenstadt%open.ac.uk> OK; well, let me know if it happens again... worth
notging the context...
```

From this chat logs, we analyze that sometimes the interaction between several tools/software interrupts the progress of the project chats. By analyzing the interruptions/breakdown situations, these recurrence problems may represent how a person organizes their work moment by moment. In this example, it is quite natural for computer scientist to have many different processes opened and working simultaneously on different matters. And we also noted that there are no exact regulation of turn taking in this scenario. The problem with BuddySpace freezing had become the goal at the moment of M.eisenstadt, while on the other hand, Lemoisson wanted a confirmation whether the ppt. slides had reached M.eisenstadt. Finally, after several sequences, M.eisenstadt answered that he had indeed received the ppt slides in good order.

The project collaboration was slowly progressing, step by step. Firstly, by resolving minor technical issues, secondly, trying to get everyone to start using the BuddySpace, and then introducing them to FlashMeeting as the next step. We illustrate in Table 2.3 (g).

Table 2.3 (g): Getting all to start using FlashMeeting.

[2004/04/19 11:14] <m.eisenstadt%open.ac.uk> Final point = we are going to add a 'FlashMeeting' button right into BuddySpace (next week)...

[2004/04/19 11:14] <m.eisenstadt%open.ac.uk> so we can immediately begin having a few online/virtual discussions ...

[2004/04/19 11:15] <m.eisenstadt%open.ac.uk> ...we want to use this HEAVILY to begin discussing real 'things' for WP6...

[2004/04/19 11:15] <Lemoisson, Philippe [4 UM2/LIRMM]> nice, meaning that we shall see eachother ?

[2004/04/19 11:15] <m.eisenstadt%open.ac.uk> yes, exactly!

[2004/04/19 11:15] <Lemoisson, Philippe [4 UM2/LIRMM]> and what about exchanging documents ?

[2004/04/19 11:15] <Lemoisson, Philippe [4 UM2/LIRMM]> and what about sharing documents ?

[2004/04/19 11:16] <Lemoisson, Philippe [4 UM2/LIRMM]> users, you know ...

[2004/04/19 11:16] <m.eisenstadt%open.ac.uk> ...next step will be whiteboard and doc sharing...

[2004/04/19 11:16] <Lemoisson, Philippe [4 UM2/LIRMM]> .. they always want more !

[2004/04/19 11:16] <m.eisenstadt%open.ac.uk> I personally am not convinced about 'joint editing in real time'

[2004/04/19 11:16] <m.eisenstadt%open.ac.uk> That is why we kept FlashMeeting so simple

[2004/04/19 11:17] <Lemoisson, Philippe [4 UM2/LIRMM]> simpleness is very important !

[2004/04/19 11:17] <m.eisenstadt%open.ac.uk> ... as long as we can see a common screen... e.g. to discuss the 3 axes... etc...

[2004/04/19 11:18] <m.eisenstadt%open.ac.uk> do you keep a videocamera plugged in?

[2004/04/19 11:18] <m.eisenstadt%open.ac.uk> I mean webcam?

[2004/04/19 11:19] <Lemoisson, Philippe [4 UM2/LIRMM]> I have one home ready to plug here ,we haven't bought ELeGI toys yet (time for opening budget ...) but shall soon !

[2004/04/19 11:19] <m.eisenstadt%open.ac.uk> ...so we can already use FlashMeeting for WP6 meetings immediately...

[2004/04/19 11:20] <m.eisenstadt%open.ac.uk> ok; I'll leave you in peace now... maybe as WP6 leader you could gently 'suggest' that everyone gets webcam/microphone 'enabled'!!!!!!!!

The joint project progress quite nicely and incrementally. The conversation topic moves from one topic to the other. When m.eisenstadt mentioned that another extra feature was to be added to FlashMeeting, this had prompted Lemoisson to ask what added advantages shall he obtain from this new feature. It also prompted him into asking if they were able to do other stuff with the new features. The next step was organizing a real meeting in Montpellier. This was a particularly interesting chat conversations, shown in Table 2.3 (h).

Table 2.3(h): Proposing a real meeting in Montpellier via BuddySpace.

[2004/03/19 15:04] <Lemoisson, Philippe [4 UM2/LIRMM]> Hi Marc !  
[2004/03/19 15:05] <Lemoisson, Philippe [4 UM2/LIRMM]> Spring will soon be there, April is a very beautiful month here ...  
[2004/03/19 15:22] <Lemoisson, Philippe [4 UM2/LIRMM]> ... a very beautiful month for spending 3 days together on ELeGI ...  
[2004/03/19 15:23] <m.eisenstadt%open.ac.uk> heh  
[2004/03/19 15:23] <m.eisenstadt%open.ac.uk> early April is very hard for both me and Jiri..  
[2004/03/19 15:24] <Lemoisson, Philippe [4 UM2/LIRMM]> What would the sooner convenient dates be for you ?  
[2004/03/19 15:24] <m.eisenstadt%open.ac.uk> heh: sooner = even more impossible!!  
[2004/03/19 15:25] <Lemoisson, Philippe [4 UM2/LIRMM]> I mean : the sooner in April  
[2004/03/19 15:28] <m.eisenstadt%open.ac.uk> hang on lemme start conf room

Referring to Table 2.3(h), which web medium is used varies on the purpose of the discussion. In this excerpted dialogues, m.eisenstadt switched to another type of channel (conference room) in order to discuss his trip to Montpellier.

Finally, we illustrate how the project coordinator coordinates the group members to go on the FlashMeeting using the e-mail system in Figure 2.3 (i).

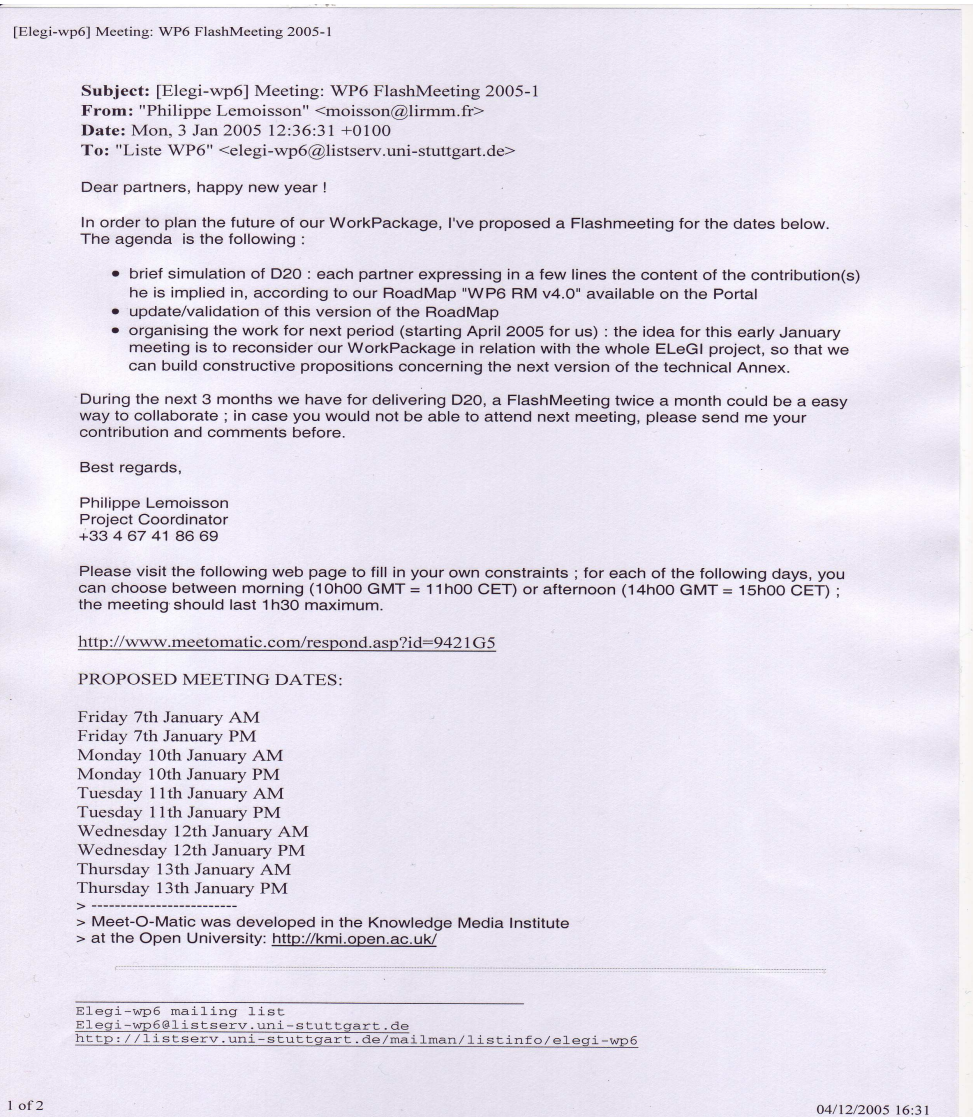


Figure 2.3 (i): An excerpted e-mail sent to the members for organizing a meeting.

Upon receiving this e-mail, interested group members belonging to the group WP6 (workpackage 6) can respond if they are interested to attend by clicking on the Meet-O-Matic link. We show in Figure 2.3(j).

Meet-O-Matic: Use this page to respond to a meeting invitation http://www.meetomatic.com/respond.asp?id=9421G5

[New Meeting](#) | [About](#) | [Quick Start](#) | [Tour](#) | [FAQ](#) | [Help](#) | [Contact Us](#)

## Meet O Matic

### Response to a Meet-O-Matic invitation

**Welcome! You were invited (by email) to an event or meeting, called:  
"WP6 FlashMeeting 2005-1".**  
This custom and private web page lets you specify your availability.


Please type your name into the box below, select available dates, and then press 'Submit' at the bottom.

**Name:**  **Comment: (Optional)**

Tip: Use Select All or Unselect All for speed (selected box = 'yes, count me in!')

**January 2005**

Mon	Tue	Wed	Thu	Fri	Sat	Sun
AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM
					1	2
3	4	5	6	7	8	9
				<input type="checkbox"/> <input type="checkbox"/>		
10	11	12	13	14	15	16
<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>			
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						



Meet-O-Matic: The World's Simplest Meeting Scheduler. Version 2.5. Copyright © meetomatic.com, 2003-2005. All Rights Reserved.

Figure 2.3 (j): Let us know when and who is attending the meeting.

Figure 2.3(j), represents the Meet-O-Matic online. Group members fill in their names and comment (if any) and is able to select the dates they prefer (am or/and pm). This section has briefly introduced how the EleGI joint project slowly takes its shape in a form of a collaborative attempt. It also demonstrates how a group member was getting used to BuddySpace.

## 2.4 Actual EleGI project meetings over the FlashMeeting

In the previous section, we illustrated how the joint project slowly progresses from using the BuddySpace communication channel to organizing a FlashMeeting. During this stage, we recorded and transcribed the meetings (each meeting lasting almost about an hour and a half). We excerpt some transcribed meetings in Table 2.4 (a) on the first WP6 meeting held over the FlashMeeting.

Table 2.4 (a): The first actual WP6 meeting carried out over the Flashmeeting.

Ph: Stefano, can you hear me?

St: Yes, we hear you but marc is not there. Oh we have marc and jiri. Hi marc.

M & J : HI everybody, everybody ok. I had just rushed back from lunch. Very good to see everybody.

Ph: Yes, good afternoon to everybody. I could see somebody from telindus, not looking like iris, maybe he can introduce to us.

Iris: Hello everybody. I am the colleague of iris, she's just coming up, in a few moments she's here.

M: btw, you all notices, there's a slightly new interface from what we used last time. So, now you notice, down below, if you click on the little chat tab, you shd see it highlighted in green actually, makes it a little easier to have a simultaneously chat while others discussion is going on.

S: Hi, Iris, how are you doing?

M: Hello iris, welcome to Flashmeeting. Hope the technology is working well for you. You probably work out on the hand button to raise your hand or you click on the interrupt button if you have something urgent to say. It's a strictly push to talk model because that makes the audio simply works a lot more reliably and it also it makes the replay of the meeting well because we know exactly who's talking at any moment. And you can stop broadcast anytime just by clicking on the , in fact un broadcasting or broadcasting again and someone will take the floor.

P: Good afternoon everybody. I am Philippe Lemoisson from Lirimm and maybe we are sized together online, maybe we could just start the meeting. So I shall start ..well, today's meeting is of course about our deliverables, WP6, that we should deliver before September 30, this means that we have 2 weeks of maybe hard work in order to do it, to finish it. Before we start, I would maybe start with the different questions. That we should take into consideration today. What have got to deliver, what is currently available and the what can be done in 2 weeks time. What have got to deliver, maybe it is not perfectly clear, for everybody because the title of D12 of our Wp6 preliminaries of web services, architecture for collaboration and conversational processes.



So there are many words around in this title, many word which we have fought a lot, already something has already been written, but what I would like to outline. It is important to know what we are going to do after I mean in the next fall, winter, spring, summer and fall again. What are we going to do as a work package and as collection of different teams in different laboratories and maybe I can just ask the question to everybody, what everybody, what each of us thinks of the next step for us. Next going with the people of sees1 meaning talking with Arnaud Martin and reading what the chemist has written also, we have thought that maybe these two tools Buddyspace and Dxyweb in a kind of interconnection should be on what we should focus on technological point of view. So if we have other tools we should try and mention them now, otherwise it is good to know these, what we are going to do afterwards in order to make the plan out the deliverables.

M: I am certainly happy to kick off with just a few words, I think of the maybe start at a maybe coarse grain level and maybe we can iterate through. Oh, by the way, hello pascal, either attempt login or just login, he's not shown on his video yet. The coarse grain story is that..the uhm..the 1<sup>st</sup> out of the 4 biggest thing that we have to do is get our heads around the integration of the Buddyspace integration of the buddyspace architecture with the grid architecture, that's on a kind on the technology level, conceptually..in fact is a technical issue, about integrating the kinda ideas Buddyspace and enhanced presence with the ideas of Montpellier about conversations and where that's going and that's probably the conceptual ones are the hardest and the 3<sup>rd</sup> issue is looking demonstrators and sees1 soon..but I think that those are kinda simpler, but let me hand back to Philippe in case I am addressing the wrong level, go ahead...

Ph: yes, thank you Marc and I am very happy with what you said because I was thinking with this kind of pragmatic answer. I think what we are going to do in the next month is in a way gratify, interconnect and broadcast existing tools. The first is of which Buddyspace and the maybe the second of which is Dxyweb which is our tool still in progress for capitalizing knowledge through XML documents and talking with Arnaud Martin and reading what the chemist has written also, we have thought that maybe these two tools Buddyspace and Dxyweb in a kind of interconnection should be on what we should focus on technological point of view. So if we have other tools we should try and mention them now, otherwise it is good to know these, what we are going to do afterwards in order to make the plan out the deliverables.

Figure 2.4 (a), the meetings illustrate how the group members started off to discuss their deliverables (writing a proposal under the WP6: D12 document). When analyzing the conversations, we assume that they had already discussed some preliminaries ideas and issues, either through 1-to-1 chat on BuddySpace, phoning or e-mailing each other. During this stage, the analyses was trackable, but when it came to differences in opinions, way of workings and technical problems, then the analyses became extremely complex.

One of the group members informed that the tool at certain times constrain him from voicing out his opinion at a moment another broadcaster is broadcasting (because of the queue system). For example, when someone is broadcasting his

opinion on the project progress, the other group member that is 3<sup>rd</sup> in queue wants to respond immediately because it had “triggered” or “stimulated” him to “object” or add his “opinion” during this particular discussion, but is unable to do. He has to wait until his turn arrives, and by the time his turn arrives he has forgotten (occasionally) what his issues were during that point of discussions. Even if there is the interrupt button that allows him to interrupt the conversation, the group member felt that it was rude to do so<sup>13</sup>. On the other hand, the project leader of the BuddySpace is quite comfortable to press the “interrupt button” whenever there is some miscommunication or technical problem (e.g., “Sorry Joost, I can't hear you, can you please repeat”). Another group member (students associated to the WP6) uses the FlashMeeting interrupt button almost spontaneously (regularly).

Referring again to Table 2.4 (a), this is when we have to apply different method of analysis. We follow the notion of “participant observers” adapted by a method of ethnomethodology but slightly tuned to the idea of Mary Bateson (1984) that is discussed in the next section. In order to understand human activities from the cognition point of view at the neural mechanism, we have to switch ourselves between multiple impulses for each collaborators. For example, when M was giving his opinion on how to approach the integration of the tools, Ph (at the last paragraph) had automatically comprehend this idea as being a “pragmatic answer”<sup>14</sup>. He had concluded that during M's proposal that this is a pragmatic approach to writing the project deliverables. Thus, we always switch our impulses, conceptualizing what each participant is perhaps actively conceptualizing and comprehending at that moment during meetings and relating it to previous events. One final excerpt from the meeting, we demonstrate that the project deliverable is progressing that involves fine tuning the document, bringing the group members to one voice, at the same time, putting flexible deadlines.

---

<sup>13</sup>We would like to thank Prof. Joost Breuker for allowing us to interview on his personal view on using the FlashMeeting.

<sup>14</sup>Interestingly, we noted that one party is referring to let say a project item of A, the other party readily (infers) this as belonging to project item B. Sometimes, both agree that the A and B belongs to the same context of what the main conversations are about.

Table 2.4 (b): Finding solutions: when goals, directions and way of working are different.

J: Ok, just to inform you about what I think is the current state at least for my part of the work. In fact section 2.5 has to be re-written completely, I started writing on a few days ago, and I threw it all away because it didn't fit at all and now I started a new and only the beginning is available, that says there are 3 phrases in surface discovery or in fact service discovery is one of the phase in getting this...that is the major step but before it's a real conceptual framework. am sorry to say but it will take another 4 or 5 days even to write it down particularly because I discovered that I went wrong, the reason that I went wrong was that I started to explain what conversation was and how it works but that should be in the context of looking for services and things like that. So I've taken another approach and the approach is more top down, so first looking for the goals and then filling all the necessary conditions, that is the reason..from don't know exactly how it can be solved at the administrative view..and also I can work on it on the weekend and also...during my trip tomorrow to amsterdam. That is a possibility but certainly philippe won't accept it.

M: oh..can u say it again..you said..uhmm..because I think that the very last, when you said certainly..you mean our project officer won't accept it. I think also of course you also have other lives to lead. So I don't want..you know..so we have to be careful you know ..i would not want by any means expect to everybody to be working you know 24 hrs a day on this. In many ways the point is to where we can draw a line under it or as newell and simon would call it, satisfying threshold , right..when we are a good enough threshold then *we can submit this go ahead philipe*.

P: Yes, I wld like to just confirm that we cannot afford more days, I mean shall have plenty of time in 1 months that just now we have to finish it to deliver D1 so I understand how joost works and what..the real quality of what joost..you deliver..i understand that this quality you cannot deliver in a few hrs but if u cld give us a drawing or a few ideas..just to tell us ur new ideas..i mean a simple mail or something like this. This would help me to draw some lines of architecture and we could close the due in version 1 without the full conceptual framework.

M: mmm also if I may add..just well I have a maybe I shud let joost come first then I come back I have some..just some very quick comments about the multiple constrains go ahead joost.

J: Yeah I do not have a real solution I can give now the short explanation or later or for that intend to do, I am very afraid it won't help you. I mean even from the framework to architecture, it's simply not possible that is what I will explain is straightforward how..in fact..let's take the human formers of idolized mode of conversations..if that is the case then we get the most complex model yup then complex model is made explain how tools are going to work..it may show where is the functions what kind of function the tools will have, that's the purpose of it, it is not the purpose can't be that you make an architecture out of it. So I don't understand the dependencies understated or it has it escape me totally what the actual of the deliverable is..

M: ok, well, my comment may be similar to Joost in a sense I think is..because we are doing so many things in this document in fact from a quick glance right now, it seems actually very impressive, I have to say, this stuff Joost has provided, is fantastic..i am sorry only looking just now but it looks very interesting, the other thing is the stuff..must be from simon on the a.section 3, also is very interesting ..and I think..the problem is as I see it and I don't know exactly how the result is, I think it's partly resulted at the beginning the problem is, in the sense it's our old problem is that we all, we really come from different universe, so that somebody that is looking at this may say..this is cool/ they say..look../..i see the presence stuff that looks interesting, seems to have some life on it's own, this conversations stuff ah that's cool, grid stuff with it's huge alphabet suite..ahh that looks kinda interesting but what the hell does these 3 things have to do with each other? Absolutely nothing. Now we can make a story , and I know we have each made a story, we each have little links, we have each have little links to the other stuff..this over architecture story, grid, human services make reference back to the service discovery and the agent and the human agent dialouge, joost's framework has some links spoke in the old section, the new section distinguishes between the pure conversations and the service based conversation the stuff on the grid architecture talks a little bit about infrastructure and communication, they are talking reference back and forth. There seems to me 2 solutions. First is to deepen the cross linking which I am sure is what exactly we're gonna do but it seems to me we can either try to deepen that cross linking now which means in the next 5 hrs or just do it later..throughout the project in and later version of the document..and just get this one submitted to the deadline..go ahead philippe..

P: yes I agree perfectly with this point marc, so what I purpose is to definitely close the major entries and I mean especially the framework entries, let us say tomorrow at noon and then I still keep on thinking that it is my duty to make a story of it, just to make the hole a little more coherent so that I can broadcast D1 let us say on friday and maybe we take 1 or 2 days to check that we accept to deliver this document but for this deliverable the big work is over as far as I am concerned.

Table 2.4 (b) illustrates the progress of the meeting, where the deadline for the deliverables is almost expiring. There is a bottleneck during the deliverable that each has its own preferences in approaching how the deliverables should be written and what should be addressed. At the same time, J's role was to write a deliverable speaking about conversational processes (and that is referring to human conversational processes but not to machines). Hence, in the end J became unsure of himself what the deliverables was actually about, was it to be about talking of the architecture of the GRID or human conversational/collaboration processes? How was the link to be made between the two opposing terms and ideas?

Refer to the beginning of the conversations in Table 2.4 (d) we hypothesized that M had inferred<sup>15</sup> what J's intention was about and had pressed the queue button before P (the project coordinator). In sensing this, P had then in turn press

---

<sup>15</sup>In this term, we mean to say he maybe has been learning through out the meetings of how each person works (they behavior and ways of communicating), hence he was able to anticipate what could possibly be J's intention.

the queue button to re-assert that it is indeed impossible to extend the deadline given. After P had pressed the queue button, M had again taken his turn and pressed the queue button, followed by J who had also pressed the queue button. In “sensing that” perhaps it was better to allow J explain himself, M gave up his turn hence “un-broadcast” and let J take the turn. They were all inferring each other's action or anticipating what the next would want to say.

It is very evident by the third meeting that each person progresses to take their own roles. It was also observable that each person has their own strengths and skills in contributing to the project deliverable. The meeting progress with first determining what is to be done, what is to be included, and recognizing the skills and expertise of each group members. Then onwards, they come to an agreement (step by step, after several meeting arguments) who is going to do which part and assigning to their specific task, as the goal was to attempt to fulfill each organization personal goals into one voice in a single deliverable.

For example, we start simply with a “role shaping” idea, Philippe Lemoisson knows (after being in two meetings) exactly when to “raise his hand” (press the queue button) to bring the group focus's back to the main plan that is to deliver the deliverable on a timely basis. He had learned to punctuate certain events (like J starts to go off into another plan that is not cited in the team plan, he punctuates this as “time to get J back to focus now” and press the queue button immediately), and categorizing these events that enables him to *anticipate* when the group discussion is not focusing on the main problem. On the other hand, Marc Eisenstadt takes up the role of connecting ideas and goals from different laboratories and seeks temporary solution that shall satisfy the group members and respect EleGI's deadline and requirements. Now as the time length of the meeting is coming to an end, everyone is putting their heads together on how they can resolve the problem and deliver a consistent deliverable to the EU commission. The focus was first on the content, the ideas, of fulfilling the objective, and it progresses to using correct syntax and discussing which bibliography should be included. The group members also discussed what was the most convenient way of uploading or sending each version and when.

Now, we shall refer to (Sacks et al, 1974) on the systematics for the organization of turn-taking to relate to our own analyses.

In Sacks et al (1974) (pp.700-701), the authors observed the following in any conversations, and we make relationship with what we have analyzed so far. If we note **true** on one of the communication tool, it means that it is not obviously corresponding to the other communication tool (e.g., **true** on BuddySpace therefore **not quite true** from our observation on FlashMeeting and vice versa; **true** simply means true for both).

1. Speaker-change recurs, or at least occurs
  - True on FlashMeeting.

2. Overwhelmingly, one party talks at a time.
  - True on BuddySpace.
3. Occurrences of more than one speaker at a time are common, but brief.
  - Very regularly on BuddySpace but hardly on the FlashMeeting because of the queue system (noted that not unless as we have discussed of the above, the current speaker can infer that the next speaker has more urgent things to say, he “unbroadcast” and give up his turn to the other speaker).
4. Transition (from one turn to a next) with no gap and no overlap are common. Together with transition characterized by slight gap or slight overlap, they make the vast majority of transitions.
  - True
5. Turn order is not fixed, but varies.
  - In some cases, the turn is left unattended on BuddySpace (like emergency, had to leave the laboratory and forgot to switch off the computer, group member on the other line waiting for a response). On FlashMeeting, it happens once when the project executive wanted to say one last word to the project coordinator but was unable to do so because he had logged out of FlashMeeting. However, it is possible that the project executive might have switched to another communication channel (like going back on BuddySpace and sending online/offline messages to the project coordinator). It was actually much easier to leave a subject un-attended because the speaker is able to change her presence online “Busy”, “DND”, “Away”, “On the phone”, “Out to lunch” etc even if the speaker is actually online and just doesn't want to speak to certain people. (e.g., get back to you, but the speaker may never get back to you).
6. Turn size is not fixed, but varies.
  - On BuddySpace, the turn size may be fixed (by the speaker) because limited by the other activities that either he/she have to attend to (e.g., Sorry only have 5 minutes; Err, can you make it quick in 2 secs, I am getting a ride home!; I gotta leave now , have A REAL Meeting for half and hour). On the other hand, on FlashMeeting, the turn size does vary but somehow is fixed for each person. There are regular patterns of who speaks the most during when and at which subject<sup>16</sup>.
7. Length of conversations is not specified in advance.
  - True, but in most cases, the length of the meeting (composed of the group members) is fixed. Hence, each group member are normally aware to give others a chance to “unbroadcast” so those who are in 2<sup>nd</sup>, 3<sup>rd</sup>, or 4<sup>th</sup> queue may have their time to voice out their opinions.
8. Relative distribution of turns is not specified in advance.
  - True, but sometimes if the project coordinator is pressing the group members to hand in their deliverables, he may utter implicit messages

---

<sup>16</sup>Also one may notice that either the project coordinator or the project leader of BuddySpace starts the meeting, and the closing ceremony of the meeting is always somehow the project leader of BuddySpace, who appears to normally wait and to make sure everyone is logging off.

to group members who should be doing what (priority) and deliver when.

9. Number of parties can vary

- True on FlashMeeting, but not true on BuddySpace, normally the group members use it for 1-1 chat. In exceptional cases, like if one of the group members in the same laboratory has not yet installed the BuddySpace, they may be two person using the BuddySpace (person 1 gives person 2 the opportunity to speak to the other group member) and person 1 resumes to speak to the particular group member after person 2 leaves.

10. Talk can be continuous or discontinuous

- True, for example, in one particular meeting, one of the project executives wanted to continue to ask one thing to the project, however, the project coordinator had already disconnected his FlashMeeting and webcam tool.

11. Turn allocation techniques are obviously used. A current speaker may select a next speaker (as when he addresses a question to another party); or party may self-select in starting to talk.

- Sometimes it is evident, but for the first project meeting, this turn allocation was not obvious.

12. Various “turn-constructural units” are employed; e.g., turns can be projectively “one word long”, or they can be sentential in length.

- True

13. Repair mechanism exist for dealing with turn taking errors and violations; e.g., if two parties find themselves talking at the same time, one of them will stop prematurely, thus repairing the trouble.

- True

It is difficult to understand or to employ precisely a systematic view of turn taking in what we have outlined in the above. Almost all what is specified as a systematic rule of turn taking by Sacks et al (1974) was observable by us and appears to be validated. However, when it came to how the tools had been designed in the first place (i.e., FlashMeeting) the turn taking systematic rule became quite difficult to apply consistently. Especially with the BuddySpace system, it was remarkably easy to not come back with an answer (turn order) (distraction by others, forgetting, real meetings in progress and etc). However, it does not imply that the group members were not serious about the progress of the project, it only implies that the tools itself sometimes gives the opportunity to escape what might be important for someone to discuss and get quick solutions. Hence, when a person on the BuddySpace is not online, the group members naturally turn back to the e-mailing system. When the list of group members becomes very large, it becomes quite chaotic to know how to maintain the communication between several people. For example, a project executive may have 6 pop up chat windows on his BuddySpace, people asking questions not relating to the progress of the project, but on the other hand, personal questions such as “Will you be there on so on and so on because I would be in England”; to

questions such as “Hey, we got someone on the other side to solve that huge server problem”.

We also interviewed a chemist that somehow refuses to go online on BuddySpace because she did not like the idea of “presence”. She prefers not to be acknowledged of her “online” presence. Her complaint was that the pop up windows or message alert sound distracts her from focusing on her job. At certain time, some of the group members from different workpackages ask irrelevant questions (in her opinion it was irrelevant).

In order to solve this problem, we then simply focus on using a simplistic view based on conversation analysis by starting to understand how individuals adapt their behavior and communications moment by moment<sup>17</sup>. We discuss this in Chapter 3. In the next section, we give an overview of what we mean by “CONSTEPS” and a brief history of how CONSTEPS and activity states was formulated. We show two different actual experiments that we have carried out to find an applicable approach that takes into consideration of non-native English speaker.

## 2.5 An overview of the complete CONSTEPS process

We present a diagram to show how the CONSTEPS were performed. At a first glance, the CONSTEPS is shown at a computational level. However, within this framework, we use our activity states framework which is based on the modeling of cognition process at the neural level.

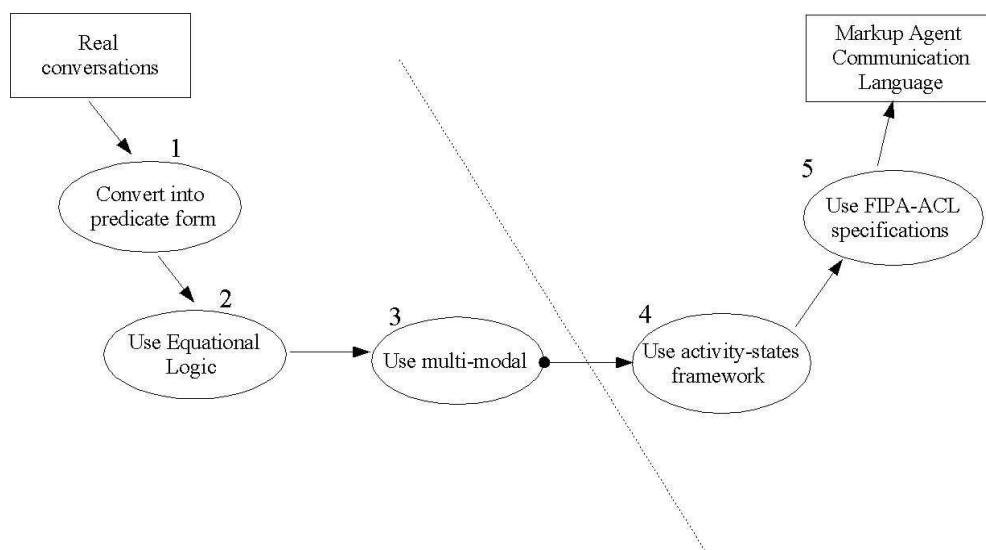


Figure 2.5: CONSTEPS.

<sup>17</sup>After we have analyzed and considered several complaints and interviewed the users, we briefly summarize that indeed different people in different domain has their own way of working and preferences hence it makes it even more difficult to understand how each eventually progress to collaborate or if the project eventually do progress mediated by the web communication tools.



Referring to Figure 2.5, CONSTEPS involve two procedures. The slanted line in the figure represents a separation between the two procedures; separated but adjoin during step 3 and 4. Figure 2.5 may be viewed by readers as one flow. However, readers must make a mental note that we are actually seeking to understand two different languages bringing them to an almost equivalent meaning. The conversion step may be viewed as a pre-processing process of raw conversations into a formalized form that enables us to analyze the structures at the same time achieving the goal for enabling the integration of human agent and artificial agent communications. Hence, we draw a line to show that the CONSTEPS is a process that can be imagined as being on a scale that must be made to fit into the defined agent language. Steps 1, 2, 3 belong to the first procedure. Steps 4 and 5 belong to the second procedure. The arrow connecting step 3 and 4 represents the point where the two procedures are associated as complementary to one another. The purpose for distinguishing the CONSTEPS into two major procedures is that both natural language conversations and agent communication languages have their own (i) syntax; (ii) semantics; and (iii) pragmatics. Hence, we need to find a unified state to bring them to a common understanding. The converted conversations from step 1 until 3 have been re-structured to conform to the defined syntax of the agent communication language. To elaborate further, we have performed these steps:

1: Identify the labeling of logical terms in sentences. We adhere to the analysis of logical terms of Al-Farabi (Fakhry, 1969) for the structuring of the sentences in predicates. We denote this result with  $W$ .

2: Re-structure  $W$  with *equational logic* (it contains function symbols, predicates and equality) for: (i) syntax purpose; and (ii) identifying the levels of the predicates. For example, a level-1 predicate is the following: can-you (John, Cindy, take (Peter, X)). A level-2 predicate on the other hand is the following: can-you (John, Cindy, take (Peter, X (Tuesday))). We obtain several different types of models. We denote this set of models with  $M$ .

3: Construct functions and functors for  $M$ . This is what we call as multi-modal. Functions are used for the mapping of functions (i.e. models) belonging to the same category. Functors are used for the mapping of functions belonging to different categories. As an example, the *ut* function (i.e. how can I, will you) belongs to the category of function for natural language, whereas the communicative acts (denoted by *ca?*) function (i.e. query-ref, inform-ref) belongs to a category of function for agent communication languages. As an example, the functor changes the function the *ut* “how can I” into a communicative act function like “query-ref”.

4: Use *activity states* framework to identify the *beliefs*, *choice* (i.e. *desires*) and *uncertainty*. The *activity states framework* is used for recognizing the *intentions* by using MD (1) (i.e. Model 1 belonging to MD (n) from the set of models  $M$ )

obtained from step (2). Later, this is associated to an *equivalent communicative act* defined in (Fipa-Acl, 2002).

5: Associate step 3 and 4

6: Produce the markup agent communication messages.

These steps are demonstrated in Chapter 5.

### 2.5.1 The *Big Picture* of the CONSTEPS

CONSTEPS is the major contribution of our work. It is mostly centered on how the *activity states* framework have been formulated within it; which is based on the observations of the web communications. It is representing a domain as media specific aspect of modeling and analyzing process. First of all, we extract most part of the ethnomethodology method<sup>18</sup> as a first step to seeking a method for analyzing conversations. We discuss in Chapter 3 and 4 that our focus is in relating the analysis of conversations to cognition theory: particularly focusing on learning and memory at the neural level.

We use existing theories as an approach for analyzing conversations: (i) *hierarchy of learning and communication* (Bateson, 1972) (ii) *situated cognition* (Clancey, 1997a); and (iii) *activity theory* (Leont'ev 1977 & 1978). The converted conversations can be clarified and viewed according to those theories. Specifically Clancey (1997a) emphasized mainly two aspects of situated cognition: the nature of perception and memory. Clancey suggested that it is very important to clear all contradictions of statements or beliefs among theoreticians (cognitive scientists). Starting from a clear understanding of what situated cognition, we relate it to social.

Clancey's approach for conducting his research has inspired us to choose a similar approach. We look into communications incrementally<sup>19</sup>. We started from

---

<sup>18</sup>Is ethnomethodological method the same as ethnography? Ethnomethodological is a method for social scientist (Wallace, 1993). However, social scientists and anthropologists methods of conducting science is different (Mary Bateson, 1984). So we can only assume that ethnomethodological even if some of the methods are crossing over with ethnography, there are a few distinctions to mark that they are not completely deriving from the same aspirations. Perhaps the major difference is that in ethnography, some of the method involves recording the communication using film or photography. Also in ethnography, you also watch the people around you to see what they regard as ordinary and what they regard as unusual, and then review your own responses because you bring you own biases and expectations. Then, if you are doing ethnography, you record carefully what your attention has allowed you to see, knowing that you will not see everything and that others will see differently, but recording whatever you can so it will be a part of cumulative picture. Hence, in our opinion ethnography is a more detailed, richer experience of the participant observer if compared to ethnomethodological method. Unfortunately, in our work because the collaborators themselves are living in different countries, we are unable to travel to do ethnography (Mary Bateson, 1984), p. 203.

<sup>19</sup>Starting from relating the conversations to situated cognition, focusing on *memory*, and at the same time relating them to the notion of activity and foundational studies of learning and communication. These theories contribute as a whole.

the very basics. Then we looked into early work to validate our observed corpus and analysis to the existing theories.

The center idea of the CONSTEPS is using the notion of object subject which was primarily derived from our own experiments (discussed in the next section). To validate if these notion indeed make sense, we then look into existing theories and find that this notion applies similarly to the notion of object, tool, subject by Leont'ev (1978) and Dewey (1925). From here onwards, we adapted the notions to understand more carefully and used it extensively in Chapter 5. Normally, in natural language analysis, an object is defined as the main agent of an event, like two men broke into the house, whereas a subject are other entities involved in the events (Amble, 2005).

In order to understand how these object, subject transformation is in relationship to how people are comprehending text moment by moment we introduce the notion of the “in-between” mechanism<sup>20</sup>. But, we shall specify those notions in the context of communication, which is discussed later. How those theories are applied to our approach in analyzing conversations is discussed and demonstrated in Chapter 4 in Chapter 5 respectively.

Readers refer to Figure 2.5, we introduce the activity states framework. Briefly, the idea of the *activity states* is analyzing conversations coupled to the comprehending (understanding) that is focused on the *process of mental reflection* mostly tied to the idea of Leont'ev (1978). The process of reflection is in turn focused at the *neural level in cognition process* based on Clancey (1997a). To further explain, in order to understand how those neural level involved in *learning and communication* is referring to Bateson (1972 & 1979). We begin by explaining the approach we used for observing communications in figure 2.5.1 (a).

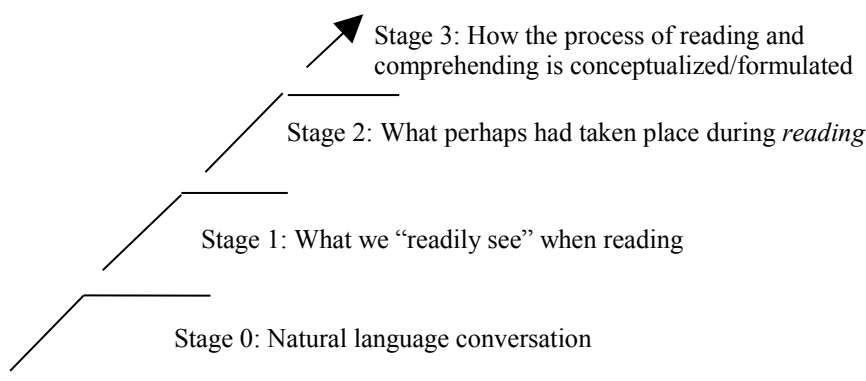


Figure 2.5.1 (a): The approach for analyzing the natural language conversations.

<sup>20</sup>This idea of in-between is not associated to the concept of duality (Ryle, 1949). The “in-between” process of the object subject that gives rise to intentions, that we have in mind is closely related to the neural level specifically when we use the idea “mental reflection”. We will demonstrate further what we mean by it in Chapter 5.

Referring to figure 2.5.1 (a), we study *level of levels*<sup>21</sup> (*stages*) for understanding the *in-between* processes that may make up the context when one is communicating.

At stage 1 and 2, we consider two possible processes. They are:

The “perception”<sup>22</sup> – what is the active “focus” at *that moment*<sup>23</sup>.

1. The conceiving process –what is being *conceived* as a representation in the “brain”<sup>24</sup> (Clancey, 1997a).

These can be represented as shown in in Figure 2.5.1 (b).

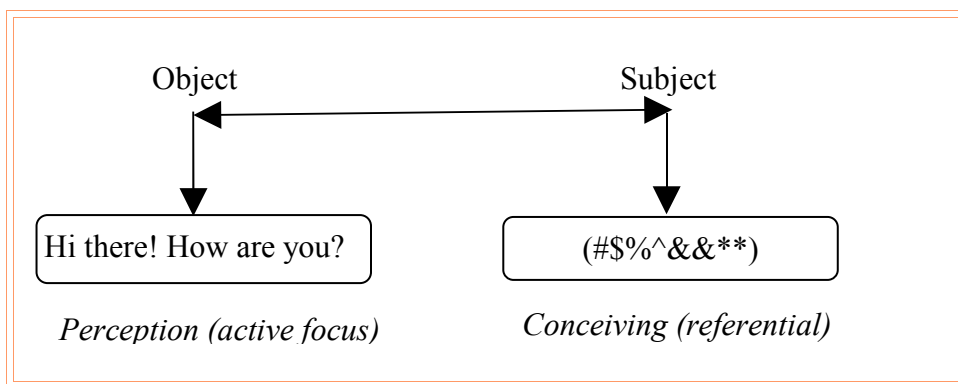


Figure 2.5.1 (b): Reading a text.

Figure 2.5.1 (b) is a representation of what may have been happening while reading and typing text. First of all, we denote the “perception” and the *conceiving process* as *object* and *subject* respectively.

The concept of reading and comprehending text is based on (Clancey, 1997a). For example, in the conceiving part (represented by the subject), representing (e.g. imagining a scene or speaking silently to ourselves) occurs in the brain but “having a representation” from an agent’s perspective involves intentionality. It is conceiving a categorization as being a thought, conceiving categorizations as being about something (referential), and conceiving the thinking process itself as

<sup>21</sup>This level of levels may seem confusing, but it's tied back to the hierarchy of learning and communication. It is introduced and explained in Chapter 4.

<sup>22</sup> When we use this notion “perception”, we are not making claims that these are exactly the process of how the perception is working. It is only an idea of what it may be.

<sup>23</sup>In a similar notion, the author (Clancey, 1997a) has related this to the “coupling” act of perceptual categorizing with meaning (i.e., conception of what text means).

<sup>24</sup> Here again, we are conceptualizing what is happening during the act of reading, typing or speaking silently to oneself.

being part of an activity (Clancey, 1997a)<sup>25</sup>. Chapter 5 will give samples of how this object-subject nature is applied.

Our conversation analysis methods are based on Figure 2.5.1 (b). In order to give a clearer understanding of how our representation of the natural interchanges of the object and subject we explain in illustrate in Figure 2.5.1 (c).

---

<sup>25</sup>There are some kind of three levels during the conceiving act: is the conceiving act of categorization some kind of conceptualization? See (Clancey, 2000). Let us discuss this further by excerpting a sentence from Fodor (1983) “You can figure out..because it follows from what you know about the numbers *and you have some ways of figuring out (some of) what follows from what you know about the numbers*”. It is coming from this conception that what appears to be a conceiving act of about what you are conceiving and of about of what is being conceived. For us, the in-between is exactly addressing this about of about at the neural level (like a coupling act). More details in Chapter 5.

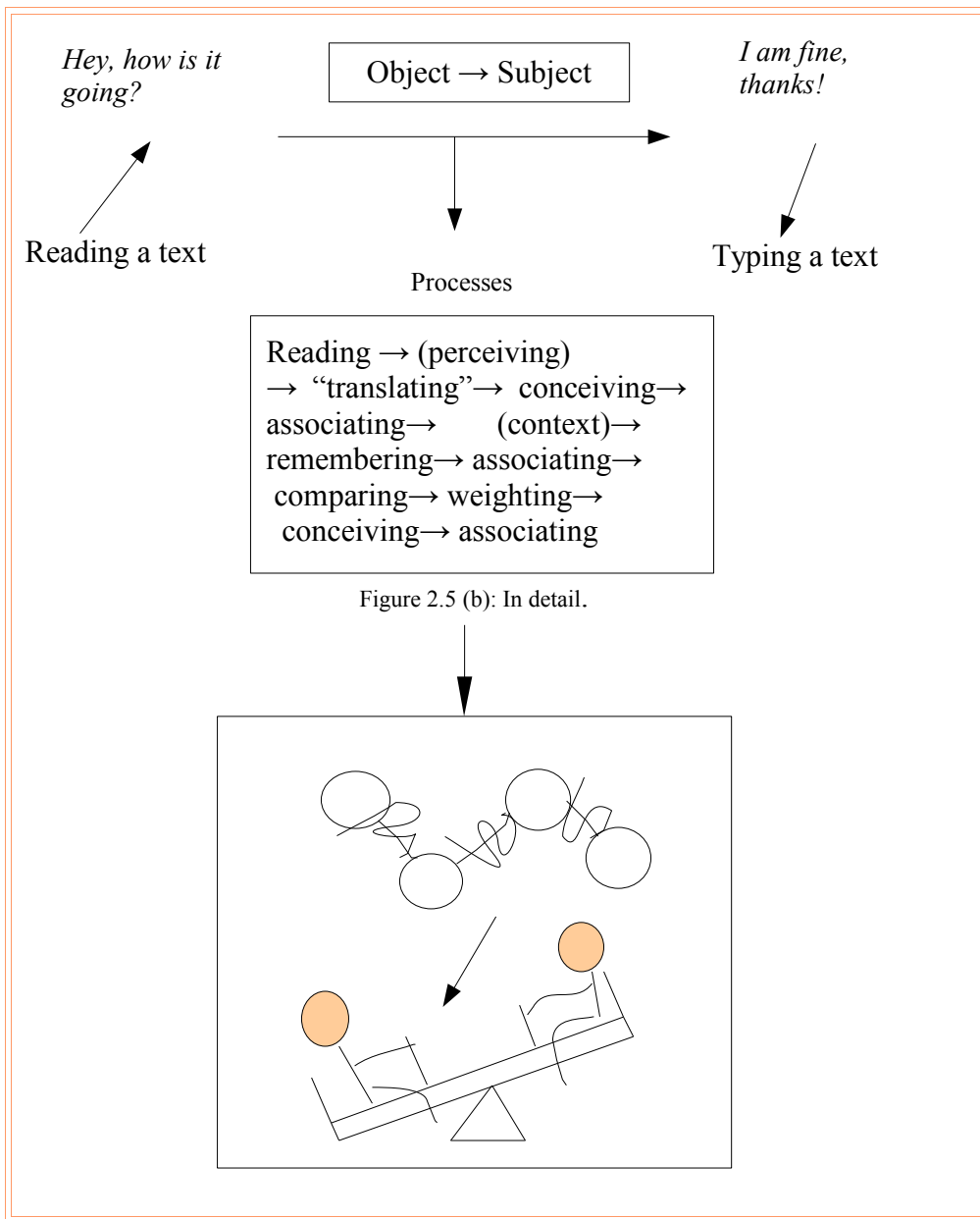


Figure 2.5.1 (c): Sometimes words are not enough.

A look into the *in-between* processes during the object to subject transformation.

The *object* and *subject*<sup>26</sup> are formulated specifically as: (i) how people conceive what they “read”, (ii) comprehending what they read together with what they perceive and (iii) actions are formulated by interaction (speaking or interaction with tools). Next, we go further into the *in-between* processes of the *object* and *subject* by relating it to (i), (ii), and (iii). Referring to Figure 2.5(c) the processes *in-between object* and *subject* are hypothesized as made up of: reading, translating<sup>27</sup>, conceiving, associating, remembering, associating, comparing,

<sup>26</sup>There are multiple object-subject relation in the process illustrated in figure 2.5 (c).

<sup>27</sup>We use in this modeling, the notion “translation”. We are not sure exactly what took place in between this transformation of the act of perceiving into conceiving of something. It seems like there is some serious gap (in the neural level).

weighting, conceiving and then associating. The remembering, associating, comparing, weighting are an act of conception. Even if the arrows are modeled in a way that most readers will read as a logical clause of IF, THEN we are uncertain if it is exactly executed in an IF, THEN. It is advisable for the readers to interpret the IF, THEN terms loosely in our work. For that very reason, Figure 2.5(d) illustrates circles with swirling lines around it to exactly model the IF-THEN in terms of object to subject transformation (and vice versa). In other words, what may be a conclusion may be a premise to another: they are always constantly shaping one another. We show in Figure 2.5(c).

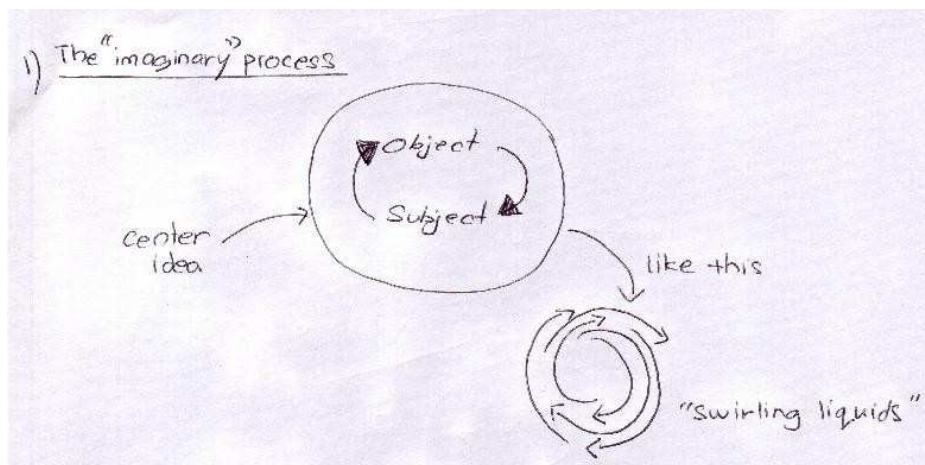


Figure 2.5.1 (d): The object and subject are always transforming into one another.

Referring to the Figure 2.5(d), we describe the transformation as “swirling liquids”. This will be explained hereafter. These “swirling liquids” are in the background of our see-saw<sup>28</sup> modeling. To summarize briefly, when we are speaking of the notion of “object”, “subject”, we are trying to formulate and applying how the realization of intentions arise, and that the in-between processes is involved in this realization. When we refer to this notion of the in-between processes, we are having in mind of the mystery of the binding of membrane surrounding it, the chemical substance with the synapses connections.

The realization of how it is arises must then be understood from a situated cognition approach (Clancey, 1997a) that may be related to neural mechanism. This “see-saw” representation introduced and is discussed in great detail in Chapter 5, section 5.5. The see-saw representation and the swirling liquid is to illustrate that the CONSTEPS of translating it from natural language conversations into marked up Acl does not occur sequentially (like IF, THEN rules), but rather almost simultaneously, like described by the author (Clancey, 1997a) on an improvised levels.

<sup>28</sup>See-saw is a play device for children. In this game, the kids want to be able to balance each other as much as possible, but at the same time, they compete so that they get to “bump” the other kid on the ground.

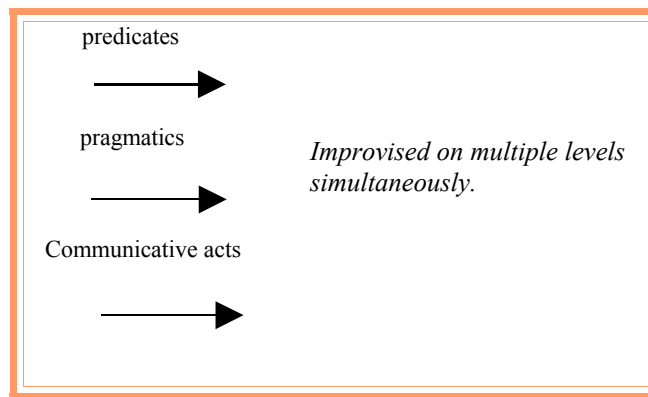


Figure 2.5.1 (e): The conversion of the natural language conversations.

Figure 2.5.1 (e) illustrates the CONSTEPS that were carried out almost in an improvised levels that are co-organizing with one another. In order to justify why we have come up with this idea of object-subject for natural language analysis was mainly because the collaborators themselves were non-native English speakers (except one of them, Marc Eisenstadt). At the same time, if we want to open an integration between human agent and intelligent agent communication, some kind of holistic analysis must be carried out to see how people in general from different ages and nationality comprehend texts. We have only carried out a small test. It was done in several stages, mainly divided into 2.

First of all, we targeted people who had no computer science background, different ages and nationality and most importantly non-native English speakers. This was called the test-bed stage, the second stage on the other hand is the real experiment. We asked selected participants to sit for the test and follow instructions to convert the natural language conversation into predicate forms.

## 2.6 Test-bed stage<sup>29</sup>

During this stage, we were exploring a method that simplifies the natural language conversations for protocol analysis into predicate form (for pre-processing) without taking yet into consideration of the agent communication language (Fipa-Acl, 2002). In Table 2.6, we show the first real raw sample that we have used to send out as instructions to our participants during this stage.

<sup>29</sup>We would like to gratefully acknowledge that this idea of conducting these experiments was the original idea of Prof. Marc Eisenstadt from KMi, Open University.



Table 2.6: Test bed stage.

We have two model frame defined as:

1. ca (spk, ls, act (who, object) )
2. ca (spk, ls, act (who) )

where we have :

ca = communicative act;

spk = speaker; the person who is talking at the moment

ls = listener; the person who is being addressed

act = action (adj/prep/verb)

object = the subject related to the act (i.e. things, place)

### Example 1

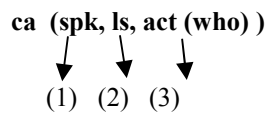
Marc: “ u there?” - (I)

Stowe: “one sec on the phone” - (II)

We take the first sentence uttered by Marc : “U there?”

Use model frame (2)

**Step 1:** Look at model frame (2), how many fields are there in this model?



**Step 2:** So, now identify what is (1), (2) and (3)

We have marc that is the speaker and Stowe is the listener in example 1. Thus we have:

- (1) Spk is equivalent-to (=) Marc and
- (2) ls is equivalent-to (=) u = Stowe
- (3) act can be an adjective which is equivalent-to (=) there

So we have for now :

Ca (Marc, stowe, there (who) )

**Step 3:**

Now look at (3)

(who) is who is the speaker addressing the question to? So we have who = stowe

Thus, we then have

there(stowe)

**Step 4:**

Now, fit the (1), (2) and (3), so we have:

ca (Marc, Stowe, there (Stowe))

All the experiments were conducted via e-mails. Instructions were sent in a powerpoint presentation that explains, illustrating images of actual scenario with funny diagrams to motivate the participants. We also promised (to further motivate them) that whoever is willing to participate until the end of the experiments will be awarded with a 100 dollars. Then, we gave each participants about two weeks to send back in the answers. We show in the next section the answers that we received from the participants.

### **2.6.1 Answers from the participants from the test-bed stage**

In this section, we show the answers from the participants<sup>30</sup>. Our first attempt, was to understand how people generally comprehend texts. We got many complains, such as that the test was confusing. We gave them simple instructions like for each sentence to convert into predicate form, we asked them simply to follow “use frame model (1), or frame model (2)”. The participants came from different backgrounds, Asian and European with different educational status and age. All of the participants did not arrive at the same answers. We then conclude that this method was not effective, but it did provide us with insights and clues to better our method. At the same time it was interesting to understand how the participants had conceived the text and conceptualized what they were suppose to be doing. It was particularly interesting to understand how they learn to understand the instructions. The experiment was carried out on the August 14, 2004. However, we do not further investigate how the participants learn to understand the instructions as it calls for a real psychological test. We show the results below.

<sup>30</sup>We thank the participants, Asran Abdullah, Nik Kaiza, Pierre Defour and Lars A.Lenders, for their patience and hard work during the experiments.

- Participant 1:

Age: 19 years old, male

Nationality: Malaysian

Occupation: First year student in Bsc. Mechatronic engineering in Malaysia.

**1. [2004/01/13 18:04] <marc> I get 'connection error'..**

Use model frame (1).

Your answer here:

*ca(mark,jiri,connection error(mark))*

**2.[2004/01/13 18:05] <Jiri> I'm logged in now as j@jdc-.csi on port 5223 with [X]SSL checked**

Use model frame (1).

Your answer here:

*ca(jiri,mark,logged in(jiri,port 5223))*

**3.[2004/02/14 14:23] <Marc> “for re3 and rs267, please! Jordan already has...tnx!!”**

Use model frame (1) and model frame (2)

Your answer here:

*ca(marc,jiri,already has(Jordan,tnx))*

- Participant 2

Age: 38 years old, male

Nationality: French

Occupation: Marketing Manager at Alcatel Malaysia.

**1. [2004/01/13 18:04] <marc> I get 'connection error'..**

Use model frame (1).

Your answer here:

*ca ( Marc, Stowe, get (Marc, connection error ) )*

**2. [2004/01/13 18:05] <Jiri> I'm logged in now as j@jdc-.csi on port 5223 with [X]SSL checked**

Use model frame (1)

Your answer here:

*ca ( Marc, Jiri, logged (Jiri ) )*

Participant's 2 complains: That's for the main action (loggin), but what about the remaining information (address, port, parameters...)? Is it supposed to be translated too?

**3. [2004/02/14 14:23] <Marc> “for re3 and rs267, please! Jordan already has...tnx!!”**

Use model frame (1) and model frame (2)

Your answer :

*ca ( Marc, ?, for ( ?, re3 and rs267 ) )*

*ca ( Marc, ?, already has ( Jordan ) )*

*ca ( Marc, ?, thank ( ? ) )*

Participant 2 complains: Difficult to translate this line without any context (previous exchanges, dialogue initiation). anyway, the subject here is a bit too “technical” for me, but maybe it's on purpose...?

- Participant 3

Age: 28 yrs old, male

Nationality: Dutch

Occupation: Business development manager for Waterpark in the Netherlands.

**1. [2004/01/13 18:04] <marc> I get 'connection error'..**

Use model frame (1).

Your answer here: Ca ( Marc, unknown, act = connection error ) )

(1) Spk is equivalent-to (=) Marc and

(2) Is is equivalent-to (=) u = unknown

(3)act can be a preposition which is equivalent-to (=) there

**2. [2004/01/13 18:05] <Jiri> Hmm..which client are you using?**

Use model frame (1).

Your answer here: Ca ( Jiri, unknown, act = usage of client ) )

(1) Spk is equivalent-to (=) Jiri and

(2) Is is equivalent-to (=) u = unknown

(3) act can be a preposition which is equivalent-to (=) there

**3.[2004/02/ 12:01] <Rick> Are you available?**

Use model frame (2)

Your answer here: Ca (Rick, unknown, act = available )

(1) Spk is equivalent-to (=) Rick and

(2) Is is equivalent-to (=) u = unknown

(3)act can be a preposition which is equivalent-to (=) there

• Participant 4

Age: 11 years old, male

Nationality: Malaysian

Occupation: Student at a primary school.

**1. [2004/01/13 18:04] <marc> I get 'connection error'..**

Use model frame (1).

Your answer here:

*Ca ( Marc, Jiri, get, ( Jiri ) )*

**3.[2004/01/13 18:05] <Jiri> Hmm..which client are you using?**

Use model frame (1).

Your answer here:

*Ca (Jiri, Marc,using (Marc,client) )*

This is a separate dialogue. Imagine rick talking to some person y.

**4. [2004/02/ 12:01] <Rick> Are you available?**

Use model frame (2)

Your answer here:

*Ca ( Rick, y, (y) )*

Referring to the four participants answers, we then explored why most of them did not arrived at the desired answer. We think that was greatly due to our confusing method and ambiguous definitions. Some of the participants did not answer all of the questions. Most of them informed us that they do not normally remember what is a preposition or verb, adjectives and so on. The closest answer according to a standard predicate form came from participant 1 and 2. Maybe this was due to the educational background of these participants. Participant 1 is studying an engineering subject that requires understanding logics and electrical circuits. Participant 2 has a Masters degree in Electrical Engineering from Germany. Hence, maybe the both participant are more familiar with logical parsing of sentences? Nonetheless, all of them in general (even the primary

school student) comprehend the text that they read and what they were supposed to do. Some of the participants (we sent out about 10 requests) did not even send back the answers for the fear of giving the wrong answers.

However, the very peculiar answer came from participant 3 who has a Bachelors in Business Studies from Belgium. Indeed, this participant simplified the answer and almost like doing mathematics, if  $1 + 2 = 3$ . The answers were similar to that. Participant 3 followed orders to give the answer in a predicate form, but at the end, could not segregate (mathematically or logically?) like the rest. He was able to identify the composition but could not form them or articulate them (did not follow the rules?) in a sequence as we directed him. We are unable to figure out why that the answer from participant 3 differs a great deal from the rest. When the rest could manage to at least form them into predicates, participant 3 was unable to do so.

We then dropped the idea of using the method of identifying preposition, adjectives or verbs, and instead focused on a the pragmatics level. We developed a method that we thought would be the most “natural way” way on how we subconsciously comprehend text. Most of those participants informed us that they took several days to sit down and obtain the desired answer. They all e-mailed to confirm us that they found that it was very difficult indeed to understand how to convert the natural language conversation into marked up agent messages. One personal comment we received by e-mail from participant 3 was “for a sentence that looks so simple, you scientist makes it so difficult!”. From here onwards, we have to look for other participants, who was willing to sit for our other test and still has no background in natural language processing or computer science. Because, 3 out of 4 participants could not bear to continue with these short test.

## **2.7 Experiment 1.0- becoming a participant observer**

Our newly improved method, demonstrated in Table 2.5 was derived from our own analysis of how we were subconsciously imagining how people are comprehending text. We then proceeded to continue imagining and to put our subconsciousness to work, pre-processing and converting it into marked up agent messages. During this stage, we realized that our approach was very much an anthropological approach. We spent about 5 months just focusing on manually pre-processing and converting the conversations. There were many things that we have learned while converting almost 50,000 actual conversations manually.

Not only was our goal was to process these conversations into marked up agent messages, we realized that it was very important to understand the EleGI collaboration conversations exchanges and the context of what each person was actively participating and conceptualizaing. This is when we became *participant observers*. In anthropology, the relationship between observer and observed is complicated by the fact that one is constantly moving between *two conflicting impulses*, the desire to leave home and the desire to discover oneself at the end of

the journey, to go away to worlds rich and strange and to discover in them the ordinary, recording and explaining initially seems exotic (Bateson, M. 1984). We were constantly moving between these two impulses while converting and pre-processing the data that we have in hand. The conversations needed to be structured but on the other hand the conversations needed to be carefully converted to preserve how we have actually structured it. In a structured form, we are able to study how the nature of communication protocols are punctuated (by looking at changes of sequences in adapted context of communications).

In a more formal definition in anthropology, *participant observations* is a research method developed by social anthropologists. Participant observers go into social situations, and take part in the ordinary life of the community. By being a part of a social setting they can learn firsthand how people act, react and interact. The participant observer learns about daily life, customs and patterns of activity by being part of them. This gives a privileged position from which to observe repeated patterns of social action, and to experience expected, and unexpected events. Over time the participant observer becomes less of an outsider, and more of a trusted insider. Over time, others in the situation let the participant observer into the local social system, so they hear and see things that strangers do not. Through participation, as well as looking and listening, the participant observer feels, acts and responds to events and interactions. He or she comes to know experientially what it is like to be part of this system. The internal logic becomes known cognitively, and also at the level of emotion and perception. The researchers own internal states become a source of data (Wallace et al, 1998). This two conflicting impulses is used extensively in Chapter 5 when we fully describe our CONSTEPS. However, we did not actively participate in all the EleGI meetings, but only was there for observations.

To continue discussing on experiment 1.0, in order to validate if this method applies to others and that it is comprehensible, we select 4 different participants. Unfortunately, we could not continue with the all the 4 participants, only one of them was enjoying and requested to be in the experiment until the end. The 100 dollars reward did not even encouraged them to go further. This experiment was carried out on the 20<sup>th</sup> of August 2004. We demonstrate the second framework we improved in Table 2.5.

Table 2.5: Improved method.

Model frames

1. ut (spk, ls, object (what, subject)) – (A)
2. ut (spk, ls, act (who, object)) – (B)
3. ut (spk, ls, act (who)) – (C)

An example, we have this sentence : “How can I help you?”

**Step 1:** Identify the object and subject

Use model frame (A) which is ut (spk, ls, object (what, subject))

*How can I help you?*

(1)            (2)

So (1) is the object, that is the moment of focus (imagine like you are having a certain goal in mind) and is “how can” he perform x.

And (2) is the subject, where x is to “help you”. Finally we have:

Object =(1) and subject = (1)

**Step 2:** Now, replace the object and subject which you have just identified into model (A)

We have:

ut (A,B, object (what, subject)) becomes

ut (A,B, how-can (B, help-anything))

**Step 3:** Use model (B). Now we decompose the object and subject

ut (spk, ls, act (who, object))

How-can is a form of inquiring

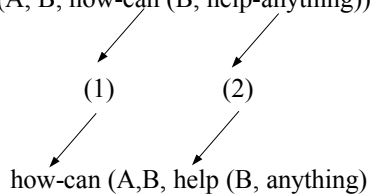
So now the ut is inquire and now we decompose the subject, help-anything into act and object.

Help-anything. Help is the act and anything is the subject. So now we have help= act and anything = object

**Step 4:** Decompose further into object and subject

So now we have:

ut (A, B, how-can (B, help-anything))





**Step 5:** Now we need to generalize the ut.

We have x (adj or aux.v or v.tr)  
y ( (aux.v or prep or pron)

Apply x and y in how-can

Thus we have how can is inquire

Step 5: now, how-can is a performative of inquire

*inquire (A,B, help (B, anything))*

In this method, Table (2.5), we came up with the object, subject term as introduced at the beginning of this chapter. We show the answers from the participants<sup>31</sup>.

- Participant 1  
Nationality: Brazilian  
Age : 21 years old, male  
Occupation: 5th year Engineering (mechatronics) student

Question: **Possible to send this file?**

**Step 1:**object : possibility  
subject : send this file

**Step 2:** model A :  
ut(A,B,possible(this file, send))

**Step 3:** model B :  
ut(sp,ls,act(who,object))  
act = send  
who = B  
object = this file

**Step 4:** possible(A,B,send(A,this file))

**Step 5:** inquiry(A,B,send(A,this file))

- Participant 2  
Nationality: Brazilian  
Age: 21 years old, female  
Occupation: 5th year Engineering (mechatronics) student

<sup>31</sup>We would like to Pedro Kouri Paim, Carla Aguiar, Pierre Defour and Christophe Rabaud.

Question: **Possible to send this file**

**Step 1** : Identify the object and subject in the sentence "Possible to send this file?"

Use model frame (A) Which is  $ut(sp,ls,object(what,subject))$

Possible to send this file : object is "possible to" cause the object is to know if something is possible to do and the subject is "this file"

**Step 2**: Replace identified object and subject into model:  
 $ut(A,B,possible\ to(send\ to\ someone,\ this\ file))$

**Step 3**: use model (b)

$ut(sp,ls,act(who,object))$

Here we have a special form of inquiring cause no word for a regular question, it's under meaning. ut is inquire send to someone . Send is the act and to someone is the subject.

send=act and to someone=object

**Step 4**:decompose

$ut(A,B,possible\ to(send\ to\ someone,\ this\ file))$

possible (or is it possible to)

$(A,B,send(someone,this\ file))$

**Step 5**: generalization

is it possible to ->inquire

so, for me the answer at the sentence "Possible to send this file" is

$inquire(A,B,send(someone,this\ file))$

• Participant 3:

Nationality: French

Age: 25 years old, male

Occupation: Phd student in Electronics

Question: **possible to send this file?**

**Step 1** : Identify the object and subject

Object : Possible (the intention of the speaker)

Subject : send file

If answer (object) → perform (subject)

**Step 2** : Now, replace the object and subject which you have just identified into model (a)

Model A

ut (spk, ls, object (what, subject))  
ut (A, B, Possible(A, send file))

**Step 3 :** Use model (b). Now we decompose the object and the subject.  
Object: Possible (it requesting for something) then it is a form of inquiring.  
Subject: to send the message  
Act : send  
Object : file  
Who : someone

**Step 4:** Decompose further into object and subject

ut(A, B, Possible(A, send file))  
                                  (1)                                  (2)  
Possible (A,B, send (anyone, file)) )  
ut (spk, ls, act (who, object ) )

now, possible is a performative of inquire

**Step 5:**  
inquire (A,B, send (anyone, file))

- Participant 4:  
Age: 38 years old, male  
Nationality: French  
Occupation: Marketing Manager at Alcatel Malaysia.

Question: **“Possible to send this file?”**

**Step 1:** Identify the object and subject using model frame (A):

ut (spk, ls, object (what, subject) )

Possible to send this file?

(1)      (2)

object (goal of the speaker) = (1), and subject = (2)

**Step 2:** ut(spok, ls, possible (spk, send this file) )

**Step 3:** the ut is inquire, and decomposing the subject “to send this file” into act and object we get act = “send” & object = “file”

**Steps 4 & 5:** decomposing further we get: inquire (spk, ls, send (spk, this file ) )

Most importantly, we received all the same answers from the 4 participants . We assume that either (i) these participants were students that had background in engineering hence they have background in logical parsing, or (ii) this method was much clearer and easier to understand. We wish to continue with this method by sending this instructions back to the previous participants during the test-bed stage to further validate if either assumption (i) or (ii) was correct. The differences of answers might be tied down to the *logical typing*<sup>32</sup> of the participants at comprehending text and receiving instructions. According to (Bateson, 1972), logical typing is defined as being inherent in genetics that person A will interpret B differently from person B due to the ordering of the logical typing. Bateson (1972) who studied communications in animals including people as well as communication between him and schizophrenic patients assumes that these different interpretation of context of communications is finally tied down to the ordering principle of the logical typing. This is illustrated in Chapter 4.

The sentence we used was not a dialogue, but just one sentence that was indeed simple. We wish to continue with the experiments by giving sequences of sentences and apply the same method of using the notion of object and subject. We hypothesize that the answers will be a diversity. However for now, based on this relatively small evidence, we investigate further to understand the underlying mechanisms. Why did this method worked and the previously did not? As a summary, based on this small evidence, we carried on with our conversion using the object and subject notion. The difficult part would be to understand how to explain the mechanisms of object and subject. This is discussed in great detail in Chapter 5.

## **2.8 Analysis of the two experiments**

Firstly, how do people readily subconsciously (and consciously?) read text and understand them? How do their mind work during the conversion steps? We are very motivated by this. Therefore, based on the test bed stage and experiment 1.0., we continued with our method of using the object-subject approach in CONSTEPS. This is mainly because it was comprehensible among the participants and all of them arrived at similar answers. One particular participant actually remarked that it was a very easy test. It is indeed a very small test with a simple sentence. However, for now, we move on to elaborate more the under-

---

<sup>32</sup>A logical typing was a study by Bateson (1972) when he inverted the context of normal communications to the communications between him and schizophrenics. He hypothesized that schizophrenics are unable to sort communication in terms of meta-messages specifying the difference between play and report and promise, or to distinguish metaphorical from the literal. Bateson would bring his work to assumption that their communication was not nonsensical or disorderly rather it had an error in logical structure (Bateson 1972, Mary Bateson, 1984). More of this will be discussed in Chapter 4.

standing of how the CONSTEPS was actually performed, at the same time analyzing the ongoing collaboration exchanges.

It was during this stage of experimenting\ that we relate this back to the existing theories because it seems some peculiar things are going on at the neural level. We summarize that the answers were similar had to do also with the educational background, despite the participants not coming from the same country, or region. Despite the age differences and sex differences, we were very interested by the 11 years old answers that shows potential at arriving at a desired answer given the right instructions (without having any engineering background yet!). Is there some kind of acceleration of learning in this participant or tied down to the logical typing (Bateson, 1972)?

In the next Chapter 3, we give the literature background. Then we move on exploring and clarifying our modelling of subject and object and the idea of the in-between in Chapter 4 and 5.

## Chapter 3

### Background

*“Equally, you must read with a certain preunderstanding of what you are looking for. You don't start with a theory, but you do start with a point of view.”*

*Clancey, W.J. in Situated Cognition:*

*On Human Knowledge and Computer Representation, 1997.*

### 3 Introduction

In this chapter, we begin with an introduction and a bit of history to our approach to analyzing communications. Then we discuss related work that emphasizes on *communication* for designing tools to facilitate human activities in work practice. This chapter also provides a justification to our approach. Then, we move on with an introduction to several important concepts by Winograd et al (1986) for computer designs. Then from there, we emphasize the notion of “breakdown and recurrence” of Winograd et al (1986). Moving on, we introduce the language action perspective (LAP). Several basic concepts of LAP are discussed. Then we continue to review some concerns that have been brought forward in designing LAP applications.

After these brief discussions, we raise the issue of using speech act theory for analyzing communications, specifically looking into the strength and weakness of speech acts theory. Most importantly, we assert why our approach is conducted in

such a way. Before we close the chapter, we briefly introduce some basic understanding in agent communication language (Acl), and current trends , and finally narrowing it to Fipa-Acl. Because our work is *partly* based on Fipa-Acl formal models.

### 3.1 Our approach to analyzing communications

In the previous Chapter 2 Example, we have elaborated and briefly analyzed the environment that we have been observing. We also gave a short history on how the idea of CONSTEPS was developed, the object-subjet and our interest of the in-between came about in the modeling of *activity states*. Our approach is analyzing how the joint project progresses was by looking into their communications, in particular into the microscopic view of the conversations structures. The web communications are used as a tool for them to work together. Our approach for analyzing the *communications as a whole* falls under *conversational analysis* (discussed in section 3.12) specifically using a *participant observers*<sup>33</sup> notion in anthropology (Bateson Mary, 1984).

For example, in analyzing the conversations among the scientists, we are constantly being an observer of what is taking place and at the same time of associating our own subconsciousness at the neural level to the observed communications. We were constantly taking different roles between the observers and observed. This is well demonstrated in Chapter 5 where readers will be exposed to these ideas. The approach falls into different level. At the first level, we use an ethnomethodological method to collecting data. At the second level, as noted, the CONSTEPS involved pre-processing these conversations into structured forms, we use Fipa-Acl as guidelines for recognizing intentions in utterance. Fipa-Acl on the other hand is known for implementing speech acts theory. So our CONSTEPS is half-formalized (the unformalized aspect is the activity states framework because its focus is not on “formalizing people” but on understanding how “conceptualization”<sup>34</sup> occurs) and Fipa-Acl is well-formalized.

---

<sup>33</sup> We hope readers are not confused by the many approaches and ideas we are introducing. To begin with, doing ethnomethodology is driven by actual data (Wallace et al, 1998). Now, the idea of *participant observers* (that happens to be a part of participant observations in doing ethnomethodology) for us is not the same idea by Bateson Mary (1984). We personally refer to the idea of participant observers by (Bateson Mary, 1984) on her personal experience with her well-know parents, anthropologists Mead (Intercultural studies, 2001) and Bateson (1972 & 1979). Our approach in analyzing communication is very similar to this idea of participant observers.

<sup>34</sup>This relationship to our work is discussed in Chapter 4 and 5.

Table 3.1 : Our communication approach demonstrated in stages.

<p>Stage 1: Uses an ethnomethodological approach to collecting actual data, verbal and recorded chat logs.</p> <p>Stage 2: Pre-process the conversations to convert into conversation structures using Fipa-Acl formal models. It is used as a guidelines for recognizing intentions in utterances. Fipa-Acl is tied back to Speech Act theory.</p> <p>Stage 3: Run a short experiment with non-native English Speaker.</p> <p>Stage 4: The experimental answers from the participants are studied and our methods are continuously modified to understand the most natural way in comprehending (hence converting) conversations for building CONSTEPS.</p> <p>Stage 5: The CONSTEPS builds an activity states framework within it (rather simultaneously) focusing specifically on the approach of the <i>participant observers</i> for understanding how intentions arise. The participant observers approach uses the three existing theories: (i) <i>hierarchy of learning and communication</i> (Bateson, 1972, 1979); <i>situated cognition</i> (Clancey, 1997a); (iii) <i>activity theory</i> (Leont'ev, 1977 &amp; 1978).</p>
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Let us elaborate these stages from Table 3.1:

#### 1. Stage 1:

At the beginning stage, we use the ethnomethodological approach for collecting actual conversations<sup>35</sup>. In doing ethnomethodology (Wallace et al,1998) there are various methods like open-ended/depth interviews, participant observations, videotaping and documentary method of interpretation. We shall list down the various methods that we have followed:

- Open-ended/depth interviews. Occasionally, with the project coordinators and some of the group members. Specifically for asking how effective the tools was for them.
- Participant observations (participant observers). As mentioned in the previous section, our participant observers is tied to the idea of (Bateson Mary, 1984). We use this significantly in Chapter 4, preliminary for the conversation analysis in annotating the sentences, and formulating the activity states.
- Videotaping. We use FlashMeeting Memo to capture the online meetings.
- Documentary method of interpretation. Here, we rely on chat logs of BuddySpace between the project coordinator and the project executive.

#### 2. Stage 2

We pre-process the actual conversations into predicate forms. In doing so, we refer to the Fipa-Acl formal guidelines on recognizing intentions. This involves several interactions until we achieve a general method.

<sup>35</sup>In Ericsson et al (1984), the author discussed several approaches to pre-processing verbal records for protocol analysis. It was normally conducted with having interviews with subjects, asking subjects to think aloud, or having someone to follow a subject to a shop and the subject must say aloud what her thoughts are about what she is thinking to buy and so on. The approach is mostly simulated.



### 3. Stage 3

We selected several non-native English participants to sit for short experiments. The experiments were carried out in several stages. We sent about 10 e-mails to randomly picked 10 people, coming mostly from Asia, The Netherlands and Brazil. Our interest was to have a diversity of people sitting for the short experiments, coming from different background, culture and ages and sex and to see if they will all arrive at similar answers based on our method. Most importantly, we did not want any participants to have any natural language processing/analysis or computer science background.

### 4. Stage 4

Each answers that we have received, were being taken into account and interactively being modified into our own method. The goal was to make sure that at least 4 people would arrive at the same answer following our instructions. As discussed in Chapter 2, the short test that we ran using the object, subject notion was based on our own experience of observing the actual communications for finding the most “natural way” that a person comprehend texts. Then this notion was linked to the work of Leont'ev (1978) and Dewey (1929). In the end, the object and subject was related to Leont'ev (1978) work on activity and consciousness. It proved to be quite easy for the participants to follow the object and notion and most importantly, they all arrived at the same answer. Hence, we proceeded with the object, subject notion. However, the philosophical idea behind this notion by Leont'ev (1978) is not as easy to follow when it comes to relating each sequences of utterances that forms a chains of object and notions interchanges<sup>36</sup>. This is discussed in Chapter 4 and 5.

### 4. Stage 5

In building the CONSTEPS, it was important to make a note that we are studying two different “languages”, one is the actual conversations, and the other is the Fipa-Acl which has a clear outline of how the syntax, semantics and protocols should be like. From the observations of understanding how the exchanges of communications are carried out, this is when we significantly use the participant observers (i.e. in studying the collaborators) to understand how intentions arise moment by moment. From this observations, we have build the activity states framework to relate the formal guidelines to actual observations of communications. In order to allow us to properly understand how the communicative behavior of each group members is adapted moment by moment at his/her situated context/environment, we go back to existing theories. These existing theories as listed in Table 3.1 fits nicely with our approach in analyzing communications. This is discussed in Chapter 4.

---

<sup>36</sup>In Chapter 5, we elaborate how activity, tools, and people can be related to the object, subject notion by extending it to the idea of reading text on the mediated tool and responding through the mediated tools.

### 3.2 History of CONSTEPS and Activity States Framework

The history of CONSTEPS and activity states framework is illustrated in a Figure 3.2.

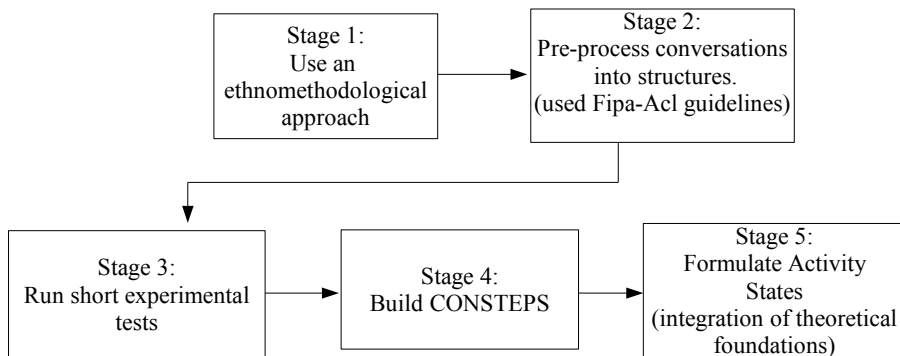


Figure 3.2: The history of CONSTEPS and Activity States.

We were conducting a communication analysis approach that was a variation of many methods, particularly inspired by *anthropology*. In anthropology, you usually cannot specify in advance what it will be important to pay attention to (Mary Bateson, 1984). One must be *open to data*, to the possibility that very small clues will prove to be critical and that accident will provide pivotal insights (Mary Bateson, 1984).

“The problem of attention and of disciplined subjectivity are part of the problem of consciousness- knowing and knowing that you know. If you can draw a frame around an event, you can briefly separate it from context, and this is what researchers believe they are doing. But an anthropologists in the field cannot generally do this, and must assume that the asking of any question shapes the answers. Even as you observer, you also participate. The context of any question, the entire conjunction of interviewer and informant, sets an meta-message for the communication. Trying to be objective, you may think you are separating off an experience by setting it in a frame, but actually frame changes the meaning of what is within in” (Mary Bateson, 1984) pp: 213-214.

It would seem almost peculiar to introduce an analysis that is wandering around in many disciplines. But by doing this, we are looking for insights and clues that may eventually fall into place. In every analysis, we are always becoming the observed, imagining what each person is actively conceptualizing. We give a related example, after several times observing one of the project executives when is not “broadcasting”, we notice a pattern of behavior. When he is faced with the same problem from a particular group member he will always scratch his head or touch the left side of his beard (gently) while flipping through what appears to be the deliverable that may perhaps sends “signals” that he is about to voice out his

opinion on this matter. These “body language” or “signals” for us represent as if he is actively conceptualizing, and perhaps knowing that this is that “punctuated event” that I must raise my hand to not make him go overboard. Indeed, the approach of this analysis becomes a role shaping for us, as a traveler between two constant impulses, of an observer and the observed. Indeed, we cannot separate the events from a contexts and generalizing it by separating it from experience.

Hence, the start of the direction of this thesis is to explore at different levels of insights based on data and foundational theories (i.e., hierarchy of learning and communication (Bateson, 1972 & 1979); situated cognition (1997); activity theory (1977 & 1978).

As stated, the objective is to *understand* how learning and communication mutually influence one another; allowing people to infer each other’s communicative behavior, at the same time understanding how *intentions arise* when people are *speaking* and *doing activities*. *This calls for a dual approach*. Firstly, the conversations has to be structured to enable us to study how intentions arise through the observation of communication protocols that have been punctuated<sup>37</sup>. Secondly, in order to do this, we must refer to some guidelines that enable us to transform this actual conversations into proper structures. Hence, we refer back to the formalism of Fipa-Acl (Fipa-Acl, 2002; Sadek et al, 1997) on the formal modeling of intentions. The formal model of Fipa-Acl is based mostly on the work of speech acts by (Searle, 1983). Sadek (1997) also refers to several work such as (Cohen et al, 1990) and (Halpem et al, 1985) for specifying the Fipa-Acl language.

In the next section, we elaborate on Stage 5 that is the main focus of this thesis that heavily discussed in Chapter 5.

### **3.3 Relating our communication approach to cognition process at the neural level**

The communication approach attempts at addressing what are the underlying neural mechanism at the cognition process that enables people to infer each’s other communicative behavior, and how people “articulate” their thoughts. In Chapter 5, we refer to several claims and evidence to support our activity states modeling. Since our objective is to understand how intentions arise, it is important to refer to multi-disciplinary fields that shall gives us insights into

---

<sup>37</sup>We give an example, M’s intention arises about inserting his idea of using social constructivism in the deliverable when he “noticed” that what J is speaking about is related to this theory. Hence, whenever the subject was indirectly related to social constructivism, M punctuates this event as being about “ My time to say something during this moment because it conforms to my intention”. Now, this intentional states may change into becoming a goal that in the end M certainly believes that we should follow social constructivism theory to write in the project deliverable. This is a very simple scenario of showing a communication protocol (like knowing to say what during when to whom). We haven’t shown yet how this involves tools. This is discussed in great detail in Section 3.4

understanding how thoughts and actions are adapted moment by moment, just like talking and doing things are adapted moment by moment.

One of our major concern is that speech act theory is not sufficient to capture and model the rich notion of context since we need formal guidelines for pre-processing and analyzing the conversations that can provides validity for us. Before we address this concern of how to capture the rich notion of context, we must be able to understand exactly what it means. Then, from here onwards, we look into the individual's transaction with the environment in her situated context. We refer to the notion of “contextualism” by (Hoffman, 1983 & 1986) and also by (Bateson, 1972) to understand what is meant by *context*. This is discussed in Chapter 4.

Now following this idea, we analyze the relationship between learning and communication of an individual in one context to another context- like a transitional flow. A transitional flow is a notion we give for describing the flow of communications, like going on chat messenger, taking a pause and so on. In other words, looking into specific communication events (decision making), and daily communication events (like chatting just to say hello, introducing oneself to one another, browsing the web together).

If we want to understand how someone does daily communication activities to a specific communication like decision making, we must relate this to a theory on learning and memory. Because we specifically need to understand what it means to be having experiences in our transactions with the environment. And how those experiences become a flow of relationship for us to differentiate the context of our experiences. As mentioned, the motivation of our work is to understand how people learn to punctuate events: knowing to communicate with whom, when, and with what. This requires us to look into communications from these angles:

1. how people adapt their actions to their situated context;
2. how people learn to adapt and merge communication protocols of others;
3. how *miscommunications* become a ground of learning for further improvement in communications;
4. how people gradually learn to communicate better when re-encountering similar contexts of communication.

The current approaches (i.e., speech act theory, conversation analysis, discourse analysis) has already some kind of formalism. But, none of those are really looking into the idea of “articulation of thoughts”. The concept of *how intentions arise*. Therefore, our communication approach starts from a very simplistic view. We go into the low-level, looking into a microscopic view of understanding how learning and communication mutually influence one another by relating it to mental process as mentioned at the neural level. We consider how this is related

to “remembering”, which then goes back to the idea of “contextualism”. Hence, the activity states is actually adapting speech acts theory to a wider context.

### 3.4 Computer, thoughts and language: Winograd and Flores

It is important to understand the philosophy behind the contributions of Winograd et al (1986) idea of building a computer system or a “tool”. We shall relate this philosophy to actual events we have observed during the EleGI joint project, and with this we further clarify why we approach our communication analysis as outlined in the previous section.

Firstly, let us introduce some important ideas of Winograd et al (1986) on understanding computers and cognition for computer designs. According to Winograd and Flores; the key to design computers as tools is to understand the *readiness at hand* of the *tools* that are being built. It is also an understanding on how to design *tools* that can *anticipate* the *breakdown* that will occur in their use. The notion of breakdown is discussed in detail in the next section. For now, we continue with the some philosophical concepts of Winograd et al (1986) at an introductory level.

Winograd et al (1986) pp. 68-69, gave an example of the word “word processor” - it must be understood by virtue of the role it plays in communication, the distribution of information, and the accumulation of knowledge. But, in doing this, we must be careful using the words, “communication” - “information” and “knowledge” for granted. The focus is then on “language” - the computer being regarded as a device for creating, manipulating, and transmitting symbolic (hence linguistic) objects.

Winograd and Flores approach to cognition and computation is in terms of what it means “to understand language in the way people do” (Clancey, 1986). At the same time, this analysis leads them to conclude that computers cannot understand natural language. This is because all programs - all representation, abstractions and primitives alike-are based on pre-selected object and properties (Clancey, 1986). Clancey (1986) also commented that in addition, the background that motivates the representations, the experience behind the designer's analysis, has been cut out.

The main message that we gather from Winograd and Flores (1986), is that to become aware of the effects that computers have on society, we must reveal *implicit understanding* of *human language, thought, and work*.

This, understanding serves as a background for development in computer technology. The most important idea that we must remember is that through the *understanding* of the *nature* of *human cognition* (in particular language as actions) and what *computers can do* will enable us to *use* them *more effectively* (Clancey,

1986). It can also help us in some way to improve communications. As mentioned, Winograd and Flores (1986) brought forward the idea for designing tools based on the notion of “*breakdown and recurrence*” - which then became the center focus of their work.

Motivated by the idea of Winograd et al (1986), the authors suggested that we can create tools that are designed to make use of human perception and understanding; yet we do not necessarily need to project human capacity into the computer to achieve the first goal of creating a readiness at hand tool. They assert that *one cannot understand technology without having a functional understanding of how it is used*. This understanding must *incorporate a holistic view of the network of technologies and activities* into which it fits, rather than treating the technological devices in *isolation*.

Refer to Chapter 2, it is very evident that we must begin to understand how people go about doing their work in their offices and what facilities are provided to facilitate the joint project over the web. The examples given in Chapter 2 and so on clearly demonstrates that we need to understand the functional point and subjective view of how those tools are used. They are many web communication tools to choose from that are currently available in the EleGI joint project. During our observations, we noticed a complex way of how each person handles his “communication protocols” of doing joint task. For example, if in case tool 1 does not work, use tool 2, if tool 2 does not work, use tool 3, and if none does not work, use what tool? How does he decide on knowing which tool to use as a communication channel when communicating with whom and when? Beginning to ask this question, we see that it is very difficult to presuppose on the surface, that just by looking into patterns of communications we are able to understand these complex human activities. Hence, we believe that we must understand cognition theories on how people do their daily activities in the actual world.

### **3.4.1 Breakdown and recurrence**

As mentioned previously, Winograd et al (1986) brought forward the idea of “*breakdown and recurrence*”. In this section, we shall introduce the essence of Winograd et al (1986) idea of “breakdown and recurrence”. We begin by explaining through some examples on breakdown and recurrence of Winograd et al, (1986) pps. 68-69. The author look at the meaning of individual words, and the problem of how a particular choice of words is appropriate in a situation. For example, the word “water” can have different interpretations in different situations. But how does it come to have the same interpretation in more than one situation? In the following, the distinctions made by language is not determined by some objective classification of “situations” in the world, but neither are they totally arbitrary (Winograd et al, 1986). *Distinctions* arise from *recurrent* (*it is*

*like hierarchy of learning-like categorization*<sup>38</sup>) patterns of breakdown in the concerned activity. This is how they go hand in hand: between the breakdown and recurrence.

In relating this notion to tools, Winograd et al (1986) pps.36-37 gave another example. In computer systems, we see that for different people, engaged in different activities, the existence of the object and properties emerge in different kinds of breaking down. The authors gave an example of typing a draft on a word processor. The authors think of words and they appear on the screen. There is a network equipment that includes his arms and hands, a keyboard, and many complex devices that mediate between it and a screen. None of this equipment is present for the author except when there is a breaking down. If a letter fails to appear on the screen, the keyboard may emerge with properties such as “stuck keys”, or they may discover that the program was in fact constructed from separate component such as a “screen manager” and a “keyboard handler” and that certain kinds of “bugs” can be attributed to the keyboard handler. If the problem is serious they may call upon to bring forth a complex network of properties reflecting designs of the system and the details of computer software and hardware.

For the authors, this network of object and properties did not exist previously. They typing was part of their world, but not the structure that emerges as they try to cope with the breakdown. Relating to this philosophical idea of Heidegger (1925), the authors relate this notion of breaking down to tool designing. According to the authors, we can design tool that is able anticipate “breakdown” - how breakdown is studied and solved is by looking at the *recurrence* of a breakdown situation.

#### **3.4.1.1 Breakdown and recurrence in daily activities**

Since the focus of building our CONSTEPS is to understand how intentions arise, let us relate the idea of Winograd et al (1986) back to where we first used the breakdown notion. Recall section 1.3, during those events (I, and II), the group members became aware of the situation at hand. Clancey (2001), specifically became aware of the pattern after generalizing a similar situation that took place during HMP 1999.

“Reflecting on the incident the next day, I was reminded of another communication issues that arose during the HMP in 1999. With these *two threads*, a *generalizable lesson* emerges”. Clancey (2001), p. 2.

The involved group members (i.e., the commander, the mission support) were seeking “alternatives” and were as well evaluating as trying to explain why those

---

<sup>38</sup>Consider that in the punctuation of events, one learns hierarchy to distinct event 1 from event 2. This terminology shall be discussed in Chapter 4.

unexpected situations had arise in the first place. They made reference to related his/her own experiences that could provide as a solution for explanations. This “seeking solution” was not “fully captured” during the meetings. Normally, when in the moment of “thrownness” as illustrated in Chapter 1 and explained in Chapter 2, there is some kind of re-generating of experiences, of associating them and reflecting them. This is what we refer to as that the seeking solution was not “fully captured” during the meetings. We make an assumption from Clancey (2001) that it had most likely occurred while the author was in a room, *remembering* the previous events. Those generalization had been constructed *in time*. In this recurrence pattern of breakdown, the author may anticipate in the future if any of a similar situation may arise, and may even note further a distinction of the contexts of events.

In other words, if we link this to the phenomena back to (Winograd et al, 1986) it can be explained by: (i) meaning arises in listening to the commitment expressed in speech acts; and (ii) the articulation of content-how we talk about the world-emerges in recurrent patterns of breakdown and the potential for discourse grounding. Particularly, we are interested to see how (i) is connected to (ii). Specifically, we want to know how the commitment “expressed” in the speech acts is in a cyclic manner of interaction with the propositional content.

Winograd and Flores also claim that we can observe other varieties of human patterns of breakdown. This includes drinking, putting out fires, and washing, for which the absence or presence of “water” determines a space of potential breakdowns. Particularly, the authors give an example of how words arise to help anticipate and cope with these breakdowns. This can be used in taking a case of the Eskimos that are known to have a large number of distinctions for forms of snow. This is not just because they see a lot of snow, but precisely because there are recurrent activities with spaces of potential breakdown for which the distinctions are relevant<sup>39</sup>.

This concept of “breakdown” and recurrence is applied equally in organization. For them, breakdowns are not just situations of trouble, but are *how concerns appear* to each *member* of the *organization*. Many of them are already anticipated in the form of work organization: standard forms to be filled out, rules for credit, policies about the level of inventories, and so forth. When we are involved in a business or a network of organization, we must know how to deal with breakdowns, and to be pre-oriented in anticipation of them.

How we came up the idea of relating this concept of thrownness, breakdown and recurrence to the idea of Bateson (1972 & 1979) is to invert the ideas and discuss how people handle these thrownness situations. It is actually a two level approach, Winograd et al (1986) looks into patterns of communications and recurrence of

---

<sup>39</sup>In our opinion, this phenomenon is like of labeling a context of communication. We discuss this labeling context based on (Bateson, 1972) theory in Chapter 4. It is like a “mechanism” for having the ability to distinguish the distinction of contexts.



breakdown and with this, how it enables the authors to build tools that can anticipate breakdown situations.

In our case, we go into analyzing what lies underneath those patterns and recurrence, hence we need to relate this to cognition theories. It begins with understanding the notions of “thrownness”, like demonstrated in Chapter 2, we are always capable to be thrown into any moment of “thrownness” because we cannot always anticipate or predict what may be the effects of our actions. However, this notion of “thrownness” is a special interest for us as it denotes a flow of activities, how people can be sensitive to “breaking down” when faced in any moment of “thrownness”. A breakdown situations as given in an example by Winograd et al particularly on using the word example to situations (how words arise as having different interpretation in different context) occurs because the activities that we go about doing our work explicitly and can be implicitly used to understand how the patterns of communicative behavior emerges. Similarly, it allows us to go one level underneath to understand how intentions arise<sup>40</sup> while people are going about doing their activities in a collaborative web communications environment. (If we are to follow this idea of recurrence).

To understand how this breakdown notion and recurrence is happening, is to understand learning and communication. In particular as mentioned in Chapter 1, to the three existing theories (*hierarchy of learning of communication* (Bateson, 1972; *situated cognition* (Clancey, 1997a); and *activity theory* (Leont'ev, 1977 & 1978) that gives us insights into how people adapt their behavior moment by moment in a situated context. In order to give a clearer idea of this, we give some real examples in the next section that arise during our observations and my own experience in my moment of “thrownness”.

### **3.4.1.2 Readiness to hand for computer design: a moment of thrownness and breakdown.**

In Winograd et al (1986), the authors put a claim.

“A system that provides limited imitation of human facilities will intrude with apparently irregular and incomprehensible breakdowns. On the other hand, we can create tools that are designed to make the maximal use of human perception and understanding without projecting human capacities onto the computer. (Winograd et al, 1986)p.137.

---

<sup>40</sup>For example, we begin with how events are punctuated, hence we must know what is the beginning, pause/breakdown and the end of it. Similarly applying this to communication protocols. So if we can know what's the start of it, we must go back how intentions arise at the first place denoting/mark a start of doing an activity/task/goal. We can similarly relate this to activity theory of Bateson (1972) and Leont'ev (1977 & 1978) in Chapter 4.

Firstly, we continue to use Winograd et al (1986) ideas to explain the quote above. And then, we give a similar situation of our own but not relating it to a system.

According to Winograd et al (1986), a popular vision of the future is that the computers will become easier to use as they become more like people. In working with people, we establish domains of conversation in which our common pre-understanding lets us communicate with a minimum of words and conscious effort. The authors states that then we become explicitly aware of the structure of conversation only when there is some kind of breakdown calling for corrective action. If machines could understand in the same way people do, interactions with computers would be equally transparent.

For the authors, the transparency of interaction is of utmost importance in the design of tools, including computer systems, but it is not best achieved to attempting to mimic human faculties. In giving another example, Winograd et al (1986) p.164 illustrates a simple idea of people driving in a car. In driving a car, the control interaction is normally transparent. We do not normally think “ How far should I turn the steering wheel to go around that curve?”<sup>41</sup>. In fact, you are not aware (not unless something *intrudes*) of using a steering wheel. Phenomenologically, you are driving down the road, not operating controls. The long evolution of the design of automobiles has led to this readiness-to-hand. It is not achieved by having a car communicate like a person, but by providing the right coupling between the driver and action in the relevent domain (motion down the road) (Winograd et al, 1986).

A bad design forces user to deal with complexities that belong to the wrong domain.

“Consider the user of an electronic mail system who tries to send a message and is confronted with an "error message" saying "Mailbox server is reloading " Mailbox servers, although they may be a critical part of the implementation, are an intrusion from another domain—one that is the province of the system designers and engineers” (Winograd et al, 1986) p. 165.

Winograd et al (1986) gave this simple example, suggested that we could produce a different error message, such as “Cannot send message to that user. Please try again after five minutes”. Successful system builders learn to consider the user's domain of understanding after seeing the frustations of people who use their programs (Winograd et al, 1986). We cannot always avoid all breakdown, but we can anticipate by making user understands in a simple language what can be done. A housewife living in Asia or an old retired man trying to send an e-mail

---

<sup>41</sup> In is interesting to note, that the idea of this transparency, yet at the same time, when certain things intrude, this transparency has to becomes transparent. How can achieve to design tool that exhibit both properties that seems to complement but at contradiction with one another?

to her daughter would not comprehend this message “Mailbox server is reloading”, he would just hit the computer and gets all angry. To further understand what Winograd et al philosophical ideas, we excerpt another example of the EleGI joint project in Table 3.4.1.2

Table 3.4.1.2: Irregular behavior on the BuddySpace.

[2004/04/02 08:47] <m.eisenstadt%open.ac.uk> test hello: (broadcast msg to all online) just testing some stuff ... if you don't see me as a 'green dot' in the roster you may need to log out and in again... some suspected DNS "issues"

[2004/04/02 08:48] <lemoisson%lirmm.fr> Re: test hello: > (broadcast msg to all online) just testing some stuff ... if you don't see me as a 'green dot' in the roster you may need to log out and in again... some suspected DNS "issues"

Every thing seems ok

[2004/04/02 08:48] <m.eisenstadt%open.ac.uk> Re: Re: test hello: > Every thing seems ok

Excellent!

[2004/04/02 08:49] <lemoisson%lirmm.fr> Re: test hello: > (broadcast msg to all online) just testing some stuff ... if you don't see me as a 'green dot' in the roster you may need to log out and in again... some suspected DNS "issues"

Everything Ok :=)

[2004/04/02 08:56] <m.eisenstadt%open.ac.uk> hi... sorry for the crazy messages..

[2004/04/02 08:56] <m.eisenstadt%open.ac.uk> we get some *irregular behaviour* from our DNS entries...

[2004/04/02 08:56] <Lemoisson, Philippe [4 UM2/LIRMM]> no problem

[2004/04/02 08:56] <m.eisenstadt%open.ac.uk> Log out and in 20 times in a row, and the 'full roster' appears about 18 times... not good enough!!!!!!

In Table 3.4.1.2, the message was broadcast giving instructions to users to log in and log out if they do not see m.eisenstadt online with an attached message saying “suspected DNS issues”. This message “suspected DNS issue” may confuse people who are not computer scientists, for example the chemists whom are also part of the EleGI BuddySpace roster list. The problem with the presence, may go unnoticed for some people that they might not even be aware that their own presence may be read as “offline” instead of “online” due to the irregular behaviors of the DNS entries.

This actual chat logs makes us realize many complexity and problems in how people do manage their work activities in joint project. It also highlights what Winograd et al (1986) has asserted that to become aware of the effects that computers have on society, we must certainly reveal *implicit understanding* of human

*language, thought, and work.* We must incorporate a holistic view of the network of technologies and activities into which it fits, rather than treating the technological devices in isolation, we agree with Winograd et al (1986).

We continue discussing Table 3.4.1.2, BuddySpace sometimes gives irregular behavior mainly due to technical issues and we assume that since it was supporting many people on the project, then the presence problems frequently arrives. Sometimes a person that is offline, maybe projected as being online. BuddySpace chat system provides also integrated functions such as viewing maps, and allowing users to connect to Yahoo Messenger, Hotmail Account, and AOL. All these different communication channels are sometimes being used regularly by some of the users. Some of them switch to Hotmail or Yahoo Messenger for different categories of people (e.g., colleagues, friends, family, virtual friends and so on). The reasons why these integration was made possible was to provide BuddySpace as a complete chatting system that makes it hassle free for user from signing in multiple instant messaging accounts that can slow down computer processes (at the same time encouraging users to fully migrate to using BuddySpace as the main chat channel).

But an interesting question would be and the main focus is that if it is really necessary to provide these alternatives for academic purposes, especially when the purpose is to facilitate computer scientists collaboration? Would the facilities of allowing multiple chat channel to be migrated to BuddySpace distract computer scientist from achieving their main purpose that is to discuss work progress instead of chatting with friends and so on? On the other hand, are these integration of different communication channel (Yahoo Messenger, Hotmail Messenger) may have the virtue in some cases when it comes to solving particular problems that can be reached through consulting personal contacts?

One of the most important features in BuddySpace is that you are able to create multiple list and associate different “presence” to different list of people, for example you may create a list of group that you are collaborating or working with “EleGI”; “KMi”; or “Cnm” and you may specify your presence on these different groups differently. For example, you may be shown as “Busy” for “KMi”, “Online” for EleGI, “DND” for “Cnm” or even appear as offline for “WorkGroup5”. In a way, this feature allows you to give priority and attention to which joint project you must put at the top of the list.

On the other hand, perhaps creating this feature (multiple lists assign with different presences) may intrude with irregular and incomprehensible behavior? We are discussing this, to point out that it is not only a design issue. But it indeed forces us to understand how different organizations and people organize their daily joint task activities mediated by the web communications tools so that in case such intrusion arrives, we can anticipate them. As pointed out by Winograd et al (1986), if we provide limited imitation of human facilities, the system will introduce with incomprehensible breakdowns. Hence, one way to cope with this is to

understand maximally how human work in organizations so we can create tools without actually needing to project human capacity.

To further raise how important it is to study and understand the spirit of the work of Winograd et al (1986), I will demonstrate my own scenario. (here I use specifically I instead of we, for this one example).

I will speak of my personal experience in the lab. Normally, a student has no access to dial internationally. However, in this particular event, I needed to have access to a Professor that is living in Morocco (because he knows the work of Al-Farabi very well, is 65 years old and is quite sick, and therefore it was very difficult to reach him in a good stable condition). The appointment was to make a call at 6.30 British time, that is 7.30 pm France time. My supervisor was not around and I have forgotten to inform him to allow me to use his phone for this important call (to trace old references of Al-Farabi). So in my moment of thrownness, I went panicky “I have promised to call the professor and it's almost 7.30 pm now, what should I do!” (I normally forget the time and stay at the lab until 8 pm). I have to seek other alternatives, “How do I reach him??” on another communication channel, or another facility to allow me to communicate with this Professor? I also do not own a mobile phone. It was too late to go back home to make the call because my ride back home takes about 40 minutes.

Hence, in that moment of “thrownness”, I felt that the rules of not allowing students to call overseas was a very rational decision (e.g., some students may abuse these facilities to call their personal acquaintance) but in a moment when it involves reaching far places that people do not normally use e-mail that concerns professional work, some other alternatives must be allowed. I started to look around my computer desk, trying to think how to reach Morocco, going around the lab looking for someone that is in the administration that can allow me to make this call. But it was almost empty. I do not have time step back and reflect on my previous actions (e.g., why didn't I leave earlier today and do so on etc.).

Then, this is when the communication channel/facilities became very apparent to me, what their functions can do became very obvious to me. What can these communicational channels, fax, e-mail, web tools can *do to help me NOW?* Something caught my attention while seating on my chair, thinking ahead in front of my computer (very frustrated to the point of giving up, but something must be done!)

There was a *sound playing of someone knocking on a door with a little pop up window* that says “*azrin is now online*” on Yahoo Messenger. Then, during this moment of “thrownness”, I “saw” this an alternative solution, would it be ok to ask my friend to become the in-between me and the Professor?

Saved by this other web tool (Yahoo Messenger), my friend said it was no problem to help another fellow PhD student to make a call on her behalf. I gave in-

structions over the chat, he repeated, and he made that call while I waited breathlessly. My friend came back after 10 minutes saying that the conversations between him and the professor went fine and typed on the chat windows the recommended references. He also conveyed the message that the professor was happy to help me further and I can call him anytime if I ever have more questions about Al-Farabi's work on logics and grammar analysis.

Now, relating this to the incomprehensible breakdown or irregular behavior of the BuddySpace, what if the presence of the members were shown as “red” but in actual fact was online due to the DNS issues, this student would have missed her chance for obtaining the references!<sup>42</sup> This actual experience also demonstrates that indeed in the moment of thrownness, we start to seek alternatives and whatever is around us becomes very apparent and obvious, we are looking on our tables, scratching our heads, trying to figure out how to solve the problems. This was similar to Chapter 1, with the problem of the communication protocols, the e-mail facility became an indirect focus of the discussions among the NASA HMP group members.

My own reflection after several days was that Yahoo Messenger's tool designers took into small consideration of the sounds, this projection of the door shutting and opening (to demonstrate that someone is online or offline) never crossed my mind as being important. I sometimes get irritated and distracted by the sounds, because I cannot help but look at my computer screen, at the left side of the taskbar to see who had just signed. But at the same time, I thought it was entertaining to watch the behaviors of others going online and offline and the interesting messages displayed next to their username (e.g., I am bored, please get me out of here!”). I have never regarded these small details as being important but merely as making it interesting for users to use Yahoo Messenger (it was also more of creating a personalized social network, not aim for facilitating scientific collaboration).


However, now that I reflected, the sound of knocking and closing on a door *mimic a daily routine* that if we are in a room working or relaxing, when someone knocks on our door, we would obviously ask who it is (or simply ask the person to enter our room). So perhaps, those little features that have been taken for granted has indeed served its purpose in my opinion for my short moment of thrownness that was related to a project.

---

<sup>42</sup> If BuddySpace could anticipate this breakdown, it could perhaps generate a message read as “Presence problem, some contacts may appear offline even if they are not” or similar to give a message so in a moment of thrownness, the person may attempt to send a message to someone that “appears to be offline”.

### 3.4.2 Summary of the events

The events which I have reviewed above illustrates first the design problem in web tools and the complexity of how each group members manage their daily activities. The second event presents an event of a student that works/studies in a laboratory. A normal scenario for a PhD student would be work late to prepare a deadline, and when something needs to be submitted, some access is not available. This scenario (even if it only project a scenario of a student) does not take into full account of human facility (i.e., a student's facility) did indeed provide “irregular breakdowns” for a person. However, this scenario is concerning a person's scenario that is able to rationalize and seek alternatives. As Winograd et al (1986), we cannot fully project human capacities on these tools, but at least we can design a tool to anticipate those moment of breakdown. We need to understand the domain of how these people manage their daily activities in a workplace<sup>43</sup>.

After several recurrence of other breakdown situations, e.g., making doctors appointment, making a mental note to buy food or to meet a friend, I have realized that I have been making distinctions through learning the recurrence of patterns. For example, if the appointment would be to make a call, I would use a yellow post-it and paste it on the left hand side of my computer monitor by carefully using a cellophane tape to make sure it stays put (since I am always in front of my monitor, message reads “Leave at 5.00 pm, call Mr. Tahar). I specifically put it at this position because my books and notes are always on the left hand side of my table, and my eyes are always traveling rapidly across the monitor from right to left, slightly distracted by the edge of the monitor (because of the yellow post-it is on the foreground of a black background). It is my habit to work by regulating these patterns, take a pause, make notes and read, almost simultaneously. Hence, I turn my head from right to left to where my stacks of books and notes are located. The movements of my body follows to slightly turn from the right to the left, the perceiving act can be slowly projected as moving in a decremental line<sup>44</sup> (  ), the post-it on the edge of the monitor never misses my eye.

This way of learning of punctuating the events (to make a long distance call and the person has no e-mail access) has prompted me until now to use the post-it as a “tool” to anticipate this “type” of breakdown. Another event occurred that was to remind me through this post-it but I had missed this important message. I realized

---

<sup>43</sup>In Chapter 2, I have briefly discussed how reluctant a chemist was to go online to use BuddySpace as a tool for collaboration purposes. Apparently, the chemist in their own “domain” are very much comfortable with using phone and had a long history of using Yahoo Messenger instead of other instant messaging. The chemist in their days as students normally communicates with one another through Yahoo Messenger to chat about work, send images of “chemical structures” and so on. But this was all done among this closed group of chemists. A collaboration for them is to pick up the phone and call that person and discuss long hours about a project. For example, another chemist on going for the first time on FlashMeeting, started to talk straight into the microphone without pressing any button (he apparently just went on to start the meeting without an introduction. He was actually responding to that tool as if it was a phone. We are grateful to Tom Visser for allowing us to interview him who collaborates with the chemists.

<sup>44</sup>Head is focus at the moment on the left side, neck is turned halfway, upper body is slightly slouching, with chest slightly projecting more towards the left side.

that I was getting “used” to the post-it that I no longer pay attention to it. (I stamp many post-it on top of one another). Therefore, I start to change the color of my pen, and the colors of the post-it and make sure only a single post-it is at that location. I noticed that after several post-its, the object (the post-its) and the properties (what's written on it) merely “dissolved” and became transparent like a part of the monitor.

Secondly, to demonstrate further, whenever friends wants to meet up, I would send an e-mail to them. This was by tacit agreement whenever we are meeting each other, we would send short e-mails to one another for organizing our outings. However, during one incident, my friend had completely forgotten to meet me up, so, after this incident (which left me cold waiting for them for 10 minutes at the University); I anticipate this “breakdown situation” by sending an e-mail message to myself but it would never be clicked by me. By doing so, the message would always be highlighted (subject title is in BOLD). At the same time, the subject of the e-mail will be read as “Remind X before this Time” and is labeled as a high priority message. Personal organizer does not work for me, this is another example that each people handle their activities and organizes their work differently from one another. The choice of communication channel and the preference varies from one person to the other.

These personal examples is to present how from a simple moment of thrownness that becomes a breaking down situation for us, we learn to distinct these situations or events by it's recurrence. The learning and communication is one step to understand how people as Winograd et al (1986) would say go with the flow and handle the moment of breakdown. Then further on, how we learn to anticipate breakdown by the recurrence pattern of those breakdown. We may begin “inventing” the most practical “tools”, like post-it, send e-mail to oneself, do not click on the message, and put a priority to it. It is interesting to understand how we distinct these context of events by learning to punctuate them, and then further on to devise *our own responses* to how to work around these problems or simply it allows us to go about doing our daily activities.

To summarize this section, we have discussed what it means by building a tool that is ready-at hand by taking examples of Winograd et al. At the same time, we have related to the EleGI joint project and the NASA scenarios to show the importance of building a tool that is ready-at-hand. We show that breakdowns occurs during our daily routine activities, and with this notion, we should invert it to build tools to anticipate breakdown and help user to know what can they do in their moment of breakdown. Winograd et al (1986) gave an example of an e-mail system, hence how can we make a system to help facilitate and anticipate breakdowns for people at offices, moreover, the focus is to help tool designers understand better what can be build to facilitate actual web collaboration? We have given also an example of the BuddySpace and my own personal experience.



A thrownness situation appears everyday, it's a part of being, of our existing in a community, working together that may be on a joint project, or communicating with a personal assistant at a shop, or our interactions with driving a car (previously discussed). My short personal experience may be summarized that on that day was "I was saved by a friend *through* Yahoo Messenger".

### 3.5 Summary of Winograd and Flores approach to designing tools

Winograd and Flores put forward the idea that the key aspects of *conversation for possibilities* is the asking of the questions "What is it possible to do?" and "What will be the domain of actions in which we will engage?" Understanding this requires a *continuing reinterpretation* (of learning, and re-categorizing) of past activity. It is not seen merely as collection of past requests, promises, and deeds in action conversations, but as interpretation of the whole-interpretations that carry a pre-orientation to new possibilities for the future (Winograd et al, 1986). Hence, based on this idea of the whole-interpretation, the authors (Winograd et al, 1986) use a hermeneutics approach to "conversational analysis" for tool building. We use this term conversational analysis quite lightly, as there are several literatures (Goldkuhl, 2003 & 2005; Ljungberg, 1997) that are opposed to (Winograd et al, 1986) for labeling their approach as a conversation analysis. This is discussed in a later section.

It is from the breakdown and recurrence notion that Winograd and Flores (1986), suggest new computer-based communication technology that can help anticipate and avoid breakdowns. Nonetheless, the authors did note that it is impossible to completely avoid breakdowns by design. Since it is in the nature of any design process that it must select a finite set of anticipations for the situation. However, the authors suggested that we can *partially anticipate situations* where *breakdowns* are *likely to occur* (by noting their recurrences) and we can provide people with the tools and procedures they need to cope with them.

We, on the other hand, suggest to make it possible to design tools that are capable of *updating* those finite set of anticipations in breakdown. By nature, breakdown cannot be completely handled when it occurs, so perhaps it can be avoided by learning?

But let us summarize so far what we have outlined before we go deeper into the review. We primarily highlighted the ideas of Winograd and Flores (1986) in designing tools. The authors proposed that we should consider designing a ready - - at - hand tool. One of the ways of achieving this kind of tool is to suggest that we must fundamentally understand the nature of language, thought and work. Later on, from this idea of constructing a ready at hand tool, the authors suggest that the notion of "readiness" can be achieved by anticipating breakdowns. And breakdowns can be anticipated in tool design by analyzing the recurrence of

breakdowns. Then to relate this to why we relate this idea of Winograd et al (1986) to our idea of understanding through the notion of punctuation of events. To continue, our next questions are: (i) How can we best understand human communication so that we can create these “ready at hand” tools? (ii) What would be the best communication model for designing tools at work practice? We shall look at the earliest modeling by (Winograd et al, 1986; Winograd 1987; Medina-Mora et al, 1992) on communication tools. Then, we track the progress and the influence of Winograd and Flores (1986) in the related scientific community. After, we discuss whether the modeling is sufficient enough to capture the nature of communications at work practice.

### **3.6 Language/action perspectives (LAP)**

Continuing from (Winograd et al, 1986), the authors in (Flores et al, 1988), had introduced their conversation-for-action (CFA) schema based on their idea of “breakdown and recurrence”. It is built on what they call as *language action perspective* (LAP). However, the term, LAP had been around for more than 10 years. The first record of the term, “language action” is the article of Goldkuhl et al (1982) from the University of Stockholm, Sweden. A language action view proposed a different notion of information system and information system development.

“In this paper, we regard information systems as “social systems” only technically implemented. They are formal linguistic system for communication between people which support their actions. This change in paradigmatic assumptions has several implications for the development of information system science as an established scientific discipline. It is *not just a science of studying objectified events* and processes....Information system development should also be regarded as *social practice* to a practical interest. The purpose is then to disclose reality under a constitutive interest in the preservation and expansion of intersubjectivity and understanding (Habermas, 1972). Accordingly, Information System Science is also a discipline for studying conditions and rules for achieving intersubjectivity in understanding and effective communication.”(Goldkuhl et al, 1982).

Goldkuhl in (Goldkuhl, 1982) was mainly attacking the traditional view on Information Systems (IS), highlighting that modeling IS is not just about studying objectified events and process. It is about regarding the system development as social practice to a particular interest/organization.

On the other hand, the term picked up by (Winograd et al, 1986) was a frontal attack on the AI pretensions of those days. In the beginning, there was no relationship in either direction between the article of (Goldkuhl et al, 1982) and with (Winograd et al, 1986). In 1986 however, the two lines-European and American-come together (Weigand, 2005). It is important in our opinion to recognize the differences. We excerpt Table 3.6 from (Weigand, 2005) on the opposing view of LAP between the European and the Americans of the LAP community.

Table 3.6 : Founding articles of LAP and its differences. Excerpted from (Weigand, 2005).

	<i>European</i>	<i>American</i>
Founding article	Goldkuhl & Lyytinen	Flores & Ludlow
Philosophical roots	Critical social theory (Habermas), social constructivism (Berger & Luckmann), neo-humanism	Phenomenology and hermeneutics (Heidegger, Gadamer, Dreyfus), biological system theory (Maturana).
Philosophical ideal	Emancipation through critical dialogue driven by the (encouraged) occurrence of communicative challenges	Evolution and adaptation through structural coupling driven by the (actual or anticipated) occurrence of breakdowns.
The Enemy	“Traditional view on IS”, “Fact-based approach”, “reductionism”	Rationalistic tradition (logical positivism (esp in AI- e.g., Minsky, Schank)
View of the organization	Platform of social interaction based on socially constructed rules	Network of commitments
Communication theory	Habermas (communicative action)	Searle (Speech acts)
Primary application area	Information System design, change analysis	OIS, CSCW

Table 3.6 is an overview of the opposing views of presenting LAP. One of the major differences was that the work of Winograd et al (1986) had used a hermeneutics approach to analyzing conversations, based on speech acts theory. This had raised concern from the “conversational analysis” community in Sweden and The Netherlands. It is not surprising that a closely related community uses different approaches to analyzing communications (e.g, Habermas vs Searle). It is because they had a different aim to achieve in mind.

Nonetheless, current and most approaches in the LAP community are still very much based on the initial work of (Winograd et al, 1986; Medina-Mora et al, 1992) of *The Coordinator*. Several similar systems followed (Rittel, 1984; Colkins et al, 1988; Chang et al, 1994; Verharen et al, 1997; Bucciarelli, 1998; Weigand et al, 1998). The basis in speech act theory was here acknowledged, but besides, they introduced this scheme as a *communicative pattern of speech acts*. Most of those systems, as an example, are still very much focused on modeling

communication based on speech-act theories. An exception to this can be found in the works of (Goldkuhl, 2003; Ljungberg et al, 1997) that uses the conversation analysis to modeling communications.

Some of the original work from LAP has been brought over to the agent society (Parunak, 1996; Wan et al, 1999; Lei et al, 1996; Maudet et al, 2002). These authors abbreviated the *abstract process* of the conversation action scheme as *protocols*. These protocols were integrated into an agent-based design for business processes and using multiagent systems for designing workflow management (Wan et al, 1999). Common modeling for designing protocols/LAP uses finite state transition diagrams, Dooley Graphs (Parunak, 1996; Wan, 2004) or Petri Nets (Nowostawski et al, 2001; Mazouzi et al, 2002). We will discuss in later section the crossover of using speech acts in modeling conversations to extending it as communication protocols.

Currently, the scientific work of LAP is still not mainstream. One of the reasons is that LAP has not demonstrated value in solutions that significantly changes the behaviors of designers or computer users at the level of tools and capabilities (Weigand, 2005). Although several LAP tools and methods (Coordinator, Action Workflow, SAMPO, CHAOS) have not survived (Weignand, 2005), some of the perspectives learned are adapted from (Weigand, 2005):

- The *complexity of communication*. The LAP has always criticized the rather “factual” view on communication in mainstream IS, and argued strongly that communication is a form (and a very essential form) of human action. What has become evident, however, is that much more than a simplified speech act theory is needed to justify all the subtleties and dynamics of communication. One of the consequences of this realization is that the LAP researchers should be more explicit about what their communications models do represent and what not (and why).
- The running practices in the organization cannot be reduced to *essential communicational models* - more attention should be given to *what shapes these forms*.

In our most humble opinion, there seem to be different kinds of problems: both in the LAP community and the agent community:

1. Tool designing problems- understand people for building communication tools.
2. Understanding people problem. There are two sorts of opposing views for modeling communications: first, *passive observers*; these observers have a formal framework for modeling communications (e.g. Speech acts). Secondly, *active observers*; they lack a formal framework modeling (e.g. Conversational

analysis). The notions of passive and active observer are discussed in section 3.4. This problem brings us to the 3<sup>rd</sup> point.

### 3. Theory of communication and methodological approach to the problem of designing communication tools.

We are not suggesting that current advances in designing communication tools are not functional (Bußler et al, 1994; Weske et al, 1998; Kappel et al, 2000). By all means, we readily agree that many systems are functional in the market. The least of what we suggest is to bridge the gap between theory and practice. We also want to contribute to fulfilling design answers in some of the complexity of tool designing. What we want to highlight here are the theoretical foundations employed for designing communication tools. We are particularly interested in understanding what shapes the forms of communications: how intentions arise while speaking and doing activity.

The following section is organized follows. We review the philosophical idea of LAP, basic concepts, the methods and tools. Then we select two related system known as the *ConversationBuilder* by (Kaplan et al, 1991 & 1992) and *InConcert* (Abbott et al, 1994). Then, we discuss what is lacking and problems in the modeling. We do not focus on the technical issues of those models, but on the problems of what is lacking in the theoretical foundations that they follow for constructing the tools. By going back and forth from theory to model, our aim is to exhibit the flaws in existing theories for tool design.

### 3.7 Philosophical idea behind the LAP

In this section, we introduce the philosophical ideas of LAP within the European LAP research community based on the paper by Lyytinen (2004). Some of the basic philosophical concepts of LAP was to formulate a social, rule/norm based and interpretative alternative of how language is constituted in social life, and analyze the implications of this view on the design and investigation of information systems as linguistic phenomena. According to the Lyytinen (2004), the LAP sought to formulate a more richer way *how symbols*<sup>45</sup> and *world interact*, how language is used and enables social interactions, and why and how language has significant psychological and social effects. LAP is based on a set of heterogeneous theoretical foundations that ranged from non-monotonic and non traditional logics (deontic, illocutionary, possible world semantics), theories of language (hermeneutics, speech act theory, discourse theory) and social behavior (ethnomethodology, symbolic interactionism) to philosophies of social action (theory of communicative action, autopoiesis) (Lyytinen, 2004).

---

<sup>45</sup>In our work, we do not believe in the notion of how symbols and interaction with the world works.

LAP can be defined as a specific localized computerization movement that originated within the academic and computer industry in the early/mid 80's (Goldkuhl et al, 1982; Flores et al, 1980; Winograd et al, 1986). It became a true movement around mid's 80 in that it grew out of multiple ideas and propositions in separate diverse fields that sought to promote the use of computers to solve specific organizational problems around coordination, information sharing, and communication.

It was a dynamic part of research in CSCW and but it also crossed over to database (conceptual modeling, workflows, transactions), human computer interaction (computer use metaphors) and artificial intelligence (what does it mean to understand language).

However, LAP was different in that its origins and goals were not so much centered on perfecting computational models and techniques, and explaining purely computational phenomena. Instead, it sought to explain and understand relations between computational phenomena and social behaviors that were “embedded” in the computer system or triggered/enabled by it.

LAP is still finding grounds into the computational movements because of its ambition to incorporate many philosophical views. There are not many well-grounded yet on the concepts of applying LAP as it is still not quite mainstream.

There are some opposing view to this philosophical idea. For example, in (Ljungberg, 1997), the author argues that mainstream LAP-research is not devoted to issues of effects of individuals, groups or organizations, but rather taking a quite mechanistic stance in its worldview. The Searlian speech act theory will provide an appropriate foundation for design, if the aim is to develop a formal theory, or a formal language to describe and implement communication. However, people’s communication and work practices are not easily addressed by such formalizations. The real problems occur on another level of abstraction.

In the next subsection, we discuss research related to LAP in terms of basic concepts, methods and tools.

### **3.7.1 Basic concepts of LAP**

As reviewed, Winograd et al (1986) had famously argued for a “new foundation for design” for computer system. The new foundation meant a shift in perspective: that people do not mainly process information and make decisions, as believed in the predominant perspectives, but that people do things through language that they act by using language (Winograd, 1988). The starting point of LAP in the IS-field goes back to these issues addressed by Winograd et al (1986). At that time, most office models were information-based, i.e., viewing an office as a network of stations through which forms or other information object flows (Ljungberg, 1997).

System design should address these acts and doing, leading to designs that support people to do what they are committed to. Instead of e.g., decision support, managers need tools supporting conversations and commitments.

The set of concepts, methods and products denoted by LAP may be seen as the forming of a new communication paradigm.

LAP is based and founded on Searle's *speech act theory* (Searle et al. , 1985) and *illocutionary logic* (i.e., the formalizations of speech act theory). The first important idea in LAP is that *language* is the primary dimension of *cooperative activity*. Action is performed through language in a world constituted through language. The design of a system should have a focus on getting things done, rather than mere storage of data (Lyytinen, 2004). The act of doing something, the recurrent patterns of interaction and the articulation of these are what should concern the designer of IS.

An organization is viewed as a network of commitments (Winograd et al, 1986; Medina-Mora et al, 1992). The communicative acts used to exhibit the network of commitments are: commissives such as promises, acceptances, and rejections, or directives such as requests, orders, offers etc.

CFA (i.e., conversation for action) are *recurrent patterns* of *speech act*, forming an interplay of request and commissives, directed towards explicit cooperative action (Winograd et al, 1986; Medina-Mora et al, 1992). The communication modeling approaches within the language action perspective (LAP) are based on two important theoretical cornerstones: (i) communication is action in accordance with generic speech act types and; (ii) communication acts are organized and framed in accordance to pre-defined patterns (Goldkuhl, 2003). The basis for the first cornerstone can be found in speech act theory, but the basis for the other must be searched for elsewhere. Where it must be searched is discussed very shortly. Continuing from our discussion, CFA (Winograd et al, 1986) approaches conversation as being co-ordinated, a coherent sequence of language acts. The idea is that *whenever a task* is being performed for a customer, for example there is a *generic pattern*<sup>46</sup> of *speech acts* that occurs. The sequence typically starts with a request from the customer, and then the performer makes a promise, etc. We discuss the basic conversation for action by Winograd et al (1986) in Figure 3.7.1.

---

<sup>46</sup>However, we witnessed that in section 1.1.1, on the NASA scenarios, sometimes the same task does not generate the same patterns.

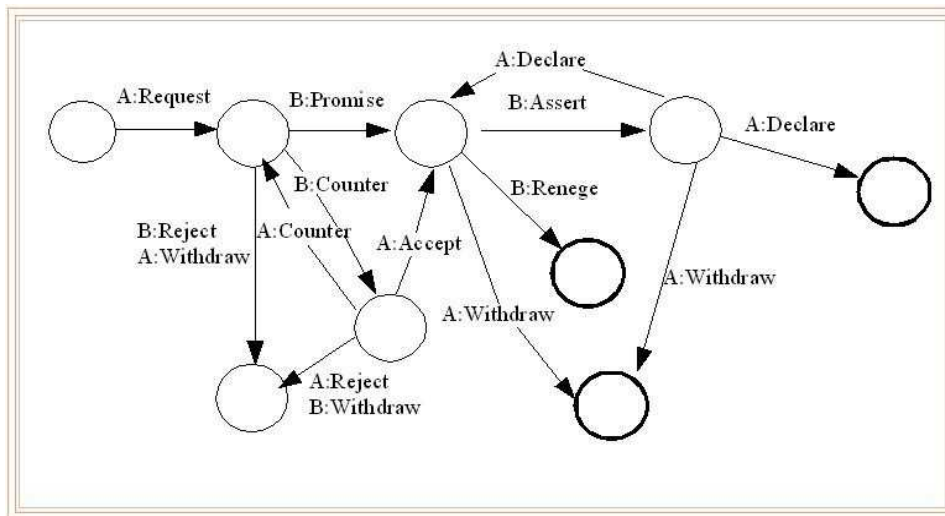


Figure 3.7.1: The basic conversation for action in general situation (Winograd et al, 1986).

Referring to Figure 3.7.1, at each point in the conversation, there is only a small set of possible action types. The lines indicate actions that can be taken by the initial speaker (A) and hearer (B). The initial action is a request from A to B, which specifies some condition of satisfaction. Following such a request, there are precisely five alternatives: the hearer can accept the conditions (promising to satisfy them), can reject them, or can ask to negotiate a change in the conditions of satisfaction (counteroffer). The original speaker can also withdraw the request before a response, or can modify its conditions. The sequence typically starts with a request from the customer, then the performer makes a promise, and reports completion, which in turn may either be declined or declared by the customer. A *discourse* is thus *defined* in a *state transition* diagram such as Figure 3.7.1. Each state transition corresponds to a speech act.

### 3.7.2 Early tools for conversations

The most well known system from the first generation of “conversational systems” was *The Coordinator* by (Winograd et al, 1986). *The Coordinator* provided facilities for generating, transmitting, storing and displaying messages. It also kept track of messages as moves in a conversation. It was thus possible to trace conversation backwards, and to keep track of commitments and obligations to others and vice versa. One point here was to allow the computer to deal with the structure and let people make the interpretations of the text. When a user retrieves a request, she can respond accordingly to a menu automatically generated by a conversational state generator. According to the recent state in the conversation, a new menu is generated. Thus, the type of speech act that is possible to perform is explicitly represented in the system.

To open a conversation for action, there were two possibilities: request or offer:



<i>Acknowledge</i>	<i>Promise</i>
Free-form	Counter-Offer
Commit-to-commit	Decline
Interim-report	Report-completion

Figure 3.7.2 : Menu options for responding to a request (Winograd et al, 1988). Excerpted from (Ljungberg, 1997).

Several studies also showed that *The Coordinator* was heavily used and appreciated by users, but mainly as a mail system (Schäl, 1996). Only a few persons used the core capabilities. Regardless of the message, people sent each other requests, (i.e., they just chose the first item on the menu (Ljungberg, 1997)) Refer to Figure 3.2.1(c). Reviews by (Goldkuhl, 2003) also claims that most users do not like to have rules imposed on them. The defined communicative actions sometimes hinder the users from exploring new alternatives instead of motivating them to seek new ones. However, there could be a possibility of adding or proposing new alternatives on the menu.

### 3.7.3 Migrating from LAP to workflow modeling processes

According to (Ljungberg, 1997), one early attempt to use speech-acts to model organizations and offices was *SAMPO* (Auramäki et al. 1992) that is an action-based office development methodology, providing a communication-oriented model of offices that ties together the purpose and structure of office communication (Auramäki 1988; Auramäki et al. 1992). We review the background from (Ljungberg, 1997).

An office is regarded as a social activity. Trying to understand the nature of this social activity requires a theory of language and its use, primarily the communicat attempts to achieve this understanding by introducing speech-act theory and discourse theory to provide a communication-oriented model of offices. Offices are viewed as networks of commitments, which are created and maintained in organizational discourses. By reconstructing and understanding the rules that govern communication, the method could support the redesign of these rules. The features of *SAMPO* (Auramäki et al. 1992) is listed below:

- description of the purpose of the communications;
- description of the conditions for successful communication
- emphasis on guaranteeing the understandability of communications;
- emphasis on guaranteeing the coherency and completeness of communications;

- simultaneous analysis of communication and organizational tasks;
- balanced design of the organization and the IS.

The aims of SAMPO were to model office communications, and provide methodological support for the information systems specification phase. SAMPO views any information system as a social, linguistic system for communication between people. The CAF schema and ideas behind early LAP efforts such as *The Coordinator* (Medina-Mora et al, 1992) and *CHAOS* (De Cindio et al, 1986) have evolved into a general base for design of business processes. A set of methods and products has emerged that use a modeling language similar to the one proposed by Flores et al (1988). For each task there is a workflow, which includes the communication with the customer, according to the schema of conversation for action. Worker accountability and customer satisfaction is made explicit. This is illustrated as a circle with four phases, illustrated in Figure 3.7.3.

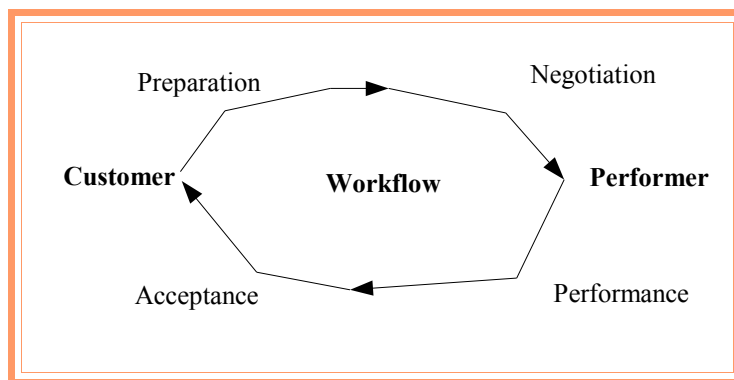


Figure 3.7.3: A graphical representation of a basic workflow loop.  
Excerpted from (Ljungberg, 1997).

Referring to Figure 3.7.3, any work activity can be sequenced in four basic steps: preparation: the customer makes a request, or the supplier makes an offer; negotiation: the parties establish a mutual agreement on conditions of satisfaction; performance: the supplier declares that the undertaking is complete, and acceptance: the customer declares satisfaction. Several circles can be interconnected with links, such that a speech act in one workflow may trigger one in another workflow. In this way, one workflow can be viewed as a sub flow to another workflow<sup>47</sup>. The basic workflow loop is used as a means to articulate customer-supplier relations, with customer satisfaction in focus. There is always an identified customer and a performer, with the loop representing a particular action the performer agrees to complete to the satisfaction of the customer. *Problems may arise when this basic loop is applied to any kind of activity* (Ljungberg, 1997).

<sup>47</sup>Normally, there should be a non-procedural content, as an example within the transition from workflow Customer to Preparation. This is discussed very shortly in section 3.10.

### 3.7.4 Several examples of LAP applications for facilitating communications

Let us move on to discussing the existing LAP applications.

We begin with the *ConversationBuilder* (Kaplan et al, 1991 & 1992). This is a collaborative open system that can be tailored to support group activities in specialized domains of applications. According Kaplan et al (1992), work activities are of a highly situated nature. As a result, it is *not possible to classify activities* exactly, since they tend to *evolve* as they progress<sup>48</sup> (Kaplan et al, 1992). This raises significant problems for work support tools. Most applications are very concentrated on how to anticipate breakdowns by understanding the regularities of people handling the breakdown situations.

Hence, one of the goals of the authors (Kaplan et al, 1991) is for the tool to “understand” at least enough of what is happening in conversations. This is to enable to help a user to understand how she got into a particular situation and what can be done next. For us, before we can make a tool to understand this, we must ourselves understand how people are able to do this. Hence, we want to begin to study how a person learns to *recognize an event as being that particular event*<sup>49</sup>. Our approach is an inversion of most ideas on approaching communications. For instance, we wish to understand the “mechanisms” or “processes” that enables a person to handle breakdown. We propose to study this based on *hierarchy of learning and communications* (Bateson, 1972). And then, with this understanding, we hope to understand how we can help tool designers to design a communication tool that can help the discrepancy between the user and the tool.

We continue discussing collaborative processes from Kaplan et al (1991), the authors observed that:

- *They are open*; there is *no one fixed way to achieve a desired result*. Different groups when presented with a particular task will carry it out in different ways; and different individuals in particular may want to tackle tasks in different ways. This implies that the actual way in which a task is performed is affected by the makeup of the group performing the task.
- *They are open ended*; there are often not clear completion criteria, and often the goals that the process is trying to achieve are vague.

---

<sup>48</sup>Does this suggest that perhaps regularities (recurrence) that emerge from correlated task (as normal occurrences of breakdown) and new “context” of breakdown sometimes cannot be anticipated for all situations?

<sup>49</sup> We assume that it may be possible that from the old category (in brain) forms associations and re-organizes itself into becoming an extended category. Hence, forming a sort of new category holding new events.

The tools for facilitating a collaborative process that are communication based should support the following:

- *allow new situations* (contexts) to be *specified* to the system. These are called *protocols* by the authors (Kaplan et al, 1991).
- help a user to *determine how she* or he got into a *particular context*.
- Enable the user to determine what contexts are available and how they relate to one another.
- Allow the description of new process protocols and the incorporation of new tools. The authors approach was to code segments of protocols so to allow combination of different ones when a user is in a new situation.

We think that the above matter was very much a fulfillment of what The Coordinator did not provide to the users. The Coordinator (Medina-Mora et al, 1992) does not say *what people should do*, or *how to deal with consequences of the acts* (such as backing a commitment) (Goldkuhl 2005a; Goldkuhl 2005b). Even if the authors (Medina-Mora et al, 1992) noted that these are very important phenomena, they are not generated in the domain formalized in *The Coordinator* (Flores et al, 1988 & Medina-Mora et al, 1992).

Hence, the authors (Kaplan et al, 1991) viewed sequences of actions in which the actions of one individual can affect the possibilities for action of other participants in the process. Then, *conversations* are seen as having an *abstract structure* by tagging utterance types. An utterance of one type by one participant in the conversations opens up a space of potential actions on the part of other participants. Readers must mark that this tool is being built for supporting collaborative processes. In order to design a tool that can support the above matter listed (bulleted points), the authors (Kaplan et al, 1991) design small but useful protocols. These protocols allow users to compose them on the fly. The user can mix-and-match to suit their needs dynamically as the process evolves.

The idea of composing protocols on the fly is used in two basic ways: firstly, allowing simple concatenating of protocols, this allows one to build linear structures. Secondly, digression is defined as the invoking of one protocol within another and returning when the invocation of the sub-protocol is complete. The idea of using digression is directed to solve breakdowns. For example, when one gets stuck, one can always digress to another level to resolve the problem within the system before continuing. So, how are the conversations being modeled? As in most approaches, the authors (Kaplan, 1991) use speech acts modeling. It is considered as being the most simplistic view by (Kaplan et al, 1991) based on the grounds listed below. Nevertheless, we noted several missing analyses in their explanations:

- rather than viewing human conversations as a tangled mess, the authors suggested that we can determine patterns and structures in the utterances, and use this information to understand what is going on and help build tools. We noticed that using only this approach ignores the relationship of the speech acts with its content base (propositional content). This can create the problem of redundancy. It can also create a possibility of generating a “contradictory” help system for the user. This is discussed in section 3.6.1.
- The idea of tagging utterances with their type abstracts the conversational structure from the domain of the conversation. This is to enable people to help to decide how they have arrived in a particular context, or situation and what can be done next. It is mostly based on a generalized conception of recurrence. However, exactly how she arrived at that situation is not included in those analyses. Also, what do the authors mean by the idea of tagging utterances that is based on a generalized conception? It is not sufficient to only analyze the communicative acts regardless of the content. Because in the end this will only contradict with the nature that a work practice is highly “situated”. Ignoring the propositional content and only focusing on the abstract recurrence patterns of the communicative acts does not conform to the idea of modeling communication tools that are highly “situated”. And abstract recurrence of patterns does not convey the essential messages. This is well illustrated in Chapter 7. However, the problem of formally explaining the patterns of recurrence between the communicative acts and propositional content is very difficult to model. But it can be suggested by understanding how the re-sequencing and re-enacting of conversation structures is explained by memory. This is also discussed in Chapter 4 and 5.
- Another idea that is employed when composing protocols is the concept of continuation. The basic point is that when a protocol is invoked it can be passed a continuation essentially specifies “..and when you are done, perform the following actions”. This is then used to view all utterances as protocols. But the problem with using pure speech acts is that not everything in a collaborative process is viewed as an utterance. For example, consider that a person is sending a link to another during FlashMeeting without verbally requesting them to view the link. This is not an utterance, but an interaction with the communication tool to convey certain intentions.

We have raised some of our concerns in the above: focusing on how the authors analyze communications in work practice. As claimed, the authors (Kaplan et al, 1991) state that the goal is for the tools to “understand” at least enough of what is happening in conversations. With the understanding, it is possible to help the user to understand how she got into that particular situation and what can be done next. Our goal is to understand “at least enough” how *people learn to discriminate one context* from another. But even before doing so, we must

understand how people learn to “punctuate an event”<sup>50</sup>. Looking into this allows us to go further into understanding how people learn when in a moment of breakdown (see again the NASA scenarios). But what are exactly the problems if one models communication solely based on speech act theory? What is really the issue here? Before we review what is really the problem which is discussed right after this section, let us continue a bit more on some other communications modeling approaches.

One of the *primary challenges* in the research is to find a way to *maximize* both *flexibility* and *active support* (Kaplan et al, 1992). Unfortunately, these requirements tend to oppose each other. Increasing flexibility can mean sacrificing knowledge about what the users of the system are doing, which reduces the handle that the designers can get on providing active support (Kaplan et al, 1992). On the other hand, increasing the amount of knowledge we have about the user sections, and thereby increasing the potential active support, tends to decrease the room for users to maneuver. This is mainly because of the complexity of understanding and modeling the rich contexts of communications.

Then, there is also the problem of characterization: the situated nature of work activities emerges strongly from all of these investigations: work activities shape themselves as they evolve. It is often in unexpected ways (Kaplan, 1992). A practical consequence of this is that it is nearly impossible to characterize most work “activities” exactly enough to be able to contemplate writing a computer program that directly supports them, as it not possible to articulate exactly what comprises activities (Kaplan et al, 1992).

Another system, known as *InConcert* (Abbott et al, 1994), is concerned with designing tools for workflow management. The authors particularly expressed the importance of integrating the procedural and non-procedural work. In their terminology (Abbott et al, 1994), a *procedural content* of a work process refers to the *structured aspects* of the *process*. On the other hand, the *non-procedural content* of the work process corresponds to *un-choreographed interactions* between people that perhaps *emerges*<sup>51</sup> as unique or new interactions among people working corresponding between the both procedures. The mix of procedural and non-procedural content depends on the process, the business, and the type of application.

The need to represent a non-procedural behavior is typically to represent actions taken when handling “exceptions” to the structured process representation. The authors listed some examples of exceptions that arise and must be handled frequently during their experiences with *InConcert*:

---

<sup>50</sup>For example, how someone knows that this context is about discussing document writings, and what must be appropriately communicated during this context.

<sup>51</sup>Since by nature, our behaviors are always situated and adapted to the context of communication, suggesting that indeed new interactions may emerge?

- re-assigning work from one person (who is unexpectedly unable or unavailable to complete work) to another person.
- Overriding the process when a required approval has not been received and is impeding progress.
- Sending work back to someone who sent it on without completing it;
- negotiating a new deadline when a task is overdue.

The authors (Abbott et al, 1994) acknowledged that it is not possible to anticipate all possible exceptions in a process. Representing them and their responses explicitly would make the process description lose its value as it would become hopelessly unwieldy and hard to understand. A challenge is to combine (those concerns above) and manage both the procedural and non procedural interactions appropriately (Abbott et al, 1994). The *CFA* schema are appropriate for non-procedural interactions, but are often overkill for a structured process where agreements to perform work do not need to be negotiated every time (Abbott et al, 1994).

Based on those reviews; we highlight some of the concerns. These are concerns that must be addressed, from creating a flexible yet dynamic systems to support the highly situated nature of work practice. These concerns cast doubts on solely relying on speech act theory for explaining actual communications during work practice. It does not seem to be sufficient enough to capture the full meaning of actual human communications for the purpose of building a workflow tool. In a very critical analysis, Goldkuhl (2005), uses a “pizza” scenario to do both a critical review of *The Coordinator* as well as an indirect opposition to modeling communication based only on speech act theory.

To summarize these applications, fixed communication protocols prove to be functional in actual work practice. However, as mentioned the activities in an organization (Chapter 1) are very rich in context, and are always “situated” and progressing. The focus on the procedural content cannot dismiss the non-procedural content and we shall review why in the next section. Those concerns raised by the authors (Abbott et al, 1994; Kaplan 1991 & 1992) are precisely what we have in mind, for suggesting as a vehicle of modeling the breakdown between the user and the tools by understanding human learning in breakdown conditions.

Before we move on, let us refresh our memory. We have outlined some of the open questions in modeling communication tools in work practice. In our perspectives, we have to get the foundation in its proper place for analyzing actual human communications. To summarize the weakness of using existing theories on communications for tool design, we focus on one main issue:

How can we design a tool that can support a procedural and a non-procedural content in communications? As mentioned, in some events, the communications taking place during the non-procedural content contribute to certain experiences in dealing with problems during the procedural content. We propose to replace this terminology of procedural and non-procedural content with, “problem solving engagements and daily activities engagements”.

Are these models of speech acts enough to explain to designers the nature of communications for tool designing? If the speech acts are used for making whole-interpretation, does it mean a sequence of experiences of communications, or a whole just residing at that moment of utterance? Recalling Winograd et al (1986), the authors used a hermeneutics approach to “conversational analysis” (see Chapter 3, section 3.1.1). Then looking into the *distinctions* that arise from this *recurrence pattern* of *breakdowns* in a situation allowed the authors to design a tool that can anticipate the breakdowns most of the times. Our interest in highlighting this notion (of distinction) is to instead relate it to a wider context. The context of understanding how a person can recognize *differing context*. A differing context is a notion by (Bateson, 1972) on how an organism responds to the “same” stimulus differently in differing context (recall how the Eskimos “responds” to “snow” in differing contexts). We provide more explanations of those notions in Chapter 3. If we are able to understand this, perhaps we can contribute to addressing the issues above for the integration of a procedural and a non-procedural content.

In order to continue justifying our approach, we extract a very significant, even if simplistic scenario of a pizza baker working at a pizza shop. Even though the nature of the communication in this example is not a collaborative one, it captures the complexity of tracking communications enough (in this case, the cooperation between a pizza baker and a pizza buyer).

We give some basic introduction to speech act theory in the remaining sections, then moving on to highlight the pizza scenario.

### 3.8 Speech acts

Fundamentally, language philosophers based their views on logical positivism; studying language meant trying to understand the meaning of phrases by indicating how it was possible to use a combination of words to make a significant utterance (Ferber, 1996). Speech acts designate all intentional actions (in the operative sense of perform) carried out in the course of communication. There are several types of speech acts. According to Searle and Vanderveken, we can distinguish the following main types of acts:

- Assertive acts serve to give information on the world by asserting something (e.g., It’s fine; John is 21 yrs old).



- Directive acts are used to give directives to the addressee (e.g., Give me your watch; Come and eat).
- Promissive acts commit the locutor to performing certain acts in the future (e.g., I'll come to the meeting at 5 o'clock; I promise to email you regularly).
- Expressive acts serve to give addressee indications of the mental states of the locutor (e.g., I am happy; I am sorry about yesterday; Thank you).
- Declarative acts perform an act by the mere fact of making the utterance (e.g., I declare the meeting open; I'm giving you the job; I curse you).

Speech acts study is concentrated on all linguistic communication that involves linguistic acts. The unit of linguistic communication is not, as had generally been supposed, the symbol, word or sentence, or even the token of the symbol, word or sentence, but rather the production or issuance of the symbol or word or sentence in the performance of the speech act (Searle, 1983). Speech acts are the basic or minimal units of linguistic communication. Speech acts have been defined as complex structures made up of three components: *(i)* locutory; *(ii)* illocutory; and *(iii)* perlocutory.

The *locutory* component concerns the material generation of utterances, by the emission of sound or waves or by the writing of characters that is the mode of production of phrases with the help of a given grammar and lexicon.

The *illocutory* on the other hand concerns the carrying out of the act, performed by the locutor on the addressee of the utterance. Illocutory acts, the most frequently studied acts in language pragmatics, are characterized by illocutory force and by a propositional content which is the object of the illocutory force. Examples of illocutory force are: affirming, questioning, asking to do, promising, ordering, informing.

The *perlocutory* component relates to the effects that illocutory acts can have on the state of the addressee, and on his or her actions, beliefs and judgments. For example, convincing, inspiring, frightening, persuading, and so on are perlocutory acts. They are the consequence of illocutory acts (Ferber, 1996).

### 3.8.1 Modeling speech acts in conversations

The theory of speech acts, as developed by Austin, Searle, Vanderveken (Austin, 1962; Searle, 1969; Searle et al, 1985), takes only account of the *isolated acts*, the initial utterance, with its conditions of application, and the local effects which it can have on the interlocutors (Ferber, 1996). It does not look into the aspects of

the located tools<sup>52</sup>. Speech acts *do not look* at the *sequence of interactions* which is established between the interlocutors during their communications or to their reciprocal expectations in conversations (Ferber, 1996). Hence, using only speech acts theory is not sufficient as a comprehensive model of conversations for agent communication. Yet, speech act modeling is still widely used among the agent community because of its simplicity.

We review in the subsections how speech acts evolved in modeling it as agent communication language.

### **3.8.2 Using the locutory, illocutory and perlocutory acts for modeling speech acts for agent conversations**

In this section we introduce how speech act theory had gradually been migrated into an agent community and then to communication protocols (finally branching into its own community know as the Acl community)<sup>53</sup>. This section is a second part of the thesis, where we have mentioned that we use the Acl, specifically Fipa-Acl as formal guidelines to recognize intentions in utterances. In order to understand how speech acts are used in Acl, we present the review by Ferber (1996).

Firstly, in order to utilize speech acts in modeling agent conversations, we can have an utterance that succeeds or fails. For example, if agent A asks B to solve a differential equation, and B does not know how to do it, the request will fail. The same applies if B has not understood the request. In both cases, the speech act has not succeeded. Thus a speech act can fail to achieve its objective in several ways:

1. In the enunciation of the act: because the message is not sent properly, because the locutor mumbles, because there is noise on the line or because the addressee does not understand the language used by the sender and the act will fail because it is not understood, or because the addressee will misunderstand.
2. In the interpretation of the act: the message is sent correctly and arrives at the right address, but the addressee does not interpret the sender's illocutionary force correctly, For example, for the question:

(M1) A : B << Question (it is raining)

then the addressee, B actually understands

---

<sup>52</sup> In our context of experiment, the members of the collaborating team are constantly communicating via a located tool. Located tools range from the e-mailing system, to instant messaging system, to video conferencing.

<sup>53</sup> Readers note that this is an entirely different focus, for example in the work of (Singh, 1996 & 1999) the author had started with workflow management and then attempts to solve the problem by using communication protocols. However, in this review, that is primarily based on the work of Ferber (1996), where the author does not have the intention of building communication protocols for workflow management.

(M1') A : B << Assert (it is raining)

B will confuse a question with an assertion, which may lead her to produce a response which A will perhaps consider bizarre:

(M3) B : A << Assert (I'll take my umbrella, then)

3. In the actual fulfillment out of the act brought about the enunciation. The reasons for failure are legion. It is sufficient, for example, for one of the interlocutors not to have the skill to carry out this act. If A asks B to solve problem involving differential equations and B does not know how to do it, this will constitute a failure. In general, a refusal by the addressee will cause any directive act to fail that is, those that relate to question or to a request to carry out an action. Likewise, promises are null and void if the senders are not capable of fulfilling their promises. The promise, "I'll give your money back tomorrow" risks failure if the sender has not a penny in the world and has no way of giving this money back. Likewise, a prisoner who promises someone not in prison that he will come and see him tomorrow is extremely likely to fail to fulfill his promise if he is not released in the meantime.

From this problem, Vanderken (1988) proposes another classification with regard to the pragmatics of speech acts by differentiating success from satisfaction. The condition of success are those which must be fulfilled, in the context of an enunciation, for the sender to succeed in carrying out this act. A promise requires, as condition of its success that the locutor actually commits herself to carry out the act corresponding to the promise. Likewise, a declaration, such as "I declare the meeting open's requires, as condition of its success that the locutor does have the authority allowing her to make this declaration. There is therefore success if the locutor carries out the illocutory act implicit in the statement (Ferber, 1996).

For example,

(M3) A : B <<AskDo (P)

Is accomplished successfully and without error if:

1. the locutor A tries to make sure that his interlocutor B adjusts the world to the words (that is, the world should be in the state described by P).
2. with a certain position of authority
3. leaving B the option of refusing
4. B is capable of doing it, and
5. A locutor wants B to do it (desire is the psychological mode relating to the conditions of sincerity of directives).

On the other hand, the conditions of satisfaction relate to the perlocutory component, and take account of the state of the world resulting from this act. For

this reason, the speech act is associated to message M3 is satisfied if B carries out P. Likewise, a question is satisfied if the addressee responds to the question, an assertion if it is true, a promise if it is kept. The condition of satisfaction is stronger, since it takes into account of the fulfillment of P. Satisfaction leads to success, but not vice versa.

### **3.8.3 Components of illocutory acts**

Searle (1969), describes the different types of speech acts through the set of conditions which he considers necessary and sufficient for their accomplishment.

1. Conditions of departure and arrival or input/output. They relate to the fact that the message can arrive from the sender, who is not dumb, to the addressee who is not deaf; clearly a working channel of communication exists between the two interlocutors. In other words, the phatic function of the communication is provided for.
2. Conditions relating to the propositional content. Speech acts generally assume a specific structure for the syntax of the propositional contents which are associated with them. These conditions therefore relate to the grammatical and conceptual restrictions concerning the content of these propositions.
3. Preparatory conditions. They relate to what has to be true in the world for a locutor to be able to carry out a speech act. In the case of an utterance such as M5, these conditions follows:
  - B is capable of doing P
  - A believes that B is capable of doing P
  - Neither A or B is certain that B will do P
4. Condition of sincerity. An act can succeed only if the locutor is sincere that is, if the sender wishes to carry out what he is claiming to do in enunciating his phrase. In the case of a request, this means that A really wants B to carry out the action P. In the same way, if A makes a promise to B to do P, this means that he really has the wish to do P in the future. Finally, if we are dealing with an affirmation, A is assumed to believe in his assertion. These conditions, which are not always fulfilled by natural agents, are obvious for artificial agents.
5. Essential condition. This actually relates to what the locutor really wants to do when performing a speech act. If the locutor asks a question, it is because he wishes to obtain information. If he asks for something to be done, it is because he wants the action to be carried out.

All of the conditions of Searle (1969) is fulfilled by the Fipa-Acl formal model of communicative acts by Sadek et al (1997).

### 3.8.4 Conversations for speech acts to communication protocols

Most importantly, the theory of speech acts has no relevance to the sequence of interactions which is established between the illocutors and interlocutors during their communications or to their reciprocal expectations. For example, an agent asking a question expects a response or a refuse, a promise by the locutor, similarly an assertion leads to an acceptance such as “I already knew that” or to a denial “that's not possible”. The concept of dialogue is sometimes forgotten by speech acts.

Nonetheless, researchers such as (Ferber, 1996), in attempt to solve this problem, extends the speech act theory based on the definition of *communication protocols* that considers that any speech act assumes a certain possible linkage of enunciations, and that it engenders certain modifications in the mental state of the interlocutors. All research trends in this area of communication protocols are based on using the speech acts theory of Searle. The modeling of the conversations in such a way is one way of the agent community to validate the sequences of messages (Ferber, 1996). That is why in most formal guidelines in Acl, protocols and semantic language are already predefined. This is very evident in the semantics precondition of the Acl where readers can refer to the Appendixes. However, in our work, we do not follow at all the guidelines of defining the protocols, but instead just uses the modeling for recognizing intentions<sup>54</sup>.

According to Ferber (1996), by considering from this perspectives of extending in the definition of communication protocols, the speech acts theory is used to relate a sequences of actions. However, this possibility leads to another problem that is defining the communication protocols and tracing back where the relationship of linkages goes back in time. For those reasons, the agent communication community has not yet open an integration of human agent-artificial agent communication despite having this model of communication protocol because how can it understand the context of conversations just by merely looking at linkages and sequences?

According to this way of extending the notion of speech acts in conversations that it not performed in isolation (Ferber, 1996) claims and it is often the origin of other acts. For example, a promise such as “I promise I'll come tomorrow: constitutes a commitment by the locutor to carry out a specific act, that of coming, at a specific time, tomorrow.

The request is then formulated as

(M3) A:B <<Request (P)

---

<sup>54</sup>However, it does not mean that we do not look follow the syntax, what we would like to clarify is that the content layer (specifically the SL (semantic language) defined by Fipa-Acl) is not strictly being followed by us and the rules that an act must be replied or follow by another work is not followed in our work.

is an act of requesting an action, and is the origin of the whole series of subsequent actions; agreement or refusal by B to carry out P, perhaps the carrying out of task P and the signaling of this to A. These consequences are important, for they lead to expectations on the part of the locutor.

The latter, depending on the messages will thus be able to anticipate the future. For example, if Agent B agrees to do P, A may suppose action P will be completed on date  $D + T$ , where D is the date and T is the normal time for carrying out P. For example, if A is the owner of the house, B is a painter, and P is the action of painting the lounge of A's house, the message M3 (to see), if it is accepted by B, may lead A to think that his lounge will have been repainted after certain time. The definition of this time may itself be the subject of transactions or else refer to the normal performance of time, that is refer to a standard concept, shared by the interlocutors, of the normal characteristics of the task.

An Agent A who asks a question to an agent B that is, who sends message taking the form:

(M6) A: B  $\ll$ Question (what is the set  $(X | P(x))$ )

expects one of the following three reactions:

1. The answer to the question:

(M7) B :A  $\ll$ Answer (M6, a1, ...,an) are the answers to the preceding question that is, the value of x which satisfy P(x).

2. A refusal to answer the question, perhaps accompanied by an explanation:

(M7') B :A  $\ll$  RefuseIncompetentRequest (M6)

3. A request for additional information (moving to the meta-level), since it necessary to speak of communication)

(M7'') B:A  $\ll$ MetaQuestion (M6, Arguments (P))

The modeling of these conversation make use, in particular the definition of protocols (among agent society) that is, of valid sequences of messages. As usual, the most common way to describe these protocols are using finite-state automata (Pitt et al, 1999; Yolum et al, 2001) or Petri Nets (Cost, 1999; Chen et al, 1999).

### **3.9 Analyzing communications from speech acts and commitment theory is not a complete analysis**

We have reviewed how speech act theory is used in modeling conversations, specifically in agent conversations. Then we move on to review how the agent community (mainly in Europe) attempts to solve the speech act problem through extending it to Ferber's (1996) definition of communication protocols. The speech act theory had been adapted to a new context, but it does not highlight the

philosophy or groundings of what sort of adaptation has been made (Ferber, 1996; van Eijk et al, 2003; Huget et al, 2003; Huget, 2003; Serrano et al, 2003).

As promised in Section 3.7.2, we shall reveal some of the rich context of communications that speech act theory fails to track and capture. We specifically excerpt the famous pizza scenario of Weigand et al (2003) Goldkuhl (2005). This pizza scenario has been used quite extensively among the LAP community to point out the weakness in several modelings, such as those by (Winograd et al, 1986; Medina-Mora et al, 1992; Kaplan et al, 1992). Even if it seems a simplistic view, we will see that this analysis actually conforms to our actual own scenarios. We show the Table 3.9 (a).

Table 3.9 (a): Excerpted from (Goldkuhl, 2005). The pizza shop case-questions and answers.

	<i>Question</i>	<i>Answer</i>
1	Hello Giorgio, why are you baking this pizza?	Lucilla, the order taker gave me an order to bake a pizza Capricciosa
2	So Lucilla tells you what to do?	Yes, she forwards the orders from the customers
3	Couldn't you take the orders from the customers yourself?	Well, I am quite busy baking the pizzas. There needs to be someone there to take orders.
4	Why is Lucilla taking the orders and you baking the pizzas? Couldn't it be the other way around?	My job is to bake pizzas-and Lucilla's job is to take orders.
5	Who has told you that you are the one to bake the pizzas? This pizza and other pizzas as well?	Well, that's is of course Aldo, the owner of the pizza shop. I am hired to be a pizza baker.
6	So, Aldo told you to bake pizzas?	Yes, it is my job here! And he is the one who decides.
7	Ok, so he told you to bake pizzas. Did he also tell you how to bake pizzas or did you know that before?	Well, I knew something before, but I got my instructions from Rikki, the old pizza baker. He told me about baking and different ingredients and how to handle the oven.
8	Can I order any pizza here from you?	As long it is from our menu. The menu tells you the name of the pizzas and which ingredients there are.
9	Who has prepared the menu? Have you done it?	Oh no! It's Aldo, the owner of course. I bake according to them.
10	Do you bake good pizzas?	Yes they are great. They are very popular. We are very busy.
11	So it is due to you that Aldo's pizza shop is running well?	He, he [laughing]. I think I do my job well. But there is the Aldo's taste of pizzas.
12	The Aldo's taste-what is that?	When I started to work here Aldo told me to remember, that Aldo's pizzas are well known to be rich in flavour of cheese and spices!

	<i>Question</i>	<i>Answer</i>
13	So you follow that ideal every day?	Yes, we must have good quality, otherwise we are out of business!
14	So when you bake this particular pizza you follow this exhortation from Aldo?	Yes, I do, but I also put on extra oregano on this pizza.
15	Why do you do that?	This is an order from John Smith. I know that he likes extra oregano.
16	Ok, so he ordered extra oregano on the pizza.	No, but I remember once when he thanked me for the pizza. He said that he liked it really tastes of the oregano.
17	Ok, thanks Giorgio. Now, I know a lot about the baking pizza logic.	Ok, thanks to you. Pizza logic, is that a new kind of pizza..?

We now focus on the pizza shop case; referring to the dialogues above (Table 3.5(a)). We review both the analysis of the Goldkuhl (2005) and our own. Firstly, what can we learn from this case?

The baking of the pizza is a response to the customer's order. Giorgio bakes the pizza because the customer John Smith asked for it. But, the analysis in table 2.5(a) implies this is not the complete story. There are other initiatives/motivations for Giorgio baking this pizza. There are other concerns of *how the intentions arise*. Firstly, considering the setting of the pizza shop; there is a role assignment, a product repertoire (the menu) and a quality norm issued by the owner directed to Giorgio, the pizza baker (Goldkuhl, 2005). Before the pizza baker got into his “designated role”, the pizza baker *learned* the instructions from the *experienced* pizza baker, and there is a former judgment from the customer. These different communication acts are not present in the actual pizza baking. They exist as *memory traces* by the pizza baker (Goldkuhl, 2005). If we may add, they are also *traces* to a *previous event*. To add more excitement to the story, had Giorgio accidentally put too much oregano, only to find out later that the customer actually enjoys it? Continuing with the analysis of (Goldkuhl, 2005), the pizza baker is in fact, *personalizing* the pizza to his favorite customers. He takes them into account when baking the pizza. They are not as apparent as the customer order. They are not what initiated the pizza baking. The author (Goldkuhl, 2005), considers the customer as the “trigger” for the pizza baking. Nonetheless, without all the other background initiatives, the pizza baker would not bake the pizza that way.

Each time Giorgio bakes the pizza, he is “*actively remembering*”, and *contextualizing the context of making pizza, in respect to* the instructions of Giorgio. When baking the pizzas, Giorgio follows the instructions of Rikki, the old baker (Goldkuhl, 2005). Goldkuhl considers this is a response to Rikki, although Rikki will not be present when he bakes the pizzas, at the same time the presence of an initiator can however not be a valid criterion for what counts as an



initiative. The pizza baking, *in parts*, can be seen as a *response* to all these communication acts (an experience). Giorgio's *adaptation to the former judgments of the customer* of John Smith was perhaps not in accordance with some particular intention of John Smith. Mr. Smith did perhaps not intentionally mean that Giorgio always should bake his pizza with extra oregano (Goldkuhl, 2005).

What can we learn from this pizza scenario? Analyzing communications is definitely not so straight forward. The backgrounds are not only made of the roles, the norms, but the *personal experiences* of one's *transaction* with another person (and environment). The remembering of certain events, transcends later into actions of communications that becomes habitual. To simplify communications just by utterances is a “gloss of” to the actual phenomenon of human communications. The utterance is just one way of allowing us to tap into what is hidden when someone is speaking and doing things. It cannot be interpreted in its own individual account, it must be related back to the whole of experience of communicating. Hence, what exactly makes up the whole of that experiences is another matter.

In summary, analyzing communications solely on speech act theory and commitment is not sufficient to explain the richness and complexity of *human learning* and *communications*. We must be able to go beyond and to ask at the very beginning, how those utterances or *intentions arise*. We must see that these communicational aspects are *dynamic*, they are *situated*.

### **3.10 What's wrong with speech acts ?**

We have illustrated a very important scenario (pizza scenario). This scenario shows that we need to consider the *experience of learning* in respect to the *remembering* when analyzing actual communications.

This pizza scenario points out the weakness of the applications that we mentioned (Section 3.3), mainly that speech act theory does not capture the whole story of communications. What are the implications if a full story of communications is not captured in the model of communication tool? We list them down:

1. Recall the problem of designing an integration of a procedural and non-procedural work. It had no reference to speech act theory for modeling- simply because speech act theory only considers utterances. As asserted by Kaplan et al (1991), not all collaborative processes are viewed as utterances.
2. Recall the problem of designing protocols for helping a user to determine how she got into a particular situation. Our very favorite words “*recognizing that event* as being that *particular event*” may seem a very trivial focus. But notice that most communication theories do not acknowledge the fine-grained

analysis. Similarly the notion by (Bateson, 1972) on the “punctuation of events” is not very much regarded as being important in mainstream communication analysis. But it is exactly those notions; those fine-grained notions that signify the missing point in existing theories. The analysis does not capture the “in between” of what we are doing.

For example, we show below:

Non-procedural content < ?? > Procedural content

Firstly, what causes the “move” from a non-procedural content to a procedural content. The “in between” is denoted by <??>. Secondly, how was that “move” made? We can similarly abbreviate this as:

----- < ???? > Event 1

What are the “making up”, (denoted by “-----”) of the in-between processes, (denoted by <???) for someone to recognize a simple event (like it's the opening ceremony of giving a speech) as being that event of giving a speech?

Our proposal is to complement current conversation analysis with our focus on learning, and memory.

Most importantly, it is not our main goal to solve the problems of speech acts theory. It has received a huge amount of attention in the past few years, a notable criticism can be found in (Allwood, 1977).

We are going to raise our concerns again on applications (some are already discussed in section 3.2). We refer primarily to the work by (Goldkuhl, 2005; Goldkuhl, 2003; Cronholm et al 2004). More critical analysis of Winograd and Flores work (Flores et al, 1988) may be found in (Goldkuhl, 2003 & 2005).

First of all, Clancey (1986), p. 15 on a review of Winograd et al (1986) states that Winograd and Flores had emphasized that the performative tell and ask actions do not come from interpreted representation. By emphasizing this point, Winograd et al ignore the crucial point that thinking involves the generation of representations and attending to them. According to Clancey's interpretations, we are constantly observers to our own thinking behavior. We are constantly responding to representations.

Secondly, Winograd et al (1986) claim that “relevant regularities are not in individual speech acts” (p. 64). However, most argumentation in LAP approaches rests upon *speech act theory* with *directed focus* on *individual speech acts*. This casts more doubts.

Thirdly, Winograd et al (1986), p. 64) claim also that *regularities* “appear in the domain of conversation, in which successive speech acts are related to one another”. They say it the “network of speech acts constitute straightforward conversation for action”. We review the specific quotation below :

“The issue here is one of finding the appropriate domain of recurrence. Linguistic behavior can be described in several distinct domains. The relevant regularities are not in individual speech acts (embodied in sentences) or in some kind of explicit agreement of meanings. They appear in the domain of conversation, in which successive speech acts are related to one another. This domain is like Maturana's cognitive domain in being relational and historical. The *regularities do not appear* in the correlation between *an act* and the *structure* of the actor, but in relevance of a pattern of acts through time. As an example, of *conversational analysis* we will consider in some detail the *network of speech acts* that constitute *straightforward conversation for action*- those in which an interplay of requests and commissives are directed towards explicit cooperative action. This is a useful example both because of its clarity and because it is the basis for computer tools for conducting conversations”

This comment by (Winograd et al, 1986) has drawn raised eyebrows from the conversational analysis community (Goldkuhl, 2003 & 2005), because what had been described by (Winograd et al, 1986) did not suggest at all a conversational analysis approach (Goldkuhl, 2003). For a more detailed issue on this, refer to (Goldkuhl, 2003).

In Goldkuhl (2003) suggests that to fulfill those missing approaches in speech act theory is to refer to *conversational analysis*. On the other hand, (Ljungberg, 1997) proposes to combine different approaches, such as discourse analysis and conversation analysis for actual communication analysis. We shall discuss if we really should refer only to conversational analysis, or combine it with discourse analysis at the end of Chapter 3.

We take the best of those approaches. We think in the best practice we cannot ignore the fundamental theoretical foundations, such as speech act theory. Even if the sentences analyzed are simple sentences, such as “I see a station wagon in front of me”, it does not mean it does not have some truth in the analysis.

We just want to stress again here that depending solely on speech act theory is not sufficient to capture and explain actual communications. The following section is organized as follows: (i) we begin with the criticism of speech acts that can be found in (Goldkuhl, 2003; Ljungberg et al, 1997). (ii) we briefly introduce conversation analysis and discourse analysis (Goldkuhl, 2003; Ljungberg et al,

1997) and then; (iii) discuss the shortcomings, and assert our own idea to hopefully contribute to current approaches.

### **3.11 Speech act theory- a cry for help**

In the previous sections, we have it going about the insufficiency of using speech act theory for modeling communication tools. Let us examine the reasons. We must find out, so that we know exactly where we should be looking for complementing the speech act theory. Historically, speech act modeling was rejected within its own field by some researchers (Whitaker, 1992). When a theory is exported to a new field, it often serves new purposes and should be evaluated on new grounds. When speech act theory is applied to a new field, it necessarily has undergone adaptation.

One line of criticism against speech act theory starts from the premise that human actions are always situated (Suchman, 1987). According to (Suchman, 1994), some criticisms of speech act theory are based on insights concerning the “circumstantially contingent character of meaning and intention” (Ljungberg, 1997).

There are many sets of criticisms or themes on speech act based design (Ljungberg, 1997). We start with (Ljungberg, 1997) the problem and limitations of speech act theory can be grounded to two types:

1. The problem of theoretical abstractions:
  - The insufficiency of any theoretical abstraction;
  - The insufficiency of particular abstractions, in this case speech act theory;
2. The problems with a rationalistic design of work (i.e., problems with rigid design versus flexibility, and global authority versus local autonomy).

In particular we are concerned with the first problem of the theoretical abstraction of conversations. We look at the problem of theoretical abstraction, discussed in the next section.

#### **3.11.1 The problem of theoretical abstractions of speech act theory**

It is important to be clear about *how speech act theory* is used to *solve new problems* in its *new active field*. In this new context, people are not concerned with abstract philosophical problems of meaning. One major difference is that most *linguists* and *philosophers* are *passive observers* (Ljungberg, 1997),

describing social interactions, while technology designers are *active designers* of such interaction.

As mentioned, the nature of work practice (activities) is highly “situated”. This already makes speech act insufficient for capturing the notion of “situatedness”. We use the notion “situated” rather loosely here. The ideal notion of “situated” is introduced in Chapter 4. The nature of highly “situated” work activities can be viewed as one of several phenomena a theory of language and work should capture. One such example is the discussion about the articulation of work that incorporates a notion of how work articulation is needed to aid work activities. The *concept of articulation of work* was developed to handle the fact that cooperating actors, have to articulate (divide, locate, coordinate, schedule, mesh, interrelate et cetera) *who is doing what, where, when, and how*, by means of what, and under which constraints. For example, how does A know how she should send Z, when this next step is not specified in the system. It is an active conceptualization of “the role” of the person using the “located tools”. The dimensions of articulation of work include actor, responsibilities, tasks, activities, conceptual structures, information resources, material resources, technical resources and infra-structural resources. All work activities are situated. It requires the understanding of learning and communication in work activities (Binti et al, 2005a & Binti et al, 2005b).

Articulation of work goes beyond a communicative approach. In several respects it has a broader scope than speech act theory. According to (Wittgenstein, 1958), *language and its context of use cannot be fully described with words*. But Searle, on the other hand believes that social use of language can be fully described by a finite set of rules constituting the how language can be used that make certain speech acts, like promising, possible and meaningful . Searle (1960, 1979a, 1979b) and Searle and Vanderveken (1985) made it formal and Aristotelian, with a set of necessary and sufficient conditions constitutive of specific acts.

“We have claimed that as far as illocutionary forces are concerned there are five and only five fundamental types and thus five and only five illocutionary ways of using language.” (Searle & Vanderveken, 1985, p. 52)

The five fundamental illocutionary forces or acts, i.e., things possible to do with language.

- *A representative* is to make a proposition about the state-of affairs, and commits the speaker to the truth;
- *A directive* is a means to get the hearer to do something, e.g. questions directs the hearer to respond with an assertive speech act, and command directs the hearer to carry out some linguistic or non-linguistic act.
- *Commissives* commits the speaker to some future course of action.

- *Declaratives* change the reality in correspondence to the speech act, e.g. pronouncing a couple married.
- *Expressives* express a psychological state e.g. apologizing, praising.

From a Wittgensteinian (1958) perspective, speech act theory focuses on certain standard ways in which communication can fail. Such a theory can be useful for several purposes, but it can never be a solution to philosophical problems. It can never function as a complete theory of meaning (Ljungberg, 1997) (pg 35).

### 3.11.2 The limited notion of context

The environment is rich and the context of where we are “situated” is a facade of many intertwined spectra. Because the speech act theory's limited analysis of actual communications referring to a wider social context (in which the conversation is embedded), it is hardly surprising that it does not take the located tools into account. In speech act theory one focuses on the performer of an idealized utterance. It has a sender perspective, rather than a receiver or social interactional perspective. The illocutionary act is constituting the core of meaning. Meaning is fundamentally emergent from the utterance, and speech act theory is therefore claimed by some authors to be drastically “decontextualized” (Ljungberg, 1997). A theory of speech acts is basically concerning *mapping* utterances into speech act categories. But mapping is a complex function to build. Mapping may rely on complex contextual cues, related to socially or culturally constituted activities where language plays a specialized role (Ljungberg, 1997). The notion of context may be quite complex and how many and which variables should be taken into account is an open question<sup>55</sup>. The CFA schema can be seen as representing one such activity type, the contracting speech event between customer and supplier (Ljungberg, 1997).

The work of (Winograd et al, 1986, Medina-Mora et al, 1992), as mentioned, ignores the propositional content of the speech acts modeling. This is also quite true in another CFA approach, where the information content of speech acts is ignored (Schmidt, 1993). The schema focuses on who is communicating when, but leaves out the notion of what is communicated. In speech act theory, on the other hand, the notion of propositional content plays a crucial role. It is for example, pointed out that the information content of a threat must not describe something beneficial for the hearer. (That is why the utterance, “Watch out, or I'll give you 1000 dollars,” may function well as a joke, but not as a sincere threat.)

Another critical remark for speech act theory is that a promise may create a commitment for an organization or a department, and not for the individual performing the speech act. This concern has sprouted ideas of capturing this missing context by ideas of “joint intention”, shared intentionality, and social agency for modeling communications (Singh, 1998 & 2003) while others are contributions to cognition theories (Tuomela, 2005; Pacherie, 2005; Bara, 2005).

<sup>55</sup>This is discussed in Chapter 4.

We on the other hand are steering away from using those notions (like shared intentionality or joint intentions or social agency), because, our concern is on understanding the *mental process*. When we speak of understanding the mental process, we are referring at the neural level. In particular, our inspiration is to use our communication approach to explain how communication and learning is situated in a context. Our theoretical approach (on cognition) is rooted in situated cognition (Clancey, 1997a). This is discussed in the next chapter. But primarily we discuss why we are not strictly following either conversation analysis or a discourse analysis for analyzing communications.

### 3.12 Conversation analysis and discourse analysis

We have briefly outlined what is lacking in using the speech act theory analysis. There are many other criticism, but we only describe here those that are directly concerning us. The authors (Ljungberg, 1997; Goldkuhl 2003 & 2005) suggest to find other approaches for analyzing actual human conversations/communications. (Goldkuhl, 2003) suggests to use conversation analysis as a complementary theory. On the other hand (Ljunberg, 1997) suggests that we can derive strength from each modeling: speech acts, discourse analysis and conversation analysis.

We start with an introduction to conversation analysis (CA). Historically, conversation analysis has its roots in ethnomethodology (Garfinkel, 1967). It is a study of the *participants own methods* for production and interpretation of social interactions. The sociologist Harvey Sacks is the originator and key constructor of this research approach (Goldkuhl, 2003). Sacks work is always *driven by data*. To quote from (Goldkuhl, 2003) pg (56): “*rather than sit in his armchair and construct grand theories of society, he preferred like the early ethnographers to get “his hand dirty” with some data*”. Sacks has a preference towards observational data, instead of interview data. According to Sacks, in order to *study real conversations*, we should *record* and *transcribe* the utterances. This is the drive behind our approach as well. The importance of working with observational data and transcripts maintains on the *focus on utterance sequences*, rather than in *single turns* of talk that we make sense of conversations.

These traditions, discourse analysis and conversation analysis, represent two different approaches to the study of language usage in linguistic research (Levinson, 1983), but when speech act theory is adopted for computer design, the terms “discourse” and “conversation” are used as synonyms (Ljunberg, 1997). According to linguistic terminology, the CFA would be called the “discourse for Cfa”.

*Conversation analysis (CA)* has primary focus towards utterance sequences and the organization of such sequences (Goldkuhl, 2003). A primary concept is *turn-taking*. It means that they take turn speaking. In understanding sequencing of conversations Sacks has introduced the concept of adjacency pair. An adjacency pair is an ordered pair of utterances (a first and a second) produced by different

speakers (Goldkuhl, 2003). A first requires a second, and not everything counts as a second. Examples of adjacency pairs are questions – answers, greetings—greetings, offer—acceptance, request---acceptance, complaint---excuse. The clear linkages to communication patterning should be recognized (Goldkuhl, 2003). But this is not the case for web activities that we have observed. Sometimes, other activities that one is engaged in distract the attention of the current speaker. For example, we have speaker A that is asking a question to hearer B. But hearer B is also engaged in another activity. The question of A put to B goes unanswered, because the activity of B affects the activity of A. Hence making A forgets that she had originally asked and requested a reply. Because of this, the distraction of the activity of B has in turn distracted the activity of A. Also the turn taking concept cannot be fully applied on instant messaging, like in Chapter 2, where we show that two people are chatting simulataneously on different topics, some may ignore or never come back with an answer. Hence, quoting from (Ljungberg, 1996) itself, when a theory is being used to analyze different domain or context, some kind of adaptation has to be made, in our domain that would be the web communication tools.

Different functions of adjacency pairs are described within CA. They are used for starting and closing conversations, for moves in conversation, for remedial changes. Adjacency pairs can also be “separated” due to different reasons (e.g., clarifying obscurities) by the aid of so-called *inserted sequences*. This means that adjacency pairs can be embedded in adjacency pairs. Furthermore, according to conversation analysis, conversational sequences are rarely structured in the way indicated by the CFA (Winograd et al, 1986) (e.g. Request-promise-assertion-declaration). Instead, certain kinds of utterances seem to go together in pairs, like question-answer, greeting-greeting, offer-acceptance, etc. This kind of pairing, adjacency pairs, is an important characteristic of conversation. Utterances that go together with requests to form adjacency pairs, are not promises, but compliances or rejections (Goldkuhl, 2003). In many situations, the most natural response to a request is complying with it (or rejecting it) without any promising taking place in between. Furthermore in real conversations it is common to issue a pre-request which functions as an initial check whether certain preconditions are fulfilled. A pre-request could also functions as an indirect request.

Then, the concept of adjacency pair has been further used and developed in dialogue theory (e.g, Linell, 1998; Schiffrin, 1994). The first is categorized as initiative and the second as response. This is due to the principle of *double contextuality of utterances* in conversations (Goldkuhl, 2003). According to (Goldkuhl, 2003), an utterance is both context-shaped (i.e., dependent on prior utterances) and context-renewing (i.e., creating conditions for possible next utterances). Utterances in this context are considered as linked actions.

In categorizing the main conversational sequence, Winograd et al (1986) use speech act theory. They define these speech acts as the main conversational



sequence: request, promise, assert, and declare. In this framework, the author (Goldkuhl, 2003) suggested that CA can be employed as a Cfa schema for LAP.

For example, turn-taking, adjacency pair, and inserted categories are categories, that may be used to describe and clarify the different steps in the conversation (Goldkuhl, 2003). The author also noted that the common acts of request and promise in CFA and LAP model, can be seen as an adjacency pair. The request is initiative and the promise is a response to it. It is suggested by (Goldkuhl, 2003) that it is also possible to model breakdown during this conversation with CA. If the second person (B) does not fully understand the request by the first person (A), he can ask for clarification. There might be an inserted sequence (of utterances) where the solicited response to the request from B is *postponed*. This is often an option in conversation (see section 4.1).

CA also considers both linguistic actions and non-linguistic (material or tools) actions and their different results, as well as interdependence between these different types (Goldkuhl, 2003). Thus, CA may complement speech act theory (Goldkuhl, 2003).

Now, moving on to the second approach: *discourse analysis* applies traditional methods and theoretical principles of formal linguistics as rules and well-formed formulas to larger units than the sentence. By isolating a set of basic units of discourse (e.g., speech act types), and formulating concatenation rules over these, well-formed sequences of these basic units are defined as coherent discourse (Ljungberg, 1997). Discourse is, in this tradition, just a larger unit than the sentence, on which the same techniques can be used to delimit well-formed of constituents from ill-formed ones (Levinson, 1979)<sup>56</sup>. This approach covers both work on text grammars and various work on speech acts. A discourse may be viewed as a generic, goal-oriented office task (in the case of (Winograd et al, 1986) in work for tool designing (Ljungberg, 1997). It is globally a managed sequence of communicative actions (speech acts), forming a coherent and predetermined course of action leading to a goal.

The obvious difference between CA and discourse analysis is that CA emerged with an approach to *sequences of social interaction, avoiding the restricted formalisms* that constrict the speech act notion of interaction (Ljungberg, 1997). The conversational paradigm denotes a more or less informal way of talking, where two or more co-present participants freely alternate in speaking as in face-to-face communication. However, many studies have also been undertaken in formal or institutional settings, where the course of turns in the interaction is more predetermined and rule governed (Ljungberg, 1997).

---

<sup>56</sup>It is beyond the scope of our work to go into the modeling of discourse analysis.

### 3.13 Basic components of Acl

As mentioned, we have employed the work of (Sadek, 1997) on Fipa-Acl formal models for recognizing communicative acts in conversations. Reasons for doing so are outlined later on. Fipa-Acl is an agent Communication Language (Acls). Acls are high-level languages whose primitives and structures are expressly tailored to support the kinds of collaboration, negotiation, and information transfer required in multiagent interaction. Acls exist in a logical layer above transport protocols such as TCP/IP, HTTP, or HOP (Draa et al, 2002). Acls address communication on the *intentional* and *social* level. Acls themselves are complex structures composed out of different sublanguages that specify the message content, interpretation parameters such as the sender and the ontology, the propositional attitude under which the receiver should interpret the message content, and several other components (Draa et al, 2002). Typical Acls also have a characteristic mentalistic semantics that is far more complex than standard distributed object protocols.

This means that Acl design is a delicate balance between the communicative needs of the agent with the ability of receivers to receive at the other end of another computer (in tractable time) the *intended meaning of the message* (Draa et al, 2002). Furthermore, it is important that the syntax, semantics and pragmatics of the various components of an Acl be as precise and explicit as possible, so that the agent systems using the Acl can be as open and accessible to developers beyond the original group.

#### 3.13.1 A little bit of background of Acls

The first attempt is to create a standardized agent communication language (Acl) came from the DARPA knowledge sharing project which produced KQML (Draa et al, 2002). The researchers developed two main components: (i) a representation language for the contents of the messages (i.e. Knowledge Interchange Format-KIF), which is an extension of first-order logic. (ii) A communication language KQML (i.e. Knowledge Query and Manipulation Language) which consists of a set of communication primitives aiming to support interaction among agents in multiagent systems (MAS). KQML includes many performatives of speech acts, all assertive (i.e. when it states a fact) or directives (i.e., it reflects a command or request) that agents use to assert facts.

KQML messages have the following (simplified) syntax :

(tell: sender A :receiver B :content “snowing”)

Referring to the above, we can read it as: the agent A tells to agent B that the proposition “it is snowing” is true. The semantics of KQML presupposes that each has its own virtual KB (knowledge base). In these conditions, telling P corresponds to reporting that P is in its KB; asking for P is attempting to extract P

from the addressee's KB (Draa et al, 2002). The main advantage of KQML is its ability to support a wide range of agent architectures with its extensible set of performatives. Some of the problems in using KQML is that it lacks precise semantic definition of the performatives (Draa et al, 2002). In order to solve those problems, these authors revised the semantics with the theoretical foundation of Searle and Vandervekan (Searle et al, 1985) and limited the use of some performatives in order to avoid ambiguities in semantics.

More recently, the Foundation for Intelligent Physical Agents (Fipa) tried to solve the problem by standardizing the Acl. Fipa is a nonprofit association whose objective consists of promoting success of emerging agent-based technology. Fipa-Acl (specifically ARCOL developed by France Telecom (Sadek et al, 1997)) is derived from speech act theory (Searle, 1969), and messages are also considered as communicative acts whose objective is to perform some action by virtue of being sent. In Fipa-Acl, the set of primitives is smaller than KQML, but new performatives can be defined by formally combining primitives. It includes assertive or directives as in KQML. ARCOL has a formal semantics based on Cohen and Levesque (1990) approach on speech acts.

FIPA assigns tasks (ontologies, semantics, architecture, gateways, compliance) to technical committees, each of which has primary responsibility for producing, maintaining, and updating specifications applicable to its tasks.

Contrary to KQML, in ARCOL, agent A can tell agent B that only if A believes that P and believes that B does not believe P. Thus, ARCOL gives preconditions on communicative acts as specified by its semantics. Although theoretically it is complete, it is seen as a weakness (Labrou, et al, 1997). According to this precondition (if agent A can tell agent B that..), it is difficult to determine whether the listening agent believes a fact or not and therefore whether a fact can be told to that agent<sup>57</sup>.

### **3.13.2 Issues in Acl**

There are several issues that have been important in the development of Acl's and is still undergoing development until recently (Singh, 2000 & 2003). Draa et al, (2002) reviewed the six major areas but in this section we shall only focus on two major areas concerning our work.

---

<sup>57</sup>We believe that perhaps this problem is rooted that in the beginning that the agent community is still using a mentalistic view of the world, hence, apparently for an agent to send a message to another agent, there is an assumption made that it is impossible to read the private mind of the other agent. From here onwards, the agent communication community is wrestling to understand how to enable agents to infer "each other's private mind" that later brings out into a new theory to solve this problem called the "social agency" by Singh, (2000 & 2003) that is discussed very shortly.

### 3.13.2.1 Theories of Agency

One of the core issues in the agent communication community (mentioned in Chapter 1) involves the linkage between underpinnings of the Acl and the theory of agency that regulates and defines the agent's behavior. In order for the message of an Acl to be formally coherent, these two theories must be aligned.

A theory of agency is a general formal model that specifies what actions an agent can or should perform in various situations. The theory of agency for software agents are usually based on a small set of primitives derived from the propositional attitudes of philosophy (e.g., belief, desire and intention- that led to BDI architecture) and a set of axioms or axiom schema which define their entailment relations (Draa et al, 2002). A theory of agency also includes accounts of the agent's general reasoning strategy and deductive model, its theory of action and causality, its account of planning and goal satisfaction, its system of belief dynamics and revision, and so forth.

An agent need not directly implement its theory of agency, but it must behave as if it did (Draa et al, 2002). Examples of the elements which compose a theory of agency include Moore's accounts of knowledge and action (Moore, 1995), Singh's know how and branching time systems (Singh 1998) Georgeff and Rao's BDI architecture (Georgeff et al, 1999), Cohen and Levesque's intention theories (Cohen et al, 1990).

An agent's communicative behavior is among many behavior regulated by a theory of agency. The semantics theories that define the meaning of an Acl message must ultimately be linked to the entities provided by the agent's baseline theory of agency. Fipa-Acl handles the linkage between the semantic and the speech act theory (Searle, 1969). Agent communication is treated as a type of action that affects the world in the same way physical acts affect the world. The message types of Acl's are considered as speech acts, which in turn are described and defined in terms of beliefs, desires, and intentions.

Current semantic theory of Fipa-Acl depends on the theory of agency which supplies a set of BDI-style primitives (refer to Appendixes, A). The semantics of Fipa-Acl is based on belief and intention, and because of its speech act theory component, treats agents messaging as a type of action. Formally, this means Fipa-Acl's semantic's theory is express in a qualified multimodal logic (model logic specifically) involving both belief and intention as primitive operators, as well as simple theory of action.

However, some of the weakness of the modeling or loop-holes (and debates among agent community) is to suppose that each agent is sincere, can we actually presuppose that the other agents also will be sincere in their communications? (Draa et al, 2002). The point in the question is that it will be very difficult to verify the sincerity of another agent. Theoretically, an agent could temporarily change

its believe to be sincere (while changing them back right after performing the speech act). Refer to Pitt (2000) for details.

The purpose of specifying the condition of sincerity was made to simplify assumption for agent communication. Another such assumption involves the ability of an agent to reliably observe the effects of another agent's actions. (Draa et al, 2002).

### 3.13.2.2 Acl's semantics

In Acl's the pre and post-condition of the communicative acts do not directly manipulate variables and values. They are conceived to operate at a higher level of abstraction given the theory of agency, and refer to the primitive supplied by this theory. Therefore, the pre and post-conditions for communicative acts are typically expressed in terms of the mental attitudes of the involved agents. Particularly, the Fipa-Acl is based on this similar semantics approach that involves specifying a message's feasibility pre-conditions (FP's) and rationality expected effects (RE's).

The precondition and post-condition goal is to supply minimal meaning for messages in Acl, however in the actual world, situations occur frequently where it is more precise and context-specific (Draa et al, 2002). Because of trying to achieve the balance that can be general enough yet at the same time can be context specific, has lead to debate among the agent communication community in Acl semantic theory. The Acl research community formulate very general pre- and post conditions are often so abstract that they are not fully adequate in all situations. Its limitation in Fipa-Acl is that it *does not specify* how to *infer* the mental states of the receiver.

Later, this situation was meant to be resolved by the idea of Singh (1998 & 2003) by what he terms as *social agency*. It considers communicative acts as part of ongoing social interaction. In this case, even if we can't determine whether agents have a specific mental state, we are sure that communicating agents follow some social laws that sustain power relationships.

In Singh's (2000 & 2003) social agency, the author's work was to bring the Acl society into focus of social aspect, hence the context that an agent is located in. According to Singh, most of the applications assume that components will be added dynamically and that they will be autonomous (serve different users or providers and fulfill different goals) and heterogeneous (be built in different ways). He later argued that it is unlikely that agents can read each other's mind: given that we cannot really know if an agent is being sincere or not. Singh argued since humans themselves cannot read each other minds, it is impossible for us to ordain the same notions to agents. Singh emphasized throughout his work: that it is a mistake on emphasizing only on mental agency- the supposition that agents should be understood primarily in terms of mental concepts-such as *beliefs* and

*intentions*. The approach recognizes that communication is inherently public, and thus depends on the agent's social context.

Singh's (2000), defined the properties of the formal semantics for social agency. He specifically stated that in defining the terms of commitment: the semantic as following:

Objective: the sender commits for *inform* that its content is true, for *promise* that its content will be accomplished, for *permit* that its content may be realized, for *declare* that its content is true.

Subjective: the sender commits for *inform* that he believes its content, for *promise* that he intends to carry it out, for *permit* that he does not intend the negation of its content, for *declare* he intends to bring it about.

Basically, the social semantics is formalized into two components: objective and subjective. Each aspect of meaning is viewed from the public perspective, because each involves a social commitment.

Singh emphasized on a stricter semantic rule: still adopting speech acts. It supposes that the agents *will understand the context* that they are located in. The "objective" is the *commitment* of the agent's of the content for social (social/world). The "subjective" is the *self-commitment* of the agent's. We will not further discuss about the social agency theory.

This whole overview of the Acl's concepts and state of the art (Singh, 2000 & 2003) is to demonstrate the problem of defining agent's semantics to enable an open communication between human agent-artificial agent that has to be brought into consensus (AC, 2005)

### **3.14 Using Fipa-Acl as a formal guideline**

Despite the criticism of speech act theory in previous sections, we must give some credit to it. Since we needed to convert/pre-process our recorded actual conversations, we need formal guidelines to identify intentions (communicative acts). The question would then be, why did we choose Fipa-Acl instead of others Acl's (e.g., KQML)? As discussed previously, Fipa-Acl formal model provides a comprehensive semantics formulation but the problem lies is that it does not specify how to infer other agent's behavior. The Fipa-Acl formal model goes back to speech act theory. It is also used in the Artemis system (Sadek et al, 1997). The Artemis system is still under development at the France Telecom R&D. Artemis (Artemis, 2002), is an intelligent technological agent that claims to allows humans to have a real conversation with a machine and get quick, sensible, logical, qualified and personalized answers to every question asked (Artemis, 2002). However, the dialogue is restricted to a one-to-one communication, and has to be in a well-defined context of communications i.e., customer-client services).

Fipa-Acl guidelines are very much based on the work of (Sadek, 1997). Nonetheless, there are some very critical remarks of those formal models of Fipa-Acl, which can be referred to (Labrou et al, 1997 & 1999; Draa et al, 2002).

Taking into account the strengths and weaknesses of Fipa-Acl, the CONSTEPS framework has adapted it within our own interpretation (developed within the activity states framework). At the same time, it is making a sort of a full circle by then re-applying the agent language (i.e. Fipa-Acl) back to human conversations. First and foremost, the Fipa-Acl for us is just a guideline on identifying intentions in sentences. The focus of the CONSTEPS and activity states framework is *how we came to identify the intentions* in the sentences<sup>58</sup>.

Using the Fipa-Acl guidelines indirectly connects us to the well-established framework of (Searle, 1969 & 1983). We have enriched the Fipa-Acl notion of *intentionality* by Searle<sup>59</sup> (1983) with Clancey's (1997).

### 3.15 Summary: People and tools

This chapter began with an introduction to our approach to analyzing communication protocols. Then, we reviewed the important ideas of (Winograd et al, 1986) on understanding cognition for designing tools that are “ready at hand”. Then, jumping onto this idea, we found similar concerns, but having different goals and approaches to modeling communications. Our concern is to help web designers to design a tool that can effectively improve web collaborations through understanding how people adapt their communicative behavior in situated context, moment by moment. Specifically, understanding first and foremost the domain of the located tool with our analysis is to help improve web collaboration tool designs, and later migrate to a more sophisticated method through using Acl. With this concern in mind and from our observation that the tool can sometimes be a constraint on the collaborators, we went into the small community of LAP. From here onwards, we focused only on two applications. Firstly, we discussed the design issues of those applications. We have also reviewed some weaknesses in the applications. After that, we went back to the theory to uncover why some of the design issues highlighted by (Abbott et al, 1994; Kaplan et al 1991& 1992; Winograd et al, 1986; Medina-Mora et al, 1992) were not solved.

---

<sup>58</sup> As mentioned, we have extended the Fipa-Acl semantics to our own domain, but unfortunately this is too much to put into one thesis.

<sup>59</sup>In (Searle, 1983), the author explores some connections between Intentional States and Speech Acts in order to answer the question “What is the relationship between the Intentional State and the object or state of affairs that it is in some sense directed at?” In 1983, Searle wrote a book on Intentionality where he laid down a foundation of linking between speech acts to what he calls as Intentional States. For example, if I make a statement that p, I express a belief that p. If I make a promise to do A, I express intention to do A. This example is where Searle (1983) attempts to extend his theory of speech acts to a wider view between illocutionary act and Intentional states. Searle explores between intentionality of perception, intentional causation and discusses this to the relationship of memory.

Hence, this thesis is first and foremost focusing on the theoretical aspects of understanding communications. The analysis is focusing on what current well-known theories on languages and communications have not yet captured and modeled in communication aspects. There is little focus in current theories on the microscopic view of communications and trying to explain it in (Bateson, 1972) terms, relating it back to mental process. Our specific interest is to conceptualize the mental process that can help look moment by moment into how learning and communications is taking place when someone is engaged in activities.

To summarize this rather long note, the CONSTEPS is an advance towards understanding how people learn from their moment of “thrownness”. Our feeling for now is that the understanding of actual human communication scenario, will allow us to study precisely how the *flow of communication is punctuated*, how people gradually adapt to handle the “thrownness” situations. As reviewed in Section 3.4.2, how from a simple moment of “thrownness”, that becomes a “breakdown” situation for us, we learn to distinct these situations or events by its “breakdown” recurrence. Finally, how people *learn* from those occurrences and what they learn from it.



## Chapter 4

### On Human Learning and Communication

### From Situated Cognition to Activity Theory



*“Anyway, I think I was feeling rather sad that day..and I tried so much to copy this particular piece, try as much as I want, the colors turned to be darker, the facial expression was solemn. Funny, it was as if, no matter how rational my mind was to paint as what I had in goal (make it a happy cheerful painting with bright colors and make her smile) my coordinative mechanism, hands, perception, interpreted differently, I could not paint them as I had rationally intended in my mind , it was as if..the emotions had control of my brushes and correlation of colors.....*

*Drawing and painting By Binti Abdullah, N.N, April 19<sup>th</sup>, 2003. An Imitation of Absinthe by Degas in 1876. Impressionism, art, leisure and parisian society. Personal notes on the 23<sup>rd</sup> November, 2004 under the influence of Situated Cognition.*

## 4 Introduction

*What is the moment of my focus, what I am referencing to? What I am conceiving? What am I feeling, What am I Conceptualizing?*

This chapter provides the basic theoretical approach of our work. The theoretical approach which we choose to follow are these existing theories: (i) hierarchy of learning and communication (Bateson, 1972); (ii) situated cognition (Clancey, 1997a); and (iii) activity theory (Leont'ev, 1977 & 1978).

We search for clues from these subjects. It is the main goal of this chapter to arrange those clues, side by side—forming a chain of possible explanations, permitting us to understand how humans are able to understand each other's meanings and the context that they are communicating. Hence, this chapter serves as a theoretical foundation, as a support of the CONSTEPS and as the analysis of the actual web communications: discussed in Chapter 2 and 3 respectively.

### 4.1 Knowing How and What (When?), Learning and Memory

In this section, we begin by asking very simple questions from Ryle in (1949) and also several simple common sense questions by Norman (1982) on learning and memory. From the brief discussions, we relate this to the overall theoretical foundations that we use as basis in our work. We start with Bateson, (1972) then proceed to relate this to Clancey (1997a) and finally to Leont'ev (1977 & 1978).

“ The ability to give by rote the correct solutions to multiplication problems differs in certain important respects from the ability to solve them by calculating them. When we describe someone as doing something by *pure* or *blind habit*, we mean that he does it *automatically* and without having to mind what he is doing. He does not exercise care, vigilance or criticism. After the toddling-age we walk on pavements without minding out steps. But a *mountaineer* walking over ice-covered rocks in a high wind in the dark does not move his limbs by blind habit; he *thinks* what he is *doing*, he is *ready* for *emergencies*, he economizes in effort, he makes *tests* and *experiments*; in short he walks with some degree of skill and judgment”. Ryle (1949), p. 42

Ryle (1949) puts an interesting question on “intellectual vs habits” (See (Ryle, 1949), pp. 42-45. For example, there are simple routines that we do by what he terms as “pure or blind habit”. On the other hand, they are certain routines or task

that we do with carefully tests and experiments, that *we think* about *what* we are doing. We are conceptualizing every moment of what we are doing. Now, to relate this simple intellectual vs habit to a very simple question from Donald A. Norman (1982) is to understand how do we remember?

“Some *events* are *easy* to *remember*. You probably made no effort to remember what you ate at your last meal, yet, if I asked you to recall that meal, you would probably do so with ease. I make no effort to remember casual conversations or the books I read or the comic strips in the newspaper. Yet I do remember them, at least for a while. Tomorrow when I read the same 20 comic strips again, I will *automatically pick up* the *thread* of *each story*, although each strip is different, each a fragment.

Sometimes remembrance comes only with difficulty. Learning a person's name, a telephone number, or a foreign-language vocabulary may come painfully and with great effort- or perhaps not at all. What is it that makes things easy to learn, others hard?” Norman (1982), p. 2.

Norman (1982) was concerned with learning and memory, how some events seems as if it requires less effort for us to remember. On the other hand, like new languages, or telephone number requires us to think, and forces us to come into “remembrance”.

Both Ryle (1949) and Norman (1982), were discussing about habits, and the “consciousness” of thinking about the thoughts that we are thinking. Norman (1982) was thinking of these terms into how memory and learning can explain how certain events we react becomes habitual and certain events we seems to make an attempt to remember them.

With these question in mind, let us rewind. Our goal was to understand how intentions arise in the first place. We then propose to go back to how communication protocols are punctuated in the first place. In order to understand this, we must understand how people go through the flow in any moment of “throwness” that exhibits moments of breakdown and recurrence patterns. From here onwards, we attempt to explain at the mental process (neural level) of how people learn, induce, adapt and merge communication protocols in his/her situated context.

Ryle (1949) and Norman (1982) had brought up very common sense questions that are taking place everyday in our lives. To understand how certain events become habitual and certain events becomes a “remembrance” (Norman, 1982), we go back to the hierarchy of learning and communication by Bateson (1972). The choice is clear, we argue why in the remaining sections.

## 4.2 The logical theories of learning and communication

We begin by presenting the major ideas of Gregory Bateson on the hierarchy of learning and communications. Before we go further into Bateson's main work on communication, we briefly introduce the definition of communication and its properties. Then, we review the first major idea - the learning hierarchy. This learning hierarchy is modeled from level 0 to level III. Here, we extract the main elements and properties on the constructs of these different levels. After, we briefly illustrate the notion of Bateson's stimulus- response ( $S \rightarrow R$ ) as a representation of communication in the abstract. Then, we relate this notion back to the learning hierarchy and summarize Bateson's modeling on communication.

### 4.2.1 Communications

*Daughter: Daddy, do our talks have rules? The difference between a game and just playing is that a game has rules.*

*Father: Yes, let me think about that. I think we do have a sort of rules...and I think a child playing with blocks has rules. The blocks themselves make a sort of rules. They will balance in certain positions and will not balance in other positions.*

*D: But what rules do we have?*

*F: Well, the ideas that we play with bring in a sort of rules. There are rules about how ideas will stand up and support each other. And if they are wrongly put together, the whole building falls down.*

*D: No glue, Daddy?*

*F: No-no glue, only logic.*

*D: But you said that if we always talked logically and did not get into muddles, we would never say anything new. We could only say ready-made. What did you call those things?*

*F: Cliches. Yes. Glue is what cliches are stuck together with.*

*D: But you said "logic" Daddy.*

*F: Yes. I know. We're in muddle again. Only i don't know how to get a way out of this particular muddle.*

Table 4.2.1: A dialogue excerpted from Bateson, Steps to an Ecology of Mind (Bateson, 1972) pg. 14 on Metalogue: About Games and Being Serious

Firstly, communication as defined by the Webster dictionary (Merriam-Webster, 2005) is the exchange of thoughts, messages or information, as by speech, signals, writing or behavior. It is classified into *verbal* (e.g. speech) and *non-verbal* (e.g. signals, gestures) (Bateson, 1972). The basis of our work for understanding communications is rooted in the learning and communication theory of Gregory Bateson. Gregory Bateson was a well-known philosopher, anthropologist and geneticist that had spent decades studying human learning and communications in different parts of the world. He had spent his years observing and studying people's daily communication and learning as well as the ones carried out in psychological experiments. In particular, as mentioned in the

opening section, the remaining sections focus exclusively on his work on communications described in the *Steps to an Ecology of Mind* (Bateson, 1972). What is particularly interesting for us is that the work of Bateson (1972) relates learning to communication together with the notion of  $S \rightarrow R$ .

Let us review some history of how Bateson's theory was formulated. It was based partly on the part of the communication theory by Russell, the *theory of logical types*. The central idea of Russell's thesis is that there is a discontinuity between a class and its member. The class cannot be a member of itself nor can one of the members be the class, since the term used for the class is of a different level of abstraction- a different Logical Type- from terms used for members. Bateson used the analysis of logical types to explain communication. He uses the theory of logical types to illustrate how human beings handle communications, where the communications have been derived from these fields: 1) various communicational modes; 2) humor; 3) the falsification of mode-identifying signals; 4) learning; and 5) multiple levels of learning and the logical typing of signals (Bateson, 1972) pp: 202-203. We focus only on 1); 4) and 5). In summary, they are described as below:

#### 1) The use of various communicational modes in human communication.

In this field, Bateson looked into signals. Examples of modes are like play, non-play, fantasy, and etc. They are thought as existing as higher logical types. They are classified as nonverbal media. The *signals* that Bateson was referring to as nonverbal media are posture, gesture, intonation, and facial expression. These signals are categorized as being nonverbal media because the signals themselves are thought to be existing at Higher Logical Type than the message they classify. Among human beings this framing and labeling as being “nonverbal media” according to Bateson was due with the peculiarity that our vocabulary for such discrimination is poorly developed, and we rely preponderantly upon nonverbal media, that are highly abstract, but important labels. However, since we analyze web communications (mainly instant messaging and video conferencing), we then consider *tool mediated signals*. An indirect act of interaction, using a tool as a medium to convey a certain message, should also be taken into consideration (e.g., sending a link to another, as in an email or copying another link into a chat window).

#### 4) Learning

In this respect, Bateson now looks into  $S \rightarrow R$  corresponding to receiving signals. The simplest level of this phenomenon is exemplified by a situation in which a subject receives a message and acts appropriately on it; taking an example from (Bateson, 1972): “I heard the clock strike and knew it was time for lunch. So I went to the table”.

## 5) Multiple levels of learning and the Logical Typing of signals

This aspect, is our particular interest. Bateson now relates the multiple levels of learning. As an example, from 4) the basic learning that “I heard the clock strike and knew it was time for lunch. So I went to the table” may be related to a more complex context of learning (which will be described later). Bateson relates those signals (in 1), as an example of being two inseparable sets of phenomena (Bateson, 1972), the two sets of phenomena that are the signals and learning are inseparable because ability to handle the *multiple types of signals* is *itself a learned skill* and therefore a *function of the multiple levels of learning*.

### 4.3 The theory of logical types

Now, we introduce formally the theory of logical types. Firstly, the theory of the logical types asserts that no class can, in formal logic or mathematical discourse, be a member of itself; that a class of classes cannot be one of the classes which are its members; that a name is not the thing named, that “John Bateson” is the class for which that boy is the unique member, and so forth (Bateson, 1972), p. 280. The theory also asserts that a class cannot be one of those items which are classified as its nonmembers. The author gives another example; if we classify chairs together to constitute the class of chairs, we can go on and on to note that the tables and lamp shades are members of a large class of “non-chairs” but we shall commit an error in formal discourse if we count that class of chairs among the items within the class of non-chairs.

Thus, we may say that: (i) a class of chairs is of the same order of abstraction (i.e. the same logical type) as the class of non-chairs; and further; (ii) that if the class of chairs is not a chair, then correspondingly, the class of non-chairs is not a non-chair. This was originally from Russell's theory on Principia Mathematica.

The whole matter of the *logical typing* turns into whether the *distinction* between a *class* and its *members* is an *ordering* principle in the *behavioral* phenomena (Bateson, 1972). One of the major point where Bateson wanted to point out in his hierarchy of learning and communication, that a simplistic view of Russell Theory deals with highly abstract matters that was first derived within the abstract world of logic. In logic, when we have a sequence of proposition that can be shown to generate a paradox, the entire structure of axiom, theoremas and alike involved in generating that paradox is thereby negated and reduced to nothing. Bateson argued why from his perspectives that this logic, the paradox had been reduced to nothing because in the real world, there is always *time*. The computer do not truly encounter a paradox but only the simulation of paradox in trains of cause and effect.

Hence, Bateson attempted to map these ordering of principles based on the theory of Russels as a guide to show the difference between logic and the real

world, in particular to the behavioral phenomena of animals and human beings (Bateson, 1972), p. 282.

#### 4.4 Basis of “learning”

Now, we turn to learning (section 4.1.1, point 5). The principle of *human learning* is that the word learning itself “denotes” *changes* of some kind (Bateson, 1972), p. 283. From here, one must question, what kind of change? Change is to be assumed to describe that “learning” is something that will have to make some sort of allowance for the *varieties of logical types*. We review again in Section 4.1, where we introduced with two short examples adapted by Ryle (1949) and Norman (1982) on why during certain events we respond to them as merely being a habit, and during other events, we think about them as we are thinking of what we are about to do in that event. Hence, these changes, from purely habitual responses, to highly complex of learning can be assumed as changes. This learning then must allow varieties of logical typing, which is actually the ordering from learning 0, I, II, and III. As an example, the most familiar form of change is *motion*. Ordering this form of change or motion implies the structuring of descriptions in terms of “position or zero motion”, “constant velocity”, “acceleration”, “rate of change of acceleration”, and so on. To properly understand the work of Bateson, let us go back to anthropology (to understand where Bateson was coming from). Bateson's work crossed over many different communication phenomena. More precisely, Bateson himself was involved with psychiatry both as patient and then in ongoing research on the therapeutic process (Mary Bateson, 1984), p. 198. Some of his observations on learning and communication were also related to the communication utterance of schizophrenic patients<sup>60</sup>. This is also highly notable in Manic Depressive patients (in particular in the acceleration of learning and association in the cognitive process of the patients) studied by Jamison (1993).

Bateson was trying to relate between the relationship of learning to motion of changes is that by ordering from the purely habitual occurrence, like at level 0, to the more complex learning (climbing the mountain) is coupled to the cognition process that may be described as the rate of change of acceleration between learning

---

<sup>60</sup> We believe that one of the best ways to understand the highly complex work of scholars such as Bateson is to start to delve into the personal background, interest, education and role of the scholar himself. Hence, through this way, we may start to view the theory of Bateson from his own point of view. An example, what were his personal aspirations, and motivations to carry on with his abstract theory on learning and communication. On what basis, is his work grounded on. We assume by reading the biography on Bateson by Mary Bateson (1984), that these highly abstract thoughts have been grounded by the daily occurrences that is greatly influenced by his own personal belief and interest. Bateson started to be involved with psychiatry both as patient and then in ongoing research on the therapeutic process, began the same decade of Bateson's rebellion against Mead. The rebellion shot through with resentment against his family and especially against his mother, ended with an analysis of patterns of communication in the families of schizophrenics, above all the role of the mother (Mary Bateson, 1984). Later on, from his experience as being in therapy and observation with the communications among schizophrenics as well as in mammals and human beings, Bateson went on to abstract the hierarchy of learning and communication using the basis of Logical Types of Russell's Theory (Bateson, 1972).

0 to learning I, to learning II and so on even vice versa. Bateson related this back to mental process, and since processes itself can change due to some external environment (e.g., weather changes, or a person that is more responsive to what he is perceiving in his environment) or internal event (e.g., chemical imbalance) may be hypothesized that the processes (cognition process) itself may change (Jamison, 1993; Bartlett, 1995). Specifically, in Bartlett (1995) pp. 33- 46, he noted the “attitude factors” influences the remembering after repeated experiments. Bartlett (1995) also noted that the temperament, interests and attitude often direct the course and determine the content of perceiving. These temperament, interests (fixations, obsessions) are in a cyclic influences with the cognition process in respect to the environment (Jamison, 1993).

This is when Bateson looked into the perspective, that *change* “denotes” *process*. However, *processes* themselves are *subjected* to “change”. These process may accelerate, they may slow down, or they may undergo other types of change such that it is said that it is now a “different” process<sup>61</sup>.

We will further explain. We give a simple example. Let us imagine that today is a beautiful sunny day and I wake up with a mood, mainly because I saw the pretty trees, looking so green, birds chirping and also I had a good dream coupled with a good sleep. My dream was about me receiving an e-mail that reads as “Congratulations Miss Nailah, we would like to inform you that you got the job at Google, please report immediately and we fax you the details”. Hence, I woke up with a good mood, and a good motivation to work harder because I have hope that I would eventually obtain a job. I go to the lab and find myself very motivated to learn, my cognition process of learning is accelerated due to the changes in the processes itself. Many factors are influencing these changes (I assume), motivation, relaxed, good feeling, intuition says maybe dreams can come true, hence contributing to the feeling of security and downplaying the feeling of fear (this is often associated with a condition known as “waking up with a mood”, see (Jamison, 1993)).

Now, let me put another example, let say, that the weather is horrible, it's just raining and raining and on top of it, I am sick, down with a flu. The previous night, I had a dream of strange people on ships, while I am on a sea travelling on this ship, being an observer. Everywhere, there was a man and a woman on a small ship. The man will urge each woman to commit suicide and that this is one of the ways of achieving happiness and get rid of the everyday struggles in life. The woman appear reluctant at first to commit suicide, very apprehensive. She was struggling between rationalism, and the supernatural of the great desire to know God. Her burden was to carry what life has cursed upon her that feels like a burning flame of fire in her mind, soul and body. The man, urged the woman to

---

<sup>61</sup>Readers may refer to Norman (1982), p. 12 on an overall view of the stages of the human information processing according to the hypothesis that the human information processing is a combination of many different factors; we noted that the thought processes, desires, intentions, motivations “shapes” up the memory structures. In a way, what we have discussed above we assume has to do with the acceleration or changes in changes of levels in learning.



try to take her own life in a gentle, secret mad whisper that is a haunting and hypnotized voice. The man urged the women in a devilish way to try, that it will be painless, it will be fine and finally you will get to your destiny and be rid of the ugly knowing of what your life is. This pretty woman succumbs to these evil and persuasive voices and put the shotgun next to her head and pulled the trigger. She ended her life in a few seconds.

Surely, with this bad nightmare of women suiciding themselves on a ship on the calm sea (a dream that felt like lasting the whole night), with me as being the observer gets me emotionally and cognitively very low. I could not take the images out of people wanting to commit suicide. I wake up and go to the lab, unable to concentrate on my work. If someone was to talk to me, my mind would be somewhere else, because I am trying to rationalize the dream. The dream, the environment, my cognition process today is not really “accelerating” due to internal events and external environment. I create my own fear, wondering what on earth was that dream about. I work, but it affects me for some time to get my learning to “accelerate”. Today, I can summarize, my process is a bit slow.

Don't we ever wonder, why on some days we go “Aha!”, but on some days, we go “Uhhh...?”. Perhaps, these are tied down that the processes (the mental process) itself is subjected to change. From our own point of view, we assume that that Bateson (1972) was very much relating it to the cognition process (1979).

We continue discussing Bateson's work. Looking into all these consideration from a bottom-up perspective had initiated Bateson to begin the ordering of his ideas about “learning” at the very simplest level, starting at learning zero. Hence, looking into this simple idea as Ryle (1949) pointed out, certain things are habit but certain events requires us to think. On the other hand Norman (1982) affirms that this is due to remembrance that some habitual events like driving a car, is not a very conscious act of remembering. Norman also suggested that certain events like going to a new environment and reading a small map requires that we learn to recall the places we went and visit.

From here onwards, we can relate very much of the above to the hierarchy of learning and communication, through the framework of Bateson (1972) by ordering it from the simplistic view of “I hear the clock strike 12 o'clock. I go the the table”. Bateson had mainly ordered the learning hierarchy into four levels. Beginning with a simple level zero to level II. He also suggested there could possibly be a fifth level. In this thesis, we focus only on learning 0, I, and II.

Herein, we review each level of learning, and then we move on to a new section on related work.

#### 4.4.1 Learning Zero

In learning zero, Bateson observes that this is the case in which an entity (e.g., an animal) shows *minimal change* in its *response* to a *repeated item* of sensory input<sup>62</sup>. Phenomena which approach this degree of simplicity occur in various contexts, here we only excerpt two examples from (Bateson, 1972), p.284:

- (i) In experimental settings, when “learning” is complete and the animal gives approximately 100 per cent correct responses to the repeated stimulus.
- (ii) In cases where the response is now highly stereotyped.

Zero learning is most often applied when there is a *simple receipt* of information from an *external event*, in such a way that a similar event at a later (and appropriate) time will convey the same information. Taking the example from (Bateson, 1972); we have “I ‘learn’ from the factory whistle that it is 12.00 o’clock”.

From here, Bateson postulated that the *external event system* contains details (e.g., signals) which might tell the organism: (i) from what set of alternatives it should choose its next move; and (ii) which member of that set it should choose. The situation permits two orders of error:

- (i) The organism may use correctly the information which tells him from what set of alternatives he should choose, but choose the wrong alternative within this set; or
- (ii) He may choose from the wrong set of alternatives. (There is also an interesting class of cases in which the sets of alternatives contain common members. It is then possible for the organism to be “right” but for the wrong reasons. This form of error is inevitably self-reinforcing (Bateson, 1972)).

The overall notion that all learning (other than zero learning) is in some degree stochastic (i.e., contains components of trial and error). It follows that an ordering of the processes of learning can be built upon a hierarchic classification of the types of error which are to be corrected in the various learning processes (Bateson, 1972). Therefore, *zero learning* will then be the *label* for the *immediate base* of all those *acts* (simple and complex) which are *not subject* to correction by *trial* and *error*.

Thus, zero learning can be summarized as having the characteristics by specificity of response, which- right or wrong- is not subject to correction.

---

<sup>62</sup>(Bateson, 1972) suggested that within this definition many very simple mechanistic devices show at least this kind of phenomena. He had also suggested that this kind of learning does not contribute anything to an organisms future skills.

#### 4.4.2 Learning I

Following the analogy provided by the “laws” of motion (i.e., the “rules” for describing motion) Bateson (1972) looks for the class of phenomena that are appropriately described as *changes in zero learning* (as “motion” describes change of position). These are the cases in which an entity gives at *time 2* a *different response* from what it gave at *time 1*. Some of the cases demonstrating these phenomena are:

- (i) Habituation: the change from responding to each occurrence of a repeated event to not overtly responding. The extinction or loss of habituation may occur as a result of a more or less long gap or other interruption in the sequence of repetitions of the stimulus event.
- (ii) Rote learning: an item in the behavior of the organism becomes a stimulus for another item of behavior.
- (iii) There is the disruption, extinction, or inhibition of “completed” learning, which may follow change or absence of reinforcement.

The list of learning I contains those items that are most commonly called “learning” in the psychological laboratories. From this observation of the learning in organisms, Bateson looked further into *context*. These contexts themselves gives clues to the relationships between contexts of contexts that make up from learning 0 to learning I. Readers must remember that this ordering that we are discussing are in an induction nature. Normally, in psychological laboratories, stimulus is somehow assumed to be the “same” at time 1 and time 2. If we assume this “sameness”, then we must also delimit the “context”, which must (theoretically) be the same at both times.

“It follows that the events which occurred at Time 1 are not, in our description, included in our definition of the context at Time 2, because to include them would be at once create a gross difference between “context at Time 1” and “context at Time 2”. (Bateson, 1972), p. 288:

Once we assume that the context is not the same at time 1 and time 2, then the whole system is not a simple deterministic procedure. It then refers to *differentiating* or correctly put “discrimination” of learning. This discrimination process is in some ways a part of the process to classify the *repeatable context*. Without the assumption of repeatable context (and the hypothesis that for the organism which we study the sequence of experience is really somehow punctuated in this manner), it would follow that all “learning” would be of one type: namely zero type<sup>63</sup> (Bateson, 1972).

---

<sup>63</sup> Then again we can note if we consider there is only one type of learning (namely zero learning): there is no further learning of understanding, inferring and learning is merely reduced to stimulus-action (without any real manipulation processes in between).

“Either we must discard the notion of “context”, or we retain this notion, and with it , accept the hierarchic series-stimulus, context, context of stimulus, context of context of stimulus, etc.” (Bateson, 1972) p. 289.

Bateson spelled this out in the form of a hierarchy of logical types as follows:

- Stimulus is an elementary signal, internal or external.
- Context of stimulus is a meta-message that classifies the elementary signal.
- Context of context of stimulus is a meta-metamessage that classifies the metamessage.

and so on.

To understand further the work of Bateson (1972), he was indeed very motivated in looking for patterns. Bateson's (1972) way of seeing was concerned with pattern, but with pattern that is different from Margaret Mead (Mary Bateson, 1984). Bateson emphasized his concern with “the pattern that connects”, or the associations of ideas that may be grouped as making sense of the whole context of environment. This pattern that connects all living beings in formal similarities of growth and adaptation, the dolphin, the crab and the flower, the people and by which they are united in ultimate interdependence in the biosphere (Mary Bateson, 1984). Hence, in our own observation, we notice quite correctly Bateson's projection of his own interest in patterns in the hierarchy of learning and communication. Firstly, the author (Bateson, 1972) observed the communication in some kind of abstraction: a person's transaction with the environment. Now, moving on, the environment is looked into as being a whole; persons, and his/her surroundings. From here onwards, looking into the occurrences of the transactions between a person with his/her own surroundings is categorized as containing details which is termed as an *external event systems*. This is analyzed in order to understand what are those *signals* or otherwise known as *stimulus* that contributes to the external event systems that are a part of making of those details. To proceed further, Bateson differentiate between *external* and *internal stimulus*. Now, categorizing those signals into external event systems, he looked into contexts. What are those signals that help people to mold the contexts that they are in so that they know what to response with? With this questions in mind, Bateson looked into the notion of S→R in the idea of context, messages (signals) etc, corresponding to the hierarchy of logical types. This show a clear induction process on Bateson's (1972) work on developing his open framework on hierarchy of learning and communication. It also shows a pattern of association from one item to the other from an inductive level.

The same hierarchy can also be built up from the notion of “response” or the notion of “reinforcement”. Alternatively, following up the hierarchy classification of errors to be corrected by stochastic processes or “trial and error”, “context”

may be regarded as a collective term for all those events that tell the organism among what set of alternatives he must make his next choice.

From here, Bateson later introduces the term “context marker” . It is used to describe that an organism *responds* to the “same” *stimulus differently* in *differing context*. Thus, Bateson proposed that one must therefore ask about the source of the organism’s information. From what percept does he know that context A is different from context B?

According to (Bateson, 1972), in many instances, there may be no specific signal or label which will classify and differentiate the two contexts. It is rather hard to pinpoint what exactly allows the organism to recognize the different contexts. Bateson assumes that the organism when it is faced in two differing contexts will be forced to get its information from the actual congeries of events that make up the context in each case, which leads to speculations that there occur signals whose major function is to classify contexts.

Bateson gives some examples of how people can rightly *recognize different contexts* of communication. For example, consider an audience watching Hamlet on the stage, and hears the hero discuss suicide in the context of his relationship with his dead father, Ophelia, and the rest. The audience members do not immediately phone the police because they have received information about the context of Hamlet’s context. Can this be considered as a simple notion of Hamlet’s context. Let us discuss the possibilities.

The audience members do not immediately telephone the police because they have received this information from many “markers of context of contexts” - the playbills, the seating arrangements, the curtain, etc., etc. The playbills resides as the marker in the context of the seating arrangement (normally on a paybill, one will notice the seat as “marking the context” within where their seating placing will be). Within this context of the placing, when one takes a seat, the curtains mark that the play is about to start when the curtains role up and so forth. This is a marker residing in a wider context consisting of the context marker of the playbill, seating arrangements and etcs. The “King”, on the other hand, when he lets his conscience be pricked by the play within the play, is ignoring many “markers of context of contexts”.

We rewind, we must imagine that we are now entering a big hall, we queue up because of the long line, this is another marker of the context “queueing for receiving my ticket or paybill”. Then secondly, we might be distracted by another marker of a context, the popcorn both. This is “marker of a context” of selling food for watching a film that is about to begin. Let us pretend that we prefer not to get the popcorns, then we encounter another “marker of context” of the heavy door (that is quite common throughout theatres with the push handle) as a context for this is the theatre hall. Now, from this idea, we briefly account markers of context of contexts.

Imagine that you are in a forest. Then you are within this circle of people, that becomes a marker of context of contexts that it is a team playing scene. The context is of you in the forest, the markers are your friends forming a circle around you and singing, and the whole becomes a context of a context of saying that this is the time to play clap and dance. However, this is a simple abstraction of explaining markers of context of contexts. Like the popcorn booth example I gave above, we would not know that if the person who goes to the popcorn booth does so in response to a “stimulus”, or to the context itself or in response to the context marker. To give further example, is the person going to popcorn booth is a stimulus of her hunger or that her little kid wants to have popcorn? On the other hand, is it a response to the context itself of the popcorn booth (selling other snacks?) Or maybe to the popcorn itself? She may instead go to buy a drink as a response to the “marker” of the context of popcorn booth but not buy the popcorn.

“ Does he do so in response to a “stimulus”? Or in response to a context? Or in response to a context marker?”(Bateson, 1972), p. 290.

In principle, even in zero learning, any item of experience or behavior may be regarded as either “stimulus” or “response” or as both, according to how the total sequence is punctuated. In Learning I, every item of perception or behavior may be stimulus or response or reinforcement according to how the *total sequence of interaction is punctuated*.

Thus, Learning I is change in specificity of response by correction of errors of choice within a set of alternatives.

#### **4.4.3 Learning II**

Now we consider the third level of learning: learning II. Some of the other common notions for this type of learning are: (i) deutero-learning; (ii) set learning; (iii) learning to learn; (iv) transfer learning.

Learning II is change in the process of Learning I. An example is a corrective change in the set of alternatives from which a choice is made. The phenomena of learning II can all be included under the rubric of changes in the manner in which the stream of action and experience is segmented or punctuated into contexts, together with changes in the use of context markers (Bateson, 1972).

Those phenomena classified under the learning I include a set of *differently structured contexts*. In classical Pavlovian contexts, the contingency pattern that describes the relation between “stimulus”, animal’s action, and reinforcement is profoundly different from the contingency pattern characteristics of instrumental contexts of learning (Bateson, 1972). In the Pavlovian case, if stimulus and a

certain lapse of time, then reinforcement. On the other hand, in the instrumental reward case, if stimulus and a particular item of behavior then reinforcement. In the Pavlovian case, the reinforcement is not contingent upon the animal's behavior, whereas in the instrumental case, it is.

Contingency pattern may be thought as a possible event of patterns. Let us abstract this into simple formula:

If Stimulus  $\wedge$  Lapse of time Then reinforcement = Pavlovian (i)  
If Stimulus  $\wedge$  item of behavior Then reinforcement= Instrumental reward (ii)

To further explain by what it means by these contingency of pattern. We give an example from Bateson (1972), p. 294. Learning II is adaptive only if the animal happens to be right in its expectation of a given contingency pattern, and in such a case we shall expect to see a measurable learning to learn. It should require fewer trials in the new context to establish "correct" behavior. If, on the other hand, the animal is wrong in his identification on the later contingency pattern, then Bateson claimed that we shall expect a delay of Learning I in the new context. The animal who has had prolonged experience of Pavlovian contexts might never get around to the particular sort of trial and error behavior necessary to discover a correct instrumental response. In it is this contrast example that Bateson (1972) attempts to show the contrast in the two learning discussed above can be described as having profoundly different contingency pattern, or in other words, different contingency of a possible even/recurrence. The patterns are different even if both are reinforcement learning because the first; Pavlovian is stimulus with lapse to time, and on the other hand the second one is stimulus with a particular item of behavior. These patterns of contingency shows an event that may occur but what constitutes the pattern of contingency are different.

Using this contrast as an example, Bateson affirms that Learning II has occurred if it can be shown that experience of one or more contexts of the Pavlovian type results in the animal's acting in some later context as though this, too, had the Pavlovian contingency pattern. Similarly, if past experience of instrumental sequences leads an animal to act in some later context as though expecting this also to be an instrumental context, this is also learning II.

To summarize it briefly, now learning II is now more focused not just on the transaction of a person with his/her environment. It considers the communication between two persons.

"In the punctuation of human interaction, the critical reader will have observed that the adjectives above which purport to describe individual character are really not strictly applicable to the individual and his material and human environment. No man is "resourceful" or "dependent" or "fatalistic" in a vacuum. His

characteristics, whatever it be, is not his but is rather a characteristic of what goes on between him and something (or somebody) else.” (Bateson, 1972), p. 298.

This being so, it is natural to look into what goes on between people, there to find contexts of Learning I, which are likely to lend their shape to processes of Learning II. In such a system, involving two or more persons, where most of the important events are postures, actions, or utterances of the living creatures, there are streams of events that are commonly punctuated into contexts of learning by tacit agreement between the persons regarding the nature of their relationship-or by context markers and tacit agreement that these context markers shall “mean” the same for both parties. It is instructive to attempt an analysis of an ongoing interchange between A and B (Bateson, 1972).

Let us recall what we said until now. We notice a *hierarchy of patterns* in Bateson's hierarchy of learning and communication. Firstly, learning zero was a simple classification of categorizing signals. Signals are considered into “external event systems”: A system that tells people what to select as response and when. Now, Bateson went further up to categorize those signals that help an organism to classify contexts, hence, bringing forth the notion of repeatable context. There must be certain signals that enable an organism to discriminate from one context to another. Now, going further up the hierarchy, particularly where we are right now, in learning II, Bateson looks into a bigger context of communication. How do the contexts of learning I: discriminating repeatable context lend shape to the process of learning II. These contexts are referred to as *streams of events*. The signals that mark those contexts are called “markers” for the punctuation of events. Then the question would be how does one punctuate these streams of events as being event 1; event 2 and so on, when communicating with another person? Hence, the notion of learning by a tacit agreement is used to represent this nature of communication. This overall notion of event is a more contextualized notion of context, which considers a much wider relationship/transactions between a person A and his/her ongoing interchange with B. It is an inductive hierarchy of learning and communication.

Thus, to summarize this account until now, Bateson considers about any particular item of A's behavior: Is this item a stimulus for B? Or is it a response of A to something B said earlier? Or is it a reinforcement of some item provided by B? Or is A, in this item, consummating reinforcement for him? Etc. These questions will reveal that for many items of A's behavior the answer is often quite unclear. If there would be a clear answer, the clarity is due only to a tacit (rarely fully explicit) agreement between A and B as to the nature of their mutual roles, i.e., as to the nature of the contextual structure which they will expect of each other.

This leads to the abstraction on the exchange of communication:



$a_1 b_1 a_2 b_2 a_3 b_3 a_4 b_4 a_5 b_5 \dots$ , where  $a$ 's refer to items of  $A$ 's behavior, and the  $b$ 's to items of  $B$ 's behavior, we can take any  $a_i$  and construct around it three simple contexts of learning. These will be:

- (i)  $(a_i b_i a_{i+1})$ , in which  $a_i$  is the stimulus for  $b_i$
- (ii)  $(b_{i-1} a_i b_i)$ , in which  $a_i$  is the response to  $b_{i-1}$  which response  $B$  reinforces with  $b_i$
- (iii)  $(a_{i-1} b_{i-1} a_i)$ , in which  $a_i$  is now  $A$ 's reinforcement of  $B$ 's  $b_{i-1}$  which was response to  $a_{i-1}$ .

It follows that  $a_i$  may be stimulus for  $B$  or it may be  $A$ 's response to  $B$ , or it may be  $A$ 's reinforcement of  $B$ . Beyond this, Bateson consider the ambiguity of the notions "stimulus" and "response", "afferent" and "efferent"-as discussed above- we note that any  $a_i$  may also be stimulus for  $A$ ; it may be  $A$ 's reinforcement of self; or it may be  $A$ 's response to some previous behavior of his own, as is the case of sequences of rote behavior. The simple abstraction of communication above on the items of behavior may be related to turn taking (Sacks et al, 1974) if one observers closely. We can also order this as parallelism.

- i.  $(b_i a_{i+1} b_{i+1})$  in which  $b_i$  is the stimulus for behavior  $a_{i+1}$  and the response of at the same time reinforces with behavior  $B$ .
- ii.  $(b_i a_i b_{i+1})$ , in which  $a_i$  is the response to  $b_i$  which response  $B$  reinforces with  $b_{i+1}$
- iii.  $(a_{i-1} b_i a_i)$ , in which  $a_i$  is now  $A$ 's reinforcement of  $B$ 's  $b_i$  which was response to  $a_{i-1}$ .

In fact if we notice on the second note on parallelism, (i) illustrates a reflexivity property. If we play around with (i) the above, and we replace respectively with the below:

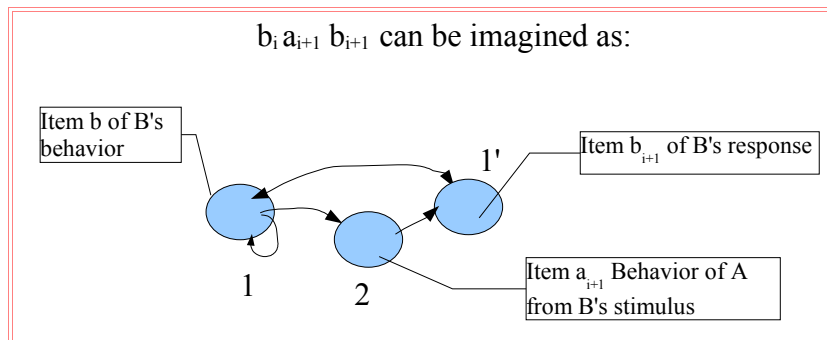


Figure 4.4.3 (a): The abstraction of items of behavior  $b$  is in parallelism.

Refer to Figure 4.4.3 (a). The item  $b_i$  of  $B$ 's behavior is now the stimulus for behavior of item  $a_{i+1}$  that then becomes an item for the response of item  $b_{i+1}$  almost at the same time? The circle labeled with 1 is a reflexivity property of behavior  $A$ , at the same time the response of behavior  $B$ , circle labeled by  $D$  becomes a stimulus for behavior of  $A$  almost at the same time, denoted by the

circle 1'. This shows some kind of a loop learning and communication transaction taking place between behavior A and B when considering parallelism. The parallelism shows the complexity (concrete complexity of human communications) that communication is not strictly turn-taking (Sacks, 1974 et al).

Hence, we continue with the simplistic view first of Bateson (1972). According to Bateson, the modeling itself already provides a general ambiguity that means in fact that the ongoing sequence of interchange between two persons is structured only by the person's own conception of the sequence as a particular manner how the sequence is structured by any particular person will be determined by that person's previous learning II (or possibly by her genetics) (Bateson, 1972).

Bateson, suggested that what is learned in Learning II is a way of punctuating events. But a way of punctuating is not true or false, because there is nothing contained in the proposition of this learning that can be tested against reality. It is like a picture seen in an inkblot; it has neither correctness nor incorrectness (Bateson, 1972). It is the way of how one conceive of a way of seeing the inkblot. Bateson gave another example (Bateson, 1972), p. 301, we have a practitioner of magic does not unlearn his magical view of events when the magic does not work. In fact, the proposition which govern punctuation have the general characteristics of being self-validating. What Bateson refer to as "context" includes the subject's behavior as well as the external events. But this behavior is controlled by former Learning II and therefore it will be such a kind of mold the a context to fit in the expected punctuation. Readers noted when we first brought up this notion in Chapter 1 and 2. We raised our interest in knowing how does an events goes through the punctuation of events that eventually allow people to induce communication protocols? The same spirit is here. The former Learning II is like a self-validating characteristics of knowing to communicate with what, when and with whom.

#### **4.5 A summary on the hierarchy of learning and communications**

We have reviewed in quite detail the hierarchy of learning types. We also relate each hierarchy to the other. The hierarchy presented by Bateson is inductive in the sense that the hierarchy of orders of the learning is presented from bottom upward, from level zero to level II (until III) (Bateson, 1972). It also assumes a reflexive relation-both inductive and deductive- obtained among ideas and items of learning. Bateson noted that his model remains ambiguous in the sense that, while it is asserted that there are explanatory or determinative *relations between ideas* of adjacent levels both upward and downward, it is not clear whether *direct explanatory relations* exist between separated levels, e.g., between level III and level I or between level zero and level II. In a nutshell, the learning hierarchy can be illustrated as below.

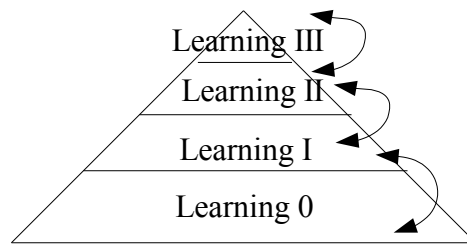


Figure 4.5 The learning hierarchy.

Referring to Figure 4.5. It is our own diagram summarizing Bateson's hierarchy of learning and communications. We can summarize the learning types as the following. The curved arrows represents two representations. The arrow curving pointing one level up in the hierarchy describes the inductive nature of the learning process. The arrow curving pointing downwards represents the deductive relation among ideas and items of learning types. In short, we can summarize it as (i) learning 0 is described by which response is right or wrong and is not subjected to correction; (ii) learning I is described by the change in the specificity of response by correction of errors of choice within a set of alternatives; (iii) learning II is described as the change of process of learning I, a corrective change in the set of alternatives from which choice is made or a change in how the sequence of *experience* is punctuated; (iv) learning III is described as the change of process in learning II, a corrective change in the system of sets of alternatives from which choice is made. We only focus on learning 0, I, and II; as learning III is claimed by Bateson to be very rare in human beings.

Bateson (1972) suggested that learning III occurs from time to time in psychotherapy, and in other sequences in which there is profound reorganization of character. In a psychotherapy session, a psychotherapist is engaged with a patient to help change their cognitive pattern behavior which is normally a therapy session. The goal is to change the patterns of thinking of the patient undergoing the psychotherapy. The changes could be to make the person less fixated or obsessed in one subject, to help overcome exitation problem when emotions are entwined with cognitive processes. In general it aims at manipulating a person's way of learning, living their life, and thinking.

We review the distinction between the levels of learning 0, I, II and III to explain why learning III is rare in human being. We adapt an example from Bateson, p. 302 specifically on therapeutic sessions between a psychiatrist and a patient. Within a controlled and protected setting of a therapeutic relationship, the therapist may attempt one or more of the following:

- i. to achieve a confrontation between the premises of the patient and those of the therapist- who is carefully trained not to fall the trap of validating the old premises (of the patient);
- ii. to get the patient to act, either in the therapy room or outside, in ways which will confront his own premises;

- iii. to induce the patient some exaggeration or caricature (e.g., dream of hypnosis) of experience based on his old premises.

We list down some of the changes which Bateson calls learning III, they are:

- i. The individual might learn to form more readily those habit forming of which we call learning II (knowing to punctuate what and when with whom).
- ii. He might learn to change the habits acquired by learning II.
- iii. If learning II is a learning of context of learning I, then learning III is a learning of the contexts of those contexts.

If we consider the last point iii) that learning III is a learning of the contexts of those contexts of learning II, may either lead to an increase in learning II or to a limitation and perhaps a reduction of that phenomenon. The idea of selfhood reaches at learning II (how one goes about punctuating events that becomes a habit forming of selfhood). How a person punctuate events is different from another person. Note that a person may take the popcorn as a marker for a popcorn both “context” and punctuate it as a context or events to step ahead and perform my “procedure” of buying popcorn. On the other hand, another person may perceive the man in a white collar shirt with a white chef hat standing behind the counter with hotdogs in a transparent case rolling around as a marker of that context of buying popcorn both that normally comes along with hot dogs, drinks and snacks. Then this person punctuates from those markers of context and contexts as an event to go ahead, stand in queue and proceed to buy a popcorn. Now, these creates a certain self, that is called as “my character”. “I” am my habits of acting in context and shaping and perceiving the contexts in which I act (Bateson, 1972), p. 304. This selfhood is a product or aggregate of learning II. To the degree that a man achieves learning III, and learns to perceive and act in terms of the contexts of contexts, his “self” will become a sort of irrelevance and in fact does not any longer represent a self, but instead an unstable “punctuation of events”. It will no longer function in this context of punctuation of event.

That is why in therapeutic sessions, the psychiatrist or the psychotherapist attempts to change that learning III that may eventually lend to a habit forming that attempts to fit in the function of social convention. In this case, of Schizophrenics or even Manic persons, involves of that person changing in himself in punctuating events, that requires changing the cognition process itself. This is why, Bateson (1972) regard it as being very rare in human being and if it so happens, it may happen through religious conversion<sup>64</sup>. This was also noted by Jamison (1993) that indeed it takes a lot of therapeutic sessions to help Manic

---

<sup>64</sup>This was noted in Bateson (1972) himself converting to Zen Buddhist. In his last days, Bateson was surrounded by his Zen students that shared the tasks of care for him and sat in meditation near his bed, breathing in rhythm, around the clock. Bateson and his symbol of the dearest moment of his childhood and of all the “fearful symmetries” of mind and nature, was piled on his body to the crematorium. The Zen friends chanted, and the control on the great oven was pressed, smoke rising to the sky (Mary Bateson, 1984) p. 276.

patients, and requires at the same time medication to inhibit the excitation or obsession in one subject (like working all day coupled with self-starvation because of high fixation/obsession in drawing) through medication that is mediated through the nervous system,

Now, comparing the framework of Bateson to most communications theory (Watzlawick et al, 1967; Langer, 1951), the latter assumes that tacitly, the logical types can be ordered in the form of a simple, un-branching ladder. However, Bateson raised many arguments that demonstrate that in the actual world, action, experience, organization and learning cannot be completely mapped onto a model. And that this model excludes propositions about the relation between classes of different logical types (Bateson,1972). To further explain, we explain from Bateson (1972) on the classical theory on communication.

The classical theory of communication supposes that, if  $C_1$  is a class of propositions, and  $C_2$  is a class of propositions about the members of  $C_1$ ;  $C_3$  then being a class of propositions about the member of  $C_2$ , the next question is then how can we classify propositions about relation between classes? As an example, the propositions “As members of  $C_1$  are to members of  $C_2$ , so members of  $C_2$  are to members of  $C_3$ ”.

If we mapped the classical theory of communication above to the model of hierarchy of learning and communication of Bateson, then we can ask several questions that the above communication theory excludes the propositions (items that mold those contexts) about the relation between the logical types.

In other words, how do we classify the members from learning 0 being members to the member of learning I. Remember that learning I is changes in learning 0. Now, if there are changes, we can assume they are members within learning 0 that is being changed by learning I (if we look into the deductive nature). Hence, what are those shared members that allow from learning 0 to be induced into learning I? What are the “correlation” members that allow us to discriminate yet at the same time changes this members into the other next class?

Let us say that I know that when the clock strikes at 12 it's time for me to go to lunch. Now the class we can imagine is “lunch” in a very abstract and simplistic view. However, what are the members belonging to the class “lunch”. Now, imagine that when the clock strikes 12, the same person goes to the table only to find that for today, the first time in his 27 years, there was no lunch on his table. Now, he learns then by the specificity (trial and error) that there was certain members belonging to that class (from his set of alternatives) that for him does not represent the class “lunch”. Hence, what are the members that allows this person to induce from 0 to I, or deduce from I to 0 that it's 12 o'clock and time for me to go lunch but today there is no lunch? There must be a relationship between class “lunch” at learning 0 to another class at learning I that he is able to induce or even deduce that there was no lunch for today. Let assume that this class

“lunch” at learning 0 consists of these items: clock ticking at 12, bread on the table, jug of water is present, napkins is on the side of the table, meat, soya sauce, vegetables. However, we know that not all lunch will always consists of the same members (menu). Let say there is a class “lunch at restaurant” at learning I that consists of members: napkins, plates, fork and spoon, menu card on the table, round tablecloth, and salt and pepper, meat, bread in a basket. The person's response in this context lunch restaurant at “Nobu” New York is not the same in the context of restaurant lunch at “The Gaucho Grill” at Chelsea, UK. Even if the context is similar, lunch at a restaurant and eating, the markers of these contexts are different, one being that you use chopstick at this time at “Nobu” and use knife and fork at “The Gaucho Grill”, your response even if the context are similar is different at Time 1 and Time 2. Perhaps within class, “Nobu”, we have members: chopsticks, wasabe (in green tube), japanese soya sauce, napkins, jug of water, california role, tempura, miso soup, udon noodles. Whereas class, “The Gaucho Grill” at Chelsea, Uk consists of members: napkins, cowskin chair, long menu cards, candles in rattan small basket, napkins, bread, jug of water, peppermint sauce, garlic stick, salt and pepper.

These members may be marker of the contexts of this is the Gaucho Grill that prepares great grill and you may order a sirlion steak weighting 1 kg! The members of Nobu restaurant may consists of markers that says this a sushi restaurant that also serves fusion food.

So we assume, that maybe there are shared members between learning 0 and learning I, between class “lunch” and “Nobu” and “The Gaucho Grill”. Perhaps the absence of napkins, bread, jug of water, and soya sauce on the lunch table that the person learns to induce that at 12.00 clock today that sadly my lunch is not there. Of course the above example is a very simplified view of classifying members into their respective classes at different levels of learning and how from one learning to the other, these members may changed within their classes. In actual situation, the members itself can be classes. For example, the member, bread can become a class itself having members as: garlic bread, rye bread, wholemeal bread, and etc.

Therefore, we assume that it seems likely there is a shared member of context: moving from zero learning to learning I and so on. Or it may be suggested a shared member moving from learning II to I, indeed as Bateson (1972) suggested that the hierarchy of learning and communication can be both read inductively or deductively.

#### **4.6 Related work to Bateson's hierarchy of learning and communication**

The previous section was devoted to Bateson's work on the modeling of the communication theory. In this section and the next, we refer several work such as John Dewey (1925), on communications and meanings to Donald A.Norman

(1982), and Frederic Bartlett (1995). *These compilations prepare us for justifying why we associate communications to the study of situated cognition* (Clancey, 1997a) and then to *activity theory* (Leont'ev 1977 & 1978).

Firstly, we begin with John Dewey's work on nature, communication and meaning (Dewey, 1925). Dewey was an educator, philosopher and a psychologist who was focused on understanding human thoughts, among many of his contributions. In one of his chapters from (Dewey, 1925), the author had touched on the subject of communication, focusing on explaining *events* and *experience* as units for analyzing communications. Dewey might not have shared the same vocabulary as Bateson, but they both were speaking of very important elements making up communication theory. The difference consists of the fact that Bateson had produced a communication theory framework, while Dewey had described it (rather candidly) in a philosophical manner.

We start by recalling the basis of the learning hierarchy: learning 0 (Section 4.3.1). In this level, readers may make a mental note that we have particularly highlighted the notion of *signals* and “*external event systems*”. The external event system contains classes and members and details (e.g, signals/stimulus) that tell people *what to select* from those classified classes. It also tells which *member* from that class to select and *when to respond*. Dewey, on the other hand, approaches it in a different way. According to Dewey, when communication occurs, all natural events are *subject* to reconsideration and revision; they are *re-adapted* to meet the requirements of conversation. Events are then described as turning into somekind of objects; those objects are things with meaning.

“*Events* when once they are *named* lead an *independent* and *double life*. In addition to their original existence, they are subject to ideal experimentation: their meanings may be *infinitely combined* and *re-arranged in imagination*, and the outcome of this inner experimentation—which is thought—may issue forth in interaction with crude or raw events.” (Dewey,1925) p. 50.

“Think back of the missionaries and cannibals problem, or to when you first learned to drive a car, to type, or to play a musical instrument. The sequence proceeds from whole to part and back to whole again. At first the task is chaotic- unorganized. Not enough is known even to perceive the situation easily. Then, with more experience, some of the units emerge. Systematic analysis reveals the component of the parts, which can then be learned separately, interrelated, and combined. Larger organizational units emerge, the topic takes on some structure and finally seems to be manageable” (Norman, 1982) p. 78.

First of all, what does Dewey (1825) means by events? In Dewey (1926), Dewey discussed events and future by referring to the literature of Broad's

scientific thoughts (Broad, 1923) that events is something that can be described as giving an indispensable character of anything which may be termed an event: namely, a qualitative variable of parts with respect to the whole which requires duration in which to display itself (Dewey, 1926) p.181. However, Dewey noted that in Broad's account of event does not regard qualitative variation to be involved in the definition of an event or even time, or jerks into what he terms as events that “becomings”<sup>65</sup> Referring to the quotation above, we put it in simpler words that events are “labeled” and “recognized” and always actively being “recombined” and “re-arranged” by the person. It is also very well said, that these events must occur during time, we must take into account of the time. Hence, what happens during these time, or time lapse or jerks? Are there merely empty rationalism? Does the mind go into a static mode when events are becoming? Hence, what Dewey perhaps is putting forward that in communication, we propose that there must be “processes” are the outcome of *testing* when a person is communicating. Does this mean that the communication protocols are being merged and then adapted? We excerpt an example from Ryle (1949) that was mentioned above, however elaborated in this section.

“..a mountaineer walking over ice-covered rocks in high wind in the dark does not move his limbs in blind habits; he thinks what he is doing, he is ready for emergencies, he economises in effort, he *makes test* and *experiments*; in short he walks with some degree of skill and judgment. If he makes a mistake, he is inclined not to repeat it, and if he finds new trick effective he is inclined to use it and to improve on it” (Ryle, 1949) p. 42.

As pointed out in Ryle (1949), even in learning and communication; the actions or responses like that of walking, or talking involves making tests and experiments. It does not not assume a long straight learning curve, but it involves level of levels of learning.

To further discuss on Dewey's idea, in our own interpretation, the events that one goes through contain details and are *labeled* and *recognized* by a person. Now, if we take a step backward, the question would be just the same: *how* does a person *label* an event being *that particular event*? Moreover, does the labeling of an event consists of a single, or multiple signals? (how many actual stimulus are there?). Now, before that event is going through that transformation (labeling and recognizing), Dewey suggested that this event is being “tested” during this transformation. The excerpted quotations above, we believe that Bateson (1972) had abstracted into inductive/deductive levels of learning consisting of learning by trial and error and so on. Testing involves some kind of *trial and error learning*. We further continue, combining this idea of Dewey, and Bateson. In considering the notion of *time*, according to (Bateson, 1972), these events are “*punctuated*” in which the sequences of events are given meaning (refer again to Bateson in learning II). This specific term “punctuated” is used by Bateson as an

---

<sup>65</sup>Refer to Dewey (1926) for further arguments on Broad's concept of events and the future.



example for denoting the ways an organism *acquires* the *habit of apperceiving* the infinitely *complex stream of events* (including his own behavior) so that this stream appears to be made up of one type of short sequences rather than another.

Now we are looking specifically into those *punctuated events*, that seem to initially be a streams of events (of parts). So the question would be twofold: (i) what are exactly those *signals* that help people (to share) to punctuate events and then this would bring us to another question; (ii) how does one *discriminate* those sequences of events into punctuated events? To summarize, what are exactly those processes of punctuation?<sup>66</sup> This can be provided by the model of the hierarchy learning.

“Meanings having been deflected from the *rapid and roaring stream of events* into a *calm* and traversable canal *rejoin* the main *stream*, and color, temper and compose its course. Where communication exists, *things* in acquiring *meaning*, thereby acquire representatives, surrogates, signs and implicates, which are infinitely more amenable to *management*, more *permanent* and more *accommodating*, than events in their first estate.” (Dewey,1925) p. 50.

The *meaning* of an event is described as going through *transformation* that forms a total meaning that constantly goes through different types of “manipulation” during communication, allowing the person to re-adapt to their communication aspects (referring to Dewey, 1925). These events acquire representatives (like signals). Signals can be interpreted as verbal or even non-verbal: in a way they are stimuli. Refer again to the quotation above, the underlined words can only mean that *learning is* taking place: mutually with communication. Because transformation of something involves *manipulation* of a certain subject constructed in *time*, and that the “manipulation” of properties or even the construction of objects- are changes. Learning denotes “changes” of some kind (Bateson, 1972). But, before one can manage those *events* having *meanings* (in “active communication”) only emphasizes that “the actions” of the person are the result of the thoughts and actions that are always actively learning at improvised multiple levels<sup>67</sup>. Learning is an “activity” that goes hand in hand with communication.

In the previous section, we highlighted that Bateson did not mention the combination of those members (Section 4.4) or even if there was a possibility of combining members from different classes. However, Bateson suggested that a person's responses becomes merely an act of apperceiving. Readers recall that Dewey mentioned the possibility that the parts (i.e., members)<sup>68</sup> of the sequences

---

<sup>66</sup>This notion is moving up to the idea of “shared intentionality”. See (Searle, 1982; Tuomela, 2000) for details.

<sup>67</sup>We discuss what we mean by actions and thoughts are learning at multiple levels in Section 4.4

<sup>68</sup> Refer to Section 4.4, where we elaborated on class “lunch” and its items making up of that class lunch. The same principles applies here, what are the parts or members/items of a sequences of events that are

of events are recombined and tested. If sequences of events were an “experimentation”, and considered as parts, it is possible that they (the parts) can be considered as members. Therefore, these members from different classes are combined.

Hence, bringing forth this notion from Dewey into Bateson's suggestion, proposes that we may further look into the potentials of those members to be recombined<sup>69</sup>. They can be recombined like a response. For example, if we use the same class example given in Section 4.4, on the clock strikes at 12 and I go to lunch but I find no lunch. However, there are the classes of restaurant “Nobu” and “The Gaucho Grill”. I assume that since the napkin is absent that indeed there is no lunch, my response is then combined from two classes of a shared member “napkins” that is obviously not on my lunch table hence inducing that there is no lunch (yet). Therefore, I go to the kitchen to call my cook. My response to that context or events is to walk over to the kitchen and communicate with my cook “Why is the lunch not ready yet?”. This example above is a very simplistic view, that is an extreme abstraction of the actual details of human transactions with the environment. At a first glance, Bateson (1972) framework on the hierarchy of learning and communication may seem a simplistic view on the basis of labeling and signals. However, we will discuss later that Bateson framework when being examined closely may be related to very specialized details of actual experiments to Bartlett (1995). Bateson's framework has to be treated like a game of lego, of building it up and then detaching it by parts, re-examing the parts and then building it again to understand how the basis of hierarchy of learning and communication can be regarded as constituting as a whole even if in a very simplistic and abstraction picture<sup>70</sup>.

Next we move on to another issue: (Bateson, 1972) had remarked a particular phenomenon: what happens when a person chooses a right class but a wrong member? Then, Bateson (1972) related this to correction of selection (learning II). So in order to look further into more clues, we analyze another quotation of Dewey:

“When events have communicable meaning, they have *marks*, notations, and are capable of *con-notation* and *de-notation*.” (Dewey, 1925), p.53 :

Readers recall, in our previous section (in learning II), we have briefly discussed the notion of *marking* of a *context* and learning by a *tacit agreement* (shared meaning of space). Referring to the above underlined words, obviously

---

recombined and tested.

<sup>69</sup>In a way, we are re-stating our questions, if it is possible let say to recombine the members from two classes. Is it possible to assume a second set of class similar to the first set of class (considering that these classes are on the same level of learning), as approximation. Giving the same example, since the class “Nobu” and class “The Gaucho Grill” both are on the same level of learning I. How do I learn to approximate from learning 0 to this two similar classes in learning I to response to that context or events?

<sup>70</sup>Intellectually for Bateson, it was critical for him to see a forest, not trees, and yet the forest is made up of trees and the details and custom that make up the fabric of life are essential to continuity. He moved from intellectual path of simplification and abstraction (Mary Bateson, 1984) p. 109.

Dewey had mentioned similar ideas. The “marks”, and “notations” that enables people to understand one another. Dewey added that these marks are capable of having *attributes* and given *signs*. Notice that we have previously raised the question if signals can be multiple. From there onwards, Dewey discussed what are the meanings of signs (or attributes).

“Language is specifically a mode of interaction of at least two beings, a speaker and a hearer; it presupposes an organized group to which people belong to, and from whom they have *acquired* their habits of speech. It is therefore a *relationship*, not a particularity. The *meaning of signs* moreover always *includes* something *common* as between *persons* and *an object*.” (Dewey, 1925), p. 57:

Here, the notion of sharing something common includes the notion by Bateson. Particularly, the notion of having a sort of “tacit agreement” during the transactions between persons. A shared common space of communication. In other words, the persons are converging to learning a tacit agreement of marking a context as being an event. Thus, they come to learning how to respond when encountering that context together. In a way, both are sharing a similar way of conceiving that this context are where you and I behave appropriately like this. Readers note that Bateson had discussed in detail the ideas of the *marking* of a *context*, and the *tacit agreement* of notions (shared meaning of space).

In order to summarize this rather long discussion, we may sum it up as: the ability to recognize a certain *communication protocol* goes through the *punctuation of context*, markers that *mark* them as certain *events* as an experience (having meanings) and are classified as “classes”. Let us elaborate the restaurant class “Nobu” and “The Gaucho Grill”. We have started off to describe with markers of contexts (see Section 4.4) on introducing how people are assumed to identify the markers of contexts and how they response to those markers of context of contexts. Later on, we elaborated specifically on the changes of learning 0 to I, that may be interpreted inductively or deductively. If we go back to our examples, how does a person recognizes a certain communication protocol (queue in line, pick up paybill, take my seat, sit down quietly, switch off my mobile phone and wait for the play to start) goes through the punctuation of contexts or events, this person may take the popcorn as a marker for a popcorn both “context” and punctuate it as a context or events to step ahead and perform my “procedure” of buying popcorn.

So, until now, we have again stressed that *communication* and *learning* are always *mutually influencing* one another. The meaning of communication is a construction of series of *transformations*. Then the question would be for us to understand what other transformation are taking place when interpreting the hierarchy of learning and communication inductively. In order to illustrate these transformation, we attempt to model it as functions that is discussed in great detail in Chapter 5.

We can summarize this section that we are very much occupied with several things, notably:

- signals and then labels
- classes and then items/members
- transformations

Dewey explained how “internally” these transformation are taking place, where communications becomes meanings. These internal “transformations” can be illustrated with Bateson's (1972) as the below:

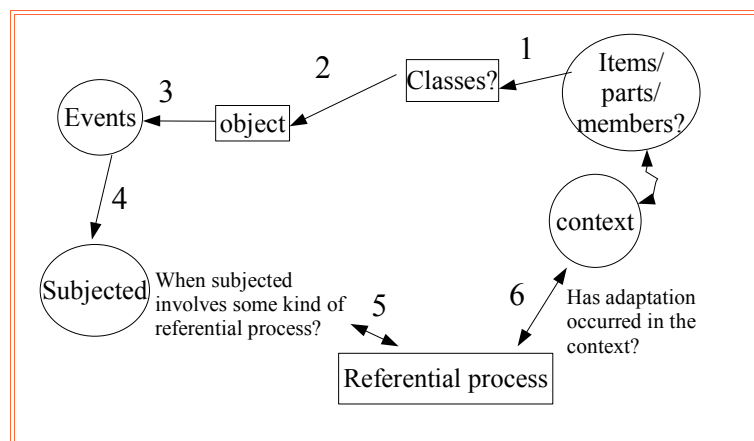


Figure 4.6: What does Dewey reveal to us to improve Bateson's framework?

Figure 4.6, is our brief summarization to use Dewey's work to help further consider the open framework of Bateson (1972). First we begin label “1”, according to some members/items/parts has its attributes that molds “classes”. Further on from here, we follow label “2”, where it becomes object and is labeled as events. Once events are “molded”, it is named and leads a double life, it is recognized yet it is independent (Refer again to the beginning of Section 4.5). But what does Dewey mean by events being independent? Perhaps event are independent because they may be freely associated to re-production forming chains of event of events. For example, I went to Carrefour shopping at Montpellier, France but parked my car at the end of Carrefour building at about 8 pm (during) winter and it was already completely dark by that time. When I went back to my car, I noticed that my car was no longer there! It was an event labeled to me as perhaps “my stolen car at Carrefour at 8 pm at Montpellier, France.” Now, after some time, jerks and interruption, I do remember this event and recall them to my friends and advice them that whenever you park you car at Carrefour Montpellier after 8 pm, make sure to park somewhere very near the entrance of the building!

Now, I am making a travel, after 3 years that “stolen car event” was perhaps somewhere in my mind. Now, I rented a car and parked at Tesco, not so far from Central London, about 15 minutes drives from Oxford Street, London. I parked my car there (underground car park) and it was in the morning. Afterwards, when

I came back, my car is there, but I find out a very peculiar thing, that I felt something was missing because my booth was slightly open and I remembered that I didn't open my booth (as I was just about to open to put fresh grocery purchases in the booth), and to my dismay remembered that when I was parking I had my portable computer and thought it was safer to put it in the booth and hence in that broad daylight, thinking it was safe, I had carried it out from my car and put it in the booth and lock it. I would have never thought that this time, my rented car is not lost but my precious portable computer was stolen in broad daylight in London!!

So, then I go back on vacation and was telling my friends “ You know I tell you never park your car at night if it's far from the building, happened once to me you know in France, and also I say if you are in London just don't take out precious things and transfer it to the booth, my notebook was stolen because I did that you know!” Now, these events first event “stolen car at Carrefour at 8 pm at Montpellier, France.” did lead a double life, it was independent yet it was associated in time to another event almost similar that shares these members or parts, car park, shopping for grocery (only in different countries). Now the first event after some time was associated to another event as “stolen notebook at Tesco at broadlight!” The first event was original in its existence, but their meanings are combined, arranged, associated to imagination (e.g., dark, so maybe some nasty thief is lurking behind, so don't park your car in dark car park that is not located near the building, you never know who is lurking about!), and it is taking place situated in the environment, having transactions/communication with going to the security guard at the Carrefour in panic, and then it becomes an association to raw events, when interacted. So events perhaps what Dewey (1925) was referring to in communication and meanings not only involve inducing, referencing, experience but imagination (like nasty people lurking around after 8 pm, he might put a knife to my throat and ask me to give up my car keys!). We are playing with our own thoughts, in construction with these events. We also assume that perhaps what we can interpret from Dewey's (1925) is that independent is related to the idea that these event might share some members on the same level of learning? (Bateson, 1972). For example, those two events, on what level are they? Perhaps from learning I to learning I, are they both equally on the same level of learning and if some, what parts of each class of “events” are being re-combined, adapted and tested (experimented) against the reality?

So let us reveal, if some of the above can be explained, particularly by focusing on explaining how the very abstract framework of Bateson can be read inductively. In Section 4.6, we review why we relate this analysis to learning and memory to better understand and explain Bateson's framework.

## 4.7 Learning and Memory

In this section, we wish to slowly unfold how the work of Bateson (1972, 1979) can be explained and related further to *learning and memory*. We start by Donald A. Norman, a cognitive scientist and Sir Frederic Bartlett, a psychologist. We begin simply with a good question by Norman (1982).

“How do we perform any actions? In part, I believe we *formulate intention*, then *guides the act*” (Norman, 1982) p. 34.

In 1982, Norman suggested that how we perform any actions (i.e., responses) are mainly due to the part of how we formulate intentions. Recall that in Chapter 1, 2 and 3, we have stressed that our wish is to understand how people formulate intentions in order to understand how people punctuate events (i.e., communication protocols). Asking this questions prompted us further into understanding what it means by formulating intentions. Recalling Chapter 3, we refer to the work of Clancey (1997a), at the same time to Searle (1969) as grounds on understanding how intentions arise or are formulated. What does this have to do with the relationship with what we have discussed on Dewey to Bateson to this above quotation by Norman (1982)?

We discuss further. Norman (1982) p.34 questions why does someone remember to mail a letter at all? What causes a person, at a random time in the day, suddenly to think “ the letter. I must mail later”. This kind of remembering according to Norman is reminding, which is perhaps the complement to forgetting.

“Memory of the present brings with it memory of the *sensory details* that *accompany* the *information*. It is a memory that is detailed, complete, and reasonably accurate in its content.....

*Sensory memory* is at the periphery of processing; it is one of the *first stages* through which *information passes*. We cannot exert much control over the processing that takes place in sensory memory. We can close our eyes or turn our heads, but the *signals* that *impinge* on our *eyes* and *ears* arrive at their *respective memories* regardless of our thoughts and desires.

The first classification of *signals*, identifying their meaningful *mental referents*, takes place soon after, and the result is made available for conscious awareness within *primary* and *secondary memory*<sup>71</sup>.” (Norman, 1982) p. 11.

Recall that Bateson (1972) had brought up the question that the external event systems (when we say external event, it means, the environment, where am I now ?). Notice, also that Norman hypothesized that “...*signals* that *impinge* on our *eyes* and *ears* arrive at their *respective memories* regardless of our thoughts and

---

<sup>71</sup>Primary memory is termed as a short-term memory, whereas secondary memory is termed as long term memory. Refer to Norman (1982) for more details on primary and secondary memory, from pp. 18-27.

desires” Consider this, I am at my “situated” environment, I am at a busy road no matter how much I try to ignore, the red double decker passing by me, the traffic light blinking yellow, and that I am in London, shopping with many other shoppers walking fast passing by me, the whisk of the shopping bags, all of these signals tells me “where am I now?” arriving respectively to my memory? What do I do next? What are my responses? Of course when we say “What are my responses?”, we do not mean that the person sit still on the road and calculate like a computer to know what response to give. The response, either verbal or non-verbal is in respect to learning and communicating, can become almost habitual, for example, I turn to see the traffic light still yellow, I cannot cross the road to Virgin Megastore to get my album on Madonna, so I wait. Hence, the external event systems must contain signals that tell people what the next course of action she should take. Also, according to Dewey (1929) the events when once they are *named*<sup>72</sup> lead an independent life. Can we assume that the naming may correspond to labeling?

The idea of how the hierarchy of learning and communication, where we focussed on the possibility of the members to be recombined, tested, and how these “performance” may shed clues on how the levels of levels are interchanging during learning and communication may be explained by memory (how communication protocols are learned, induced, merged and adapted).

In the literature Bartlett (1995), Norman (1982) also speaks of items or members

“Every intellectual *chains of reproduction* illustrated how *rationalizing process* were the applied to a particular *item*”  
(Bartlett, 1995) p. 85.

Item in the context of Bartlett work referred to an experiment where Bartlett selected a special story, entitled “The War of the Ghosts”. During his experiments, Bartlett was interested in what actually happens when a popular story travels about from one social group to another where the story presented did not belong to the level of culture and social environment of the subject sitting for the experiments. With this goal in mind, Bartlett thought that possibly the use of this story might throw some light upon the general conditions of *transformations* under such circumstances. We only discuss some of his findings on the transformations. The reproduction of the story by several subjects were being reproduced with an interval of 20 hours.

Interestingly, from (Barlett, 1995), pp.71- 72, we notice that in the story when it is being reproduced by several subjects, certain sentence like “ something black” (Bartlett, 1995), p. 72 concludes the story may be assumed like a “marker” to end the conclusion of the story? May a “marker” of context and contexts can

---

<sup>72</sup>A name is a label for a thing, person, place, product (as in a brand name), and even an idea or concept, normally used to distinguish one from another (N-Wikipedia, 2005).

be extended to the notion of marker being a mark of the “beginning” of the context of contexts and the “ending” of the context of contexts?

“Another possible censoring mechanism involves *marking* the *memory* itself, putting some *tag on T* that indicates that it is not to be retrieved. This view of the procedure has both virtues and difficulties. If you imagine the *marker* as some sort of *activation*, perhaps one that can *spread* to relate to *concepts*, you can soon imagine that the attempt to repress T represses a group of related concepts” (Norman, 1982) p. 35.

Norman (1982), spoke of *marking* of the *memory* itself. Here, we are going up to the memory level. Now, imagine then when Crickey is approaching the marker of the context of contexts Hamlet play, suggests that the marker can be associated to being a “marking” in the memory itself that is being some sort of “activation” to recognizing the context of Hamlet's play?

“..In fact, all incoming material, if it is to be accepted and deal with in any manner, *must be somehow be labeled*

How these labels are developed and in what ways they are taken over ready-made from society are matters of some interest. The rationalism which stops short at finding a label is interesting in two ways. Firstly, the *process* is emphatically not merely a question of relating the newly presented material to old acquirements of knowledge. Primarily, it depends upon the *active bias*, or *special reaction tendencies*, that are *awakened* in the *observer* by the *new material*, and it is these tendencies which then set the *new* into *relation to the old*.” (Bartlett,1995) p. 85.

Bartlett from his experimentations and observations noticed several important results. Mainly, in this sentence “that are *awakened* in the *observer* by the *new material*, and it is these tendencies which then set the *new* into *relation to the old*.” New material is given, then is being perceived. What if we relate this new material as being now I am in this environment and I see a car I have never seen before in Malaysia? How is it from this new material that is awakened in me from my perceiving at this environment, where I am right now sets new relation to the old? This is exactly what we pointed out in Chapter 1, how do people recognize that event as being that event?

Recall the very simple story that we illustrated in Section 4.4, on the markers of the context of contexts. Now, if a marker can be assumed as a marking in the memory itself, may this marker be related to the idea of labeling. Because a label is richer notion to a specify of context as discussed by Bartlett above.

“Rationalisation in regard to form its found its main expression in *linking together* of *events* within the stories, rationalism as



concerned with the details of material was usually carried out by *connecting* the given *items* with something *outside* the *story* and supplied by the observers mind” (Bartlett, 1995) p. 86.

According to Bartlett (1995) experimentation on the process of rationalisation through the reproduction of story hypothesized that the main expression how people form stories (or reproduced stories) is by linking together events within the stories. Particularly, we noted that the rationalism was carried out by connecting items with something *outside the story* (contextualism?). For example, Bartlett (1995), p. 87 hypothesized that there was a process, in all instances witting during its early stages, but later producing unwitting transformations, by which presented material was connected with other matter outside the story, but having some general nature. Does those material presented that is connected outside the story is very much influenced by whole events or environment circling the person that is producing the story?

We continue with the discussion by Bartlett (1995).

“a *particular stimulus*/feature of a *situation* give rise to a tendency to *respond* in *specific manner*....At first the tendency is held in check and produces slight or perhaps no manifest results. As *time elapses*, apparently the *unexpressed tendency* may *gain strength*, and so manifestly affect the respond, or other tendencies simultaneously excited may lose strength, and in this way also a new manifest change of response may appear” (Bartlett, 1995) p. 91.

Very interestingly, the assumption that a particular stimulus of a situation give rise to a tendency to respond in specific manner was abstracted earlier on by Bateson (1972). Readers recall that in learning I, Bateson emphasized on the notion of repeatable context. Following from there, Bateson spelled out his hierarchy of logical types as stimulus that is an elementary signal, internal or external and the context of the stimulus is a meta-message that classifies the elementary signals (see Section 4.3.2). Indeed, Bartlett (1995) had noticed that a particular stimulus (which later on Bateson also spoke of signals) give rise for the person to response in a specific manner. Now, from here, we can speculate that learning I and II is taking place, inductively, because now the person is punctuating the events.

Note, that as time lapse, apparently the unexpressed tendency may gain strength. How is it so? Does it suggests that in jerks, interruptions, even during those time lapse, we are subconsciously “slowly” associating the members/signals/items into parts of classes by inducing or deducing from the hieararchy of learning and communication? Perhaps, during some time lapse, those unexpressed tendency gain better strength because they are more logically associated than the rest? Or can we assume that during these time lapse, some

part of subconsciousness is occurring that slowly clusters these unexpected tendencies?

“Many of the manifest changes, when they appeared, did so in *close relation* to other *transformations* which were actually in the *series of reproduction*.” (Bartlett, 1995), p. 92.

The changes of the reproduction of stories was done in close relation to other transformations before that may be viewed as series of reproduction. Now, how does the transformations occur? How is that from learning I to II is taking place, like a some kind of transformation of “law” or “motion” of changes is occurring? How do people remember to reproduce this series of reproduction? We give an example. Let say using the same restaurant example (Section 4.4.), now we name that person as Crickey. He noticed that his lunch was not on the table, because the jugs, bread, soya sauce and napkins were not there. Now as a response, he goes to the kitchen to ask his cook why his lunch is not yet prepared. Let say that at a restaurant, Crickey waited for 10 minutes at the table but no waiter was approaching him, he then flags a waiter and asked to be served. Even if they are both not in the same environment, but the changes, is in a close relation to the series of reproduction of responses to a similar situation.

“When a *sign* is already regarded by the person who learns it as representative, but contains details detached from the central design and not apparently adding to the representational significance of the whole, such *detail* is to be *omitted*.” (Bartlett, 1995) p.106.

If we can begin to narrow down the signs or signals (e.g., like seeing a sign of coffee break on the chat system or the sign of “.....” followed by ☹, I may disregard the first sign even if it may represent that I don't know what else to say (“...”) and add a sad face, I may omit the “....” and understand that the person sympathizes with me because of the sign ☺) that people generally omit that does not signify as a whole. We can then perhaps understand what those essential signs, by negating the signs that do not add to the representational significance of the whole. Quite clearly pointed out during Bartlett's experiments,

“grouping is generally effected on the basis of some obvious and easily perceived likeness of form” (Bartlett, 1995) p. 110

The grouping is perceived as being similar of some form. Hence, recall Dewey, that perhaps these can be extended to the grouping of parts, when the parts or members are being combined, even on the same level of learning I<sup>73</sup> (for example), this grouping may be assumed as giving rise to the habit at level

---

<sup>73</sup>Does this suggest that the easiness or familiarity of “perceiving” that Bartlett (1995) termed as “likeness of form” suggests that the classes that are not similar yet sharing same members are on the same level of learning?

learning II of apperceiving the complex streams of events including his own behavior.

Now, we move on from transformation, reproduction of similar situations to propositional information by Norman (1982).

*“Images and propositional information must coexist. It must be possible to refer to images through words, through inferences. It must be possible to construct new images from parts of old images, to make inferences, to have images organized in such a way that appropriate ones can be found when they are needed”* (Norman, 1982) p. 64.

Readers recall that in Chapter 3, we introduced our concept of “perceiving”, actively perceiving a bowl, or even perceiving the text he is reading on the chat messaging. Now, the “image” of perceiving the bowl must exist with a referential process. In Norman (1982) words, they must coexist, and must made possible to refer it through words, through *inferences*. The inferences made must be possible from parts of old images, remembering some *parts* of the *old images*. It is like remembering some part of the previous messages/word when communicating. However, instead of using the notion of inferences, we use it as being referential process. Note that Norman (1982), suggested that in order to make a conclusion with the new image and propositional that coexist, we make it possible through inference, by old parts, into being organized that may make up of recognizing new images when needed. We hypothesized from Norman's quotation that in order to draw the conclusion from images or proposition, remembering occurs as a premise THEN conclusion. However, the premise may be a conclusion itself, and conclusion may be a premise. That remembering is not a simple inference process, hence for the reason that we term our notion to the perceiving of anything is coupled to a referential process that is an act of referring to something. The reference can be made to anything that connects from different parts constituting as a whole.

*“Story is treated as a whole, the tendency to make all details fit together”* (Bartlett, 1995) p. 128.

If story is treated as a whole, then perceiving of the text has the tendency to make it all fits together may be explained by activity theory Leont'ev (1978)<sup>74</sup>.

*“Remembering is not the re-excitation of innumerable fixed, lifeless and fragmentary traces. It is an imaginative reconstruction, or construction, built out of the relation of our attitude towards a whole active mass of organized past reactions or experience and to a little outstanding detail which commonly appears in image or in language form”* (Bartlett, 1995) p .213.

---

<sup>74</sup>This is discussed in Section 4.9.

Remembering involves an imaginative reconstruction, that is built out of relation towards a whole active mass, and to little outstanding detail. Where are we headed with this? Let us recall back. First, we were concerned with markers, labels, stimulus, punctuation of events. The learning and communication is now extended to understanding learning and memory. How the labels are recognized, or how context are being marked and how people learn to punctuate events. Hence, all these phenomena involves some kind of a whole active mass of relating past experience to present situation and to outstanding details (i.e., signals, or labels). This involves also, built out of the relation of our attitude towards the whole that further brings us to another point below.

“What sets out the characteristics is mainly interest, settings...” (Bartlett, 1995) p.214.

Now, following in this line of understanding, the characteristics of remembering cannot be omitted without taking into account of the interest (i.e, motivations, intentions) and settings (i.e., where am I? In the lab? At the supermarket? At home?). This bring forth to situated cognition (Clancey, 1997a) and activity theory (Leont'ev, 1977 & 1978). However, let us reveal more arguments why situated cognition and activity theory is essential in understanding cognition theories for our purpose of work.

Let us continue a bit more by Edelman (1992),

“it can result in a *categorization response similar to a previous one*, but at *different times* the *elements* contributing to that *response* are *different*, and in general they have likely to have been altered by *ongoing behavior*” (Edelman, 1992) p. 102

Edelman, is a neuroscientist who won a Nobel Prize for physiology or medicine in 1972. He hypothesized that memory is the result in categorization response similar to a previous one, but at a different times. The elements contributing to that response are different, likely to be altered by ongoing behavior. This is correlated with the idea of Bartlett (1995), that remembering is activing doing something all the time, whereby we are actively conceptualizing our role that includes part of our response/behavior in a society working at a cyclic approach. The environment and our adaptation of thoughts and actions are ongoing behavior when engaged in activities. We highlighted the words such as elements contributing to that response are different, likely to be altered by ongoing behavior. What elements? Members? Items? These elements contribute as whole, and altered by the ongoing behavior. However, what is the parts of the ongoing behavior? Motor activity? Coupling mechanisms?

“Memory is procedural and involves continual motor activity and repeated rehearsal in different context” (Edelman, 1992) p. 102.

According to Edelman, memory is *procedural*. Does this mean that certain activation in the categorization leads to another categorization? It is again stressed that it involves continual motor activity and repeated rehearsal in different context. Hence, we notice again that the memory, (in accordance to the response) is a repeated rehearsal in different context (as discussed by Bateson in learning I).

“Thus because of the new associations arising in these contexts, because of changing inputs and stimuli, and because of different combinations of neuronal groups can give rise to a similar output, a given categorical response in memory may be achieved in several ways” (Edelman, 1992) p. 102.

The stimuli or parts of details of the whole may give rise to new associations in the contexts, and is recombined into different neuronal group may give rise to similar output, that a categorical response in memory may be achieved in many ways. We relate back to Bateson (1972), Dewey (1929) and Bartlett (1995). All of them spoke of different contexts, stimuli and combinations. Can we hypothesize now that we are closer to explaining how the analysis of transformation process can be explained at the neural level? Let us continue with several important findings of Edelman (1992).

“Recognition must be *relational*, it must be able to *connect one perceptual categorization* to another, apparently unrelated one, even in the absence of the stimuli that triggered those categorizations. TNGS suggests that in *forming concepts*, the brain *constructs maps* of its *own activities*, not just external stimuli, as in perception. The brain areas responsible for concept formation contains structures that *categorize, discriminate, recombine* the various *brain activities* occurring in different kind of global mappings.” (Edelman, 1992) p. 109.

Those recombination of members or items into classes may form into concepts in the brain allowing one to respond in differentiating contexts at a rehearsal or repeatable time? If we have the members or items being inductively constructed into classes, Bateson had clearly noted that there could be an internal or external stimuli. According to the TNGS<sup>75</sup> of Edelman (1992), after forming these concepts, it contains structures that categorize, discriminate, and recombine the various brain activities. In fact, we relate this idea that the brain area responsible for the concept formation has structures to categorize the classes and members, discriminate which classes or members to be recategorized as concepts and the recombination of classes and its members that may explain better the induction nature of the hierarchy of learning and communication (Bateson, 1972).

---

<sup>75</sup>TNGS stands for the theory of neuronal group selection.

“Structures able to perform these activities, are likely to be found in the frontal, temporal, and parietal cortices of the brain. They *must represent a mapping of types of maps*. They must be able to activate or reconstruct portions of past activities, of global mappings of different types- for example, those involving different sensory modalities, they must be able to recombine or compare them.” (Edelman, 1992) p. 109

The mapping involves some kind of recombination and comparing that is like constituting as a whole. This mapping types of map is referring to the neuronal group. Now that we have considered from the abstract notion of Bateson (1972) and as we have suggested that to understand the work of Bateson is to treat it like a lego game. We detach the abstract notion that may for some is viewed as a simplistic view of communication and attempted to go into details to re-attached the abstract notion going into remembering and now into neural level.

“The best pilots, for example, claim they become a “part” of the aircraft, anticipating, 'flying ahead of the plane'. Poorer pilots keep their heads in the cockpit”.(Norman, 1982) p. 72.

This good observation by Norman (1982), point to the idea of *contextualism* (that we will soon speak of) and the notion of an active conceptualization taking place during doing activities, like of that example above, flying a plane. Note, that even if the contrast between the best pilot and the poorer pilot was claimed that first became a part of the aircraft (actively conceptualizing his role, and his activity with the “mediated tool) does not mean that the later is not conceptualizing. Even if Norman (1982) speculated that poorer pilots keep their heads in the cockpit, the cockpit itself is an environment, a situated environment where he is continuously engaged in an activity.

“In order to understand how and what we remember, we must set into relation to this how and what we perceive.” (Bartlett, 1995) p. 25.

The above is very well said, and readers will be exposed to the work of Clancey (1997a) that relates perception to remembering. We attempted this by relating the act of “perceiving” in our modeling of the object and subject (referential process) respectively.

“Here, once more, we see how, although a given perceptual complex may be treated as a unit, or a unitary pattern, nevertheless certain of its features regularly play a more predominant part in settling what it seen and what is remembered than others”. (Bartlett, 1995) p. 25.

Certain features of images that captures our mind even if they are being treated as a unit, nonetheless, there are certain features that play a more predominant part than others can we explain this by relating it to Clancey (1997a) notion on the moment of focus? That perhaps during this moment of focus, certain features like a glass, a pot of flower, even if we are looking at it as a whole, as a unity, there are certain features that we may subconsciously remember and relate them more than others. Perhaps, the yellow bowl that has v patterns surrounding become our moment of focus, and we are more dominantly fixated on the v patterns surrounding this whole bowl.

“...the importance of prior experience in determining how and what we perceive now became more salient than ever. (Bartlett, 1995) p.31.

Now, it doesn't just end here with the perceiving and the referential process, the prior experience in determining how and what we perceive becomes more salient (the neuronal group maybe now becomes more clustered, much stronger in synapses?).

“In most instances of constructive recall it appears that some detail must have been fairly discriminated and given a central position.” (Bartlett, 1995) p. 55

This has been repeated for quite some time, details that give rise to some discrimination process at the neural level and has now taken into position that maybe itself becomes a categorization of concepts? (a class on learning I has now been developed inductively).

“The rationalism which gives to material as a whole its appropriate frame is only a part of the total process. Details also must be dealt with, and *every chain of reproduction* illustrated how the rationalising process was *applied to particular items*”(Bartlett, 1995) p. 85.

We encouraged readers to visualise on understanding the work of Bateson (1972), that in looking at a whole, the details of the whole must be taken out and put in again, and it is exactly what Bartlett hypothesized that the rationalism must not only deal with the whole of its frame, but also details and every chain of reproduction, of how those whole are applied to particular items. These chains of reproduction is like understanding every in-between processes of how the induction process of Bateson's framework on the hierarchy of learning and communication.

#### **4.8 Summary on Learning and Communication to Learning and Memory**

We have elaborated and attempted to relate ideas from Dewey (1925), to Norman (1982) and to Bartlett (1995) as well as to Edelman (1992) on how we can carry further on to elaborate the framework of the hierarchy of learning and communication by Bateson (1972). We are now focused on memory and we have attempted to argue with the above why we consider situated cognition by Clancey (1997a) as a proposal in our analysis as the ground basis for explaining some of our concerns. Before we proceed further on situated cognition, we sketch below based on our previous discussions (from Section 4.6 to 4.7) as a proposal to understand further the theoretical foundations in relationship to neuronal maps (TNGS) (Edelman, 1992). Then, from these small sketches, we emphasize the logical relation why situated cognition, is a well-theoretized cognition theory that takes into account of the discussions and the purpose for the understanding of the nature of web collaboration. All of the italic words, little ideas points to situated cognition that can be explained on an activity theory framework. Let us first show the sketches.



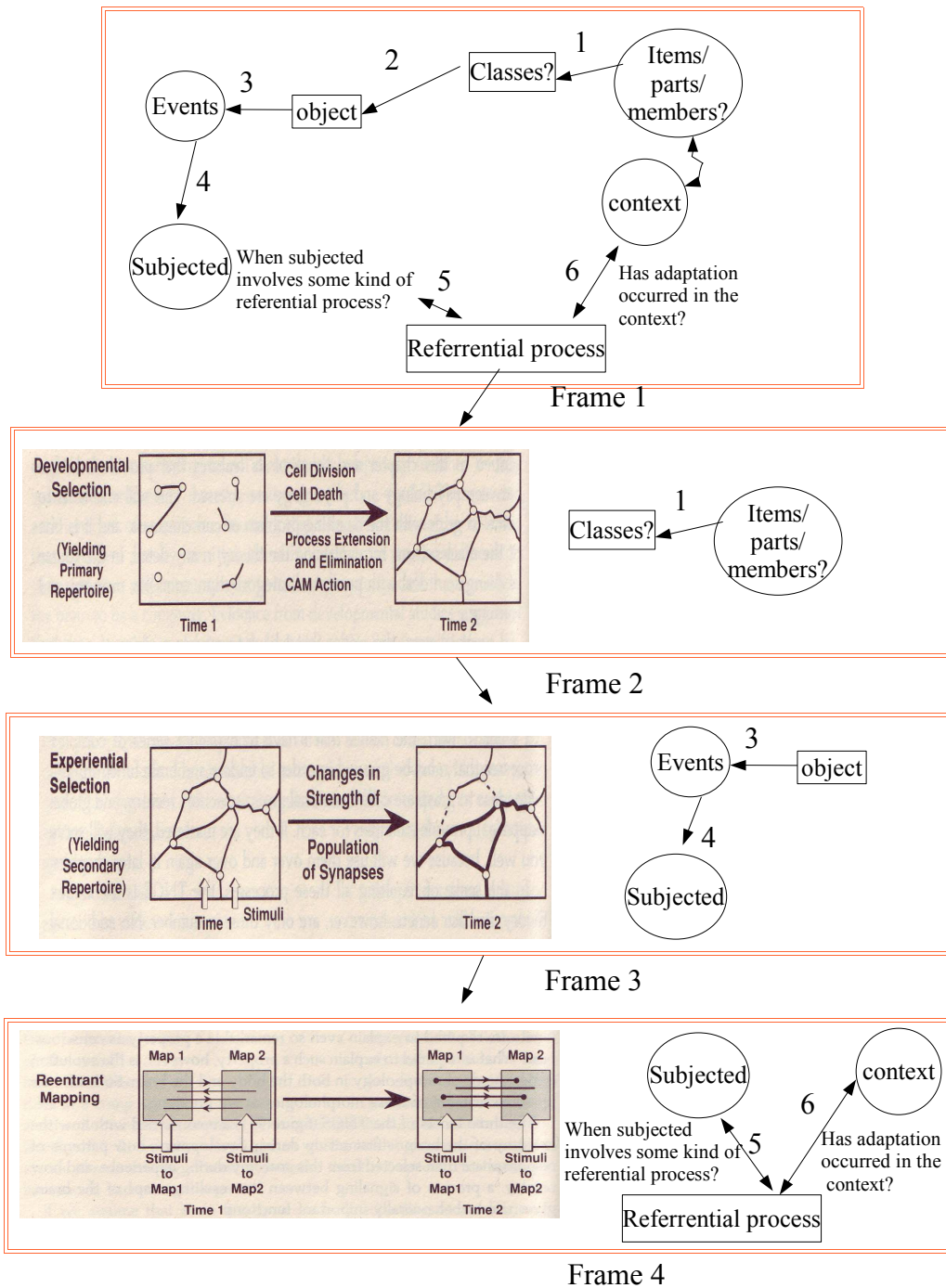


Figure 4.8 (a): Relating ideas to one another.

We will explain Figure 4.8 (a) carefully. In the first frame, we have what Bateson (1972), Dewey (1925) Bartlett (1995), Norman (1982) refer to different ideas of members, items, parts. The first frame is adapted from Section 4.5, Figure 4.5 where readers may refer to the detailed explanation. To briefly re-account the story of Frame 1, label “1”, according to some members/items/parts has its attributes that molds “classes”. Further on from here, we follow label “2”, where it becomes object and is labeled as events. Once events are “molded”, it is named and leads a double life, it is recognized yet it is independent (Refer again

to the beginning of Section 4.6). But what does Dewey mean by events being independent? Perhaps events are independent because they may be freely associated to re-production forming chains of events. Now, we relate this to learning and memory especially beginning from Bartlett (1995), to Norman (1982) and finally to a neural theory from Edelman (1992).

Before we proceed to relate Frame 1 to the other. Frame 2,3 and 4 are adapted from Figure 9-1, Edelman (1992), p. 86. We shall explain Frame 2,3 and 4, the three tenets of TNGS from Edelman (1992), p. 83. The tenets are concerned with how the anatomy of the brain is first set up during development, how patterns of responses are selected from this anatomy during experience, and how reentry, a process of signaling between the resulting maps of the brain, gives rise to behaviorally important functions. The Frame 2 is called the development selection. This occurs as a result of molecular effects of CAM and SAM<sup>76</sup>, the stochastic fluctuation of cell movement, cell process extension, and cell death during development, and the activity-dependent matching of connections that is superimposed on neural branches (or neurites) as they explore a developing brain region. This entire process according to Edelman is a selectional one, involving populations of neurons engaged in topobiological competition. A population of various groups of neurons in a given brain region, comprising of neural networks arising by processes of somatic selection, is known as a primary repertoire. The genetic code does not provide a specific wiring diagram for this repertoire. Rather, it imposes a set of constraints on the selectional process. Even with such constraint, Edelman proposed that genetically identical individuals are unlikely to have identical wiring, for selection epigenetic<sup>77</sup>.

Now, from Frame 1 to Frame 2 relating it to the first tenet of TNGS, little can be said, only our primitive assumptions. Firstly, the beginning stage of where people start to group or develop items/members into classes may be explained by how the entire process is related to cell process extension, and cell death during development, and the activity-dependent matching of connections that is superimposed on neural branches as they explore a developing brain region. This activity may then be assumed to be related to the ongoing behavior of the person in her environment. Edelman suggested that entire process according is a selectional one, involving populations of neurons engaged in topobiological competition. However, how one is selected on what basis, can we assume to be tied back to what one is actively perceiving and conceiving in their situated context?

Now, relating this further, can we assume that these members become classes developing a brain region, how they are populated perhaps slowly forming into classes? The next tenet is the Frame 3. In Frame 3, the TNGS provides another

---

<sup>76</sup>CAM stands for cell adhesion molecules that link cells together directly, SAM stands for substrate adhesion molecules that link cells indirectly but provide matrix or a basis on which they can move/stand for. (Edelman, 1992), p. 60. Refer to Edelman (1992) for more in-depth explanation.

<sup>77</sup>Something that affects a cell, organ or individual without directly affecting its DNA. An epigenetic change may indirectly influence the expression of the genome (Medterm, 2005).

mechanism of selection that, in general, does not involve an alteration of anatomical pattern. It assumes that, during behavior, synaptic connections in the anatomy are *strengthened* or *weakened* by specific *biochemical processes*. This mechanism, which according to Edelman, *underlies memory* and a number of other functions, effectively “carves out” a variety of functioning circuits (with the strengthened synapses) from the anatomical network by selection. Such a set of variant functional circuit is called a secondary repertoire. Before we go further, we recall that in previous section from Bartlett (1995), p. 91, “as time elapses, apparently the unexpressed tendency may gain strength...and so manifestly affect the respond or other tendencies simultaneous excited may lose strength”. It is very interesting, that both strengthening and weakening are at different play, being organized as if competing, yet complementing with one another. May this also explain how the classes on the different level of the hierarchy of learning and communication by Bateson (1972) are being recombined, between classes/members to form new classes that an organism may know how to respond to?

Edelman also suggested that to some extent, the mechanisms leading to the formation of primary and secondary repertoires are intermixed. This is so because at certain times and places the formation of the primary repertoire depends on changing synaptic strengths, as in the activity-dependent matching of connections. Even in developed brain, “sprouting” can occur, in which new neural processes form additional synapses. In some cases, such as the development of bird song and frog metamorphosis, the formation of new parts of the nervous system involving simultaneous primary and secondary repertoire formation occurs during behavior in the world.

Now, relating this perhaps how the classes are being organized by the cell birth and cell death, we notice that it yields into connected synapses going into Frame 3, when we have stimuli to the TNGS, we noted the changes in strength of the population of synapses. Specifically, referring to Bartlett (1995).

“We have seen that in perceiving the data presented have to be *actively connected* with *something else* before they can be assimilated. In *remembering* the task is made *more specific*. That with which the *immediate stimuli* of the reactions have to be *connected* is more *narrowly defined*, and must now be some specific thing or event which was presented before at some specific time” Bartlett, 1995) p. 46.

Now referring to Frame 3 again, we notice that at Time 2, the population of synapses are strengthened indicated by the bold paths, and the weakening by dashed paths. Why and how are they being weakened and strengthened? Can strengthened path be related to something that is being actively reconceptualized, or something that from learning from I becomes almost habitual to learning 0? And does the dash path represent slight connections that may lead to possibility

that even if it is weakening, but certain details may become the focus of the detail after some time lapse?

Finally, we relate to Frame 4, from here, it is concerned with how the selectional events described in the first two tenets act to connect psychology to physiology. It suggests how *brain maps interact* by a process called *reentry*. To Edelman, this is perhaps the most important of all the proposal of his theory, for it underlines how the brain areas that emerge in evolution *coordinate* with each other to yield *new functions*. In this re-entry, the linking map occurs in time through parallel selection and the correlation of the maps' neuronal groups, which *independently* and *disjunctively receive inputs*. This process provides as basis for perceptual categorization<sup>78</sup>. Dots at ends of the active reciprocal connections indicate parallel and more or less simultaneous strengthening of the synapses in reentrant paths. Strengthening or weakening can occur in both intrinsic and extrinsic reentrant connections. We show the final excerpted diagram from Edelman to conclude this section.

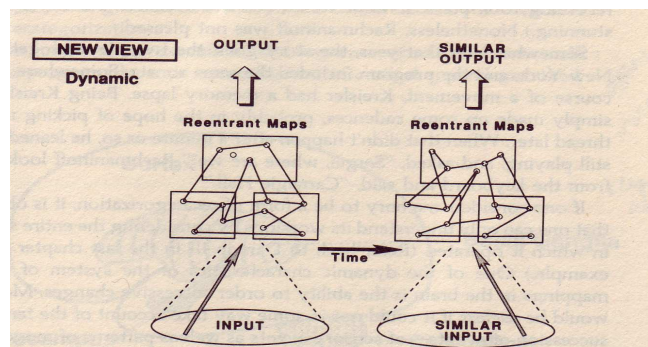


Figure 4.8 (b): Excerpted from Edelman (1992), p. 103 on two views of memory.

In Figure 4.8(b), TNGS suggest that memory is a specific enhancement of a previously established ability to *categorize*. This kind of memory emerges as population property from continual dynamic changes in the synaptic populations within global mappings- changes that allow a categorization to occur in the first place. Alteration in the synaptic strengths of groups in global mapping provide the biochemical basis of memory.

As hypthosized by Edelman (1992), in such system as the TNGS, memory is then not a stereotypic recall mechanim. It is instead under the influence of continually changing contexts; it changes, as the structure and dynamics of the neural populations involved in the original categorization also changes. In Figure 4.7 (a), many similarly *categorized objects* can give the same output, and mistakes can be made. This memory is a property of the entire system, although its fundamental mechanism is change in synaptic strength, as indicated by changes in the lines between the neuronal groups (small circles) inside the maps (Edelman, 1992). Can we relate the idea of categorized objects to our own

<sup>78</sup>Readers are encouraged to read the critical review by Clancey (1997a) on TNGS from pp. 147-161 that gives in depth details.

assumptions of members that become object according to Dewey's term (see Section 4.4).

The memory is always under the influence of continually changing contexts, going from shops, to classes, to walking to tram station, to taking a nap and hiking in the mountains. When these context changes, the structures and dynamics of the neural population involved in the original categorization also changes (maybe this is how the hierarchy of learning and communication is changing between level of levels?) When we observe carefully the change in synaptic strength that is indicated in the lines between the neuronal groups inside the maps maybe corresponds to how some actions or responses are habitual and some are changes of learning I, and so on as suggested by Bateson (1972). If we could only measure these distance of the change of synaptic strength between the neuronal group could shed more insightful information to how people punctuate events and from there how “habitual” responses are formed that can help us read the hierarchy of learning and communication inductively and deductively.

To conclude this section, we tell a story, instead of drawing more diagrams to illustrate all that has been discussed above by encouraging readers to imagine and visualize the everyday experience to those discussions above.

“It is a nice sunny day today at Bakers Street, London, United Kingdom. I look out of my window. Feeling a bit restless at home, everyone has gone out shopping. Maybe I should take a break and go out too? Wait, do I have the keys to go out? Oh, I can't remember where Harris put the extra key, oh I know! I can call him up and ask him where the keys are. (I am in my room, dressing up while talking silently to myself<sup>79</sup>). Hmm, yes, need my address book, never seem to remember phone numbers (Open up my handbag, take out the brown purse and continues to fumbles to take my address book). Ok, ..... N...yes, “reads Nik Harris, phone number is 07990834507” (Carries the phone book over to the living room, to the small table with the phone book page open at Nik Harris's phone number). Picks up the phone. Err, these buttons, press number first, or then press talk first? Let me try ( I don't call people so often, sheehs, technology interfaces really catching up!). Dialing number, automatically got ringing tone (In my head, “Oh, that was easy!”). Speaks to Harris, Harris says he is coming back about 5 pm, I can go out as he will be home by the time I finish roaming around Oxford's street. Puts down the phone. Dresses up, look around (In my head, “Am I forgetting something..nah..it seems ok”). Goes down the stairs and open the main door of the apartment building and off to Oxford Streets”

Part two of story.

---

<sup>79</sup>This “speaking silently to oneself” is a notion we borrowed from Clancey (1997a).

“Now at Oxfords Street. Silently speaking to myself, so many people!! Mmm..where am I? (orienting myself, can't remember now the road or the shopping complex). What should I do? Don't have a plan actually. So noisy..this bugs me. Stop at a junction, Wow..nice Jaguar. Must be a super rich lady. Continue to follow looking at the Jaguar turning to the left, admiring the sleek design, and loving the silver color of the Jaguar. Jaguar out of sight, mmm..cross the small junction, walking down the street, noticed nice furry boots. Speaking silently in my head, nice boots. Hmm..then goes up to see her dress, pretty blonde lady. Eh...(turns around) mmm..notice a shopping bag “Sale ZARA” (Noticed by the “whisk” or the “soft brisk” of the shopping bag against her skirt?) And by the way the shopping bag is a soft plastic. Wait, there..maybe I should go to ZARA, seems a pretty good idea, I do need a simple nice blouse.”

The first part and the second part of the story might get readers wondering, what on earth are these stories related to the Figure 4.7 (b) in explaining learning and memory (in respect to communication)? Simply put, we wanted readers to visualize everyday scenario to how we are conceptualizing role as who we are, what am I doing now, what am I thinking, categorizing them as objects, being actively doing something all the time (Bartlett, 1995) in different modes or states, to feel the changes as we are orienting in a new place, as we walk, as we wonder around, as little signals like the whisk of her rustling skirts, or the smell of her newly washed cloth “ignite” old memories or even create new events. These implicit signals and senses are perhaps what Bateson (1972) is looking for finding out what exactly are they that tells us what to do the next in our responses?

We want readers to imagine when on some days, the weather outside influences how we are feeling, the restlessness (environment influencing my internal motivation like, I don't seem to have no motivation to do anything productive today because of the nice sunny day!), noticing small details yet at the same time as a whole, speaking silently to oneself, walking around as “habitual”, but yet at a certain moment, I am uncertain and need to stop and actively reconceptualize what I do next, being influenced by external signals that may be stimulus to our active reconceptualization. The story attempts to illustrate the active conceptualization (by relating it at the neural level) of a person situated in her environment, moment by moment. But what do we mean by active conceptualization and most importantly the notion of situatedness? This is explained in the next section.

#### 4.9 Situated Cognition: for understanding the whole picture

In the previous sections, we have reviewed the communication theory of Bateson. Then, we have compared and discussed the work of (Dewey, 1925). Later, we then relate this to the theory on learning and memory by Bartlett (1995) and Norman (1982) with an extension at the neural level referring to Edelman (1992). In the end, we have been looking into three different perspectives on communication; Bateson an anthropologist, social scientist, and a geneticist, Dewey a philosopher and a psychologist, F.C Bartlett a psychologist, Donald A. Norman, a cognitive scientist and a psychologist and Edelman, a neuroscientist. It is an eclectic mix of studying communications.

As stressed before (Chapter 3), we only consider the aspects of *learning and communication coupled to memory*. We have summarized that the learning and memory may be related to situated cognition (Clancey, 1997a) because certain details mentioned in all the literatures (Bartlett, 1995; Dewey, 1929; Norman, 1982; Edelman, 1992) is explained and taken into account in situated cognition. Hence, we discuss why situated cognition is a natural choice for us for explaining how the basis of the CONSTEPS have taken place. Recall that in Chapter 2 and 3, within CONSTEPS, we have attempted to integrate situated cognition (Clancey, 1997a), hierarchy of learning and communication (Bateson, 1972) to activity theory (Leont'ev, 1977 & 1978). We also apply the it as being fundamental for analyzing the communication protocols. Thus, in this section and herein, we go into the theory of situated cognition by Clancey (1997a).

William J. Clancey (1997a) is a computer scientist focusing on cognitive science. The author focuses in his book on situated cognition on the nature of *perception* and *memory* in respect to what defines situated cognition. Herein, the sections are organized as the following: (i) an introduction to situated cognition; (ii) contextualism (on remembering); and (iii) transactional experience (applied to reading text).

*Situated cognition* defines that *every human thought and action* is freshly adapted to the *environment as perceived and conceived by the action in the moment*. When we say that every human thought and action is adapted, then our question is: what are the details. For example as we reviewed in Section 4.6, what we refer to as details may be: the signals, the experience, the particular dominant detail of reading a text of perceiving a sign (the capturing of the moment, the environment, the categorization of this simplistic view of members and classes into TNGS?) that play a role in the formation to explain how thought and actions are situated. Going further into our own question, does thought come just before action? Now, if we assume in a typical view that thoughts and action can be modeled as a  $S \rightarrow R$  (a simple IF then representation) then how do we explain when considering someone who is engaged in an activity (such as reading and typing almost in parallel, like what the writer is doing right now). Or are thought

and action most likely an aggregation of levels, mutually working with one another?

In an indirect answer to our own questions, Clancey (1997a), states that the term “situated” means that people are not just located in an environment as a social-physical setting. The *context/environment* for the people is *categorical* through *perception* and *conception*<sup>80</sup>. That is the context/environment for a person is a *mental construction*. Then we must consider what are the mechanisms enabling people to construct “actively” the context they are situated in. Situated cognition proposes this by considering the *internal mechanism* that coordinates sensory and motor systems and how a similar *coupling mechanism* is the foundation of *conceptualization* (the term *conceptualization* is discussed later).

Thus situated cognition is an approach that combines many disciplines and objectives that relate (i) *social*; (ii) *behavioral/psychological*; (iii) *neural perspectives* of knowledge and action. It is a both-and framework; to show how different views can be reformulated in terms of different causal influences. Going back to our concern with the notion of “situated” and “context”, we deal with the idea of “situatedness”, followed by context (i.e. “contextualism”). We highlight first the three kinds of “situatedness” that requires deep understanding (Clancey, 1997a) p.25.

- How perceiving and moving are related (structural view)
- How this physical coordination process is related to conceptualizing activities, whose content is inherently social (functional view).
- How *subconscious processes* of perceiving and *conceiving* relate to the inherently *conscious process* of representing in speech, text, drawing and so on (the behavioral view)

Our interest is looking into the third point. What is exactly the act of *conceiving* in respect to perceiving? For us, it concerns what one is doing during the inherently conscious process of reading and typing text. Perceiving is a structural view (refer to the points above). However, we do not enter in depth into an analysis of perception because it is beyond our scope<sup>81</sup>. In Section 4.6, at the ending, we quote from Bartlett (1995) on understanding the chains of the reproduction, hence what we term as understanding the in-between processes, like reading and comprehending. They are not to be mistaken as being two activities,

---

<sup>80</sup>There was a similar discussion by Al-Kindi, in about 874 A.D reviewed by (Lindberg, 1996). In Al-Kindi work on the theory of knowledge that the sensory perception is achieved through the contact of the senses with sensible particular objects. And since the sensible objects are in continuous motion and in a constant changing, therefore knowledge based on sensation is unstable and localized to the perceiver. Al-Kindi did not provide in detail what he meant by “contact of senses” but he was conscious that the knowledge which we are “constructing” is unstable (meaning has motion) and localized (“situated”) to the perceiver.

<sup>81</sup>There are several reasons why we are not going into perception. Most importantly, our own theoretical work (i.e. activity states) is still primitive, we have to keep things simple. Thus, at this moment, we focus on how one person comprehends what she is reading and how she is formulates her representations. Therefore, in a way, the perception mechanism is being taken by granted by us.



because we refer to the idea of chains of reproduction that are related and associated to one another.

Simply put, what we refer to as in-between processes falls into two perspectives, mainly there are:

- how we can explain the induction and deduction process from the framework of Bateson (1972) in the hierarchy of learning and communication to the cognition process by Bateson (1979) to Clancey (1997a) and Edelman (1995).
- The in-between of this, response and action, we assume can be related to what happens when we are reading, and comprehending, what are the chains of reproduction of these?

So how does one conceive<sup>82</sup>? We refer to the notion of “conceptualization” that highlights some aspects of conceiving. To briefly elaborate on the notion of conceptualization, we excerpt an example from (Clancey, 1997a).

“ Harold Cohen's knowledge as an artist is pervaded by how he conceives his participation as an artist in our society. This conception constitutes a choreography by which he produces drawing....That is, his knowledge is functionally developed and oriented..From the perspective of participation, an activity is not merely a movement or action, but a complex choreography of role, involving a sense of place, and social identity, which conceptually regulates behavior.

Thus, Cohen's conception of what he is doing, and hence the context of his actions- is always social- even when he is alone- because he conceives of himself as a person, as somebody (and indeed, some *body*). Professional expertise is therefore contextualized in the sense that it reflects knowledge about community's activities of inventing, valuing, and interpreting theories, designs, and policies. This conceptualization of context has been likened to the water in which a fish swims; it is tacit, pervasive and necessary” (Clancey, 1997a), pp. 23-24.

The conceptualization of Cohen as an artist is contextualized in his environment, that is constituting as whole, and as conceiving as who he is playing his role as an artist or as what he would like to project to the society as who he is. On the other hand, if we are to consider the notion of conceptualization at a neuropsychology level, involves a composition of categorizations- the process by which perceptual categorization occurs at a higher level in coordinating perceptual categorization, both in simultaneous multimodal relations and

---

<sup>82</sup>Conceive (or conceiving) is defined as to apprehend mentally to understand or comprehend as an idea or category that relates objects, actions, properties, events, and etc in time.

sequentially, over time (by Clancey, 1997a) p. 151. Now, in order to understand this at a neural level, we go to what representation is according to Clancey (1997) below.

“..Representing occurs in the brain (e.g, imagining a scene or speaking silently to ourselves), but “*having a representation*” from an *agent's perspective involves intentionality: conceiving a categorization as being a thought, conceiving a categorization as being about something (referential), and conceiving the thinking process itself as being part of the activity.*” (Clancey, 1997a) p.343.

The act of conceiving a representation can be viewed into 3 associated levels: (i) conceiving a categorization as being a thought; (ii) which is referential to something (iii) conceiving the thinking process itself as being part of the activity. For us, this representation (i) to (iii) is like that of occurring as some kind of making an induction relationship or a chains of reproduction that is occurring on an associated multiple levels. Firstly, the level of categorizing as being a thought that becomes a chain or reproduction of referential to something and that the level (i) and (ii) of conceiving the thinking process itself as being part of the activity. In some ways, it is an act of “conceptualizing” of our own role and activities situated in a context.

“Conceptualization is a dynamic process of reconstructing “global maps” relating perceptions (Edelman, 1992). Conceptualization is inherently multimodal (even when verbal organizers are dominating), adaptive (Ygotsky: “Every thought is a generalization”), and constitutes an interactive perceptual-motor feedback system. Conceptualizing is itself a behavior in animals capable of imagery and inner speech (“Hearing” a tune in one's head is also an example of conceptualizing).” (Clancey, 1997b), p.280.

Conceptualization is a higher level of the notion *context*. As an example, what am I conceptualization in my situated context. Logically, when I ask this, my mind begin by asking what am I conceptualization that for us seems like a higher level or perhaps an abstraction view of context. It is “looking into the overall” function of what one is doing. It is therefore being described as being a necessary function. We do not have a specific definition to date on what is exactly conceptualization. For now, we refer to the definition of (Edelman, 1992) that conceptualization can be hypothesized as involving a composition of *categorization*- the process by which perceptual categorization occurs. Conceptualization is required to coordinate categorization dynamically with ongoing sensori-motor behavior (see chapter 7 of (Clancey, 1997a)).

Because thoughts and action are adapted to a context/environment, the conceptualization process requires the notion of learning, as learning in a general sense is described by changes (we have mentioned this in Section 4.3). And context changes all the time. This is clearly pointed out in the situated cognition approach. It asserts that *learning is occurring with every human behavior*. The *memory- actions* are always at some level improvised, and the improvisation is situated with respect to perceptual coupling of sensation and motor actions (inherently interactional) (Clancey, 1997a) p. 344 and this is achieved through physical coordination. Situated cognition is also with respect to conceptual coupling of timing, sense of place, role, and choreographies of participation which are inherently social (Clancey, 1997a) p. 344. *Human knowledge* is located in *physical interaction* and *social participation*.

Going back to our main objective of the thesis: the CONSTEPS is for explaining at the same time relating it to *how* we have converted the conversations records into marked up agent messages to cognition theories. First of all, it is like putting ourselves in the situated cognition theoretical framework: to understand how the learning, in respect to analyzing conversations is coupled to memory.

As a closing remark for this section, we adapt from Clancey (1997, p.344). Situated emphasizes that the perceptual-motor feedback mechanism casually relates animal cognition to the environment and action in a way that a mechanism based on logical (descriptive) inference alone does not capture. Embodiment is more than receiving signals from the environment or modifying the environment. Being situated involves a casual, *in-the moment coupling* within *internal organizing* (forming new coordinations) and between *internal* and *external organizing* (changing stuff in the world). Hence, new ways of seeing and ways of making changes to the world develop together.

From here we move on to the idea of contextualism.

#### **4.9.1 Getting the “remembering” right: Contextualism?**

The basic concept of contextualism was originally by Jenkins (1974). Jenkins outlined the origin of the contextualism that is a shifting perspective from stored units to experienced events. We excerpt a quotation of Jenkins from Clancey (1997a).

“The term contextualism is not highly familiar to American psychologist, but it is an American philosophical position that has been intimately intertwined with American psychology for three quarters of century. Another name for it is pragmatism, and has its roots in William James, C.S Peirce and John Dewey.....

Contextualism holds that experience consist of events. Events have a quality as a whole. By quality is meant that the total meaning of the event. The quality of the event is the resultant of the interaction of the experiencer and the world, that is, the interaction of the organism and the physical relation that provide support for the experiences. The relations can be thought of and analyzed into structures. A texture of strands lying in context.” quoted from (Clancey, 1997a) p. 63<sup>83</sup>.

We review the work by Robert Hoffman a psychologist and a social scientist that continues and extended this notion of contextualism. Most importantly, we focus on two articles by Hoffmann (1983) where he explained in great detail of the whole account of how contextualism research started. Historically, the word “context” appears in the literature of psychology with many meanings.(Hoffman et al, 1983). In experiments on memory, it was possible to refer to sentence as the “contexts” for recall of target words. The entire sentence might be regarded as “the” stimulus. For example, a sentence such as “The sea is wide” is regarded as the stimulus.

However, to the contextualist, even if they agree with the general use of such word as “context”, they disagree with the strategy of granting this special acknowledgment to isolated “stimulus” variables. Hoffman et al (1983) then propose that this idea of special acknowledgment to isolated “stimulus” variables which only one or few variables are manipulated may be unreliable to fully memory. A metaphoric view of the sentence was conducted in an “ecological psychology”<sup>84</sup> approach. In a methaphoric view (Hoffman, 1983) p. 512, metaphors in linguistic, philosophy, and psychology reveals that even definitions of metaphor are themsevles based on metaphorical notions of what meaning is. In theories of metaphor, metaphors are described as “feature filters”, as “way of seeing the world”, as “mirrors of the world”, as “ornaments of language”, as “analogy mappings”, as “transformation of meaning features”, as “masks of the truth” and “puzzles to figure out”. To give an example, we excerpt from (Hoffman, 1983) on using a metaphoric view of sentence, “ The land is an ocean” spoken by someone who is riding in a car past wheat field. This way of analyzing memory from metaphoric view the comprehension or production of this utterance would rely on complex linguistic and informational processing. On one hand, understanding could be based on direct perceptual experience of waves, as these are preserved in the pattern caused by wheat field.

Firstly, the contextualism by Hoffman (1983) begins from “metaphor”<sup>85</sup> by Pepper (1942). Contextualist world view *relies* on a *single ontological* starting point, “*events*”. The basic metaphor theme, an abstract one, is “The world is

<sup>83</sup>Excerpt is originally from (Jenkins, 1974) p. 786.

<sup>84</sup>The ecological psychology considers that perception is of events. Its experiential basis is the direct manipulation of the environment and participation in events.

<sup>85</sup>

events” (Hoffman, 1983), p.518. In contextualism, events are real and occur independently of cognition, awareness, perception or judgment. However, any *description* of an *event* is actually *tied* to the *observer's purpose* and *method* (Hoffman, 1983). Therefore, contextualists theories are *relativistic theories*, that is, relative to specific domains, niches, or purposes, and are expressed in terms of *changes* and *invariants* (Hoffman, 1983). A basic premise in the contextualist view is that there may be no general formula for describing events that will cut across all domains (as distinguished by the judgments of the theories). Each domain may be an “island of regularity” in a sea of incredibly complex phenomena (Hoffman, 1983).

“The inferences the expert makes may appear to be made in a serial order (e.g., where to put the stethoscope), but the *actions* are *governed interactively* and *dynamically* by *past experiences* and *present* information.”(Hoffman, 1983) p. 521.

Hoffman noted that *actions* of a person are always the product of an “active state” that is *interactive* and *dynamic* by *comparing past experiences* and the *present information*. Thus, the contextualism claim is that the interpretation of “basic units” which are the events at any one level of description must rely upon contextual factors at another level. It is only by research that specifies the contextual level that one will be able to disclose the full complexity of events at the “basic level.” The principle of contextualism is that comprehending and remembering are forms of problem solving. Contextualism seeks to show how perception must be considered not as a separate module, but as integral to the comprehending and remembering process. Thus, remembering viewed from this approach does not consider the memory as a simple storage system and stimulus retrieval.

Hence, a person's thought and action is situated considers that the human memory as “actively doing something all the time” or “actively contextualizing what I am doing”. It is then associated to the term “*contextualism*” as we have introduced in the beginning of this section. We look into the main substance of contextualism highlighted below:

The main thesis of contextualism is on shifting the stored units to experienced events. The *experience* must not be viewed as *isolated stimuli*. Experience cannot be regarded by us and presented to others as an isolated stimuli. Rather, what is experienced is a construction of the person (called the “quality of the event”), the result of the interaction of the experiencer and the world. And what is constructed is a kind of gestalt or integrated whole, a *meaning* (Clancey, 1997a).

By adhering to the concept of contextualism, is suggesting that we are “undergoing” some transformation which we actually call *comprehending of something*. It is *during* this *transformation*; that we apparently constructs a kind of a holistic view of what is happening to a person (Clancey, 1997a).

The heart of contextualism uses *events* as a point for analyzing how a person *regulates* his *behavior*. Therefore, *human experience* consists of *events*; this experience is segmented into *named objects* and *relations*. As a result, the named objects and relations are not isomorphic to the experience itself (Clancey, 1997a). In contextualism, it is the *interaction* that *constructs ontology*, which is partly what we experience (Clancey, 1997a).

In summary, approaching “remembering”<sup>86</sup> from a situated cognition approach assumes a complex interplay between nature and nurture, inside and outside, construction and world, and neural and social. The study of human memory suggests that this relating, coordinating process occurs by a mechanism that is interactive and historical, operates on many level of organization simultaneously, and involves feedback in a way different from the serial and parallel architectures of computational systems (Clancey, 1997a).

#### 4.9.2 Looking into a transactional experience

The scope of communication have been enlarged. We have reviewed several works and tied the theory of Bateson to situated cognition in the relationship to memory. There are many ideas that we have collected and “associated” to one another. We have the: (i) learning hierarchy based on the law of motion (changes); (ii)  $S \rightarrow R$  in the abstract of communication; (iii) thoughts, and action is situated that can be explained by going back to to understanding learning and remembering. Then we have hypothesized that with the collected readings on learning and memory is a detailed elaboration that may explain how people punctuate experience/events for comparing and learning to produce right responses in *differing context*; to the situated notion of one's activity that is always mutually constructed within one another (Section 4.7 and Section 4.8) in formulating representations that involves intentionality hence; (iv) dynamically constructing “sentences” when communicating always involves “remembering”.

We have emphasized on the concept of contextualism because through understanding that, readers would not be mistaken that situated cognition (and the communication protocols) is a mental or a social view of cognition. It does not fall into either-or, in fact, it is both-and. Contextualism is presented as being inherent in situated cognition, and the above discussion is to clarify that there is a logical relation *why it is inherent* in the first place in situated cognition. Situated cognition first and foremost considers the three notions of situatedness as mentioned previously.

First of all, situated cognition looks into how the whole mechanisms of a person are always in a cyclic relationship (the *memory- actions* are always at some level improvised, and the improvisation is situated with respect to perceptual coupling

---

<sup>86</sup>There are many other discussions on several different theory of remembering in the book of (Clancey, 1997a). For example, a particular interesting one is by Dewey on Coordination Memory. Readers are encouraged to refer to (Clancey, 1997a) for an in-depth discussions.

of sensation and motor actions ) with his/her transactions with the environment. As an example, when I am focused on putting my pieces of lego together, I am conceptualizing my role as a lego player (in this situated context) with what I am conceiving my actions of the lego building is a cyclic relationship to what I am learning by improvising my memory and actions to suit my desired “mental image of my design” during my lego game. I am “perceiving” with amazement the shapes and how they fit together and “conceiving” these actions of mine in turn either motivates me up to continue to play or to stop because I am frustrated.

In the previous sections; we have reviewed the theory of situated cognition: introducing the basic elements of what constitutes *conceptualization*. Then we focused on one aspect of remembering: contextualism. We have emphasized the center idea of contextualism: is that it treats experiences as consisting of events. This is an opposite view in descriptive modeling, where objects are made out of experiences.

In this section, we will concentrate on one particular chapter from (Clancey, 1997a). We begin by adapting an example from the author that has examined how the act of *conceiving* can be *structurally coupled*. We begin by illustrating the example. Firstly, the author (Clancey, 1997a) had received a phone message at his hotel in Nice. The message read “En Votre Absence: mR.Clancey. Amerait vous voir, Message: you must be at the train station as soon as possible—6.30 at the later. Recu par: Monique” This is how the author had translated the messages:

- R.Clancey: The author translated it as “Rosemary Clancey”
- “You must be at the train station as soon as possible: The author went into panic mode. Somebody is forcing the author to leave town.
- “6.30 at the later”: The author translated as “tomorrow morning” and asked himself “Why?”.

Each of the messages was translated *incrementally/indexically*. This message according to the author was supposed to be read over the phone to the author while he was still in Antibes. It illustrated the indexical nature of representations. The indexing can be described as:

- How we interpret a representation as a description.
  - How we perceive its form.
  - How we conceive its meaning.

All of this indexing depends on the ongoing activity of a person. In this case, it depends on the time the author had received the message, the city the author was in, and the previous activity in which the author had been engaged (the author had

a nice dinner and maybe had a few drinks too many). This general description by the author (Clancey, 1997a) demonstrates that perceiving and conceiving meaning may be *structurally coupled*. The meaning is *contextually* determined, and what constitutes a *situation* to the observer, that is the context, is *itself partially constructed* within the *interpretation process* (Clancey, 1997a).

According to the author (Clancey, 1997a), the perceptual form of the representation and its meaning is hypothesized by the author as rising together- they are not in serial, not parallel-independent, but *coupled* and *mutually constraining*. Clancey also proposed that the reading and comprehension suggested by the author is not merely a process of indexing labels and associated meaning from memory (as descriptive theories suggest), but constructing a coupled *perception-interpretation* on the spot. Clancey had also suggested that from this “unintentional transactional experience” the perceiving act of the person can be hypothesized that is not only determining the representation of what it means but also determining what forms should be treated as being representational.

“This process is dynamically influenced by possible meanings: *Data* are *construed* as present while *understanding* is *developing*. The perceptual-conceptual construction of interpreting is *not merely fitting a context to a message*. That is, for a human being, the primary notion of *context* or *situation* is with respect to the person as a *social actor*, as being someone who is right now constrained by social norms and right now playing an interactive role in some persona (even when alone).” (Clancey, 1997a) p.204.

The text comprehension is not as simple as retrieving and matching words to a defined meanings that had been “kept” statically in memory. Rather, as the author had stated, the meaning is always constructed dynamically. It must consider the context of the interpretation of the text. This was also mentioned by Dewey (1925) (see our section 4.5).

“Meaning is contextual, but the process of interpreting occurs within, as part of-the ongoing process of constructing what the current activities are.”(Clancey 1997) p.204.

Conceptualization via coupling is a form of recognition, like perceptual categorization. As the story of the author showed, the interpretation of the body of the message occurred secondarily, “on a different cycle.” We excerpt the author's interpretations (Clancey, 1997a). Firstly, the conception of the message body (a stern order: “Must be at the train station...at the later) and inquiry (Why did my mother call me?) had been combined to infer that the message is a warning. Then this conception (“paranoid thought”) arises after the earlier categorization of the sender and the message tone. But the relation is not another coupling, rather a deduction operating on these held-in-place categorizations. “R.Clancey” and “CC” arise together, but forming the conception of being run out of town involved



holding “CC” (Mother called) and the categorization of the message's superficial content (involving where to go and when) active at the same time and then relating them to a third idea (“this message is a warning”). The author speculated that there are two kinds of mechanisms for temporarily relating categorizations: structural coupling, in which categorizations arise together, and inference, in which categorizations are held active in the awareness and related.

According to the author, the perceptual-conceptual construction in interpreting the Nice message is not merely fitting a context to a message. The way in which the context is conceived and changed by the interpretation process itself is important Clancey (1997a). For example, further on, Clancey suggests that the transaction of two people, how they are occurring simultaneously influenced by stimuli, and doing a conscious activity (experiences) like speaking, moving or visualizing. This actively doing something, is related by Clancey to neuropsychology coordination that is being shown in circles, involving the whole dynamicity, of emotional, perceptual and conceptual organization.

We continue with our previous discussion. The *process or transformation* of how the person's act of conceiving and comprehending the text is the center of our work. We show that the author's example can be related to our own CONSTEPS. The CONSTEPS were applied without any a-priori knowledge of Clancey's Nice example. Only after converting about 50,000 words, we found that what Clancey had described was related to our own way of comprehending the conversations and translating it. Clancey's theory of situated cognition conforms to our own framework to how the CONSTEPS have been performed. This both goes weight to Clancey's account and provides as stepping stone in our own analysis to understand how people do collaborative work by interpreting text (on chat messengers and e-mails) as well as online video conferencing while using a computer-mediated tool.

Let us recall back some of the collected essays that we attempted to put together in justifying why situated cognition is being used as a fundamental theory throughout our work. We begun with the work of Bateson (1972) and relating it to cognition process also by Bateson (1979) that will be discussed in Chapter 6. Next, we attempted to relate that the basic framework of the hierarchy of learning and communication of Bateson can be extended and explained by learning and memory. After expressing some important quotations from Bartlett (1995), Norman (1982) and Edelman (1995), these accumulated evidence made it more obvious that situated cognition takes into account of these discussions that is lacking in the literatures above that we have discussed (Section 4.6).

Not only that, certain keywords we underlined like situations, reproduction, transformations, settings, are all being considered by Clancey (1997a) in formulating his theory on situated cognition. We hope with this primitive justification, readers will understand where the work is headed and why situated cognition is a

theory that attempts to bridge different ideas and look into loopholes and contradictions in past and present literatures in cognitive science.

#### 4.10 Activity Theory

Finally, the last link to complete our understanding is relating learning and communication, (in respect to memory) and situated cognition to activity theory (Leont'ev 1977 & 1978). There are actually two important ideas from activity theory. Firstly, the relationship between consciousness in respect to the activity of achieving a goal using a *tool* (and we must consider the located web communication tools). Secondly, the relationship between how those consciousness or the subjectivity of formulating a goal is in respect to the *transformation process*. We elaborate further what Leont'ev (1978) meant by transformation process, but before we do so, we begin with a bit of historical background on activity theory.

Historically, the activity theory has been present since the late 19<sup>th</sup> century. (AT-Wikipedia, 2005). While its roots can be traced back to at least the 19th century (Raeithel, 1992), activity theory was mainly a result of a larger effort to develop a new psychology based on Marxist philosophy, an effort which started soon after the Russian revolution of 1917. Its founders were Alexei Nikolaevich Leontyev, and S. L. Rubinshtein (1889-1960). It became one of the major psychological approaches in the former USSR, being widely used in both theoretical and applied psychology, in areas such as the education, training, ergonomics, and work psychology.

The origins of activity theory can be traced to several sources, which have subsequently having given rise to various complementary and intertwined strands of development. This account will focus on two of the most important of these strands. The first is associated with the Moscow Institute of Psychology and in particular the *troika* of young and gifted researchers, Lev Semyonovich Vygotsky(1896–1934), Alexander Romanovich Luria (1902–77) and Alexei Nikolaevich Leont'ev (1903–79). Vygotsky founded cultural-historical psychology, an important strand in the activity approach; Leont'ev, one of the principal founders of activity theory, both continued, and reacted against, Vygotsky's work. Leont'ev's formulation of general activity theory is currently the most influential in post-Soviet developments in activity theory, which have largely been in social-scientific and organizational, rather than psychological research.

The second major line of development within activity theory involves scientists, such as P.K Anokhin (1898-1974) and N.A Bernshtein (1896-1966), more directly concerned with the neurophysiological basis of activity; its foundation is associated with the Soviet philosopher of psychology S.L Rubinshtein (1889-

1960). This work was subsequently developed by researchers such as Pushkin, Zinchenko & Gordeeva, Ponomarenko, Zarakovsky and others, as is currently most well-known through the work on systemic-structural activity theory being carried out by G.Z Bedny and his associates (AT-Wikipedia, 2005).

We continue to discuss the essence of activity theory.

Firstly, it seeks an interpretation of how human consciousness is determined. This was mentioned in the beginning of our introduction as being the second main idea of activity theory; focusing on how the consciousness or the subjectivity of formulating a goal is in respect to the *transformation process*. This approach is expressed with classical clarity in the 19<sup>th</sup> century psycho-physics and physiology the sense of organs. It was based on the “*stimulus-response*” pattern. However, these approaches are considered to be limiting to explain psychological facts on the basis of special forces. The special forces are referred such as that of *active apperception, inner intention* or *will*. In other words, the special forces appeal to the active nature of the subject, but only in idealistically interpreted, mystified form (Leont'ev, 1977). We assume when Leont'ev (1977) is discussing about the active nature of subject (i.e., the person) when he is referring it as to be ideally interpreted in a mystified form is that ideally we cannot really know how the will or the inner intention arises, only if we think of it as being interpreted in a mystified form (other special powers enabling us to have wills or inner motivations or intentions).

In (Leont'ev, 1977), the author had formulated the *activity theory* by relating it to a broader framework of human motives (not constraining it to problem solving). Firstly, the essence of activity theory is that the relationship between a person and objects of environment are *mediated* by cultural *means: tools* and *signs*.

Secondly, it also emphasizes that *internal activities* cannot be understood if they are *analyzed separately, in isolation* from *external activities*. Because there are *mutual transformations* between these two kind of activities: internalization and externalization (Bannon, 1997). Activity theory also emphasizes social factors and interaction between agents and their environments, explaining why the principle of tool mediation plays a central role within the theory (Bannon, 1997)

Activity theory is also defined as the engagement of a subject toward a certain goal or objective. An activity is undertaken by a *human agent (subject)* who is motivated toward the solution of a *problem or purpose (object)*, and *mediated by tools* (artifacts) in collaboration with others (community). Activity theory emphasizes that the organism is doing something all the time (Bartlett, 1995) (the essence of the word “activity”) and that subjectivity is realized within and constructed by *interaction* (Clancey, 2003).

The basic *unit of analysis* in activity theory is the *human (work) activity*. Human activities are driven by certain needs where people wish to achieve a certain purpose. This activity is usually mediated by one or more instruments or tools (the concept of mediation is central to the whole). Human beings mediate their activities by artifacts (Bannon, 1997). As an example: a carpenter uses a hammer to drive a nail, the nurses use language and records to coordinate their actions towards the patients and each other, etc.

In summary, activity theory may be viewed *as a response to* two competing theoretical extremes:

- passive, innate response of the organism without subjectivity in behaviorism, and,
- the disembodied, contemplative, egocentric response of organism in mentalism.

Activity theory centers on the notion of “psychic reflection” which we instead refer as “mental reflection”. All activity has a circular nature: *initial afferentation* → *effector processes regulating contact with the objective environment* → *correction and enrichment by means of reverse connections of the original afferent images*. Now the circular character of the processes (the circular processes) is to point that, it is not in the circular nature itself that an organism realizes its interaction in an environment, but the mental reflection of the object world is not directly generated by the external influences themselves, but by those *processes* through which the subject comes into *practical contact* with the *objective world*, and which therefore necessarily obey its independent properties, connections and relation (Leont'ev 1977).

Explaining this in detail, it means that the “afferentator” that direct the processes of activity initially is the object itself and secondarily its image as a subjective project of activity that fixes, stabilizes, and carries itself its objective content. In other words, a double transfer is realized: the transfer object → process of activity, and the transfer activity → its subjective product.

The basic, constituent feature of an activity is that it has an *object*. The very concept of activity implies the *concept of the object of the activity*. The expression “objectless activity” has no meaning at all. The object of activity appears in two forms: (i) in its independent existence, commanding the activity of the subject, and; (ii) as the mental image of the object, as the product of the subject's detection of its properties-which is effected by the activity of the subject and cannot be effected otherwise. This notion of object, that is then arising and turning into subject is the center of the thesis. Put in another way, the foundations that we have laid so far, are dealing with how consciousness arises, but to narrow our work is to understand how intentions arises. Those processes that Leont'ev (1977) discussed about is related to neuropsychology. So the notion of the object, of becoming a mental image in our minds, existing as a part of the objectified

world (the tree exist a part of the world) becomes a chains of transformation of series as I have for example, see this tree, and chops it off with an axe. My actions operating on this tree is an activity that is a circular nature, because the object now that has become my moment of focus that had arised from special forces (like that of a will or motivation) turns into a subject for me. As I am myself a subject, the subject itself is a referential process to what I am conceiving, and conceptualizing my role as a “tree chopper” at the one evening.

We are interested in looking into this notion, the nature of how the *transformation* of the *activity one* is doing *interchanges* with the *formulation of intentions* with respect to the *activity* at hand.

We illustrate an example below to show Jenny, a computer scientist working at her laboratory.

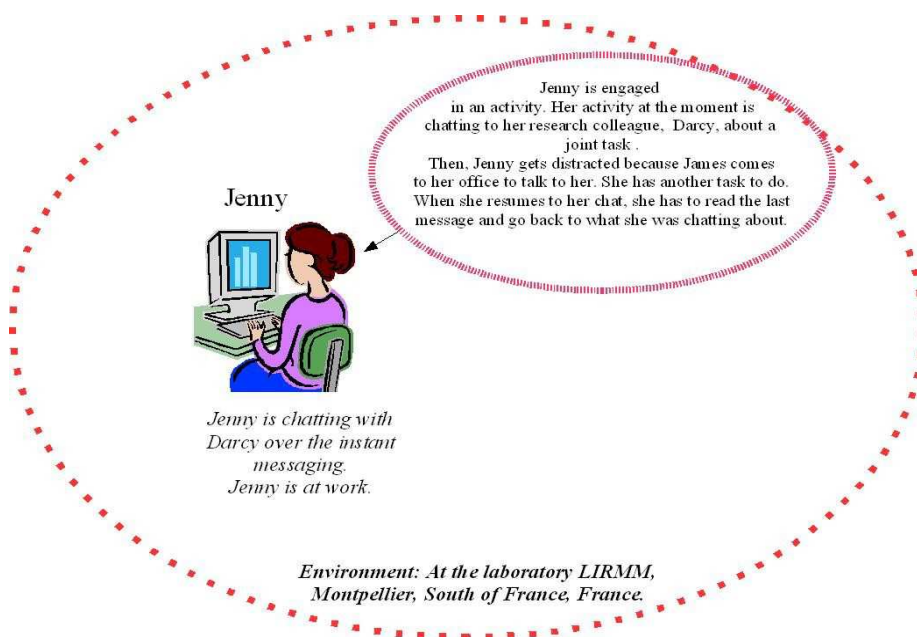


Figure 4.10: Jenny at work.

Figure 4.10 shows Jenny at work. Here the activity is chatting about *task A*. We suppose the task is about writing a proposal together. In this example, the environment refers to Jenny's surroundings, physical also conceptual (i.e. also social). For example, there, is there is a phone, the computer, a fax machine, a drawer nearby and an vase of flowers. Naturally at an office, one has a job to do and needs to execute certain tasks related to her job. The modeling of the activity theory comes into picture when we are considering how Jenny's intentions arises. Let us ask some questions. Firstly, what and how is Jenny conceptualizing her task at that moment? Secondly, how does Jenny coordinate herself; between stopping to take a pause to speak to her colleague and then resuming to chat to

her online collaborator (Darcy via the instant messaging as the mediator in achieving her task)? Thirdly, how does Jenny know exactly what she should take as her next action after resuming to chat with Darcy? Fourthly, how does Jenny remember what had taken place before, and associate to her present state (how does her mental reflections operate)? In this example, Jenny is chatting to Darcy on writing a proposal together. Some of their discussions are: should Jenny include problem Z first then C, or should Jenny include Darcy's definition of problem with hers? Jenny's activity is always being constructed dynamically during communication, and thus as a consequence her intentions are also dynamically constructed constrained by the things she is doing at the moment, her past experiences and at the same time what she would like to do in the future.

In our interpretation using the activity theory, an object is considered as the moment focus of Jenny towards achieving a goal. The tool is a mediator for Jenny in achieving her goal. The subject in this example is Jenny.

#### **4.11 Overall picture of the theoretical integration**

Firstly, readers was given a basic introduction to Bateson's (1972) on the logical theory and hierarchy of learning and communication. From there onwards, we related the work of Bateson to Dewey's specifically on the nature of meanings and communications (Dewey, 1925). First of all, the hierarchy of learning and communication focuses on changes (incremental) and adaptation of learning. The lower "class of learning" contains significant elements that provide a basis for the "upper class". Each learning is focused on: (i) learning 0 is on "external events; (ii) learning I is on repeatable context; and (iii) learning III is on punctuation of events and  $S \rightarrow R$ .

We emphasized on the notion of transformations and whereby the events are labeled and leads an independent yet a double life by Dewey (1925) (see Section 4.5) to extend our understanding on the hierarchy of learning and communication of Bateson (1972). It can be looked from two perspectives: transformation or changes from learning 0 to II (shared members from C1 to C2) at the same time transformation taking place between the  $S \rightarrow R$ .

Then onwards, we moved on to relate from the previous discussions on Bateson (1972) and Dewey (1925) to learning and memory, particularly focusing on the work by Bartlett (1995) and Norman (1982).

We highlight several key ideas:

- to understand learning and communication, we must understand memory;
- however, in order to understand memory, we must therefore understand what underlies the memory mechanism/processes. This is when we attempted to relate it to the work of Edelman (1992);

- The memory is always under the influence of continually changing contexts that brings us further into the situated cognition (Clancey, 1997a) and activity theory (Leont'ev, 1977 & 1978).

The three existing theories had been applied extensively in our analysis of the communication protocols, and on one hand they also provide a validation for our own modeling CONSTEPS.

Situated cognition claims that we are always automatically adjusting even as we follow a plan. That is, the relation is both-and: We are always recategorizing circumstances, even as we appear to proceed in lock-step with our prescribed actions. Our internal representation is coupled such that perception, movement, and conceptualization are changing, with respect to each other moment-by-moment (Clancey, 1997b).

Not only does situated cognition by Clancey (1997a) provides insight into an interdisciplinary view of understanding cognition: specifically relating to perception and memory, it also looks into activities.

*“Individual decisions and behaviors are in general shaped by an a priori mixture of personal and social descriptions, plans and codes. The pace of surprise in the town is different from running rapids, but local adaptations are occurring when new buildings are proposed and blueprints are interpreted during construction.”*  
(Clancey, 1997b), p. 262.

Our initial work has been to focused on people collaborating online, Clancey (1997b) gives an example of the ongoing activities of a seaside contractor at Florida. In individual decisions and behaviors, for example if we go back to our own case study are generally shaped by an a priori mixture of personal and social descriptions. This was observable as well if we look at the nature of the ongoing activities of the project coordinator (Chapter 2) where the decision is a mixture of personal goal (e.g., the project coordinator is also a PhD student that is married and needs to have a salary while working on his PhD hence takes up the job as the project coordinator). At the same time, the project coordinator is also shaped by social descriptions, plans and code. We assume that Clancey (1997b) may perhaps referring by what the outlined of the plans, regulations and codes that an organization or social imposes on an individual. For example, the project coordinator has two kind of role, being that of a student and a project coordinator, needing to follow the plans and code of the project and set aside time to write his own thesis. He also needs to make use what he is working on can fit into his thesis to make sure that his first goal is to graduate on time. Now, the project coordinator is learning, communicating and responding not as being alone, all his actions are situated in his context, are always social. His decisions, in relationship to his ongoing activities (e.g., chatting on the instant messaging, going for video-conferencing, phoning and faxing, writing proposal together, getting into dispute

into what communication channel should be used) are always locally adapted to the situated context (the context of his activities).

“ Human activity, whether one is rafting down a river or managing a construction site, is broadly pre-conceived and usually pre-described in plans and schedules (even the rafting company). But the *details* are always *improvised* (even when you are pretending to be a robot). At some level, all “actions” happen in a *coordinated way* without a *preceding description* of how they will appear. The grainsize of prior description depends on *time available*, *prior experience*, and *your intentions* (which are also variable pre-described depending on circumstances). (Clancey, 1997b), p. 262.

Human activity whatever we are engaged in, can be roughly summarized that the details of these activities are always improvised. The actions happen in a coordinated way, as the story we have illustrated in Section 4.7, directly attempts to show that the actions happen without a preceding descriptions of how they will appear. In our context of study, the activities of a collaborator depends on time available (e.g., “I can't have a video-conferencing now because I have a real meeting in a few minutes!) , prior experience (e.g., “In my experience in doing European Union projects for 25 years, it is ok to delay the proposal) and their intentions (e.g., “we have to integrate our tools to present in the deliverables for the EleGI for the fundings”)

“ to understand how *situated cognition* suggests new ways of using *expert system* technology in *tools* for *collaborative work*, we need to explore further *what people* are *conceptualizing*, which *produces* these *different views* of the world, and why these conceptualization cannot be replaced by a program constructed exclusively from descriptions” (Clancey, 1997b), p. 263.

Situated cognition focuses on what people are conceptualizing. In the context of EleGI collaborative work, it is evident during the online meetings, what each person is actively conceptualizing is of different views of the world (See Appendix A for the actual transcribed meetings). If we start to understand how people are conceptualizing their activities, we can further understand the nature of collaboration, and how they learn and communicate effectively to achieve each of their goals mediated by tools.

“....Individual activity is when I am alone, social activity is when I am interacting with other people. This is essentially the *biological, either-or* view of “*activity*- a state of alertness, of being awake doing something. But the social scientist, in describing human activities as social, is not referring to kinds of activities per se. Rather what we are doing, are actually constructed. Even though



an individual may be alone, as in reading a book, there is always some larger social activity in which he or she is engaged.” (Clancey, 1997b), p.264.

Even if the communication exchanges that we analyzed are for each individual, as suggested by Clancey (1997b), we do not associate the communication protocols as being individual/private because as stated by Clancey (1997b) (through enough true our own observations) that what we are doing are actually constructed dynamically with our ongoing behavior. Even when the project coordinator may be alone in his office on a weekend, there is always some larger social activity in which he or she is engaged. We explain this in Chapter 5, Section 5.3 through our modeling of object, and subject.

We continue a bit more on situated cognition and activities (in particularly relating it to activity theory).

“ For example, suppose that I am in a hotel room, reading a journal article. The cognitive perspective puts on blinders and defines my task as comprehending text. From the social perspectives, I am on a business trip, and I have thirty minutes before I must go by car to work with my colleagues at Nynex down the road. The information processing perspective sees only the symbols on the page and my reasoning about the author's argument. The social scientist asks “ Why are you sitting in that chair in a hotel room? Why aren't you at home? That is, to the social scientist, my activity is not merely reading- I am also on business trip, working for IRL at Nynex in White Plains, NY.” (Clancey, 1997b), p. 264.

It is stressed and stressed again that our protocol analysis is not defined as being private/social. We do not adhere to the concept of either-or, but instead to the view of both-and.

“An *activity* is therefore not just something we do, but a *manner of interacting*. Viewing activities as a form of engagement *emphasizes* that the *conception* of activity *constitutes* a means of *coordinating action*, a manner of *being engaged* with other people and things in the environment, what we call choreography. Every human actor is in some state of participation within a society, a business, a community”. (Clancey, 1997b), p. 266.

To conclude an activity viewed from Clancey (1997b) is as being a manner, a process as well of interacting. Activities viewed from the form of engagement that the conception of activity constitutes as means of coordinating actions. As an example, my conception of what I am doing right now, is that I am writing this thesis to be submitted before the 5<sup>th</sup> of February to the Bureau de Dred at 20h40 is

the conception of what I am doing at this moment (see the circular nature of it) constitutes my coordination. What should I write next? How do I organize my coordination between eating, typing, taking a break and thinking about my critical questions that I must answer in my thesis? They are all involved simultaneously at an improvised levels.

The same observations goes to the collaborators. We might ask the same question for the project coordinator (taking him as a subject), what is his conception of his activity? And how does he coordinate his activities, to chatting with the project executive, fulfilling his own goal, yet the social plans and rules, to attending online meetings and so on?

“People understand interruptions, “being on task”, and satisfaction with respect to activities. For example, contrast your experience when interrupted by different people when you are reading: a stranger in the train, a colleague in your office, your spouse when you're reading the paper in the morning. Your conceptual coordination of the interruption is shaped not just by your interest in what you are reading (and why you are reading it) but the activity in which you are engaged. *Activities* provide the *background* for *constructing situations*; they make *locations* into *events*.” (Clancey, 1997b), p. 267.

The above quotation from Clancey (1997b) is extremely important and interesting. Activities is also viewed as providing the background for constructing instructions. Activities make locations into events. In fact, the activities of what I am doing now, is the conceptualization of what activity am I doing right now? When one is engaged in her activities, then that slowly emerges for constructing situations, a counter for re-countering events (Clancey, 1997a). Hence, activities then becomes sort of a location for “remembering” the events. Does this relate to neuronal maps? (Edelman, 1992).

“ For example, in modeling medical diagnosis (Buchanan and Shorfliffe 1984) we chose the physician's activity of examining a patient, diagnosis, and treatment recommendation, ignoring physical exam. But the physician is also in the activity of “working at the outpatient clinic” . We ignored the context of patients coming and going, nurses collecting the vital signs, nurses administering immunizations, parents asking questions about siblings or a spouse at home, etc. In designing medical expert system like Mycin, we chose one activity and left out the life of the clinician. We ignored the union meetings, discussion in the hallway about a lost chart, phone calls to specialist to get dosage recommendations, request for the hospital to fax an x-ray, moonlighting in the Emergency Room. Indeed, when we viewed medical diagnosis as a task to be modeled, we ignored most of the

activity of a health maintenance organization! Consequently, we developed a tool that neither fit the physician's schedule, nor solved the everyday problems he encountered.” (Clancey, 1997b), p. 268.

This was highlighted as being one of our major concerns in Chapter 3, Section 3.10 on understanding the procedural content and non-procedural content at workplace.

All of the above discussions gives weight to the approaches and our proposal of integrating the theories of (i) hierarchy of learning and communication (Bateson, 1972); (ii) situated cognition (Clancey, 1997a); (iii) activity theory (Leont'ev, 1977 & 1978).

We conclude that communication must be considered from a “situated” approach. At the same time, we also highlighted *memory* and *perceiving*. We then relate the hypothesis of remembering in the context of “contextualism” (actively doing something all the time) to understanding how people relate their past experiences, and present event when communicating.

Since the actual web communications have all been facilitated by tools, the tools must be considered in their “located” context. How a person is learning when doing something changes what one is doing in the objective world. Hence, the response of that person (the subject) in that objective world is a behavior that is communication. These changes occur as an intermediary process that is somehow responsible in behaving, learning, doing something to achieve a goal (in activities). As argued above by excerpting quotes from (Clancey, 1997b), situated cognition approach together with communication has to be related to the activity theory.

We illustrate a global view of the three major existing theories that we have followed as an approach (Bateson, 1972; Clancey 1997a; and Leont'ev, 1977 & 1978) below.

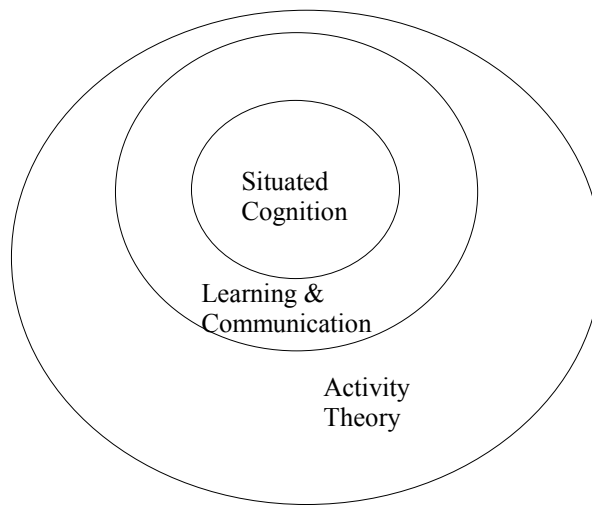


Figure 4.11 : Sitting on top of one another.

Refer to the above Figure 4.11. In a nutshell, the situated cognition theory sits within the activity theory; using it as a framework for relating how actions in daily activities can explain how human thought is situated and adapted (Clancey, 1997a & 2002). On the other hand, the hierarchy of learning and communication sit in-and between these two theories (between situated cognition and activity theory). Situated cognition provides us with a backbone framework for understanding the mechanisms that can be fitted in. It also provides a framework to explain how learning and communication occurs simultaneously at an improvised level when thoughts and actions are adapted in situated context. In other words, a framework to explain *how human communication is inter-dependent on how thought and action are adapted to the environment* moment by moment in a context/environment. These multiple views of association of mechanisms are crucial for the complete understanding of our own goals of how communications protocols are *learned, punctuated, induced, merged* and *adapted* to the *situated context/environment*.

These existing theories are necessary for us to incorporate, so that we can explain:

- how a person *coordinates* (i.e. situated cognition) as a whole;
- by *conceptualizing* her *context* (i.e. situated cognition, learning and communication);

of *what* her *activity* is (i.e. situated cognition, activity theory) when communicating (i.e. learning and communication, situated cognition) structured by her *internal rules* (discussed in Chapter 6). At the same time, the choices of the theories complement one another:

- 1) The logical theory of learning and communication main focus was of course on learning and communication. However, it does not consider tools in formulating responses/actions.
- 2) The situated cognition focuses on memory and perception. It suggests that “given meaning by statements that represent what is happening..” shifts from viewing describing as coupled perceiving-conceiving-description creating to locating meaning in statements, making descriptions manipulation appear to be the only mechanism and conflating the distinction between different kinds of internal categorization and statements (Clancey, 1997a) p. 373. Therefore, it is logical to relate the hierarchy of learning and communication to Clancey (1997a) work however more focused on relating the mental processes by Bateson (1979) to Clancey's (1997a) own focus at the neural level (in remembering).
- 3) The activity theory focused much on how consciousness come about from the depths of psychology. It touches on aspects of communications and languages, but not thoroughly about learning.

“To understand what “social construction of knowledge” means, you must first understand activities, the choreographies of human action, develop within ongoing activities. Our capacity to plan what we will do, to design new methods and tools, and to formalize what we know, develops within and depends upon our pre-existing activities.” (Clancey, 1997b), p. 271.

We are aware that the link between the three existing theories must be made stronger. However, for now we lay the clues side by side, even if it is not as strong as we hope it to be. Nonetheless the link exists, and denying the existence of the link will be a gross error for us.

#### **4.12 Where we are headed: Understanding the “transformations” when communicating**

We have reviewed the study on hierarchy of learning and communication of (Bateson, 1972). Bateson emphasized how learning and communication mutually influence one another. Bateson had stressed these keywords; *change* that has to do with *processes*; *context* that may be the *stimulus* itself for the communication among people; *learning* that enables a person to *discriminate classes* of *context* when *responding* to a *behavior*; an internal and external stimulus that influences response of the behavior. For Bateson, stimulus denotes a member of a class of information coming through a sense organ, that may be imaged as making it seems like a push or shot of “energy”. In summary, we can briefly state that:

Context *is a* stimulus for person Y to respond  
 Behavior of person Z *may be* stimulus for person Y to respond  
 Y's inner “stimulus” *may be a* stimulus for person Y to respond

How person Y responds to person Z is *learning how to know which member to select from which class*.

If we carefully note the above, Bateson's (1972) notion on the hierarchy of learning and communication may be directly summarized as a simplistic abstraction on communication and learning. However, readers note the meaningful abstraction on “learning how to know which member to select from which class” can be deduced from a top down complexity. It may be viewed as containing depths of complexity, because just to explain learning how to know which member to select from which class is not a simple event that can be easily described. It must consist of items that are grouped (or maybe categorized?) into members that form into neuronal groups? However, what are these chains of process taking place from this simple question- learning to know which member to select from which class? It may be extended into knowing to learn to communicate with *what*, *when* and *whom*. For some readers, it may seem somewhat reductionist that ignores transactional aspect that activity is in the dynamic interaction and transforms action of materials and ideas. However, readers recall that Bateson (1972) mentioned “external event systems” that and also mentioned on the transactions may be deduced by looking at this passage (re-adapted from the previous summary in this Section 4.11):

*Context is a stimulus for person Y to respond*  
*Behavior of person Z may be stimulus for person Y to respond*  
*Y's inner “stimulus” may be a stimulus for person Y to respond*

Therefore, it's a starting point for us to build the view from Bateson (1972) that can eventually be related to the proposal of the three integrated theories: hierarchy of learning and communication (Bateson, 1972) to situated cognition (Clancey, 1997) that can be associated to activity theory (1977 & 1978) that may be eventually modeled into the modeling criteria of mental processes by Bateson (1979).

As we have mentioned previously, Dewey (1925) focused on events that go through “transformation”. We borrowed this notion of transformation from object to subject. Let us discuss how we propose to use the notion of Dewey on transformation (that was also discussed by Bartlett (1995) to Leont'ev (1978)) on object to subject. What we refer as borrowing the notion of Dewey (1925) on transformation is only at the level of relating it to the idea of object and subject to explicitly reveal it by using a participant observers approach (Chapter 5). It is for the understanding of the underlying neural mechanism at play at the cognition process that might have taken place throughout these transformations.

Dewey (1925), was focused on the inner mechanism that had taken place, by emphasizing how communication “shapes” up to enable for them come to a “tacit agreement”. In Dewey (1896), the author discussed in great detail the “transformation” process which we shall review in the next section.

Therefore, we need to know what takes place in-and between the stimulus-response. That is to understand the transformation, the re-production of comprehending text, in respect to situated action and thoughts.

First of all, we review briefly the essay on *reflex arc concept* in psychology by (Dewey, 1896) and as well Leont'ev (1978); described in great detail in the *genesis of consciousness* and *activity and consciousness* in (Leont'ev, 1977). We open this discussion in the next section.

#### 4.13 Transformation in-between the Stimulus-Response<sup>87</sup>

Dewey (1896), contrasted between the older concept of dualism concerning sensation and idea, which is repeated in the 1980's dualism between peripheral and central structures and functions. But we are still optimistic that the idea of S→R of both (Bateson, 1972; Dewey, 1896) are not the same views as most general readings (Bara, 2005; Castelfranchi, 2001) on S→R. Dewey proposed that we should interpret the character of sensation, idea and action from their place and function in the sensory-motor circuit.

The *common* reflex arc idea (like basic input-output programs or functions) is defective in that it assumes sensory stimulus and motor response as distinct psychical existences. In reality they are always *inside a co-ordination* and have their significance purely from the part played in maintaining or reconstituting the coordination (Dewey, 1896)<sup>88</sup>.

“Falling to see the *unity* of *activity*, no matter how much it may prate of unity, it still leaves us with sensation or peripheral stimulus; idea, or central process (the equivalent of attention); and motor response, or act, as three *disconnected existences*, having to be somehow adjusted to each other, whether through the intervention of an extra-experimental soul, or by mechanical push and pull.” (Dewey, 1896), p.5.

We excerpt an example from Dewey (1896), p. 5. If one is reading a book, if one is hunting, if one is watching in a dark place on a lonely night, if one is performing a chemical experiment, in each case, the noise has a very different psychical value it is a different experience. “Stimulus” here is defined as *emerging* out of this *co-ordination*; it is born as its matrix (Dewey, 1896), p.5 (like corresponding to memories); it represents as it were an escape from it (Dewey, 1896) p.5. Bateson (1979), p. 93 suggests that stimulus denotes a member of a class of information coming in through sense organ. Bateson then

---

<sup>87</sup>Readers might notice that this analysis is redundant with the theory of situated cognition since the author Clancey (1997a) already has a hypothesis that takes into account of the internal mechanism. We think our work might be interconnected along the way. The major difference is that our analysis of the internal mechanism (which we simply refer as the in-between of S→R) is just focused on the communication at the cognition process (neural level) aspects.

<sup>88</sup>See (Clancey, 1997a) for a related discussion on Dewey: Coordination memory from pp. 92-97.

distinguishes stimulus into “stimulus internal” and “stimulus external”. Appropriately, we can summarize that the “stimulus external” might be responsible in the “emerging” of the stimulus internal from the co-ordination, that is “contextualizing” it out of the “matrix” of the memory.

Looking into both perspectives of (Dewey, 1896) and (Bateson, 1972), we are headed to the idea of “transformation” or what Bartlett (1995) would say the transformation or re-production. We relate this to the idea of in-between processes of  $S \rightarrow R$ . Specifically as we have mentioned in Chapter 2 during our actual short experiments with the participants (see Section 2.6) that we have noticed from our own observation on the notion of object and subject that is related back to activity theory.

Therefore, we focus our attention to the discussion by Leont'ev (1977) on “Activity and Consciousness” as well as by in 1978 on “Pyshic Reflection” on the expression of transformation that is related to object and subject.

“then the main question is *what* these *processes* are that *mediate* the *influences* of the *objective world* reflected in the human brain”. (Leont'ev, 1977), p. 4.

The transformation that is considered from the point of view of Leont'ev (1977) is questioning what are those processes that mediate the influences of what we perceive in our brain in our objective world?

“But the concept of *subjectivity* of the image in the sense of its belonging to the subject of life *includes* in *itself* an indication of its being *active*.”. (Leont'ev, 1978), p.5.

To Leont'ev, a subject (like a person) being implicitly written, we assume as “subject of life” when being critically thought of this subject having a subjectivity of the image (of what she is perceiving) includes in itself (the subject itself) that indicates the subject is being active.

Leont'ev's motivation was to deal with the problem of how consciousness is determined. For Leont'ev, his basic answer to the question of what are these processes that mediate the influences of the objective world reflected in the human brain lies in acknowledging that these processes are those that realise a person's actual life in the objective world he is surrounded. In other words, these processes are his activity.

Hence, this proposition from Leont'ev requires a further definition that by activity he means not the dynamics of the nervous, physiological processes that realise this activity. He proposed that we must draw a distinction between the dynamics and structure of mental processes and language that describes them. On



the other hand, he also noted that the dynamics and structure of the subject's activity and the language describing, on the other (Leont'ev, 1977).

Thus, for Leont'ev (1977) to deal with the problem of how consciousness is determined, he remarked that we are confronted with the following alternative. The alternatives proposed that either we accept the view implied in the “axiom of immediacy”: i.e., proceed from the ;

- (i) “object-subject” pattern (or the stimulus-response” pattern, which is the same thing) or either proceed from;
- (ii) a pattern which includes a third, connecting link—the activity of the subject (and correspondingly, its means and mode of appearance), a link which mediates their interconnections, that is to say;
- (iii) to proceed from the “subject-activity-object” pattern (Leont’ev, 1977).

Let us explain a bit further of the above and what is the relationship to our main objective of understanding how intentions arise to transformations (and now to consciousness!). Firstly, recall in Section 4.6, how do we perform any actions, which Norman (1982) believes we formulate intention, then guides the act. Hence, in formulating intentions, there are motivations, deliberation occurring that shapes the subject (the person) to arising to formulating intentions may be viewed as constituting of what the whole of a part of shaping the consciousness. Therefore, in Leont'ev (1977), he suggested to understand precisely how consciousness arise is to take several alternatives. Firstly, either we consider an object-subject pattern or similarly as stimulus-response pattern, which is actually the same thing. The object that I am perceiving is a stimulus to my action, that is my response, and subject in activity theory is the person. They may be expressed as  $\text{object} = \text{stimulus} \rightarrow \text{response}$  is of subject. Secondly, we have another alternative to solve this problem, that is understanding a pattern (a pattern of transformation perhaps?) which includes a connecting link between the activity of the subject to the object (and correspondingly, its means and mode of appearance). The link which mediates their interconnections to proceed to the pattern of subject-activity-object pattern. To summarize it quite simply, the transformation (link which mediates these interconnections at different levels) between person, the subject that is constructing actively its referential process (therefore the referential process is a reflexivity property of the subject) during engagement in the objective world having an “objectified focus” or the act of the “perceiving of the moment” to the activity as being the link of the pattern the stimulus-reponses.

From this relationship of understanding how consciousness is determined, Leont’ev focused on human activities to formulate how consciousness arises. Thus, the constituent *feature* of *activity* is that it has an *object*. In fact, the very concept of activity (doing) implies the concept of the object of the activity (Leont’ev, 1977), p. 3.

The *object of activity* (consciously engaged in an activity) has an object on its own that may be in *two forms*. The first form is the *independent existence* (will, or motivation) commanding the activity of the subject (the person who is in activity). The second form is that the object appears as a *mental image* to the subjects, as a product of the subject's detection of its properties. This is affected by the activity of the subject's detection of its properties. In fact the object of the activity has *two faces of transitions*, the inner object as having some kind of motivation or goal, and *changes* into a *different face* when the *subject* is made *aware* of the mental image of the object. And these changes are a production or an association of the subject's physical processes with the object, consciously constructed.

This *object-subject*, in a *circular* nature of the *processes* affecting the interaction of the organism with the environment, however the main focus lies that the *mental reflection* of the objective world is *not directly generated* by the *external influences* themselves. Rather by the *processes through* which the *subject* comes into *practical contact* with the objective world, and which therefore necessarily obey its independent properties, connections, and relations (Leont'ev 1977), p.3.

This means that the afferent agent, which controls the processes of activity, is primarily the object itself and only secondarily its image as the subjective product of activity, which registers, stabilizes and carries in itself the objective content of activity (Leont'ev, 1977). The agent (i.e., the person) who is in control of the process of activity, is in fact, primarily the *object* itself and only secondarily, its image as subjective product of the activity. This suggests for us that the agent undergoes a sort of transformation of the image of his object, which later becomes the subject of his product of the activity he is engaged in. This subjectivity of his activity will register, stabilizes and carries in itself the objective content of the activity initially (Leont'ev, 1977).

Different activities are distinguished by their motives. The concept of activity is necessarily bound up with the concept of motive. According to Leont'ev there is no such thing as activity without a motive. "Unmotivated" activity is not activity that has no motive, but activity with a subjectivity and objectively hidden motive.

The basic components of separate human activities are the actions that realize them. *Action* is regarded as the *process* that *corresponds* to the *notion of the result* which must be achieved, that is, the *process* which obeys a *conscious goal*. Just as the concept of motive is correlated with the concept of activity, so the concept of goal is correlated with that of action.

Referring to Bateson (see section 3.1), change denotes processes, and learning signifies change. Behaving is an action (and behaving is a response). In the scope of activity theory, action is regarded as the process that corresponds to what is to be achieved and the process which obeys to what are the conscious goals of the

object. We try to simplify the connection in both theories into equation Eq.(1) and Eq.(2) shown below. We denote: CH that denotes changes; PR denotes process; LR denotes learning; BH denotes behavior and ACT denotes action. WHT denotes what (what is being carried out) and CS\_Goal denotes the conscious goal. These abbreviations: (= =) denote “transforms”;  $\wedge$  is the “and” operator;  $\leftrightarrow$  denotes the “equivalence”; and  $\rightarrow$  denotes “coupled to”.

$$(CH \rightarrow PR) \leftrightarrow (LR) = = BH \leftrightarrow ACT \quad (1)$$

$$ACT \rightarrow (WHT \wedge PR) \leftrightarrow (CS\_Goal) \quad (2)$$

Let us label equation Eq.(1) a summary of Bateson’s hierarchy of earning and communication. We label equation Eq.(2) as a summary of the activity theory of (Leont’ev, 1978) on action and process. From equation Eq.(1), we have that change is coupled to process. At the same time, when there is a change, there is learning. This suggests that learning is a process of changes. This process of changes “transforms” as behavior, which is an equivalent to doing an act which is a behavior. From Eq.(2), act is coupled to “what”, “what” is the existence of what the subject is doing. And the “what” with the process of achieving the act, is a conscious goal of achieving the act from the beginning. Those changes correlate: *changes* taking place during an *activity*, *learning* and *communication*. In other words, to explain our equations Eq.(1) and Eq.(2): these “changes” take place in the process that is influenced from the objective world (an environment, or what I “perceive”). These changes occur as an intermediary process that is somehow responsible in behaving, learning, doing something to achieve a goal (in activities). And how one is learning when doing something changes what one is doing in the objective world and the response of that subject in that objective world is a behavior that is communication.

Although (Leont,ev, 1978) and (Bateson, 1072) were dealing with different context of studies: both were focusing on “changes” taking place in the process that is influenced by the objective world (environment, or what I see) as and intermediary processes that is somehow responsible for the changes in behaving, acting, learning, and doing something to achieve a goal. Leont’ev noted that human activity is “actively” (contextualism: actively doing something all the time) existing as action or as chains of actions.

This is our focus during the CONSTEPS: modeling the circular processes of the object-subject. We have adapted the notion of object-subject (discussed in Chapter 5) but merged it with our own definition. The next chapter will show how we had converted the conversations and how these existing theories that we have outlined in this chapter are related back to the CONSTEPS.

#### **4.14 Summary: the views from existing theories**

This chapter introduced three existing theories: (i) hierarchy of learning and communication (Bateson, 1972); (ii) situated cognition (Clancey, 1997a); and (iii) activity theory (1977), which became the fundamentals in our approach to understanding and analyzing communications. This chapter aimed at explaining the relationships between our choices of theories. Our proposal of relating the three chosen theories, mainly hierarchy of learning and communication by Bateson (1972) to situated cognition by Clancey (1997) and activity theory by Leont'ev (1977 & 1978) prepares us as the first step towards understanding how a person handles the “thrownness” situation (like illustrated in Chapter 1). Firstly, we focus on the hierarchy of learning and communication by (Bateson, 1972) for the understanding the “punctuation of events” in terms of changes in parts of communication (Dewey, 1925 & 1896). Our agenda is to understand how the hierarchy of learning and communication is changing from one level to the other by relating this to the work of (Dewey, 1925 & 1896), Bartlett (1995), Norman (1982), Edelman (1992) to memory (transformation) at neural level. This understanding of how level 0 is induced into level I and so on is being described in our work as looking into the “in between” processes. We call it in general as the transformations from object to subject in between the  $S \rightarrow R$ .

From here onwards, we seek to explain how the CONSTEPS is related back to our concern in the above (the transformations). In order to understand this, we look further into situated cognition because of the nature that thoughts and actions are dynamically situated and adapted to its situated context. In order to precisely understand what are the influences in how one person induces one level to the other (or in other words, “made a jump” from level 0 to I) we start by looking into the understanding of the notion “context” in remembering. From there, we further look into contextualism.

Activity theory provides us with the notion of object, subject and mediator (tool). In relating this to the CONSTEPS; we prescribe the notion of object and subject as focus at the moment, and the referential process of what the person is in active construction of learning and communicating to the object respectively (in respect to using the tool as a mediator for communicating). Instead of referring to the subject as the person speaking, we use the notion subject interchanging with object to demonstrate changes or transformations in the between process. This is discussed in great length in the next chapter: 5.

## Chapter 5

### CONSTEPS + Formulating the Activity States

#### A Participant Observers Approach

*“The faith in great work is the nearest to religion I have ever got and it supplies religious people get from superstition....Of course, there is a great work that is not science, great art, for instance, is perhaps greater still, but that is for the rarest and is scarcely in the reach of people like ourselves. Science I am certain comes next and that is well within our reach, at least I am sure within yours. It was just because I could never see that Martin had the real spark of art that his change of place was alarming”*

*Excerpted from Mary Catherine Bateson, “With daughter's Eye, a memoir of Margaret Mead and Gregory Bateson, page 200, Chapter XI, Participant Observers. An excerpted personal letter from William Bateson to Gregory Bateson after the public suicide of Martin Bateson.*

#### 5 Introduction

This chapter is divided into two parts: Part A is organized as follows. In Part I: (i) a formal introduction to Fipa-Acl syntax and semantics; (ii) an exposition of a dialogue, where each sentence is annotated; (iii) a brief introduction to *equational logic*; (iv) the application of *equational logic* for our models; (v) the demonstration of the functions that have been applied to the annotated sentences. Part II shows a demonstration of how the activity states framework is applied to the annotated sentences.

Part B is organized as follows: (i) a formal introduction to the *theory of activity*

*states* which is derived from the foundations of *situated cognition* (Clancey 1997), *activity theory* (Leont'ev 1977 & 1978), and *the logical theories of learning and communication* (Bateson 1972). This has been discussed in Chapter 4. and finally; (ii) The explanation of *how* the conversions have been formulated, focusing on the *mental processes* that in turn uses a modeling known as the *see-saw* that is based on (Bateson, 1979). Finally, the Chapter will conclude where we are heading with these analyses.

## 5.1 Some preliminaries on Fipa-Acl

Before we proceed with the CONSTEPS, we introduce the formal syntax. The complete semantics of Fipa-Acl (see Fipa-Acl Communicative Acts Specification, 2002) is provided in Appendixes A and B.

### 5.1.1 Syntax of the Fipa-Acl

The ACL syntax is:

```
(act
  :sender i
  :receiver j
  :content C )
```

The symbols are explained in Table 5.1.1.

Table 5.1.1: Notations of Acl syntax.

Symbol	Usage
act	To denote an action type. Example: act = INFORM-IF communicative act
sender	The sending agent of that message. <i>Agent i request agent j</i> to inform it whether Lannion is in Normandy. Here <i>agent i</i> is the <i>sender</i> .
receiver	The receiving agent of that message. <i>Agent i request agent j</i> to inform it whether Lannion is in Normandy. Here <i>agent j</i> is the <i>receiver</i> .
content	A tuple of actions, or a proposition. <i>Agent i request agent j</i> to inform it whether Lannion is in Normandy. Here <i>agent j</i> is the <i>receiver</i> . The request of agent <i>i</i> to inform it whether Lannion is in Normandy in this example is a

### 5.1.2 Formal Model of Fipa-Acl

In this section, we present an informal way, the model of communicative acts that underlies the semantics of the message language. We show this in Figure 5.1.2. In the formal model of the Fipa-Acl we have in abstract terms that Agent  $i$  has amongst its mental attitudes the following: 1) some goal or objective  $G$  and some intention  $I$ . Note that neither these statements entail a commitment on the design of Agent  $i$ :  $G$  and  $I$  could equivalently be encoded as explicit terms in the mental structures of the a BDI agent, or implicitly in the call stack and programming assumptions of a simple Java or database agent.

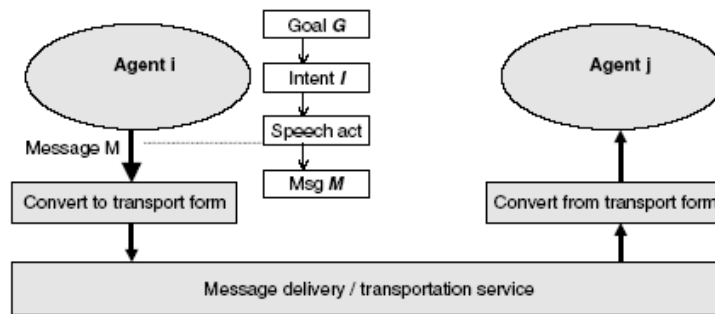


Figure 5.1.2: Message passing from two agents. Excerpted from (Fipa-acl, 2002).

Assuming that Agent  $i$  cannot carry out the intention by itself, the question then becomes which message or set of messages should be sent to another agent ( $j$  in Figure 5.1.2) to assist or cause intention  $I$  to be satisfied? If Agent  $i$  is behaving in some reasonable sense “rationally”, it will not send out a message whose effect will not satisfy the intention and hence achieve the goal. For example, if Harry wishes to have a barbecue ( $G$  = “have a barbecue”), and thus derives a goal to find out if the weather will be suitable ( $G'$  = “know if it is raining today”), and thus intends to find out the weather ( $I$  = “find out if it is raining”), he will be ill-advised to ask Sally “have you bought Acme stock today?” From Harry's perspective, whatever Sally says, it will not help him to determine whether it is raining today.

Continuing with the example, if Harry, acting more rationally, asks Sally “can you tell me if it is raining today?”, he has acted in a way he hopes will satisfy his intention and meet his goal (assuming that Harry thinks that Sally will know the answer). Harry can reason that the effect of asking Sally is that Sally would tell him, hence making the request fulfils his intention. Now, having asked the question, can Harry actually assume that, sooner or later, he will know whether it is raining? Harry can assume that Sally knows that he does not know, and that she knows that he is asking her to tell him. But, simply on the basis of having asked,

Harry cannot assume that Sally will act to tell him the weather: she is independent, and may, for example, be busy elsewhere. In summary: an agent plans, explicitly or implicitly (through the construction of its software) to meet its goals ultimately by communicating with other agents, that is, sending messages to them and receiving messages from them. The agent will select acts based on the relevance of the act's expected outcome or rational effect to its goals. However, it cannot assume that the rational effect will necessarily result from sending the messages.

Deciding to satisfy  $G$ , the agent adopts a specific intention  $I$  (Fipa-Acl, 2002). In Fipa-Acl, most of the “reasoning” is done by using a model logic approach to allow execution of messages. Assuming that Agent  $i$  cannot carry out the intention by itself, the issue then turns to “which message or set of messages” should be sent to another agent  $j$  to assist or cause intention  $I$  to be satisfied? To enable reasoning about the action, the universe discourse is involved, in addition objects and agents, sequences of events. A sequence may be formed with a single event. This event may be also the void event. The language involves terms (in particular a variable  $e$ ), ranging over the set of event sequences. The logical model uses a model logic (kripke structure KD45 possible-world-semantics) following Halpern (1985) with the fixed domain principle by Garson (1984).

An agent plans, explicitly or implicitly, to meet its goals ultimately by communicating with other agents, sending messages to them and receiving messages from them. The agent will then select acts based on the relevance of their expected outcome or rational effect to the agent's goals. However, the agent cannot assume that the rational effect will necessarily result from sending the messages. A rational effect is also referred as perlocutionary effect. For example, the agent  $i$  cannot predict of except that after sending message  $a$  to agent  $j$ , that agent  $i$  can have effects on the state of the addressee, and on agent  $j$  actions, beliefs or judgments. Agent  $i$  may not get to convince agent  $j$  to carry out agent's  $i$  intentions to achieve a certain goal on his behalf.

## 5.2 What is information in our work?

In , the authors wrote a detailed comparison between Van Foerster (Ref) and Bateson's (1979) description on information<sup>89</sup>. In this section, we shall relate Bateson's (1979) description on information and the notion of information from neuroscience (Dowling, 1993). To Bateson, he implicitly distinguishes information between information and description of information (Clancey, 1997a). The two basic properties of description (e.g., words, rules) - dimensionality and location – do not apply to information when it is viewed as an analytical term. Bateson treats form, meaning pattern, similarly because

---

<sup>89</sup>For a detailed account on this, readers are encouraged to refer to Clancey's (1997) specifically on Chapter 4 on sensorimotor maps versus encodings.



patterning is itself a relation with respect to some larger functional context (Clancey, 1997a). To say something is a pattern, such as a configuration of trees on a hillside or strokes made by a pen on paper, is to detect a difference, a frequency, a symmetry, a correspondence, or the like relative to some larger universe of items or events. This detection doesn't necessarily involve anything as complex as human conception and description (Bickhard, 1993). Through our analysis, when we use the notion "information" and user will encounter the term "coded information" is nothing similar at all to a Morse code (encoded information) in (Bickhard, 1993).

"The brain, like all organs of the body, is made of discrete cellular elements. But it is the *interaction* between the *nerve cells* that underlie much of the brain accomplishments, that allow organism to behave, learn things, remember things, abstract things, and creating things from mathematical theories to symphonies." (Dowling, 1992) p: 31.

According to Dowling, it is the interaction between the nerve cells that underlie much of the brain accomplishments. We are not going further into discussing nerve cells. We begin with conceptualization, and categorization to give the first layer insight of this underlying interaction between different parts of "maps" like in Edelman (1992) to the cognition process.

"Most nerve cell communicate with one another chemically, much like cells of the endocrine system. Neurons carry *information* by means of electrical signals, but cells in all tissues generate steady *potential differences* between *inside* and *out*." (Dowling, 1992) p.31.

Based on this, we refer to both Bateson's idea and Dowling (1992) idea on information, that anything that is "detected" of being focused at the moment creates a differences is information that is perceived and conceptualized at that the moment of a reading text. Relate this back to Chapter 4 in Section 4.6.2, on the transactional experience of Clancey (1997a) whereby Clancey (1997a) proposed that each messages that the author translated was *incrementally/indexically*. The indexing can be described as how we interpret a representation as a description, how we perceive its form and how we conceive its meaning. We are starting from the third stage that is how we conceive its meaning. This indexing depends on the ongoing activity of a person.

Throughout this approach in Chapter 5, we use an approach that tries to regulate the underlying of the speaking and typing activities to neuroscience.

"Biological regularities underlies all these activites. These regularities can and should be studied. But until, at some distant time, we have constructed conscious artifacts capable of speech,

biological methods are too clumsy to be used to make neural correlations with the meaning of the thoughts of a “pure thinker” during a process of reasoning. We can, however study the fundamental neural processes that underlie these acts, and we can do so without becoming property of dualists. But practically speaking, it would be foolish to use only biological methods in the name of scientific purity” (Edelman 1992), p. 176.

Edelman (1992) was referring that we must be practical by looking into different perspectives to study the fundamental neural processes that underlie these acts of thoughts, speaking, and intentions. Edelman was specifically suggesting on understanding what drives thinking, the higher products on consciousness, judgments and emotions.

We are not using the property of a dualist in our approach, even if it is a dual approach (that is unified). What we propose is to understand these acts of how intentions arise is to study the fundamental the process by using the participant observers approach (Mary Bateson, 1984). Hence, to understand how intentions arise, we must go back to Clancey (1997a) on how these constructions of intentions arises and by using a neural approach to analyzing conversations.

In this Chapter, readers will be exposed to different interrelating studies from neurobiology to mental diseases to support our assumptions and hypothesis. Let us begin with the annotated sentences which most it is an assumption that we make that might be taking place during the underlying acts of reading and typing.

### **5.3 Annotated sentences**

In Chapter 2 (Example), we have introduced that our approach to analyzing communications falls under the anthropological method- of using the participant observers and again we assert our approach is a very much participant approach or some might suggest is being a dual approach. In our view, the dual is a unified approach and we shall elaborate this in Section 5.3.1. We are constantly changing our roles between being an *observer* and being that is *observed*. Hence, we introduce a narrator to convey the two complementary impulses. In this stage, the role of the *observed* uses a situated cognition approach at the neural level of understanding the coordination of thoughts and actions. It is exactly through this method that we were able to recognize intentions in each utterances. Previously, we have introduced the general approach to the CONSTEPS. Next, we have briefly reviewed the concept of the *in-between* processes of *object* and *subject* (Chapter 2). Then, we introduced the syntax and the formal model of Fipa-Acl as our guidelines for converting into an agent message.

This section is arranged in this order:

1. Identifying information<sup>90</sup>.
2. Applying the notion of *object* and *subject*.
3. Use “*narrators (participant observers)*” to describe how the object and subject are applied in the sentences.

In order to convey our idea of using the two impulses of the participant observers, we introduce a “two-person” representation. This “two-person” representation are referred to as “Person 1” and “Person 2”. Our “two-person” involvement in annotating the sentences is the first step towards capturing the the underlying acts of the interchanging of the transformation of the object and subject notion which we introduced in Chapter 2 and Chapter 3 Example. It is relating then back to the act on conceptualizing of (Clancey, 1997a).

“Anthropological method is probably the most personal of the social sciences, for the circumstances of research are often such that it is impossible to divide space and time, shifting gears from a personal to an impersonal mode and working within a formally structured framework of attention.” (Mary Bateson, 1984).

This is demonstrated as how we want work both at a structured level, trying to fit in the articulation of thoughts of the cognition process at the neural level. The narrator of using “Person 1” and “Person 2” may seem unusual but it's our first insight into trying to articulate moment by moment how the speech is articulated by the speaker in accordance to doing activities. We are not separating the idea of thoughts and articulating speech by segmenting Part 1 and Part 2. This Part serves as correlation to both views: to provide a functionality of converting the conversations; and then to provide a primitive hypothesis/assumption of understanding how the CONSTEPS were performed.

In particular, Person 2 is used to specifically describe the in-between (at the neural level, of the connections and organization in the brain) mechanism of *object* to *subject*. In summary, Person 1 and Person 2 can be described as below:

- (i) Person 1- is the “observer”.
- (ii) Person 2- is the “observed” that can be represented as an abstraction of the speaker's inner process(s) during typing or speaking.

The “narrators” are used as a modeling of informing us being as the observer, what is *being observed* and the second speaker is used as the observed of articulating the *transformation* of the observers and *how it is formulated*.

“The process is an aesthetic one, one of listening or observing, of wandering for resonance between the inner and outer an echo that brings

---

<sup>90</sup> We use the word information here as reference to what we are actively conceiving at that moment (in the environment). So it, could be of anything that we conceive.

the attention into focus. Poets work this way as the curve of leaf evokes the poignancy of a past moment. Therapist work this way, moving back and forth between their own task of self-knowledge and the task of understanding a patient, knowing that without a double insights there would be no insights at all.” (Mary Bateson, 1984) p. 201.

The inner and outers are intertwined, that become one voice, unable to be separated. We are finding a balance and connecting this articulation by firstly attempting to relate it to situated cognition of (Clancey , 1997) and activity theory by Leont'ev (1977) and then relating this underlying mechanism by using functions at the cognition processes using Bateson's (1979) on mental process criterion (to be shown in Section 5.14).

However, not all the sentences are able to be processed with the detailed steps as we wish so. Sentences such as greetings (e.g., Bonjour), and chat jargon (e.g., heh, oh) are not shown in an object and subject notation (we aren't sure how to make a conception out of this). Also, we are not going to prescribe any specific communicative acts during this stage (e.g., some obvious sentences that are REQUESTS, we simply describe it as INFORM). This is because we would like to show how we arrived at describing the communicative acts. Specifically, we take a simple example presented in Figure 5.3 demonstrates recurrent (habitual) activities of collaborating members over the web communications. We highlight this particular conversations because of the general occurrence throughout the project progress; that the coordination of multi-tasking activities is very common scenario.

Table 5.3: Conversations excerpt between two collaborating members.

[1] <person-Q> bonjour; ca va?  
[2] <person-W> tout va bien, rédaction en cours d'un article pour ITS à poster lundi !  
[3] <person-Q> aha!  
[4] <person-Q > would you be interested in using a version of that 'map with faces' I showed in Barcelona?  
[5] <person-W> Indeed !  
[6] <person-Q> hang on... I should be able to 'push' it to the entire consortium here on BD...  
[7] <person-Q > just need 5 minutes...  
[8]<person-W> Please Q, could you explain to me how I can chat with somebody ALREADY registered in BuddySpace but not yet in EleGI?  
[9] <person-Q> ok gonna first publish map  
[10] <person-Q> sorry had phone call  
[11] <person-Q> just publishing now  
[12] <person-W> I am on the phone too, sorry  
[13] <person-Q> heh oh; I have just published the map  
[14] <person-Q> OK... go on the menu to Maps... Get published maps...

Refer to Table 5.4, person -Q and person-W refers to the collaborators, Marc and Philippe respectively. It does not refer to our narrators. They are chatting about an article that W has to submit to a conference soon, that includes partly the idea of the EleGI objectives.

### 5.3.1 Applying the narrator approach to analyzing sentences

Each sentences are analyzed using the participant observers approach. We explain for sentence label [1]. If readers refer again to Figure 2.4 (Chapter 2, Example) on the overview of the complete CONSTEPS process, the next illustration falls under step 1 (converting the real conversations into predicate form).

#### Analyzing sentence label [1]

In step (i), we treat each sentences by imagining that we are the observers. Here, our role is to observe the sentence (even the comma and the question mark) then switching to the observed. In order to parse what is being perceived (text, as information), we use the idea of how the object and subject is interrelated that gives rise to consciousness by Leont'ev (1978). We do not use the object and subject in the first step because we are unable to trace the object and subject notion. As an example, “bonjour, ca va” might not have any directional intentional states instead may be merely a social convention to greet someone. On

the other hand, it could be a directional intentional states, if we consider from this perspective. The social greeting may be assumed as reminder or a motivation to get the group members to become more integrated on the BuddySpace for the collaboration purpose.

Since we want to track moment by moment how the object arises that changes faces into becoming a subject that may turn into a goal, task, or a purpose. Our reasons for doing so is to understand from the moment a person starts to read the text from left to right and the focus at the moment and how the text gives rise to meanings during the passing of information in neurons and networks that is later related to cognition process. For those reasons, the information as we used and refer to is referring to each moment correspondingly to what might the person be reading at the moment (taking into account from left to right) in an indexing way. The information parts is relating to processes of how conceptualization and reconceptualization is occurring at an aggregation levels (shown in Section 5.17).

Leont'ev (1978) uses the concept to understand how consciousness arise when people are doing activities. Here, the activity is demonstrated being mediated by the web tools. The object is treated as the focus at the moment, the start (or will, or motivation, deliberation, inner intentions) to start typing the text (or conceptualizing in the mind of what we are about to articulate as speech).

→ Step (i)

Sentence [1]: <i>bonjour</i> ; <i>ca va</i> ?
-----------------------------------------------

- There are two kinds of information in this sentence, which we represent as two parts. The first part is information of greeting, “*bonjour*”. The second one is a information of inquiring the state of the speaker, “*ca va*?”. When in parsing this sentence, we are treating moment by moment of what us as the observer is actively observing as information.

→ Step (ii)

In this step, we are now looking into the relationship between the identifying information that we identified moment by moment. We move on now to the other step of translating it into predicate form that is shown in step (iii).

Part 1: <i>Bonjour</i> is a greeting
--------------------------------------

Part 2: <i>Ca va</i> is inquiring
-----------------------------------

→ Step (iii)

Formalize Part 1 and Part 2 (that have been identified in Step (i) and (ii) respectively using model (4.1).

$x(Q, W, \text{utterance}(\text{"bonjour"}))$   
 $x(Q, W, \text{utterance}(\text{"ca va"}))$

In this step, we shall not prescribe yet the communicative acts (or intentions) as previously stated. The *communicative acts* is denoted as  $x$  throughout the annotated sentences. As we go through, we shall relate how this  $x$  is eventually being related back to activities, situated cognition and learning and communication. In this analysis of sentence, we do not know how to prescribe the notion of object and subject. Since, the questions is involving a self-reflection of the state of being (or could be habitual response?), we leave out the steps object and subject.

## II. Analysis of sentence label [2]

### → Step (i)

Sentence [2] tout va bien ,rédaction en cours d'un article pour ITS à poster lundi

- There are four kinds of information in this sentence. Identify the parts. The first part is information of informing, “tout va bien”. The second part is the information of informing the current activity of the speaker, “rédaction en cours”. The third part of the information is informing in reference to what is the object of the activity “d'un article”. The fourth part of the information is informing in reference of what is the subjectivity of the object “pour ITS à poster lundi”.

### → Step (ii)

Part 1: <i>tout va bien</i> is informing to previous sentence [1]
Part 2: <i>rédaction en cours</i> is informing of the current activity of W to Q.
Part 3: <i>d'un article</i> is informing of what is the object of his activity.
Part 4: <i>pour ITS à poster lundi</i> is informing what is the subjectivity <sup>91</sup> of his activity.

### → Step (iii)

Use (4.1).

<sup>91</sup>A subjectivity may be consider as a goal or purpose of his activity.

x (W,Q, utterance (“tout va bien”))  
 x (W,Q, utterance (“rédaction en cours”))  
 x (W,Q, utterance (“d'un article”))  
 x (W,Q, utterance (“pour ITS a poster lundi”))

→ Step (iv)

- In this sentence, we are able to visualize and relate it to the neural level of how the intentions arise- moment by moment situated at the context. We the notion of *object* and *subject* (denoted by (1) and (2) respectively), is narrated respectively after by *Person 1* and *Person 2*, we identify it in each information parts. We shall explain parts by parts how we label the *Part 1* and so on with the label of *object* and *subject*.

Part 1: Tout va bien  
 (1) (2)

Previously discussed in Chapter 3 on activity theory (Leont'ev, 1977) that the very concept of activity implies the concept of the object of the activity. Hence, referring to Part 1, sentence 2 (of the above) When the moment arises, of the contact of the perception with what he is reading becomes now at the moment of focus is the object. When the speaker detects it's properties, it gives rise to a subject that involves as a product of the speakers detection of what is being reflected moment by moment when reading the text. As an example, in some text, when we do not understand let say the subject part, we always go back to the first sentence, (which we call the moment of focus) to get the focus back into what the sentence is about. A same kind of principle applies in this example. Now, we illustrate to for each the transformation between object-subject-object becomes some kind of a cyclic approach<sup>92</sup>, always actively being conceptualized by the speaker.

Part 2: *redaction en cours*  
 (1) (2)

Now, the subject turns to become a focus at the moment (becomes an object during Part 2) which is what is the current activity of the speaker

Part 3: *d'un article*  
 (1) → (2)

---

<sup>92</sup>We review again the center idea of activity theory, according to Leont'ev (1978), a mental reflection of the objective world (but here do not mislead with the object which we use the notion of focus at the moment) is not directly generated by external influences themselves. Assuming that it is not directly generated (give references) remembering again that according to Bateson (1972), the communication may either be an external stimulus/internal stimulus.



Let us enlighten ourselves again with the work by Leont'ev (1978) to give a better explanation of using the object, and subject notion. As previously discussed in Chapter 4, Section 4.9, we review again the essence of how we applied the notion of object and subject from activity theory in our analysis. All activity (speaking, typing) has a circular nature (as shown above (1) and (2)) forms a circular nature: initial afferentation → effector processes regulating contact with the objective environment → correction and enrichment by means of reverse connections of the original afferent images. In other words, a double transfer is realized: the transfer object → process of activity, and the transfer activity → its subjective product. The initial afferentation is carrying an inward to central organ to section, as nerves that conduct impulses from the periphery of the body to the brain of spinal cord (Dowling, 1992). From here onwards, it becomes a nerve fibre that is being process regulating contact with the objective environment. Let us see how the subject notion that we use has a transitivity properties.

Object is a subset of belonging to the objective world. The object at the moment is the focus at the moment “*d'un article*” that is a text that is being typed, has become realized from within the underlying articulation of neural level at our cognition process. Hence, when this notion is being realized on the text, becomes a subset of the objectified world. Then, this becomes a pattern, an information to the receiver or the other end of the speaker that reads this text at the moment.

Here, we witness a particular conceptualization ( refer to Clancey (1997a), p. 117 that a conceptualization via coupling is a form of recognition), like perceptual categorization, with the subjectivity that is now combined and arises in different cycle. The object or the moment of focus has now become a subject is the referential process hence has properties to it (what is an article and .what attributes this article has).

Part 4: *pour ITS*    *à poster lundi*  
(1)                      (2)

Herein, the participant observers approach is apparent in this step. It will be demonstrated below.

Part 1: (1) “tout” which “means all” is the object and (2) “va bien” which means “fine” is the subject.

- Person 1:

Sentence 2, Part 1 is an action of informing/responding that everything is fine.

- Person 2:

The speaker is perceiving his condition at that moment, of his state of being. The speaker conceives the question- moment of pause. Then it is the act of translating, associating and at that moment of conceiving the state of condition. It is then the articulation of the thoughts-coordinating with the environment (tools).

Part 2: (1) “redaction” which means drafting is the object and (2) “en cours” which means “at the moment” is the subject.

- Person 1:

The person is informing of his current activity at that moment.

- Person 2:

The current focus at that time is the conceiving of previous and at the moment activity. He is engaged in a dynamic task of the construction of drafting, at the same time alternately informing to the end listener. The person is perceiving his activity of and conceiving a “voluntary reflex” of information and associating it to the environment/context of the situation that he is currently situated in.

Part 3: (2) “d’un article” which means of an article is the subject.

- Person 1:

The person is informing that the precise activity at that moment is *being directed* in the article.

- Person 2:

The subject is a reference to the object described previously. The object of focus at the moment is the article which then becomes the subject of task (i.e., make concrete). The conceiving act of that person at that being moment, previous moment or at that “pause” moment, is pausing to refer to a previous moment of activity (i.e. according to Bartlett (1995), the importance of prior experience in determining how and what we perceive now became more salient than ever, they are

forming connections, conceptions). Now, from the previous Part 1 (i.e., arising together as a conception of what he is currently engaged in an activity), it is then associating to the context of that moment. It is conceiving of the object which then is conceived to a specific time and place i.e., from Bartlett (1995), p. 46, his experiments have shown that in perceiving data (in our case, text), presented have to be actively connected with something else before they can be assimilated. In remembering the task is made more specific. That with which the immediate stimuli of reactions have to be connected is more narrowly defined, (and must now be some *specific time*) that is the subject of the object (i.e., as we mentioned of the transitivity property from Leont'ev (1978), it is in a process of being objectified, bringing to a realization of consciousness, and now the subject that is a referential process arises from the person itself it a transitivity property hence has become a realization of an object into becoming a double life. Referring to Leont'ev (1978), this means that the “efferentator” that directs the processes of activity initially is the object itself and only secondarily image as a subjective product of activity that fixes, stabilizes, and carries itself its objective content<sup>93</sup>.

Part 4: (1) “pour ITS” which means for ITS is the object and (2) “a poster lundi” which means to send by Monday is the subject<sup>94</sup>.

- Person 1:

The speaker is informing who he is doing it to the other person Q and why he needs to do it now.

- Person 2:

The speaker is articulating the subject in reference to the object informed previously. The conceiving act of the person at that moment is what he would like to convey to the listener of his activity in correspondence to his thoughts, maybe we can relate this to Bartlett (1995) p. 213 that remembering is not the re-excitation of innumerable fixed, lifeless and fragmentary traces. It is an *imaginative reconstruction*, a construction, built out of relation of our attitude towards a whole active mass of organized past reactions or experience and to a little outstanding details which commonly appears in image or in language form. What sets out the characteristics is mainly interests, settings. We are considering the situations, interests

<sup>93</sup>This sounds similar to the idea of Dewey (1929) on the double life. See Chapter 4, Section 4.6 on where Dewey (1929), we recall “*Events* when once they are *named* lead an *independent* and *double life*..”

<sup>94</sup>We do not specify whether it is a goal or a task during this step to show how incrementally the underlying neural at work.

and the settings of the speaker of what he is actively engaged in during his the conceptualization of his activity to the hearer. This representation of formulating in the brain<sup>95</sup> is then translated<sup>96</sup>. We compare this this to Bartlett (1995), p. 87, where the authors found that the text written by the participants during the psychological experiments in remembering that an individual bias and interest most directly determine the transformation effected. A transformation here is considered as a type of rationalization in which individual interest and peculiarities come mostly clearly into place. First type of process which is witting tends to follow the lines of current belief (a language expression which have been built into several communicating habits of a community, hence there is existing a gap here that allows one to articulate what to speak or write that follows the line (or the language expression used)) into an action.

### III. Analysis of Sentence label [3]

#### → Step (i)

Sentence [3] Q: Aha!
----------------------

This is a stimulus reaction<sup>97</sup>. We denote a stimulus reaction as being a “reflective” or almost “habitual” response towards an external stimuli that engages the subject of a strenghtening in recalling the items of a group (Bateson, 1972; Bartlett, 1995).

#### → Step (ii)

Since it is a stimulus reaction, for analysis sentence 3, we use model 4.1 to encapsulate it as predicate form.

4.1(a) ReferringtoStimulus (Q,W, utterance (“aha”))

---

<sup>95</sup>There are two different ideas that can be used with this term “formulating” It could simply be an idea of conception. If we say that is this is an idea of conception, is it similarly to the idea of imagining in the mind? According to Bartlett (1995), there are two kinds of “act of remembering” the visualizer or the vocalizer. They could be both. This remains an open question. We assume that the formulating is involving process that could be directly responsible for the imagining or recalling a subject in mind (subconsciously).

<sup>96</sup>Refer to Chapter 2, section 2.5, we introduce the notion “translation”. It is the same notion applied here. As mentioned, we are not sure exactly what took place in between this transformation of the act of perceiving into conceiving of something. It seems like there is some serious gap (in the neural level).

<sup>97</sup>Actually, this analysis is incomplete because before the “Aha!” is being uttered, there is an expectation that is rolling into construction. This comments are contributed from Dr. Jeffrey Bradshaw, Senior Scientist at IHCM, University Of West Florida and we thank him for his detailed comment on this particular analysis.

We note here, that instead of annotating this predicate as  $x$  (e.g.,  $x$  (W,Q, utterance (“tout va bien”)) like the previous analysis of sentence 1 and 2, we specifically denote it as ReferringtoStimulus.

→ Step (iii)

Now, we note the difference between this step and the previous step. Let us recall back the conversations. The conversation started with Q simply greeting and asking W how is he doing. From there onwards, W was simply informing of what he was currently doing. However, during the occasion that W was simply informing his state of work, in particular about the goal he has to finished that caused a quick stimulus reaction from W. From here onwards, we denote this step as conceptualization of the sentence.

We label (4.1)a as a reply that may also be a stimulus reaction to what W had said.

There is no step (iv) here because we are unable yet to capture it into language. From here onwards, we do not go into details of every cognition processes that we assume might be taking place at the neural level for each sentences. Only significant sentence that we find supporting ideas to our assumption do we explain further.

#### IV. Analysis of sentence label [4]

→ Step (i)

Sentence [4] Q: would you be interested in using a version of that 'map with faces' I showed in Barcelona?

- There are three sets of information in this sentence. Divide it into three parts. The first part is information of proposing, “would you be interested in using”. The second part is referring to “a version “map with faces” in reference to the first part of information. The third part of information is informing in referring to the second part of the information “I showed in Barcelona?”

→ Step (ii)

Part 1: <i>Would you be interested in using</i> is a stimulus reaction to the previous sentence [2]
Part 2: <i>a version map</i> is giving information of part 1
Part 3: <i>I showed in Barcelona</i> is giving reference to the information of part 2

→ Step (iii)

Use (4.1):

x(Q,W, utterance (“would you be interested in using”))

x (Q,W, utterance (“a version map”))

x (Q,W, utterance (“I showed in Barcelona”))

→ Step (iv)

Part 1: Would you be interested in using  
(1) (2)

Part 2: a version map

(1)→(2)

Part 3: I showed in Barcelona  
(1) (2)

Part 1: (1) “would you be” is the object and (2) “interested in using” is the subject.

- Person 1:

The speaker is requesting if the listener would like to make use of something

- Person 2:

The moment at focus is formulating his intentions and also an internal stimulus<sup>98</sup> that is partly responsible in conceiving this intentions in articulating his desire in something, associating it. It is articulated in the subject part of “interested in using” that, which is referential to the

<sup>98</sup>Refer to Chapter 3, section 3.2 on internal and external stimulus.

object. Whereby the object of the focus is the version map (below in Part 2) which then becomes the subjectivity.

Part 2: (1) “a version map” is the object which is transferred into subject.

- Person 1:

The speaker is informing in reference to a document that is the object being the version map.

- Person 2:

The current focus at the moment of conceiving is the object version is transcending from objectivity to the subjectivity. It is transcended from the conversation which had been previously mentioned and becomes an object of focus.

Part 3: (1) “I showed” and (2) “in Barcelona”.

- Person 1:

The speaker is informing in reference to a previous of information in Part 2, and explaining where the reference was showed which is in Barcelona.

- Person 2:

The speaker is conceiving a process that is referencing to the memory . to past events. “in Barcelona” is the subject in reference to the exact place that the speaker is referencing to.

“I showed” is an articulation of the thoughts coupled to referencing to previous events, which is situated at that moment of where the event had taken place, of a particular location (Dowling, 1992). The speaker is specifying at that moment the event had taken place<sup>99</sup>.

---

<sup>99</sup>Bartlett (1995), pp. 234-235 suggested that from the experiments shown that in every situation presented for perception (in our context is reading the text) or for *recall certain dominant, or over-weighted, elements stand out from the rest*. The factors which *determine dominance* are all of the nature of active tendencies. If any situation, certain partial constitutes are dominant, these, together with their determining tendencies, are apt to set the meaning of that situation, of any parts of it. Our assumption based on this idea may be linked to the the factors of dominance (i.e., the map that is a part of the BuddySpace significant features) that commercial instant messaging (Yahoo Messenger, Hotmail Messenger, Skype Chat) does not have these feature.

In summary, the underlying mechanism is referencing and associating the context (which is some kind of recalling act and that involves the triggering of memory (stimulus) for the speaker. It is then retrieving active memory (the grouping of similar effected on the basis of some obvious and easily perceived likeness to form) of which is related to the previous event (situated at the previous moment of where the event had taken place at a particular place).

#### V. Analysis of sentence label [5]

##### → Step (i)

Sentence [5] W: Indeed!

- This is a stimulus reaction and a reply to the previous sentence [4] where W is agreeing.

##### → Step (ii)

Use (4.1)a:

x (W,Q, utterance (“indeed!")) (4.1)g

##### → Step (iii)

Conceptualize the context of the sentence:

We label (4.1)g as a stimulus reaction of agreeing to the previous sentence [4]

#### VI. Analysis of sentence label [6]

##### → Step (i)

Sentence [6] Q: hang on... I should be able to 'push' it to the entire consortium here on BD...

- There are three kinds of information in this sentence. Divide it into three parts. The first part of information is requesting “*hang on*” to W to wait. The second part of the information is informing of what Q capabilities “*I should be able to push it to*” of Q’s action. The third part



is informing in reference to the action “*the entire consortium here on BD*”.

→ Step (ii)

Part 1: “ <i>Hang on..</i> ” is acknowledging and informing to the previous context.
Part 2: “ <i>I should be able to 'push' it to</i> ” is a information of informing what Q is about to do.
Part 3: “ <i>the entire consortium here on BD</i> ” is a information referring to location of the execution of the action.

→ Step (iii)

Use (4.1) a.

x (Q,W, utterances (“hang on”))  
 x (Q,W, utterances (“I should be able to 'push' it”))  
 x (Q,W, utterances (“to the entire consortium here on BD”))

→ Step (iv)

Part 1: Hang on  
(1)

Part 2: I should be able to 'push it'  
(2)→ (1) (2)

Part 3: the entire consortium here on BD  
(1) (2)

Part 1: (1) “hang on” is the object

- Person 1:

The person is requesting the other person to wait for a while.

- Person 2:

The speaker’s at the moment focus is the object is “hang on”, is momentarily formulating another task in the brain (temporary retrieving some memory location) to switch to a different activity. The person is

articulating what *activity* he *is in* with respect to what he is conceiving<sup>100</sup>, and anticipating in what the activity that he would like to do in the near future. The speaker is now conceiving at that moment at where he is to do it (the location on the features on the BuddySpace) in respect to retrieving at the moment activity memory of shortest path<sup>101</sup> to execute the task (i.e., involves planning of what he is going to send the map to W, the task is defined here as being the involvement of planning this).

Part 2: (1) “I should be able” is the *object* and (2) “to push it” is the *subject*

- Person 1:

The speaker is informing and requesting that the listener should wait while the speaker performs the activity.

- Person 2:

The attention switches to formulating task to be carried out together with the conceiving of the intention in regards to his formulation to carry out

---

<sup>100</sup>The essence here is to attempt in understanding and show how the conceptualization is taking place at these aggregation of levels. We are always constantly conceptualizing and understanding the re-constructing of “maps” that consists of connected synapses. For example, in Dowling (1992), the modifications of synapses are believed to underlie the phenomena such as memory and learning. From here onwards, we try to relate to Edelman's (1992) pp. 84-85. Where Edelman (1992) whereby the author's illustration of the maps that is changing in strength (cell strengths) for us is indirectly related to the idea of (Bartlett, 1995) of “weakening and strengthening”. We have explained that all activities that we are engaged in are circular in nature, having an afferentor (like carrying an inward to central nervous system that conduct impulses from the periphery, through to the two main nervous systems) by Leont'ev (1977). Hence, we assume there is a complementary difference that is united bringing arise to how we conceptualize our activities.”how” we are conceiving our activity at that moment that becomes our present activity.

<sup>101</sup>We can only make an assumption of this by linking ideas together. Firstly, we refer to Edelman (1992) p. 84 and p. 103 in relationship to the notion of changes of strength by Bartlett (1995), p. 92 suggested that when the less we are re-encountering the situation, the lapse time causes us to forget. In the case of duplication of signs (sending or pushing certain items, uploading files through the BuddySpace), it is an evidence that the laws of “associative” co-excitation and the strengthening of early formed association (Bartlett, p. 116). Quoting from Bartlett (1995) p. 126, no doubt the net of the result of any process of serial construction, or reproduction is due to the *gradually accumulated effect of a number of slight alterations*, all of which follow along the *same line of change*. If this gradual changes of accumulate effect changes, according to Bartlett it becomes strengthening. Our curiosity is to explore from here if it becomes a stronger circuitry path (hence for our term as shortest path) by looking at the diagram of Edelman (1992) with observation on the movement of the re-entry path (see Chapter 4, Section 4.8). If only it would be possible to calculate if these re-entry path when having 'stimuli 1' and 'stimuli 2' becomes more composed and is being organized that seems to be a “shorter path” and “stronger path” hence may in turn becomes habitual. For example, when we are actively engaged in an activity that catches our “attention” (this was also discussed in Bartlett), we become familiar with that situation and is very fast in our action to knowing where to go to, in order to realize our task. Here, we assume that since Q is very “adapted” that his actions resemble to us almost habitual on the BuddySpace instant messaging for collaboration purposes (after all he is the project leader of the feature, he does things very quickly - through our observation) involves dealing with solving problems that is concerning the important parts (items belonging to the group of his “class” of activity) that becomes a response.

other task. (of how to carry it) of formulating how he is to come about it. He is now articulating his thoughts of formulating the activity in respect to the intended activity. The speaker's at the moment focus is the object "I should be able". The speaker is again conceiving of what he is about to carry on in his activity, at the same time articulating , and pausing to inform the other person of his intention to do so.

Part 3: (1) "the entire consortium" is the object and (2) is "here on the BD" is the subject.

- Person 1:

The speaker is informing in reference to a particular place.

- Person 2:

The speaker's at the moment focus is referencing the object to Part 2, and that the subject "on the BD" is the location of the reference of the object. The person is articulating his thoughts in reference of where his activity is to be carried out . He is now in an active mode of pursuing his goal.

## VII. Analysis of sentence label [7]

→ Step (i)

Sentence [7] Q:just need 5 minutes
------------------------------------

There are two sets of information here. The first part is where requesting W "just need". The second part of the information is informing "5 minutes"

→ Step (ii)

Part 1: Just need is requesting
---------------------------------

Part 2: 5 minutes is informing in reference to the request
------------------------------------------------------------

→ Step (iii)

Use (4.1)a.

x (Q,W, utterance (“just need”))  
x (Q,W, utterance (“5 minutes”))

→ Step (iv)

Part 1: just need  
(1)

Part 2: 5 minutes  
(2)

Part 1: (1) “just need” is the object.

- Person 1:

The speaker is informing and requesting that he needs some time in order to execute the activity that he has in mind.

- Person 2:

The object “just need” is referential to the previous sentence [6]. It is an active conceiving, of requesting, and then articulating the intentions at same time of executing the task at hand, of coordinating the thoughts to convey the status of the person.

Part 2: (2) 5 minutes is the subject.

- Person 1:

In reference to Part 1 of the object.

- Person 2:

The coordination is now referred as a counter for informing the calculated time for task.

### VIII. Analysis of sentence label [8]

→ Step (i)

Sentence [8]: Please Q, could you explain to me how I can chat with somebody ALREADY registered in BD but not yet in E?
-------------------------------------------------------------------------------------------------------------------------

- There are 5 parts of information in this sentence. The first part is requesting again “*Please Q*”. The second part is the information of giving information of the request, “*could you explain to me*”. The third part of the information is referring to the second part of the information, “*how I can chat with somebody*”. The fourth part of the information is referring to the third part of the information, “*ALREADY registered in BD*”. The fifth part of the information is explaining to the fourth part of the information, “*but not yet in E?*”

→ Step (ii)

Part 1: <i>Please Q</i> is requesting
Part 2: <i>Could you explain to me</i> is inquiring
Part 3: <i>how can I chat with somebody</i> is informing of the request
Part 4: <i>ALREADY registered in BD</i> is giving information to the request
Part 5: <i>but not yet in E</i> is explaining to the request

→ Step (iii)

Use model (4.1)a.

x (W,Q, utterance (“please Q”))  
 x (W,Q, utterance (“could you explain to me”))  
 x (W,Q, utterance (“how can I chat with somebody”))  
 x (W,Q, utterance (“already registered in BD”))  
 x (W,Q, utterance (“but not yet in E”))

→ Step (iv)

Part 1: Please Q  
(1)

Part 2: can you      explain to me  
(1)                  (2)

Part 3: how can I      chat with somebody

(1) (2)

Part 4: already registered in BD  
(1) (2)

Part 5: but not yet in E  
(1) (2) (1)

Part 1: (1) “please Q” is the object

- Person 1:

The speaker is asking for a favor.

- Person 2:

The object of that moment for Q is focusing on a certain subject about to articulate into *active memory*<sup>102</sup>.

Part 2: (1) “can you” is the object and (2) “explain to me” is the subject

- Person 1:

Speaker is requesting that the listener do an act for the speaker.

- Person 2:

Formulating internal stimulus of an intentional act in respect to conceiving the current moment he is in that situated context, and then articulating it.

The object of the speaker is to request of something “can you” from the listener, and that the subjectivity of that request is to “explain to me”.

The speaker is articulating at that moment of his intention. He is reconstructing his subjectivity: of asking the user of what he wants as a

---

<sup>102</sup> When we refer to this term as active memory, we are supposing at that point of articulating what one is about so say, there are clustered neuronal maps at that focus moment of locating what one is saying, is the act of conceiving in relationship to an active memory.

favor. It is articulated in response to what the intentions of the speaker has at that moment, in relation to a certain particular subject.

Part 3: (1) “how can I” is the object and (2) “chat with somebody” is the subject.

- Person 1:

The speaker is now specifying his request of the exact activity he would like to be engaged in.

- Person 2:

The speaker is associating his intentions, conceiving, and formulating it in reference to a particular subject of the objectified task. The person is articulating in respect to what the subjectivity of what is previously thought, to the current introspection of the focus of the moment, referential to Part 2. The speaker is conceiving what he wants to achieve, an activity in the near future that the person wishes to do.

In summary, the object of “how can I” is the desire or wish of the person to convey to the other of the very subject of the wish/desire is to “chat with somebody”. The inter-relationship of object and subject inter-changing is a chain of thoughts.

Part 4: (1) “already registered” is the object and (2) “in BD” is the subject.

- Person 1:

The speaker is informing of the concern of the current attention that is directed to explain what is a priori of information that is involved in this request.

- Person 2:

Now, referring “the reasons” for formulating that intention is in retrieving memory (active) from a certain co-related cluster. The speaker is articulating in respect to his active memory of what he is remembering of the information in respect to what he is about to articulate his thoughts of the concern of the activity that he would like to do.

Part 5: (1) “but” is the object (2) “not yet” is the subject and (1) “in E” is the object.

- Person 1:

The speaker is then explaining in referential to Part 4 on the reason for asking the listener to explain of his request.

- Person 2:

The speaker’s current focus at that moment of retrieving of what is to be said next, and then re-adapting to that next moment of stating why the request was made in the first place. The statement of the person is articulated to a point of reference, coupled to a certain location being “in E” that is objectified during formulating of its subjectivity.

#### IX. Analysis of sentence label [9]

##### → Step (i)

Sentence [9] Q: ok gonna first publish map
--------------------------------------------

- There are two sets of information in this sentence. The first one is acknowledging. The second information is informing of what the speaker will do at the current time.

##### → Step (ii)

Part 1: <i>Ok gonna first</i> is informing to W of what Q is about to do
Part 2: <i>publish map</i> informing of the state of the activity of what Q going to do as action

Here, the Q goes into a PAUSE mode and suspends the activity where Q go to another activity to publish map.

##### → Step (iii)

Use model (4.1)a



x (W,Q, utterance (“ok gonna”))  
x (W,Q, utterance (“publish map”))

→ Step (iv)

Part 1: ok            gonna first  
          (1)            (2) → (1)

Part 2: publish map  
          (2)

Part 1: (1) “ok” is the object and (2) “gonna first” is the subject where is later transform into becoming an object.

- Person 1:

Speaker is acknowledging the listener and informing of what his intentions are at that moment.

- Person 2:

The person current focus is in articulating what he is about to do, and articulating it in references to what his intentions are of carrying it out in the next coming moment. And that the subjectivity of what the person is going to do, becomes an object for that person in doing which is being conveyed in sentence [8]. It is in reference to the association event that he had carried out in sentence [7].

Part 2: (2) “publish map” is the subject.

- Person 1:

In reference to Part 1, of the subject of the object.

- Person 2:

The speaker’s current focus is in articulating of the subjectivity of the object conveyed in the previous part 1. He is conceiving the activity of what he is about to do, which becomes an object for now. Then

associating to another sub-part that has been formulated in a located “clustered active memory”.

X. Analysis of sentence label [10]

→ Step (i)

Sentence [10] Q: sorry had phone call
---------------------------------------

- There are two parts of information in this sentence. The first part is “Sorry” which is apologizing. The second part is explaining why speaker is apologizing, “had a phone call”.

→ Step (ii)

Part 1: “sorry” is apologizing
--------------------------------

Part 1 : “had a phone call” is explaining why Q is apologizing
----------------------------------------------------------------

→ Step (iii)

Use model (4.1)a.

x (Q,W, utterance (“sorry”))  
x (Q,W, utterance (“had a phone call”))

→ Step (iv)

Part 1: sorry  
(1)

Part 2: had a phone call  
(2) → (1) (2)

Part 1: (1) “sorry” is the object

- Person 1:

The speaker is apologizing.

Part 2: (2) "had a" is the subject which then becomes (1) the object which and (2) "phone call" is the subject.

- Person 1:

The speaker informs of what the person had been engaged at.

- Person 2:

The current focus at the moment is actively retrieving of the previous activity that the person was engaged. It is actively remembering from the active memory and articulating what the subjectivity was at that moment. And associating to the current task that it has in the foreground, where now the other task is in the background.

#### XI. Analysis of sentence label [11]

→ Step (i)

Sentence [11] Q : just publishing now

- There are two information in this sentence. It is informing of what Q is doing at the moment "just" and that the act is "publishing now".<sup>103</sup>

→ Step (ii)

Part 1: "just" is informing to W of "what" at that moment.

Part 2: "publishing now" is informing of what exactly Q is doing as action.

→ Step (iii)

Apply (4.1)a:

$x(Q, W, \text{utterance}(\text{"just"}))$   
 $x(Q, W, \text{utterance}(\text{"publishing now"}))$

→ Step (iv)

Part 1: just

<sup>103</sup>It is quite hard to express this particular sentence in language. Hence, a more detailed explanation is expressed through formulas, in section 4.13.

(1)

Part 2: publishing now  
(2) → (1) (2)

Part 1: (1) “just” is the object.

- Person 1:

Speaker is informing actively of what he is doing.

- Person 2:

The current focus at the moment is at executing a task, and articulating for conveying it to the other person. It is a multi-tasking of doing thing: coordinating mechanism; of typing and doing another task that involves the conceiving of two subjectivity at one moment (at least) alternately. Focusing actively retrieving that “active part in memory” associating to previous task to current activity.

Part 2: (2) “publishing now” is the subject.

- Person 1:

Speaker is referencing to what he is currently doing.

- Person 2:

Formulating and conceiving two different parts and element in the situated context and articulating it.

## XII. Analysis of sentence label [12]

→ Step (i)

Sentence [11] W: I am on the phone too, sorry
-----------------------------------------------

- There are three parts of information in this sentence. The first part is where W is informing of about W “*I am on the phone too*”. The second part is referring to what W is doing “on the phone too”. The third part is apologizing, “*sorry*”.

→ Step (ii)

Part 1: “I am on the phone too” is informing and replying to Q of what W’s current activity.
Part 2: “sorry” is apologizing in reference to the explanation given before.

→ Step (iii)

Use model 4.1 (a).

x (W,Q, utterance (“I am on the phone too”))  
 x (W,Q, utterance (“sorry”))

→ Step (iv)

Part 1: I am on    the phone too  
 (1)            (2)

Part 2: sorry  
 (1)→(2)

Part 1: (1) “I am on” is the object and (2) “the phone too” is the subject.

- Person 1:

The speaker inform in reference to previous messages that the person is also engaged in a similar activity.

- Person 2:

The person is articulating in retrospective to what the he is doing. The focus at the moment is to convey what the other person had been actively conceiving, translating and doing to the other end person. The speaker is conceiving his state in that orbit of environment and then associating his state to the senders state (like a shared context) by relating where the

object is the conceiving of the person in respect to the subject of what he is situated in<sup>104</sup>.

Part 2: (2) sorry is the object which then becomes the subject.

- Person 1:

Apologizing.

- Person 2:

Then associating to the sentence (11) and previous sentences because did not respond earlier.

### XIII. Analysis of sentence label [13]

→ Step (i)

Sentence [12] Q: heh oh; I have just published the map

- There are two parts of information in this sentence. The first part “*heh oh*” is acknowledging to what W had said previously. The second part is informing of what Q is doing “*I have just published the map*”.

→ Step (ii)

Part 1: *Heh oh* is acknowledging

Part 2: *I have just published the map* is informing in reference of Q’s current activity.

---

<sup>104</sup>“The difference might also be revealed by the kinds of abnormalities of memory that can occur or in the disruption of memory by other activity or accidental trauma. There are other differences as well. Viewing memory as an activation suggests that the capacity of primary memory is related to the problem of discriminating activated items from those that are not activated. Does activation decay with time? Does each activated item requires some sort of reactivation process to be kept alive? Does the activation level decrease as more items become activated?(Norman, 1982) p. 23. Here, we are relating the idea by Norman in (1992) to how a person is using either a more activated neuronal map groups than the other. For example, there is a certain particular “item” that catches the attention of person W and in fact he is discriminating two sorts of situated context, one being on the phone and one chatting to a friend, that causes a difference. Somehow, person W activation may be assumed to decrease as more items become activated (phone ringing again, someone coming in through the door, and etc.)

→ Step (iii)

Use model (4.1)a.

x (Q,W, utterance (“heh oh”))  
x (Q,W, utterance (“I have just published the map”))

→ Step (iv)

Part 1: heh ok  
(1)

Part 2: I have just      published the maps  
(1)                              (2)

Part 1: (1) “heh ok” is the object.

- Person 1:

The speaker is acknowledging to the previous sentence [12].

- Person 2:

The person is comprehending of the previous sentence [12] and associating to his current and previous state of activity. Then he is associating moment of the activity subject/task formulating.

Part 2: (1) “I have just” is the object and (2) “published the maps” is the subject.

- Person 1:

The speaker is informing of the current activity that he is doing at the moment to the listener.

- Person 2:

He is conceiving, its subjectivity of the objects that it has been executed. He is (retrieving) memory then intentionally formulating it in respect to the task in the background that have been completed.

The current focus at the moment is to inform of the state of what had been conceived and had been achieved through out the subjectivity of the interaction between the speaker and the listener.

#### XIV. Analysis of sentence label [14]

→ Step (i)

Sentence [13] Q: OK... go on the menu to Maps... Get published maps...
------------------------------------------------------------------------

- There are three parts of information. The first is acknowledging “ok”.The second part is informing “go on the menu to the maps”. The third part is “Get published maps” informing in reference of the label.

→ Step (ii)

Part 1: <i>Ok</i> is acknowledging
Part 2: <i>Go on the menu maps</i> is informing of what W should do
Part 3: <i>get published maps</i> is referring to the label of the information in reference

→ Step (iii)

Use model 4.1(a).

$x(Q,W, \text{utterance ("ok")})$   
 $x(Q,W, \text{utterance ("go on the menu to Maps")})$   
 $x(Q,W, \text{utterance ("get Published Maps")})$

→ Step (iv)

Part 1: Ok  
(1)



Part 2: Go on the menu to Maps  
(1) (2) →(1) (2)

Part 3: get published maps  
(1) (2)

Part 1: (1) “ok” is the object

- Person 1:

The speaker is acknowledging the activity.

Part 2: (1) “Go on” is the object and (2) “the menu” is the subject which then becomes the object for (2) “to maps” which is the subject

- Person 1:

The object “go on” is a request for the person to carry out an activity or a task over on “the menu”.

- Person 2:

The current focus at the moment is to achieve a goal, therefore it is articulated actively, conceiving of what had been achieved previously by the speaker, and then translating of what it had been carried out on the web communications and actively conceptualizing of how the others “will perceive: on the user interface.

Now it is in “active memory” space: retrieving the command and associating it to the conceiving process of the user interface with respect to the coordinated task of subject.

Part 3: (1) “get” is the object and (2) “published map” is the subject.

- Person 1:

The speaker is referencing the information to request on what the listener should carry out during his activity.

- Person 2:

Then it is now an object to request specifically location and execution of what (referential) to a subject.

The current focus at the moment is to articulate step by step on the instructions of what the speaker is currently engaged in, conceiving it actively, in respect to what the listener might be perceiving at that moment to carry out the activity more or less the same as how the speaker had been normally carrying out.

It also involves, that the focus at the moment, is conceiving of what it had been carried out and what he would like others to carry out, and translating and articulating this actively in its' memory.

#### **5.4 Summary of the annotated sentences.**

In the previous section, we have followed these steps in most sentences.

1. Distinguished parts of information.
2. Applied the notion of object and subject in each identified parts of information.
3. Used the Person 1 and Person 2 as participant observers approach to explain the object and subject processes.
4. Produced the information parts into predicates.

We have briefly explained our approach to analyzing the communication introduced in Chapter 2 , Figure 2.5.1 (a). Stage 0 is the natural language conversations, stage 1 is what we “readily see” when reading that is becoming the observer. Stage 2 was explicitly explained that is to understand what perhaps had taken place during reading, by moving into another impulse as the observed. Stage 3 involves how the process of reading and comprehending is conceptualized that is represented in Section 5.17.

There is no clear line between objectivity and subjectivity (between the moment of focus that gives arise to intentions or deliberation or motivations of working) But the senses of working, in coordinating thoughts and actions, but looking into the study of situated cognition allows us to show how the subject (or subjectivity) arises from object. Observation does not preclude involvement.

In the remaining section, we introduce some formal concept of *equational logic* and our own *multi-model* concept.

## 5.5 Equational Logic

Equational logic was developed over the years (beginning in the early 1980's) by researchers in the formal development of algorithms, who felt a need for an effective style of manipulation and calculation (Gries, 2002). People involved include Roland Backhouse, Edsger W. Dijkstra, Wim H.J Feijen, David Gries, Carel S.Scholten and Netty van Gasteren. It is a formalization of the deductive methods encountered in studying the set of equations that can be derived from a given set of equations (Rams, 2001). The equational logic is naturally associated with abstract algebraic structures. The equations involved are interpreted as being true for all variables involved, and so are best thought as identities. In complexity, equational logic sits somewhere between propositional and first-order logic (Rams, 2001). Equational logic is often referred to as universal algebra because of its natural association with abstract algebraic structures.

The emphasis in proofs is on *substitution of equals for equals*<sup>105</sup>, instead of modus ponens. Equality, or equivalence, assumes an important role instead of being a “bit player” as in most propositional logics. The terms of equational logic are built up from *variables* and *constants* using function symbols (or operations). Identities (equalities) of the form

$$s = t$$

where  $s$ , and  $t$  are terms, constitute the *formal language* of equational logic. (M-world, 2005)

The syllogisms of equational logic that is listed below covering from 1 to 5 forms an equational system are summarized below:

1. Reflexivity:

$$\frac{}{s = s}$$

2. Symmetry:

$$\frac{s = t}{t = s}$$

3. Transitivity

$$\frac{s = t, t = v}{s = v}$$

4. For  $f$  function symbol and  $n \geq 0$ ,

---

<sup>105</sup>The CONSTEPS involved substitution from one function and/or functor to the other function and/or functors. This “natural way of doing” corresponds closely to equational logic systems because again we remind readers that we need to substitute “parts of language” to another type of “parts of language”.

$$\frac{s_1 = t_1, \dots, s_n = t_n}{f(s_1, \dots, s_n) = f(t_1, \dots, t_n)}$$

5. For  $\theta$  a substitution (cf. unification)

$$\frac{s_1 = t_1}{s \theta = t \theta}$$

We do not use all the syllogisms for our modeling. We use only 1 until 3 as our syllogisms as a formal figures of inference.

In the above equational system, the rules state that if the formula above the line is a theorem deduced from axioms by application of the syllogisms, then the formula below the line is also a formal theorem. Usually, some finite set  $E$  of identities is given as *axiom schemata*. Equational logic can be combined with *first-order logic*. In this case, the fourth rule is extended onto predicate symbols as well, and the fifth rule is omitted. These syllogisms can be turned into axiom schemata having the form of *implications* to which *modus ponens* can be applied.

If every identity in  $E$  is viewed as two re-write rules transforming the left-hand side into the right-hand side and vice versa, then the respective term rewriting system is equivalent to the equational logic defined by  $E$ , the identity  $s = t$  is *deducible* in the equational logic iff  $s \leftrightarrow^t t$  in the term rewriting system. This property is called *logicality of term rewriting systems*.

Equational logic is complete, since if algebra  $A$  is a model for  $E$ , (i.e., all identities from  $E$  hold in algebra  $A$  (cf. universal algebra,)) then  $s = t$  holds in  $A$  iff it can be deduced in equational logic defined by  $E$ .

### 5.5.1 Formal definitions

We introduce some of the formal definitions in equational logic. We have a language  $L$  of algebras (or algebraic structures) that consists of:

- i. a set of  $F$  function symbols  $f, g, h, \dots$
- ii. a set of  $C$  constant symbols  $c, d, e, \dots$
- iii. a set  $X$  variables  $x, y, z, \dots$

Each function symbol has an **arity** to indicate how many arguments it takes. If the symbol takes  $n$  arguments we say it is  $n$ -**ary**. As example, we have the language  $L_{BA}$  that has:

$$F = \{\vee, \wedge, '\} \quad C = \{0, 1\}$$

$\vee$  and  $\wedge$  are binary function symbols,  $'$  is a unary function symbol. The constants are zero and one (i.e.  $\{0,1\}$ ).

The meaning of the symbols; given a set  $A$ :

- i. Function symbols are interpreted as functions on the set.
- ii. Constant symbols are interpreted as elements of the set.
- iii. A function  $f$  that maps  $n$ -tuples of elements of  $A$  to  $A$  is called an  $n$ -ary function on  $A$ .  $f: A^n \rightarrow A$  is written to say  $f$  is  $n$ -ary on  $A$ .

### 5.5.2 Three Basic Properties of Equations

( $\approx$  behaves like equivalence relation)

- i.  $A \vdash s \approx s$
- ii.  $A \vdash s \approx t$  implies  $A \vdash t \approx s$
- iii.  $A \vdash s_1 \approx s_2$  and  $A \vdash s_2 \approx s_3$   
implies  $A \vdash s_1 \approx s_3$

### 5.5.3 Interpretations

An interpretation  $I$  of the language  $L$  on a nonempty set  $A$  assigns to each symbol from  $L$  a function or constant as follows:

- i.  $I(c)$  is an element of  $A$  for each constant symbol  $c$  in  $C$ .
- ii.  $I(f)$  is an  $n$ -ary function on  $A$  for each  $n$ -ary function symbol  $f$  in  $F$ .

An  $L$ -algebra (or  $L$ -structure)  $A$  is a pair  $(A,I)$  where  $I$  is an interpretation of  $L$  on  $A$ . Given an algebra  $A$ :

- i. the interpretation of the constant symbols are called constant of the algebra.
- ii. the interpretations of the function symbols are called the fundamental operations of the algebra.

## 5.6 First step towards applying equational logic in the natural language conversations

In the previous section, we have briefly introduced the concept of equational logic. We only touched on some important characteristics of equational logic. Our main focus is not on logics, but rather on how we can design a model that can correctly convert the minimum meaning of natural language conversation into

agent messages<sup>106</sup>. The arguments for using equational logic instead of other logical method in our work is outline below.

- It was already naturally performed by us.
- In programming, we want to compute functions and equational logic is a formal system to express things with functions.
- It is an expressive logic
- It is a simple logic
- It is sufficient for all computations.

We will explain why equational logic is expressive.

- The quantifiers can be eliminated in first order logic by Skolemization (Mathworld, 2005) that is to say by replacing quantifiers with new symbols for functions.
- Remain quantifier free expressions with Boolean operators, relations and functions.
- Relations are nothing else than particular functions, namely those that take values “true” and “false”.
- Boolean operators are also particular functions, they are defined for Booleans and return Booleans.

Hence, in equational logic, we are left with functions and equalities, and that is exactly what equational logic can handle. Hence, it's a simple logice. The point that equational logic is sufficient for all computations has been proved by a great logician, Yuri Gurevich (Gurevich, 1999). He formulated Abstract State Machines with equational logic. These ASM (Gurevich, 1999 & 2000) can perform computation computable for example the program the running of an elevator, of a cash distributor, compute a polynomial, and recursive functions. The equational logic is also easy to check that they do what they are suppose to do. They come with a natural verification system (Hölldobler, 2004).

Having said the above arguments as using an equational logic approach in CONSTEPS, it is nonetheless just a vehicle for us, not a subject for us. There is also one major reason that our model is not rigidly formalized: when the logic is more formal, the model is not able to accept a variety of sentences having a more or less the same meaning. It is also quite unlikely to actually formalize conversations that can cover a wide range of contexts. On the other hand, it is possible to apply a strict formalization, when the context of communication is strictly well-defined (e.g., one to one about purchasing a menu online). Thus, in the end we opted that this modeling be functional, in the sense that it can be validated to a certain degree by performing simple composition (e.g. functions and functors); yet it allows a certain sense of “heuristic” manipulation.

---

<sup>106</sup>We cannot claim that our CONSTEPS is exactly bringing two languages to an exact meaning (between the actual natural language conversations and agent communication language) hence we use the notion as “minimum meaning” that we expect at least if the CONSTEPS will open a possibility for an open integration between a human agent and artificial agent, where they shall understand the “meaning” among them.

The sub-sections are organized as the following: (i) abstracting some formal models from the annotated sentences; which corresponds to (ii) the demonstration of applying equational logic on those formal models and annotated sentences; (iii) an explanation of each transformation from one level predicate to another level predicate.

### 5.6.1 Abstracting some models from the annotated sentences

We have left the predicates (in section 4.3) at the simplest form: the first level predicate. Now, we need to extract some common properties in those first level predicates (in other words, from the *utterances*). We use the work of Al-Farabi (Fakhry, 2002) on the labeling of the *type* of *terms* in *sentences*. This is a crucial step to further discriminate a sentence (utterances) into a specified model predicate (predicate level 2, 3 or even 4). Al-Farabi, a logician and a philosopher provided a methodical analysis of a series of technical terms used by logicians, including deduction, prior, noun, verb, article and “to be” in his book *Kitab Al-Huruf*<sup>107</sup> (Fakhry, 2002). He borrowed grammarians' terms which to him were relevant to the study of logic. His aim was to relate both analysis from the grammatical perspective and the logical perspective into understanding contexts of different informations; (i) the scientific; (ii) the dialectical; (iii) the sophistical and the rhetorical. The grammarian terms include pronouns, definite article, copula, and negative and positive particles. He argued since the aim of logician is to determine the existence of quantity, time and quality of a given entity or action, they will need to borrow from the grammarians the appropriate terms. Terms such as: (i) “what” is used to determine the existence of the object; (ii) “how” is used to determine the modality; (iii) “which “ is used to determine the type of the thing<sup>108</sup>.

Al-Farabi also discusses the different degrees of the meaning (word) “what” is used. For example, “what” is also used to determine the reason why it is what it is. Then we can go on asking what's its cause, as when we ask why it exists. “What” can be a form of asking of its definition, as when we ask “what” which is also one of the causes of the existent (i.e. formal cause). If we use the “what” in another context, like the question “by what” refers to its efficient cause. This is what Al-Farabi means by that the “what” is a kind of a universal existence that have different degrees of meaning. This is almost the same kind of distinctions that Winograd et al (1986) suggested in the example of the snow. Only in the context work of Al-Farabi, he abstracted the levels of meaning. In other example,

---

<sup>107</sup> *Kitab Al-Huruf* discusses in depth the analysis of logical terms to identify existence, meaning and interpretations. Refer to Al-Farabi work re-written in (1969).

<sup>108</sup>The most related work we can find that carry such analysis is by Turchin (1977), however we noted a very wide difference in the natural language analysis is that the author focused very much on concepts, continuing with an Aristotelian Logic. Al Farabi (Fakhry, 2002) also referred to Aristotelian Logic but instead Al Farabi abstracted into different hierarchy of levels (like those of Bateson (1972)), for explaining the existence of being which was the fundamental inspiration in his book *Kitab Al-Huruf*. However, we cannot say for certain that this kind of analysis has never been carried out before by other researchers in the domain of computational linguistic or philosophy.

Al-Farabi also discusses words such as how that could be to inquire whether the existence of the object is ascertained.

Other terms discussed, are interrogatory terms, which include “who”, “whether”, “why”, “how”, “how much”, “where” and “when”. The terms “when”, “where”, “how” and “how much” belong to the class of the well-known categories of place, time, quality and quantity.

The aim of a grammarian is to determine the *relation of terms*, according to the *rules of composition*<sup>109</sup>, whereas the aim of a logician is to determine the *relation of concepts* according to the *rules of prediction*. Inspired by this philosophical ideas of Al-Farabi, that we have related both the grammarian terms and logical analysis to correctly place the sentences in predicate forms. For example, readers refer again to section 4.3 on object and subject. Recall that our notion differs a great deal from the notion used commonly in computational linguistic (that have been discussed in Chapter 2, Section 2.5.1).

The object refers to an act of perceiving which in some ways refer to “what” is being perceived (e.g., “The “what” I am perceiving is the car turning on the left). On the other hand, the subject (e.g., the construction of me perceiving “this what” that it is turning to the left becomes a realization that is it turning to the left) refers to a referential process which can be abstracted in these terms; being “what” is the “what” of that “what” (e.g., the car (being the what) is turning to (is that what of) left (of the what which is the car). Notice, that this is a kind of circular notion just like Leont'ev suggested which we can be abstracted further.

Hence, following this logically, would be arising from the subject if we use Leont'ev (1977) notion of the subject (the person), we then begin to ask this question, the “what” may be specified as *to where* (location) or even to *whom* is being referred<sup>110</sup>.

Hence, referring to both work of Al-Farabi’s and the specification by (Fipa-acl, 2002) on intentions, beliefs and desires; we denote a sentence as consisting of :

Beliefs, Desires → Intention ≡ what<sub>lhs</sub> <=> what<sub>rhs</sub>

To demonstrate our abstraction; we give a sample of a sentence below.

*I should be able (1) to push it (2)*

---

<sup>109</sup>Ring a bell? This was partly some of the ideas that we had generally put together from different literature (see equational logic). Basically, we wanted a model that could provide steps from the highest level of language to the lowest level of language (with rather complete mechanisms that could change within themselves). Perhaps the notion of “complete mechanism” does not truly exist, but we are still quite optimistic.

<sup>110</sup>Notice, that in the previous section, in our approach of using the participant observers approach through the narrator 1 and 2 is accordingly being abstracted into inference rules.



where (1) is  $\text{what}_{\text{lhs}}$  and (2) is  $\text{what}_{\text{rhs}}$  represents the “what” of the left-hand side and right-hand side of the sentence (i.e. lhs) respectively. (1) and (2) will be further decomposed into either:

- i) what (who,where);
- ii) act (who,where);
- iii)proposition (who,act);
- iv)proposition (who, what (object, where)).

These abstraction of predicates above is abbreviated with  $MD(n)$ .

### 5.6.2 Setting parameters and notations

From the annotated sentences, we define the general parameters and notations that are used in our modeling.

Table 4.6.2: Abbreviations and notations.

<i>Abbreviations</i>	<i>Meaning</i>
ut	Utterances
Ca	Communicative acts.
Spk	The speaker (the person who is currently talking). <u>Example 1</u> Jason : Can you please pass me that salt? Richard: Sure, here you go. Jason is the speaker.
Ls	The listener (the person who is addressed). Refer to example 1 above, Richard is the listener.
What	<i>What</i> <sup>111</sup> is to determine the existence of the object (e.g., I am looking at the car that is existing as an object of, <i>what</i> can be of a place, people, time, quality or quantity or even an action that can in turn be conveyed as a statement).
Act	Action.

<sup>111</sup>Recall we have discussed the “what” notion of how it is used in different degrees. We start with the “what” of the existence of an object. We want to show how this realization of the “what” of the existence of an object is being adapted moment by moment by thoughts and mind in the situated environment, following activity theory on how the intentions arise.

<i>Abbreviations</i>	<i>Meaning</i>
Object	The “perceiving” <sup>112</sup> act of the speaker at that moment (e.g., looking at the bowl. The bowl is the current focus of the speaker. The bowl is the object).
Subject	The referential process of the speaker in respect to what she is “perceiving” (e.g., what I am conceiving when I am looking at the bowl).

There is of course the mediator (tool) when the person is trying to achieve the object-subject which is not explicitly mentioned in the table. The table above explains the basic notations that we used in our *MD(n)*.

### 5.6.3 Looking for properties in sentences

We have introduced some abstracted predicates (i.e., *MD(n)*) in the previous sections: from looking into the abstraction of modeling the predicates, to the common parameters and notations that must be fixed within the modeling. In this section, we review some of the common properties that we found with regular occurrences in sentences. We demonstrate these abstraction in formal methods for validation.

We have noted that in every sentence there exists:

1.  $\exists(\text{obj})$
  2.  $\exists(\text{subj})$
- as well as:

3.  $\exists(\text{B})$
4.  $\exists(\text{D})$
5.  $\exists(\text{int})$

where *obj* = object; *subj* = subject; *B* = belief *D* = desires/wishes and *int* = intentions. The uncertainty of the speaker can be modeled in the beliefs state (*B*).

<sup>112</sup>When we use the notion “perceiving” it does not only apply to real objects (like a bowl, cars, trees). If we were to use this notion then it contradicts with our idea of using the idea of information that is “perceiving something larger in the functional context, the strokes, a pen, the difference is a detection” in Bateson's idea (recall Section 5.2). Hence, the “perceiving” act we extend to the idea of the actual moment of focus. Let us give an example besides the bowl object. Imagine that we are perceiving this text right now “just need” has become a moment of focus “need WHAT?” could be running through our minds, then we begin to construct the meaning, coupling act (recall that in a similar notion, the author (Clancey, 1997a) has related this to the “coupling” act of perceptual categorizing with meaning (i.e., conception of what text means)) that is now categorizing and referencing to the WHAT of What the speaker has just typed. Then this moment of focus becomes a flow into interchanging to the subject (5 minutes) the WHAT is now referred to time that is 5 minutes and is the focus at the moment that is now becoming the object (yes, I need to wait for 5 minutes) which is actively being constructed in the memory.

Below, we show the conceptual framework of the existing properties in a sentence.

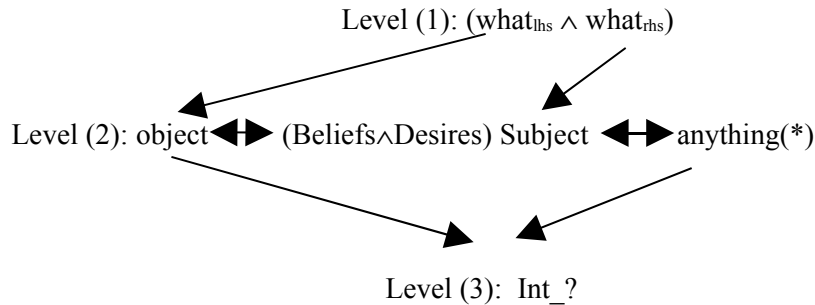


Figure 5.6.3(a): A sentence having these properties

Referring to Figure 5.6.3(a), we show the different levels of abstraction. As witnessed in previous sections, the work is organized in a sort of specialization-generalization and specialization order. Here again, we repeat the same style. First, we have (i) Level (1) the highest level of abstraction<sup>113</sup>; (ii) Level (2) the second highest level of abstraction; and (iii) Level (3) the third highest level of abstraction.

Level (1) describes as the “conscious” conceiving of the construction of reading and comprehending. Basically, it describes the existence of an *object* and a *subject*. And *object* and a *subject* describe *space*, *location* and *time*. Level (2) describes the moment by moment process of a person's “internal activities” in respect to the act of perceiving and engaging in a coordinative activity. Level (3) is the modeling to denote the “shaping” up of the influences during the formulation of intentions<sup>114</sup>.

In other words, we can formulate these levels as below:

$$\text{Level (2) + Level (3) = } [((B \wedge D) \rightarrow (Obj)) \wedge (\text{anything}(*)) \rightarrow \text{subj}] \rightarrow \text{int\_?} \rightarrow \text{ut}$$

Where we define; (i)  $((B \wedge D) \rightarrow (Obj)) = Lhs$  and (ii)  $\text{anything}(*)) \rightarrow \text{subj} = Rhs$ ; and we conceptualize it respectively as:  $Lhs \rightarrow \text{what}_{lhs}$  and  $Rhs \rightarrow \text{what}_{rhs}$  where anything (\*) can contain more than one element. The  $\text{what}_{lhs}$  and  $\text{what}_{rhs}$  imply the intention of the speaker. We show the proof:

$$(IR0) \quad (\text{what}_{lhs} \wedge \text{what}_{rhs}) \rightarrow \text{int\_?}$$

Where (IR0) stands for inference rule 0.

<sup>113</sup>So far, it is the highest level of abstraction that we have noticed.

<sup>114</sup>Beliefs and desires are the basic units of Intentional states. There could be deliberation, motivation that are behind those beliefs and desires (Clancey, 2002).

Proof (1)

$$\frac{\frac{\vdash B, D}{\vdash \text{what}_{\text{lhs}} := \text{Obj}(B, D)} \quad \frac{\vdash \text{anything}(*)}{\vdash \text{what}_{\text{rhs}} := \text{Subj}(\text{anything}(*))}{}^{115}}{\vdash (\text{what}_{\text{lhs}} \wedge \text{what}_{\text{rhs}}) \rightarrow \text{int}_?}$$

(B,D) and anything(\*) are the hypothesis. The hypothesis is that when we decompose a sentence into object and subject we can identify respectively; the beliefs and desires (i.e. (B,D)) and what is the intended task/goal/request/information<sup>116</sup> of the speaker. The types of elements existing in each decomposition (i.e. beliefs, desires and the subject of the intended) implies the intention of the speaker.

Here, we denote the intention as *int\_?* where ? could be of any type of intention. As examples, one could have the intention of (i) offering services; (ii) questioning; or (iii) requesting.

We stress again that since we are taking into account two “languages”, an agent language and actual conversations (natural language), in order to bring the actual conversations into an abstract modeling (agent messages) we have to analyze how to generalized the predicates so they conforms to the syntax and semantics of the agent language. Consider the below:

Table: 5.6.3 (b): Why we need to formalize?

A speaks Language Y	B speaks language X
A learn grammar, semantics of her own language Y and the conceptualization of her comprehension of language is social (influenced by her social community).	B learns grammar, semantics of her own language X and the conceptualization of her comprehension of language is social (influence by her social community).

Now, consider we want A to understand B, in this scope (recall Chapter 1, our second contribution is to propose to open an integration between human agent and artificial agent communication in multiagent systems), we must bridge this by finding a balance to use some modeling that can substitute the meaning of language Y to language X so A and B can understand each other.

<sup>115</sup>We found that our inference rules appear to be similar to (Searle, 1983) where the author had also suggested that the beliefs and desires are not to be taken as the basic units of intentional states. The reader may refer to (Searle, 1983) pages 34 and 104.

<sup>116</sup> Giving some examples.

## 5.7 A simple model for asking questions or services

Now, we must enter into the more formal part of the chapter. We define 3 models; denoted by  $MD(n)$  based on the sentences properties that we have observed so far. Here, we replace the ? in  $int\_?$  with a sentence of asking questions or offering services denoted by  $do\_what$ .

We define the inference rules below:

$$\begin{array}{l} (IR1) \vdash ut \rightarrow int\_do\_what \\ (IR2) \vdash int\_do\_what \rightarrow CA \\ (IR3) \vdash ut \rightarrow CA. \end{array}$$

(IR1) and (IR2) has a property of transitivity.

(IR1) denotes inference rule 1, and similarly for (IR2), (IR3) and so on.

(IR1) implies that whenever we have the ut then we can identify the int\_do-what.

(IR2) implies that whenever we have the int\_do-what, then we can obtain the communicative act.

(IR3) Following modus ponens, we can deduce from the ut, the communicative act.

Below are some of the models that we have formulated:

$$\begin{array}{l} MD(1) \quad int\_do\_what (spk, ls, object (anything(*), subject)) \approx \\ MD(2) \quad ut (spk, ls, act (wh)) \approx \vee \\ MD(3) \quad ut (spk, ls, act (where, wh)) \approx \vee \\ MD(4) \quad ut (spk, ls, act (who, wh)) \approx \\ MD(5) \quad CA (spk, ls, act (who, wh)) \end{array}$$

The demonstration for MD(2) and MD(3) is not shown. The first model MD(1) is the most abstract. We can decompose this model MD(1), into several different models, into MD(2), MD(3) or MD(4).

We show the demonstration of MD(1)-MD(4)-MD(5).

$$(IR4) \vdash object (anything(*),subject) \rightarrow int\_do\_what(sp,ls, object (anything(*),subject))^{117}$$

$$(IR5) \vdash is-a-parameter-of-anything(x) \wedge \exists x person (x) \rightarrow to-whom(x)^{118}$$

$$(IR6) \vdash \exists x is-anything (x) \wedge person(x) \wedge subject \rightarrow act (x,wh)$$

$$(IR7) \vdash subject \wedge \neg \exists x person (x) \rightarrow act (wh)$$

$$(IR8) \vdash subject \wedge \exists x place (x) \rightarrow act (where,wh)$$

(IR5) states that whenever there exist a reference referring to a person (i.e. name or “you”) in the subject, then we can induce that the subject contains a reference to-whom.

<sup>117</sup> In a sentence, there is always an object. It implies that we can induce what is the intention to do what.

<sup>118</sup> Whenever we have anything.

(IR6) states that whenever there exist a reference to a person in the subject and an action specified, then we can induce the function act.

(IR7) states that whenever we have a subject but there is no reference made to a person, then we can induce the function act only with a single value (i.e. wh denotes what).

$$\text{MD(1)} \quad \frac{\frac{\vdash \text{anything}(*), \text{subject}}{\vdash \text{anything}(*)\vee \text{subject} \rightarrow O := \text{obj}(\text{anything}(*), \text{subject})}}{\vdash \text{ut}(\text{spk}, \text{ls}, O)}$$

$$\text{MD(1)-MD(4)} \quad \frac{\frac{\vdash \text{to-whom} \wedge \text{subject}}{\vdash \text{Spk}, \text{ls} \quad \vdash \text{to-whom} \wedge \text{subject} \rightarrow A := \text{act}(\text{who}, \text{wh})}}{\vdash \text{ut}(\text{spk}, \text{ls}, A)}$$

$$\text{MD(4)-MD(5)} \quad \frac{\vdash \text{ut} \rightarrow \text{CA} \quad \vdash \text{ut}(\text{spk}, \text{ls}, A)}{\vdash \text{CA}(\text{spk}, \text{ls}, A)}$$

## 5.8 Applying the MD(n)'s and using equational logic systems on annotated sentence

We have spent long grueling sections on explaining many details of how we arrived at converting the natural language conversations. Finally, we have come to the section where we show a short example of applying our previous models. We apply some of the models ( $MD(n)$ ) using equational logic on one sample annotated sentence. Equational logic is used as a substitution from one model to the other in order to arrive to a desired predicate.

Readers may refer again to section 5.5. Specifically, we had left off the predicates at step (iii). Next, we have applied the notion of object and subject to the sentences in step (v). From there onwards, we now continue to the next crucial task of making the sentences have an equivalent semantics to an agent message.

We take sentence [7], annotated in section 5.3. We show the interpretation for the model, in a specific context: making a request. An interpretation  $I$  of language

$L$  on a non-empty set  $A$  assigns to each symbol from  $L$  a function or constant as follows:

$f^A$  is an  $n$ -ary function on  $A$  for each  $n$ -ary function symbol  $f$  in  $F$ .  
We have  $(A, F, C)$  and  $L = \{f^A, X_1, X_2, \text{Actor}\}$

Let  $A = \{X_1, X_2\}$  where  $X_1, X_2$  corresponds respectively to object and subject<sup>119</sup>.

As introduced in the previous section, we are using our specialization-generalization-specialization approach. The modeling below of object and subject is to enable the actual conversations to be converted into a computational method through equational logic. Recall in Section

Using the models defined in Section 5.7, we demonstrate the function interpretation of predicate model MD(1), MD(4) and MD(5).

$$\begin{array}{ll} \text{MD(1)} & \text{int\_do-what (spk, ls, object (anything(*), subject))} \approx \\ & \text{MD(4)} \quad \text{ut (spk, ls, act (actor, wh))} \approx \\ & \text{MD(5)} \quad \text{CA (spk, ls, act (actor, wh))} \approx \end{array}$$

Let the symbols be: spk, ls, subject, wh, actor, anything(\*) // a constant  
 $f^O$  2-ary: object, act  
 $f^O$  3-ary: int\_do-what, ut, CA

We have sentence [7]: “just need 5 minutes”. So we have  $X_1 = \text{“just need}^{120}\text{”}$ ,  $X_2 = \text{“5 minutes”}$  and  $\text{Actor} = \{Q\}$ . So:  
 $A = \{\text{just need, 5 minutes, I}\}$ . Where  $X_2$  is decomposed into act and anything (\*).  
 $X_2$  is equivalent to subject. *Just-need* is a  $f^{act}$  function.

$$\begin{array}{l} (6) \text{ object: (anything (*), subject) } \rightarrow f^O \\ (7) \text{ act:wh (actor, ?) } \rightarrow f^{act} \text{ (i.e. following IR6)} \\ (8) \text{ OtoP} :: f^O: (\text{spk, ls, } f^{act}) \rightarrow \text{ut}(\text{spk, ls, } f^{act}) \\ (9) \text{ PtoCA} :: \text{ut}(\text{spk, ls, } f^{act}) \rightarrow f^{CA}(\text{spk, ls, } f^{act}) \end{array}$$

Applying the function symbols we have:

$$(5a) \quad \text{ut (spk, ls, object (anything (*), subject))}$$

Using function (6), we have:

$$(6a) \quad \text{ut (spk, ls, } f^O(\text{anything (*), subject) )}$$

<sup>119</sup> We assume there is a parser to assign the object and subject respectively to  $X_1$  and  $X_2$ .

<sup>120</sup>The “perception” here is the moment of focus “that could be imagining or formulating in the brain of what is the next task to do. It is an active “perception” that is why we use the perception notion in our brackets.

We compose function (6a) and function (7),  $7 \circ 6a$  we have:

$$(7a) f^O(\text{spk, ls}, f^{\text{act}}(\text{anything}(*), \text{"5 minutes"})) \approx$$

$$(7b) f^O(\text{spk, ls}, \text{just-need}(\text{anything}(*), \text{"5 minutes"})) \text{ apply (6)}$$

$$(8a) \text{ just-need}(\text{spk,ls}, \text{minutes} (5)) \approx$$

$$(9a) f^{CA}(\text{spk, ls}, \text{minutes}(\text{spk}, 5))^{121}$$

In step (9a), this is when the “*activity states*” framework comes to play a role. The activity states framework will be introduced in the following.

## 5.9 Summary of Part A-I

Let us summarize what we have presented so far. In Part A-1, we:

1. Used function composition as a vehicle for deriving predicates from sentences.
2. Formulated a description for general predicate model(s) (i.e., MD(n)).
3. Used equational logic systems as substitutions for these predicate model(s).
4. To be continued with *activity states*.

## 5.10 Part A-II: Introduction to activity states

This section shall introduce the activity states framework. But before we do so, let us recall the previous sections. So far, we have spoken at some great length about the notion of *object* and *subject*. We also have left the *see-saw* notion hanging (Chapter 2, Section 2.5.1). Now, we need to relate that and insert back those basic elements in their fitting role in the activity states framework.

So, exactly we arrive at this notion of *activity states*? The concept is based on the communication exchanges among the collaborators. Based from those observation, we validate it with these approaches: (i) Transactional Dynamics (i.e. situated cognition); (ii) Mental reflections on action and operation (i.e. activity theory); and (ii) Mental states (i.e. Intentions, Beliefs, Desires). The objective is to allow the selection of communicative acts that best represent the "mental reflections" of the agent during different states of activities.

The word “activities” is a process that is interactional and dynamic. This term of being interactional and dynamic may be hypothesized as having varying states of “mental reflections that is coupled to the process of learning<sup>122</sup>”. *States* for us is based on a medical definition, like a situation, a condition. We are specifically

<sup>121</sup> How the function  $f^{CA}$  is evaluated is shown in chapter 4.14 and its following.

<sup>122</sup> Recall that in (Bateson, 1979), on the hierarchy of learning and communication. The ordering of this form of change or motion implies the structuring of descriptions in terms of “position or zero motion”, “constant velocity”, “acceleration”, “rate of change of acceleration”, and so on. We can notice this behavior in Clancey (2002), p.5, through the author’s observation and propose to link this idea of the acceleration of process in learning and communication (responses/behavior in situated context) of the activity taking a nap. We explain this in the next section.



relating this to the context of clinical psychology by Jamison (1993). We briefly introduce this notion of states in the next section that seems to be a paradox of some kind in Section 5.11.

Thus, we consider the varying states of mental reflections that is based on the study of Leont'ev on *activity and consciousness* (1977) as well on *psychic reflection* (1978). It is considering the time these mental reflections take place. This is how the *activity states* got its name. The objective of activity states is to give *guidelines* to the *agent communication community* for opening an integration for human agent and artificial agent communication. The *guidelines* are focused on the selections of communicative acts that best represent the mental reflections of an agent during the different states of activities. As we have mentioned in Chapter 1, this guideline also contributes to the conceptual *modeling* of the *understanding of learning and communication* in respect to using located tools in a situated context of environment. These guidelines consist of:

1. A method for identifying current mental reflections that gives rise to the conscious conceptions of an agent at time  $n$  by looking into the previous utterances, at the current moment utterances and future utterances.
2. A method for looking into events as an analysis of that context of communication of the previous, current and future utterances.

Thus, the center idea of activity states is that; *what a person wishes to communicate with others is influenced by her current mental activity states*. Mental states<sup>123</sup> are generally concern the beliefs, desires and intentions. We extend the notion to *mental activity states* inspired by the concept of *mental reflections* on action and operation by Leont'ev (1978). We look into the (i) current activity they are engaged in (i.e. what is my current objective world); (ii) the flow of the conversations (i.e. what is my relationship with what was I doing previously, what am I doing presently and what I would like to do in the future); and (iii) changes of context during conversations (i.e. my process is influenced by external factors that had triggered me to change direction), beliefs and desires. We also look at it from both views; (i) activity states of the speaker; (ii) activity states of the hearer. Readers must be careful when we refer to this as mental states. We are trying to stay away from the conventional idea of a “mentalist” view. When we use the notion mental activity states is looking at the interchanges of what the speaker is perceiving at the same time of what the speaker is formulating in her brain (what she is actively perceiving when communicating).

*Intentions* in most literature (Searle et al, 1985; Searle, 1969 & 1983) are defined as the effects the speaker wants to have on the hearer, and on what the speaker *believes* that the other does not know. We give an example, there might be a person who has vast knowledge about a certain subject, and she *supposes*

---

<sup>123</sup> Our definition of mental states is within the context of “activity”. In daily conversations, not all mental states and events have Intentionality. Fears and hopes are Intentional, but there are forms of nervousness, elation and undirected anxiety that are not Intentional (Searle, 1983).

(i.e. *believes*) that the other person she is communicating with might not have the amount of knowledge that she has about a certain subject. In the Fipa-Acl formal model, this is represented by formalizing: (i) the beliefs of the speaker; (ii) what the speaker believes that the hearer might not know about a certain fact, and (iii) what the speaker might be uncertain of or knows partially.

In our guideline, we model a person's intention, beliefs and desires as a two-way relationship with her; (i) inner processes and (ii) the activity that she is engaged in. The speaker are always mutually *conceptualizing* the *context* of her action. We do not suggest that people conceptualize belief is conceptualization. We refer to the idea of active conceptualization that gives rise to the beliefs, desires and intentions (in circular notion) to do a task or formulate a goal:

A conceptualize B where B is beliefs ≠  
 A conceptualizing C gives rise to intentions  
 Where C is the conceptualization of her situated context in respect to her inner  
 process (cognition process) to the activity she is engaged in.

Now, starting from this notion shifts many ideas around. Therefore, the intentions conveyed more likely to be *activity directed* depending on the task that the person has to do. In some cases, activity directed can turn some task into short term-goals or long-term goals (i.e. persistent goal). We give a scenario below to illustrate why we model the intentions as *activity-directed*:

*I think I want to do C* -(1) → *I am going to do C* -(2) →  
*I will do C* -(3) → *I am doing C* -(4) → *I have done C* -(5)

These are representations of some mental activity states in respect to a person's activity (as example) that has been manipulated during time. What manipulates the "states" has direct relationship with the activity states and so forth implying what the person is *actively conceptualizing*. What happens when there is an interruption to do C during step (3)<sup>124</sup>?

*C can't be done* -(6) → *I think I can't do C* -(7) → *I think maybe I won't do C* -(8)  
 → *I think I really won't do C* -(9) → *I won't do C* -(10) → *C won't be done by me* -  
 (11)

For this, we argue that not all communication is goal-directed. Communication may initially start with intention and beliefs (and possibly motivation/deliberation, see (Clancey, 2004)) and with some other ongoing activities that may influence the states of beliefs and intention. As a consequence,

---

<sup>124</sup>This observation was related to the observation by Maue (1979) excerpted from pp: 53-54 " A specific technique controls the ending of all the individual one-to-one dialogues. When a player senses an ending coming into a conversation, she or he may say "Pass" in lieu of saying a sentence. This means, "*I feel an ending is coming*" rather than a definite, "*I want to end now*".

the current activity she is engaged in might make her to change goals/direction during the course of interaction or conversations.

The next question is, how do we study the “*impeachment*” of states? Our first clue is to relate this to the *transactional dynamics* (Clancey, 1997a). Transactional dynamics is one of the widely favored *transactional approaches*. A *transactional approach* is an approach that treats events as the fundamental unit of study (Dewey, 1925). Events are composed of psychological, temporal, and environmental aspects and therefore require methodologies that tap these different facets of a unitary scene. The researchers treat the process as embedded in a context, and no context can be assumed to be widely generalizable. This field benefits from attempts to sample settings broadly. For example, it generalizes that perhaps context 1 is almost equivalent to context 2 and so on. However, such context can never be assumed to be almost equivalent in different places, because location, attitudes and behavior of the observer are aspects of the phenomenon (Clancey, 1997) p: 177.

In particular, the *transactional dynamics* concerns the flow of events from an agent's perspective, considering self-regulation (error correction and homeostasis) and oscillation (integrating change over time) (Bickhard, 1995 & 1997). In psychological studies, concepts such as motivation, recurrence, intention, and equilibrium are described as a framework of persons, processes and context mutually defining one another and serving aspects of the whole, not as separate elements. These aspects do not combine to yield the whole, because the whole are defined by and define one another. To make it brief, transactional dynamics is concerned with a moment of flow of “*events*”.

Although we relate our study to this approach, we do not use the term “transactional dynamics”. We are concern with the *in-between* states, that eventually contribute to the relation of properties and attributes to *events* (Clancey, 1997a). But we still maintain the main substance of this approach. Also, we are looking at the different phases of behavior of the subject interaction on the web tool (e.g., one moment she may be on the instant messaging and at another moment on the video conferencing or simultaneously together). In summary, the *transactional approaches* segment context of conceptualization in isolation, treating them as an individual; even if this approach is looking at events lying in a context, and because it seems to miss the point of activity conceptualization as occurring with subsumption architecture.

Therefore we replace the term “transactional dynamics” with *transitional states* as a consequence of the observation of the different states (i.e. phases) a person goes through; on the web communications. At the same time, we are looking into the sequences of events that have contributed to the change of her behavior from one state to the other. As mentioned in (Bateson, 2002), the sequences of life experience, action is segmented or punctuated into *subsequences* or *contexts*. In the punctuation of human interaction, transactions are described as “transactions”

between the individual and her material and human environment. Hence, if we recall the interest of our work on understanding how the punctuation of events in a context is punctuated in the first place, we go back to the understanding subsequences of contexts (that may consists of time lapse).

This framework still poses on important questions. Are events always arranged in flows of sequences. We may consider a flow of sequences, like musical phases, or punctuation of context. Bartlett (1995), p.92 mentioned that in reconstructing or remembering, it occurs within *time lapse*<sup>125</sup>. Can we assume that this idea can be related to the musical phases in musical punctuation? The time lapse could actually mean that the musician is perhaps involving in articulating his emotions (can this be an in-between?) onto the musical elements (like playing the piano, stops to catch up his breathing, focus, conceptualizing his role, next conceiving the notes in his heart coupled to the emotions he wishes to evoke in the audience). For example, imagine that Mozart is playing on the piano, he plays, then stops, involving emotions, different active states that makes him begin to actively reconceptualize his situated context (audience, setting, play, rhythm in mind) and the stress could prolonged to give rise or impact on the hearer, a stress to convey a non verbal communication of sadness, joyness, excitement. Are these not some kind of articulation of the in-between processes on how they are being categorized and conceptualized? However, with all the arguments of the above, it is sometimes quite impossible to know its connections to all other things, because these connections or sequences extend in time and in space where humans are also parts of those connections consists of time lapse, episodes, experiences and situations.

### 5.10.1 The categories of activity states

Hereafter, we discuss how we relate *activity states* with the *communicative acts* (FIPA-acl, 2002).

Communicative acts in our framework are defined as being a convention for showing different degrees (recall the notion of words having different degrees of meanings by Al-Farabi in Section 5.6.1) of mental activity states. This notion of degree is discussed together with our concept of states in Section 5.11. The difference in degrees is based upon the predecessor (cause) and successors (effects) of current utterances in the structures of conversations. The structure

---

<sup>125</sup>In Bartlett (1995) p. 94, he suggested the case of rationalism has three main forms: (a) The given material is initially connected with something else- usually with some definitely formulated explanation- and treated as a symbol of that other material. Eventually, it tends to be unwittingly replaced by that which it has symbolised; (b) The whole rationalising process is unwitting and involves no symbolisation. It then tends to possess characteristics peculiar to the work of the individual who effects it and due directly to his particular temperament and character; (c) Names, phrases and events are immediately changed so that they appear in forms current within the social group to which the subject belongs. Hence, there is *evidence delay in manifest change*, transformation being foreshadowed weeks, or perhaps months, before they actually appear. This delay in manifesting change is what we call as “*time lapse*” like that of being a marker to context of contexts and they are undergoing transformations.

depends on the context of conversations. Below is an illustration of the “mental activity states” of a speaker during a context of conversation.

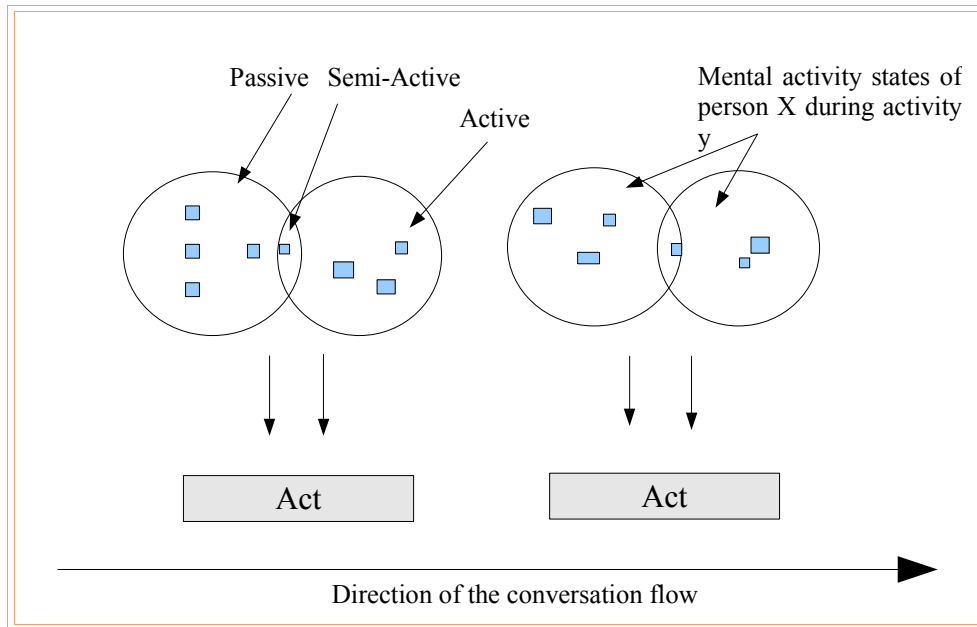


Figure 5.10.1(a): Modeling how we can give guidelines for agent designers to model autonomous agents that enable the agents to select its intentions.

Refer to Figure 5.10.1 (a). The circles represents a certain “active” *space*. Each *space* represents the action of conceiving and formulating sentences or comprehending of sentences. The tiny squares in the circles are representations of the intentions. We shall give an example of this in Section 5.11.

We have noticed during our observations of communications, that we can generally categorize three degrees for representing intentions: (i) passive; (ii) semi-active and; (iii) active. States<sup>126</sup> is condition, when we refer to passive, as explained later on it denotes a condition of *near-start*. Each degrees has members, these members are the communicative acts. The rectangle “act” is the eventual action or utterance at a moment. This modeling is referring an assumption and an abstraction of what might be the different states in the brain, where we propose to make it simple by distinguishing it into three steps for agent language conversion guidelines for the agent community.

Below, we show an example of the categorization of activity states.

<sup>126</sup> We can hypothesize that states is what's active for maybe partially the real percentage but not of the whole state (condition of a person), because it would be rather impossible to measure it.

Table 5.10.1(b): An example of the categorization of activity states.

Utterances	Communicative Acts	Activity states
going to→	inform→	passive
just doing x→	inform-ref→	semi-active
Ok publishing now→	confirm→	active

Looking at table 5.10.1(b) above, readers might be asking: Is this a fixed classification of communicative acts based on the activity states categories? The answer is for now: more or less. The communicative acts are being categorized in terms of incremental regulation of activities. It starts from the *near-start-in between-near ending*<sup>127</sup>. Again this concept is explained in Section 5.11. To give an example, below we show a sample of the activity states categories: a sample.

Table 5.10.1(c): Activity states categories: a sample.

<i>Activity states categories</i>	<i>Examples of communicative acts</i>
Passive	{greet, ack, inform, query-ref}
Semi-Active	{inform-ref, disconfirm, agree, cfp, query-if, refuse, reject-proposal, inform-if}
Active	{confirm, request, request when, request whenever, not-understood, failure, cancel, propose}

In table 5.10.1(c), passive is defined as being the starting state: but not being completely in any “sleep” state. Semi-active is defined as a state that is normally characterized as having a direct intentional act that is directed towards a task. But this notion of “incremental” states is not *always* clear cut. If there is an external factor that interferes with the states that might have been at the near -ending, this state may fall back to the near-start. Simplifying it in this abstraction, we try to make it easier for the agent designer to open an integration for selection of communicative acts for human agent-artificial agent communication. The communicative acts above are those defined by the Fipa-acl communicative acts.

## 5. 11 The controversy notion of “states” and “degrees”: Manic Depressive Illness – a clue to the idea of hierarchy of learning and communication ?

Primarily in this section before we proceed to describe the pseudocode of integrating the activity states within the CONSTEPS, we will explain our notion of using “states” in relationship to “activities” that are processes. This is greatly influenced by the observation of Bateson (1972) notion on learning and mental process as well as our own observation between the collaborators on the web tools.

<sup>127</sup>This is what we have actually noticed during the observation of the communications, as well as during the CONSTEPS.

Refer to the work of Clancey (2002), p.5 where Clancey studied people at their workplaces. We are intrigued by the activity of *napping* (for us this is a “recharging period of states”, the near-end states but can be abruptly brought to near start states). We find that there is a relationship between this actual scenario with the states during the collaboration meetings (extremely evident on the BuddySpace).

Now, let us show some potential evidences for our notion of states. States in computer science exist in diagrams and computer models of a certain type. This is not our idea of states. As mentioned previously in Section 5.10, states represents a cognition process influenced by condition and situation. In order to show evidently what we mean, we invert the context of everyday analysis to a more explicit analysis of manic depressive patients (i.e., bipolar disorder). This disorder consists of different states for diagnosing major depressive episode, manic episode, cyclothymia, and hypomania.

We begin with an excerpt from Jamison (1993).

“Manic and hypomania thought are flighty and leap from topic to topic, in *milder manic states* the *pattern of association* of ideas is usually *clear*, but, as the mania increases in severity, thinking becomes fragmented and often psychotic” p. 29.

“For a physician's estimate of it, I can only refer them to my physicians. But there were some conditions of it which I knew better than they could: namely, first, the precise and sharp distinction between the state of morbid inflammation of brain which gave rise to false vision (whether in sleep, or trance, or waking, in broad daylight) with perfect knowledge of the real things in the the room, while yet other were not there” (Jamison, 1993) p. 97.

Manic depressive illness is an inherited vulnerability to a disease that can manifest itself in a wide range of fluctuating emotional states, *behaviors*, *thinking patterns* (cognition) and styles, and energy levels. Heightened passions and partial derangement of the senses tend to come and go. One thing seems reasonably clear, however. Many of the changes in mood, thinking, and *perception* characterize the *mildly manic states* – restlessness, ebullience, expansiveness, irritability, grandiosity, quickened and more finely tuned senses, intensity of emotional experience, diversity of thought, and rapidity associational processes- are highly characteristic of creative thoughts as well. Note, here we are concern with the different states that are more evident to study among the manic depressive patients. We are not generalizing that by doing this method (of inverting the context of average people to those who suffers from this illness) generalizes or support our claim on the different “degree of states” that is tied to the activity (process). What we would like to emphasize and suggest that maybe

these processes are not always in a same kind of process that is actively doing something all the time (Bartlett, 1995), but sometimes we actively doing something in a much milder states compared to a previous states.

In Clancey's (2002), the author presented actual analyses of understanding behaviors of people working at their workplace. For example, we only suggest that person taking a nap might have been in a very active cognition process (states) and after exhaustion, these cognition processes becomes milder hence the need for the nap.

Nonetheless, by looking into this different point of view, we are able to find other ideas that may allow us to understand what gives rise to intentions. Readers also note that we observed these kind of degrees of states (implicitly observable) through the analyses on the BuddySpace. However, it is not very evident to show hence we show it through taking evidence by those who potrays a higher different degrees of states.

So how does this degrees of states is related to Bateson's notion on learning? Let us look further into some more interesting findings from Jamison (1993).

Jamison (1993), look at the cognitive aspects of hypomania that might benefit imaginative thought. Firstly, two aspects of thinking in particular are pronounced in both creative and hypomania thought: fluency, rapidity, and flexibility of thought on the one hand, and the ability to combine ideas or categories of thought in order to form new and original connections on the other. The importance of rapid, fluid, and divergent thought in the creative process has been described by most psychologists and writers who have studied human imagination. The increase in the speed of thinking may exert its influence in different ways. Speed per se, that is, the quantity of thoughts and associations produced in a given period of time, may be enhanced. The increased qualitative aspects of thoughts as well; that is, the sheer volume of thought can produce unique ideas and associations. Psychologists J.P. Guilford, who carried out long series of systematic psychological studies into the nature of creativity, found that several factors were involved in creative thinking; many of these, as we shall see, relate directly to the cognitive changes (in process) that take place during *mild mania states* as well.

Fluency of thinking, as defined by Guilford, is made up of several related and empirically derived concepts, measures by specific tasks: word fluency, the ability to produce words each, for example, containing a specific letter or combination of letters, associational fluency, the production of as many synonyms as possible, and the ability to produce ideas to fulfill certain requirements in a limited amount of time.

“The thinking of the manic is flighty. He jumps by by-paths from one subject to another, and cannot adhere to anything. With this



ideas running along very easily and involuntarily, even so freely that it may be felt as unpleasant for the patient...

Because of the more rapid flow of ideas, and especially because of the falling off of inhibitions, artistic activities are facilitated even though something worth while is produced only in very mild cases and when the patient is otherwise talented in this direction. The heightened sensibilities naturally have the effect of furthering this” (Jamison, 1993) p. 107.

More recently, several hypomanic traits contribute to performance on test measuring creativity; of particular relevance here he found that creative cognition is far more similar to hypomanic flights of ideas than it is to loose associations that are characteristic of schizophrenia (Jamison, 1993). Other studies have found that rhymes, punning, and sound associations increase during mania (often without any previous interest in either reading or writing poetry). Likewise, in studies of word-associational patterns, researchers found that the number of original responses to a word association task (in which an individual is asked to give as many association as possible to a particular word) *increase threefold* during *mania states*. Recent studies also shown that a strongly positive, or “up” mood facilitates creative problem solving (Jamison, 1993). Ordering this form of change or motion implies the structuring of descriptions in terms of “position or zero motion”, “constant velocity”, “acceleration”, “rate of change of acceleration”, and so on (Bateson, 1972) might suggest that during this hypomania states, the thinking involving learning being heightened by sensitive perception is accelerated? Let us continue to see if any of this make sense.

Making connections between opposites, crucial to the creative process, is in many respects a specialized case of making connections in general, seeing resemblances between previously unassociated condition or objects (Jamison, 1993). The neurochemical and anatomical processes responsible for the cognitive changes occurring both pathological and highly creative states are poorly understood.

Now, how does this study relate to our own analyses of the communications and to the three existing theories (hierarchy of learning and communication and mental process (Bateson, 1972 & 1979; situated cognition (Clancey, 1997a) and; activity theory (Leont'ev, 1977 & 1978)?

Let us elaborate one final point how the previous section based on our own observations of passive, semi-active and active states may seem more pronounced if we demonstrates manic depressive illness states.

“It seems counterintuitive that *melancholy* could be associated with *artistic inspiration* and *productivity*; the *milder manic states* and their fiery energies would seem, at first thought, to be more *obviously linked*. The extreme pain of the deeper melancholias,

and the *gentler, more reflective* and solitary sides of the milder ones, can be extremely important for the *creative process*, however. *Hypomania* and *mania* often *generate ideas* and *associations*, propel contact with life and other people, induce frenzied energies and enthusiasms, and cast an ecstatic, rather cosmic hue over life. *Melancholy states*, on the other hand, tends to *force a slower pace*, cools the ardor, and puts into *perspective* the *thoughts*, observations, and feelings generated during more enthusiastic moments. *Mild depression* states can act as ballast; it can also serve *critical editorial role* for work produced in more *fevered states*. *Depression* prunes and sculpts; it also ruminates and ponders, and ultimately, subdues and *focuses thoughts*. It allows *structuring*, at a *detailed level*, of the more expansive patterns woven during hypomania.” (Jamison, 1993) p. 118.

In fact, these changes of states contribute to sharp thinking (learning?) cognition processes, accelerated of the motion of learning (the ordering of the members into groups in the hierarchy of learning and communication in learning 0, I and II that can be both interpreted as inductive and deductive). Notice the italic words above, we make a diagram to show these changes of states corresponding to the changes in cognition processes below:

Our last discussion on manic depressive illness excerpting a figure from Jamison (1993) on the correlation between different states to the productivity of paintings and writings.

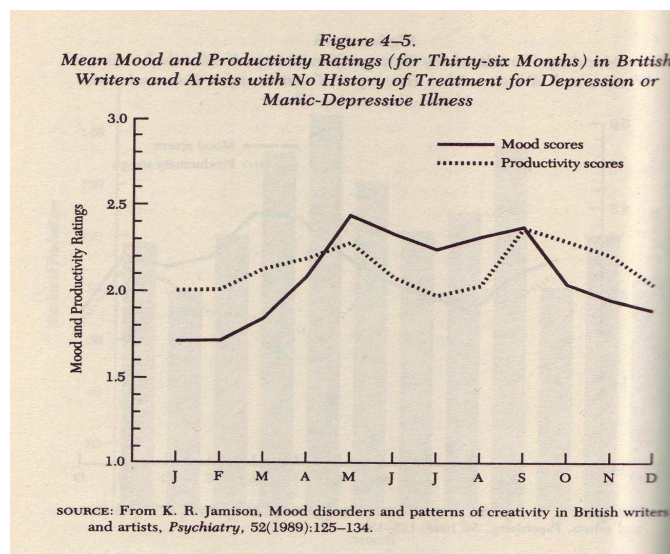


Figure 5.11 (a): Different states and productivity ratings for manic depressive patients with no history of treatment.

In Figure 5.11(a), productivity in the group showed a tendency to peak in the fall or late fall and in May. The writers in the groups with no history of treatment

showed mood and productivity curves that more closely correspond with one another. We show another figure of the groups who receives treatment.

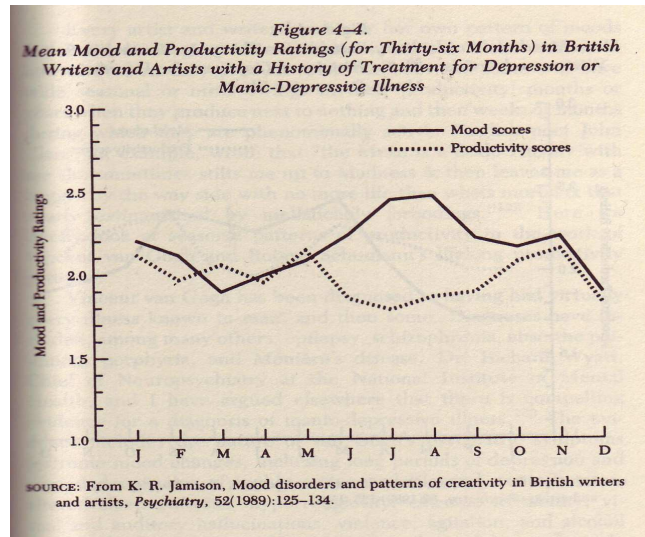


Figure 5.11 (b): Different states and productivity ratings for manic depressive patients with no history of treatment.

In Figure 5.11 (b), these groups were patient with a history of medical treatment, showed inversely related curves for summer productivity and moods. In this group, the peaks of productivity precede and follow the mood peak by three to four months.

We show Figure 5.11(a) and Figure 5.11(b) to demonstrates that these alternating different degree of states does project changes in cognition process by looking at the productivity level of the writers and poets. Interestingly, we show a sample of Van Gogh charts in Figure 5.11(c ) that clearly demonstrates the peaks of his productivity according to the changes of his cognitive process (in our opinion, what we assume to be a form of what we refer to as mental activity states)

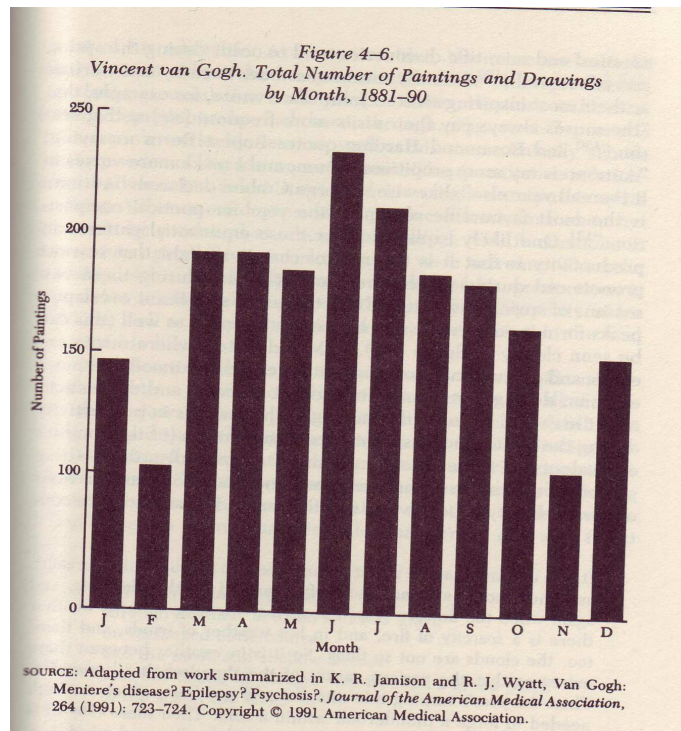


Figure 5.11 (c) : Vincent Van Gogh. The total number of paintings and drawings.

Figure 5.11 (c) sees us the dating of Van Gogh artwork (which is considerable, due to van Gogh extensive documentation in his correspondence). In Jamison (1993), the author has illustrated the total number of paintings, watercolors, and drawings done by van Gogh during different months of the years. Jamison also discussed the productivity according to his different manic states. We review them. The summer peak in productivity is consistent with what they know about his own description of his frenzied moods and energy during those months of the year, as well as with a perhaps natural tendency to paint in the longer, warmer, drier days of summer (Jamison et al, 1991). Perhaps more interesting, however, his patterns of productivity during the winter and late fall. From his letters it appears that van Gogh had relatively more “pure” depressive states during November and February, and more “mixed” depressive states during December and January. The increased agitation of these mixed states may well have resulted in both more energy, and more motivation to paint.

To summarize this rather long section, not does this evidence reviewed from the work of Jamison (1993) suggests for us that the the activity states (the condition of the process, in particular the cognition process) is being influenced by the environment, weather that gives rise to sensitive perception that in turns influence the hyperactivity states as we reviewed, the cognition process appear to be much creative and sharper at problem solving.

Where does this work leads us to for now? It as for us suggesting that even in the states of actively doing something all the time, the degrees of this notion of

“actively doing something all the time” varies. Note that our notion of states is not similar as Clancey's (2002) that is termed as phrased, to *sustain a mode of interaction*, imported from electromechanical engineering that is applied to best apply to human behavior. Our states notion is imported from medical definition that is closely related to clinical psychology.

Clancey (2002) is speaking in terms of the activities that a person does from moving from one room to the other, or like shown in pg 5 of (Clancey, 2002) where napping is viewed not as a mental state, rather as an activity..

Does our idea of activity states crossover with the idea by Clancey on his own view and analyses of work activities. From our rather primitive analyses and conclusion, it may suggest that it can be associated to the analyses of Clancey.

Let us discuss for a while. For example, states here is to describe a certain mode of sustain (but beware, the author does not relate the idea of states to mental activity states, rather than napping itself is an activity). On the other hand, our notion of states is demonstrating situation, condition of the cognition process that is also viewed as an activity that comes from the inward view of object, subject as discussed in Section 5.3 and 5.3.1.

We leave this discussion for another time and place, it is still quite premature for us to dive into any conclusions.

## 5.12 Abstracting the communications

Now, that we have basically touched upon the basic elements of activity states, we look into another level of abstraction: the nature of communication exchanges among people. This have been reviewed in Chapter 4. But we recall it since it is important in the framework.

As stated in section Chapter 4, section 4.3.3. The stimulus-response is abstracted as  $a_1b_1a_2b_2a_3b_3a_4b_4a_5b_5$ , where the  $a$ 's refer to the items of  $A$ 's behavior, and the  $b$ 's refer to the items of  $B$ 's behavior, we can take any  $a_i$  and construct around it three simple contexts<sup>128</sup> of learning. These will be:

- (i)  $(a_i b_i a_{i+1})$ , in which  $a_i$  is the stimulus for  $b_i$ .
- (ii)  $(b_{i-1} a_i b_i)$ , in which  $a_i$  is the response to  $b_{i-1}$ , which response  $B$  reinforces with  $b_i$ .
- (iii)  $(a_{i-1} b_{i-1} a_i)$ , in which  $a_i$  is now  $A$ 's reinforcement of  $B$ 's  $b_{i-1}$ , which was response to  $a_{i-1}$

---

<sup>128</sup>It is possible to include parallelism in this modeling that is more closely highlight actual communication among a collaborative work group discussed in Chapter 4.

This abstraction in communication is used within the CONSTEPS for the selection of communicative acts.

### 5.12.1 Using the activity state for relating the ut to the CA

In the previous sections, readers have been exposed to the main inspiration of the activity states framework. The activity states is a concept based on many inter-related ideas. We have finally come to the point of completing the CONSTEPS from section 4.9. We present in the remaining sections the steps to identify the *ut* corresponding to the Fipa-Acl *CA* (Fipa-Acl, 2002) specifications.

### 5.13 Applying activity states

Activity states is applied here as a framework for collaborating people. Using the activity states guidelines, we *associate*, *connect* and *contextualize* the sentences in order to translate them correctly into a markup Acl. The simple abstraction that we demonstrated in Section 5.10, in Figure 5.10.1 is being included in our pseudocode is a preliminary suggestion on guidelines to allow agent designers to evaluate the appropriate CA's that can be automatically assigned to the communicating agents engaged in their respectively activities.

Steps involved:

- (i) When we have identified the FP's (i.e. feasibility preconditions) and RE (i.e. rational effect)<sup>129</sup> we have identified the intention.
- (ii) When we have identified the intention, we relate it to the syntax structures, as defined in section 3.4.1.
- (iii) When we have the syntax and the intentions, we relate it to the *CA* defined in the Fipa-Acl.

Table 5.14 illustrates the formalism for relating the *ut* to the *CA* of Fipa-Acl<sup>130</sup>. We define:

- (i)  $ut_n(\text{spk}, \text{ls}, A)_{\text{prs}}$  is the message of either spk (i.e. speaker) or ls (i.e. listener) denoted by *prs* (i.e. persons) at the current time<sub>n</sub>;
- (ii)  $CA_t(\text{spk}, \text{ls}, A)_{\text{prs}}$  is the equivalent agent communication language act of the *prs*.
- (iii) Activity-states<sub>cr</sub> (i.e. current) at time<sub>n</sub>;
- (iv) activity-states<sub>prv</sub> (i.e. previous) at time<sub>n-1</sub>;
- (v) activity-states<sub>fr</sub> (i.e. future) at time<sub>n+1</sub>;

<sup>129</sup> The communicative act (CA) components are involved in planning process that characterized as both by:  
1) the conditions that have to be satisfied for the act to be planned; referred as *feasibility preconditions* or FPs.

2) the reasons for which the act is selected and; referred as *rational effect* or RE.  
(refer to Appendix A for the FP's and RE's of the Fipa-Acl)

<sup>130</sup> The agent communication language could be of any language; Fipa-Acl or KQML, etc.

- (vi) subject-of-context<sub>spk</sub> at time  $n-m$  where  $m$  is the previous point of time where the subject of the current context of activity had been introduced;
- (vii) activity-of<sub>spk</sub> where *spk* is the speaker's activity at time<sub>n</sub>;
- (viii) context-of-activity<sub>spk</sub> at time<sub>n</sub> is the context of the activity of the *spk* (i.e. speaker) at that *current time* (e.g. chatting about how to click button A on the instant messaging);
- (ix) stm<sub>ext</sub> external stimulus (e.g. listener's response);
- (x) stm<sub>int</sub> internal stimulus (e.g. speaker's stimulus that may exist to execute a task, a simple response to previous conversation of a goal);
- (xi) task<sub>z</sub>, task that has to be done (e.g. publishing map);
- (xii) action-type<sub>is</sub> is the expected action or response that the *spk* wants from *ls*.
- (xiii) goal<sub>x</sub> the goal that the speaker (i.e. spk) has (e.g. invite person *A* to give a talk);
- (xiv) longterm-goal<sub>lg</sub> where *lg* is the long-term goal (i.e. to integrate technology *W* with technology *Q*);
- (xv) CA<sub>t</sub> is the category type of the communicative acts CA-st<sub>n</sub> (e.g. inform; inform-ref)
- (xvi) CA-st<sub>c</sub> is the communicative act states category (e.g. passive, semi-active, active).
- (xvii) B<sub>spk-ls</sub> is the belief of what *spk* believes about *ls*
- (xviii) B<sub>spk-spk</sub> is the spk's belief about her own knowledge

Table 5.13 : The pseudocode of the activity states framework.

```

Intialization where n=1
Procedure Convert_1 // To identify the feasible precondition (FP's) and
rational effect (RE), the first thread in the conversation, where time is = 1
{
Call Associate_MD(1)_1 (sentencen)
Call Markup_ACL (msg (b,c, A)prs, param_CAi)
n+
}

Procedure Convert_2 // n+ iteration of conversation
{
Matching sentencen of spk to the CAi where timen>1
If no sentencen of spk exist where timen>1 then
{
Exit
}
else
{
Call function Conceptualize (sentencen)
}
}

```

```

Conceptualize(textn)
{ If activity-ofspk at timen ≈ ≈ activity-ofspk a timen-1 // e.g., spk is still just
about to establish a chat session with ls
Call function Contextualize_1
Else if activity-ofspk at timen ≠ activity-ofspk at timen-1 //e.g., spk is now
sending files to the ls or sending a link
Call function Contextualize_1
else if activity-ofspk at timen-1 do not exist // e.g., there is no comparison to
make because there is no previous message of sk
Call function Contextualize_2 }

```



```

Contextualize_1      //spk's current activity is similar to previous activity
Look at the previous CAt(spk,ls, A)prs // looking at previous message
  Identify activity from the sentencen of spk at timen
  If activity-statesspk of sentencen at timen can be related to the same
  CA-stc of CAt(spk,ls, A)prs //e.g. is spk and the prs (i.e. could be
  that the previous sentence is the spk's or
  the ls) previously sharing
  more or less the same activity states;
  sharing the same activity space, but
  coordinating activity differently

  {
    a-sprs := activity-statesspk
  Call Reflect_1 (sentencen, a-sprs)
  }
Else if activity-statesspk of sentencen at timen cannot be related to the
same CA-stc of CAt(spk,ls, A)prs //e.g. before the spk communicate
with inform-ref and currently with
propose and both are in different ca
category states

  {
    a-sprs := activity-statesspk
    Call Reflect_2 (sentencen, a-sprs )
  }

```

```

Recoordinate
  Identify activity-ofspk at timen //e.g. answering the phone
  activity_spk := activity-ofspk
  Look at previous CAt(spk,ls, A)ls at timen-1 //e.g. still asking questions to spk

  Look at sentencen of spk at timen //e.g spk is referring to something else
  Identify the subject-of-contextspk at timen
  subjContx_spk := subject-of-contextspk
  If stmext from the environment //e.g. a call from in office
  {
    Identify the stmext
    stimulus_ext := stmext
    Call Associate- stimulusExtInt (activity_spk, subjContx_spk,
stimulus_ext)
    Call Associate_MD(1)_1 (B,D,U)
    Call Markup_ACL (msg (b,c, A), param_CAt)
  }

```

```

Contextualize_2
Look at previous CAt(spk,ls, A)ls
  If sentencen of spk in response to CAt(spk,ls, A)ls at timen-1 then //e.g.
  {
    Call Evaluate_ActivityStates(sentencen)
    Call Associate_MD(1)(B_new, D_new, U_new)
    Call Markup_ACL(int-do-whatx(spk,ls, A)spk, param_CAt)
  }

Else if sentencen of spk is not in response to CAt(spk,ls, A)ls at timen-1 then
  {
    Call Evaluate_ActivityStates(1)(sentencen)
    Call Associate-MD(1)_1(B, D, U)
    Call Markup_ACL(int-do-whatx(spk,ls, A)spk, param_CAt)
  }

```

```

Reflect_1 (textn, a-sprs) // CAt(spk,ls, A)prs at n-1 can be related to utn
  If CAt(spk,ls, A)prs previously == CAt(spk,ls, A)spk
    ∧ context-of-activityspk at timen ≈ context-of-activityspk at timen-1 // e.g.
    Jack is chatting and conceptualizaing his role as program coordinator
    ∧ subject-of-contextspk at timen ≈ subject-of-contextspk at timen-1 // e.g.
    sending a document to the Peter ∧ action-typels not taken yet then
    {
      Check previous CAt(spk,ls, A)spk communicated at timen-1
      If CAt(spk,ls, A)spk at timen-1 of CA-stc where c is passive then
        //e.g. the previous message sent was less active than the current
        message sent
        Call AssociateIncrP-reflect
      Else if CAt(spk,ls, A)spk at timen-1 of CA-stc where c is semi-active
      then
        Call AssociateIncrSA-reflect
      Else CAt(spk,ls, A)spk at timen-1 of CA-stc where c is active then
        Call AssociateIncrA-reflect
    }
  else if CAt(spk,ls, A)prs at timen-1 == CAt(spk,ls, A)ls
    // not the current human agent that sends the previous
    message; but another human agent
    ∧ context-of-activityspk at timen ≠ context-of-activityls at timen-1
    ∧ subject-of-contextspk at timen ≠ subject-of-contextls at timen-1
    ∧ action-typels has been taken
    {
      Call Associate_stimulus
    }

```

```

Evaluate _ActivityStates(2) (textn)
{
  Bspk-ls state of spk towards ls increase in relation to stmext //e.g. I believe
    He is talking about this subject so I shall respond to acknowledge it
    B_Spk := Bspk-ls
  Bspk-spks state of spks' increase //e.g. I believe I should acknowledge him of
    the subject he is talking about
    B_Ls := Bspk-spks
  U state of spk's is increase //e.g. spk is uncertain that spk actually know
    what spk is referring to
    U := U
  Keep B_Spk, B_Ls, U in the memory
  Conv_Statesn has B_Spk, B_Ls, U at timen
  Return (B_Spk, B_Ls, U)
}

```

```

Reflect_2 (sentencen, a-sprs)
  If CAt(spk,ls, A)prs at timen-1 = CAt(spk,ls, A)spk //e.g. spk is not talking
  about the same subject, suddenly spk introduces a new subject
  {
    Check previous CAt(spk,ls, A)ls communicated at timen-1
    Identify the subject-of-contexttspk at timen-1
    subjContx_Spk(1) := subject-of-contexttspk at timen-1
    Identify the subject-of-contexttspk at timen
    subjContx_Spk(2) := subject-of-contexttspk at timen
    Keep in memory of Convspk
    if subject-of-contexttspk at timen is not a new taskz and stmext is related to CAt
  at
    other previous message of spk from timen-m
    {
      Call Associate_ ActivityStates (sentencen,
subjContx_Spk(1),subjContx(2))
      Call Associate-MD(1)_1(B, D, U)
      Call Markup_ACL (int-do-whatx (spk,ls, A)spk, CAt)
    }
  }

```

```

Else if subject-of-contexttspk at timen is a new taskz and has no influence from
the
stmext of CAt previous of the ls
{
  Call Evaluate_ActivityStates(3) (sentencen)
  Call Associate-MD(1)_1(B, D, U)
  Call Markup_ACL (int-do-whatx (spk,ls, A)spk, CAt)
}
}

else if CAt(spk,ls, A)prs at timen-1 = CAt(spk,ls, A)ls //e.g. spk is not talking
about the same subject as ls
{
  Check previous CAt(spk,ls, A)ls communicated at timen-1
  Identify the subject-of-contexttspk at timen-1
  Identify the subject-of-contexttspk at timen
  Identify the subject-of-contexttls at timen-1
  subjContx_Spk := subject-of-contexttspk at timen-1
  subjContx_Spk(1) := subject-of-contexttspk at timen
  subjContx_Ls := subject-of-contexttls at timen-1
  If subject-of-contexttspk at timen is a new taskz and is influenced from the
stmext
of CAt previous of the ls
{
  Call Associate_ActivityStates(1)(sentencen,subjContx_Spk,
subjContx_Spk(1),
subjContx_Ls)
  Call Associate_MD(1)_3(B_Spk, B_Ls, U)
  Call Markup_ACL (int-do-whatx (spk,ls, A)spk, CAt)
}

  else if subject-of-contexttspk at timen is not a new taskz and stmext is related
to CAt
at other previous message of ls from timen-m
{
  Call Evaluate_ActivityStates(4) (sentencen)
  Call Associate_MD(1)_4 (B, D_S, D_L, U)
  Call Markup_ACL (int-do-whatx (spk,ls, A)spk, CAt)
}
}

```

```

AssociateIncrP-reflect
{ Check to know if taskz of activity-ofspk not completed
  Call Evaluate_ActivityStatesP(sentencen) //FP's and RE is changed

Call Associate_MD(I)_P (Bnew,Dnew,Unew)
  Call Markup_ACL (int-do-whatx (spk,ls, A) spk, CAl) }

```

```

Evaluate_ActivityStatesP(textn)

If subject-of-contextspk at timen has been introduced in timen-m then
activity-statesitr := activity-statescr; //passive state

{ B state increase for spk // i.e. of what spk B of what he beliefs in and
what he beliefs Ls's current activity states is

  Bnew := B

  D state increase for spk

  Dnew := D

  U state decrease for spk

  Unew := U

  increase activity-statesitr + //increase with degree of I

  Keep Bnew, Dnew, Unew in memory

  Conv_Statesn has Bnew, Dnew,Unew at timen

Return Bnew,Dnew,Unew }

```

```

Associate_MD(I)_P (i,a,b)
{
  Call MD(I)
  Bnew, and Unew are defined as the Feasible Preconditions (FPs) for
sentencen of
  spk

  FPs := B ∧ U
  Define the Rational Effects (RE) of ls for sentencen of spk
  REs := Dnew
  Bnew, and Unew are defined as the Feasible Preconditions (FPs) for
sentencen
  of ls from spk's point of view
  FPs_Ls := Bnew ∧ Unew
  Associate this two perspective of spk of spk's own personal beliefs with
what spk
  beliefs of what ls beliefs of spk.
  Associate the (FPs), (FPs_Ls) and (REs) as intentions to
      int-do-whatx (spk,ls, A)spk
  Match the int-do-whatx (spk,ls, A)spk to the CAt
  Keep B,U, D, B_new and U_new in memory
  Conv_Statesn has B,U, D, B_new and U_new at timen
  Return (int-do-whatx (spk,ls, A)spk, CAt)
}

```

```

AssociateIncrSA-reflect //for semi active state
Check to know if taskz of (activity-ofspk not completed  $\vee$  activity-ofis has not
been
executed )  $\vee$  goalx of activity-ofspk is not completed
{
activity-statesfir := activity-statescr; //semi active state
Call Evaluate_ActivityStatesSA_1 //FP's and RE is changed
Call Associate_MD(1)_SA(Bnew,Dnew,Unew)
Call Markup_ACL (int-do-whatx (spk,ls, A)spk, CAt)
}
else check for stmext
{
if context-of-activityspk has 2 context during the activity-ofspk at timen //e.g.
publishing a map and answering the phone
Call Evaluate_ActivityStatesP_2 (sentencen) //FP's and RE is changed
Call Associate_MD(1)_SA (BS,BL,Dnew,Unew)
Call Markup_ACL (int-do-whatx (spk,ls, A)spk, CAt)
}

```

```

AssociateIncrA-reflect //for active state
Look at CAt(spk,ls, A)spk at timen-1
Look at subject-of-contexttspk at timen-1
activity-statesfir := activity-statescr;
Call Evaluate_ActivityStatesA (sentencen) //FP's and RE is changed
Call Associate_MD(1)_A (BS,BL,Dnew,Unew)
Call Markup_ACL (int-do-whatx (spk,ls, A)spk, CAt)
}

```

```

Markup_ACL (param_msg(param_S, param_L, param_A)prs)
Call MD(4)
Call MD(5)
Add number message to param_msg(param_S, param_L, param_A)prs
Return (id, param_msg(param_S, param_L, param_A)prs)

```

The formalism above, Table 5.13 review how we have “abstractly” related the ut to the specific communicative acts (i.e. intentions) according to the Fipa-Acl formal model. Specifically, during the function conceptualization and contextualization: we have modeled it the conceptualization as functions which is discussed in section 5.14.

## 5.14 Summary of Part A-II

Let us summarize how we got started up until the previous section. We started with an overall picture of our approach to the CONSTEPS, which is based on the analysis of the web communications. Next, we have introduced the notion of object and subject, as well as emphasized the *in-between processes* of this notion. This will be discussed in great detail in the coming section. Then, we have demonstrated the models of predicates and how to perform the function/functors composition for the second level abstraction. We have completed Part A; which is focused on the CONSTEPS. Now, we move to Part B. the most difficult section, explaining *how* CONSTEPS has been performed.

## 5.15 Part B: The many hows, when will it ever end?

As readers have noticed, the whole approach of our work is concerned with “transformations”. We are now into Part B, where we are more concerned with *how* we have converted the natural language conversations into agent messages. First of all: the CONSTEPS seem to be made up of many segments. This analyses is focused on how the collaborators are communicating, as we have mentioned we are using the participant observers approach. In order to understand the underlying acts of those collaborative communication, we further elaborate that we attempt to understand two things in the cognition processes:

1. Recall Chapter 2, we showed several experimental answers from the participants on how we arrived at the CONSTEPS method. Further from this, we want to understand through the observation of the changes of the predicates (articulation of predicates) that this indeed related to situated cognition (Clancey, 1997a) specifically where we focus again the in-between at the neural process.
2. In Section 5.17, we attempt to model those narrator underlying processes in Section 5.3 by relating it back to hierarchy on learning and communication of Bateson (1979); situated cognition of (Clancey, 1997a) and activity theory of (Leont'ev, 1978).

To begin with this rather confusing Section, we start by asking three main questions that is directed to point 1 above.

1. How we modeled it.
2. How we got about modeling it.
3. How we got about *about* modeling it<sup>131</sup>.

---

<sup>131</sup>This may seem similar to like meta of meta-message, but it is not that. In fact, it is a process that we want to convey about the modeling of how the categorization are adaptly constructed, how they are arranged and associated in order that the coupling act of knowing how to do A in the first place, has to come from some kind distant memory that enables us to do A (like -A and - -A).



and so on.

How was the modeling of CONSTEPS was comprehensible for the participants? Hence, we analyze from looking into the movements of the predicates that can be abstracted in the three point above. How does the predicate (recall Section 5.8) can be explained from the cognitive point of view? We shall demonstrate that this cognitive process is indeed situated at the context. It is an act of coupling at the neural level.

We focus on two perspectives (1 and 2 above) on modeling the conversions steps. The first perspective is shown in Figure 5.15(a). The second perspective is shown soon after.

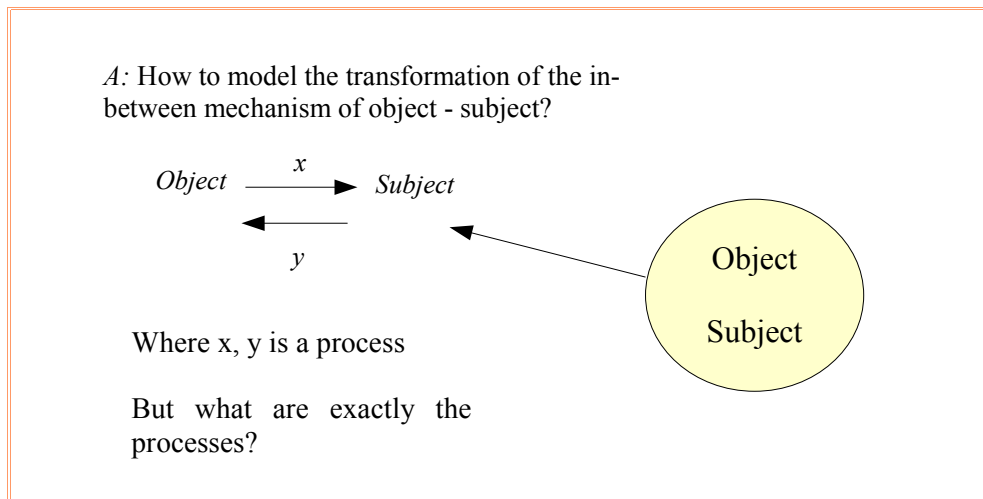


Figure 5.15(a): Modeling the transformations of object to subject.

Figure 5.15 (a) is a relationship to the processes show on how predicates are articulated. The swirling liquids is an imagination drawing to show how these interchanges are constantly inter-changing within ourselves, that gives rise to intentions – our communicative behavior that is a response towards the activity that we are engaged in. Imagine that most synaptic contacts in the brain are chemical, that is, a substance is released from the presynaptic side of terminal, diffuses across a narrow cleft of extra cellular space, and interacts with specific receptor sites on the postsynaptic side of the contact (Dowling, 1992). Neurons are *excited*, *inhibited* or *modulated*. The swirling liquids is an abstraction of how we make a conception of how these synapses are interacting, that acts in a chemical, liquidized surrounded by membrane cells (Dowling, 1992). These are just conception of what may be happening when people are collaborating together, one another reading text (chatting) or video conferencing that if the text may be abstracted as images? Recall that in the experiments on Bartlett (1995), he founded that there was always this act of construction of remembering in perceiving images as well as reading previous text written by others and re-writting what they remember and understand from those writings

Refer to Figure 5.15(a), we hypothesize how people “naturally” recognized the object and subject in sentences. These have been introduced in section 4.3, explaining the processes of the in-between object and subject. But then the next question is how do we relate these transformations from object to subject in different parts of knowledge in those sentences? Secondly, if we assume that there are two inter-mediate processes between object to subject and vice versa; how do we model those intermediate processes?

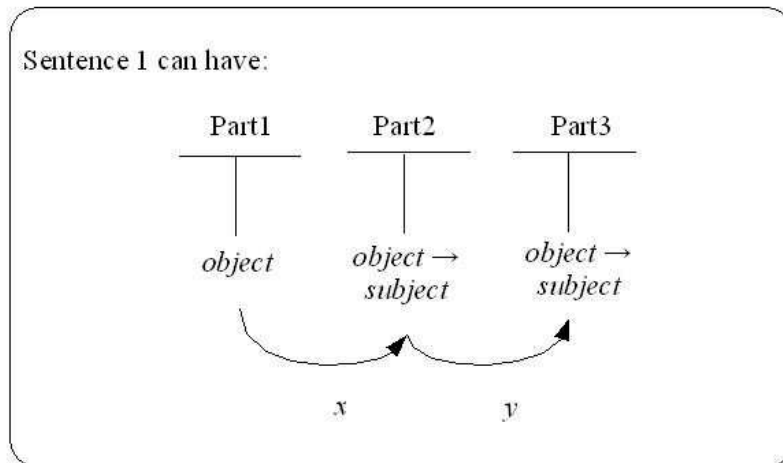


Figure 5.15 (b): Going from  $x$  to  $y$  and so forth.

Figure 5.15 (b) is a conception of process  $x$  and  $y$ . Sentence 1 is an example of a sentence in which we identify different information parts. So the focus of our modeling is on those two processes:  $x$ , and  $y$ . This was introduced by our narrator, person 2 on the conceiving and translation of processes. Now, we look into the second perspective, the *articulation of predicates*. This is shown in Figure 5.15(c).

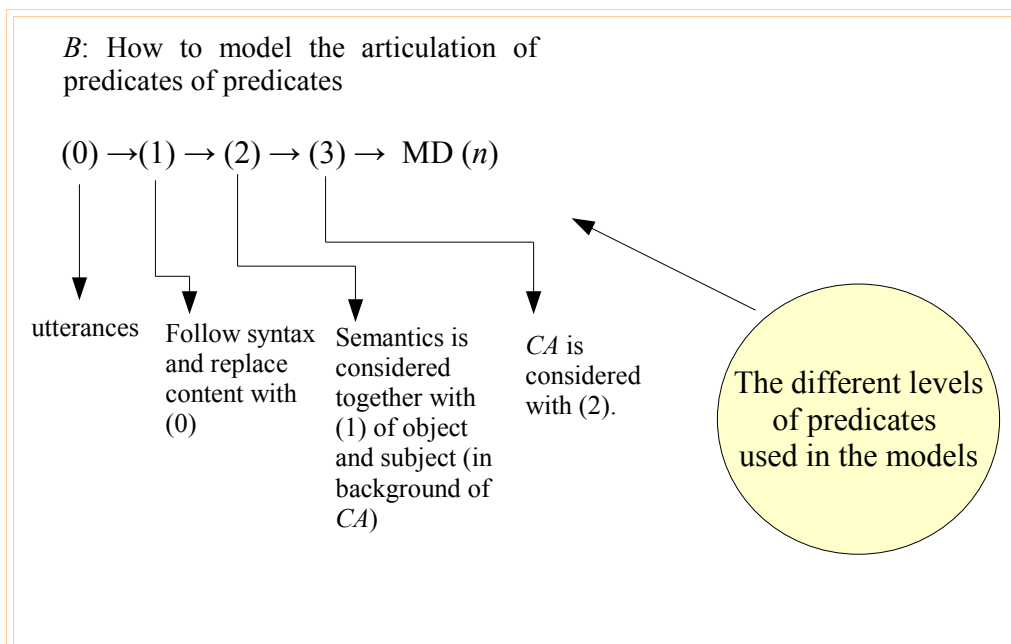


Figure 5.15 (c): The second perspective: How do we model the articulation of predicates that involves re-arrangement according to the syntax and semantics of the agent language?

Figure 5.15 (c) is a conception of the articulation of the predicates. For example, the natural language conversations (i.e., utterances) is labeled as (0) then is being “transformed” into predicate at level 0 labeled with (0) following the syntax and is being replaced by what what we assume people have remembered and comprehend into articulation of level (0) into now level (1) and so on. T

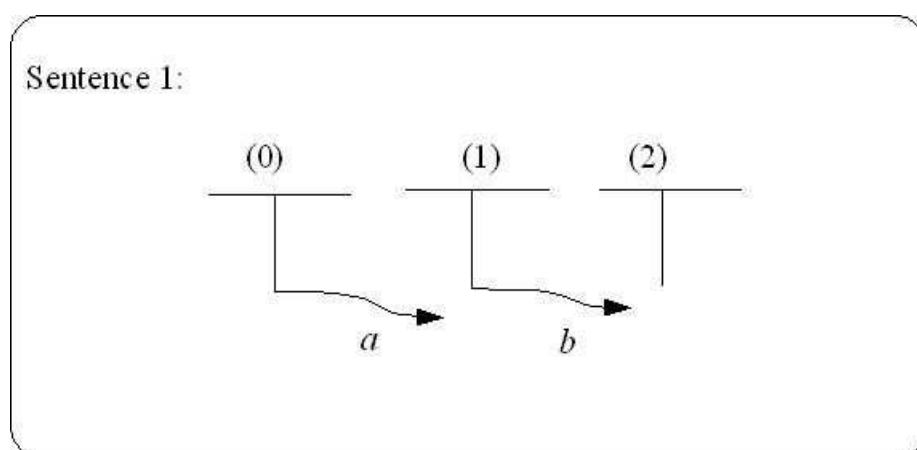


Figure 5.15(d): Levels of predicates.

Looking at figure 5.15(b), and figure 5.15(d) above; they are concerned with the same perspectives: how is the “coupling mechanism performed ? from *a* to *b*, or from *x* to *y*. However, both the in-between processes seem to be different because they are both in a different context. Thus, suggesting, even those mechanisms of simple manipulation of *A* and *B* must be *situated* in their *context*. In order to give

our own evidence (rather primitive one), they are discussed in the summary. This hypothesis is similarly raised by (Clancey, 1997a). This mechanism is in some literature known as the *structural coupling* (Clancey, 1997; Maturana, 1999).

So, now we need to recall our CONSTEPS: starting from section 5.3. We start by showing the abstraction of the steps shown in section 5.7 below. We have:

- A sentence =  $ut_x$
- An agent language syntax =  $Sy_t$
- An agent language semantics =  $Sm_t$  and we also have;
- An agent message =  $AGm_n = = Sy_t \circ Sm_t \circ P$  where  $P$  is the proposition or statement.

We must understand that the end goal (the intention that one has) is to have it abstractly as this:

$$\boxed{ut_x \circ Sy_t \circ Sm_t = = AGm_n} \quad (1)$$

Refer to (1) above, we have  $ut_x$  which is composed with  $Sy_t$  and composed with  $Sm_t$ . This will return a new “value”  $AGm_n$  which is the agent message. The idea of “transformations” is to keep track of transitions of predicates: from zero levels to the first level, second or to even third level. That way, we can observe a certain flow of articulation of thoughts from these multi-level predicates. We give a simple step of the “transformation”. To simplify, we start by considering two levels of predicates when we have any  $ut_x$  as the input (if we disregard the level (0) as in the utterance). These analyses are important for us to go to the underlying act of how people are articulating their conversation through the observation of how the participants are constructing and comprehending the natural language conversations into predicates. Maybe there are some kind of re-constructing and recategorization during the conceptualization of understanding text by understand how they recognize acts and manipulate these into proper predicate levels (Recall Chapter 2 on the experiments). We also compare these results with our own desired results (see Chapter 3, Section .3.2).

We continue to evaluate and understand.

i. Construct the first level of predicate following  $Sy_t$ :

→ Get first level of predicate:

Example:

$x$  (Q,W, utterances (“just need 5 minutes”) (1)

ii. Construct the second level of predicate following the  $Sm_i$  and the object and subject:

→ Get second level of predicate from (1):

Example:

$x\_is\_inform(Q, W, just\_need(Q, minutes(5)))$  (2)

Looking at steps (i) and (ii) above, we then focused on understanding to model the transformations from moving the level predicate 1 to 2 (and possibly to level 3). Below, we demonstrate the overall concept of the transformation from one level predicate to the other.

$$x(Q, W, ut(R)) \xrightarrow{\circ(1)} x(Q, W, R_1(y, R_2)) \xrightarrow{\circ(2)} x\_is\_act_t(Q, W, R^1_1(y, R^1_2)) \quad (3)$$

We have the following,  $R$  is a sentence, and  $R_1$  is the first part of the sentence and  $R_2$  is the second part of the sentence; which is the *object* and *subject* respectively. The  $R^1_1$  and  $R^1_2$  is the element of the  $R_1$  and  $R_2$ . We use  $\circ(1)$  to denote a composition/transformation from  $x(A)$  to  $x(B)$  because it's like an act after coupling.

Some of the key questions looking at (3) above are:

1. How do people make the transformation from  $\rightarrow^{\circ(1)}$  to  $\rightarrow^{\circ(2)}$ ?
2. How can we model this transformation step by step: in detail?

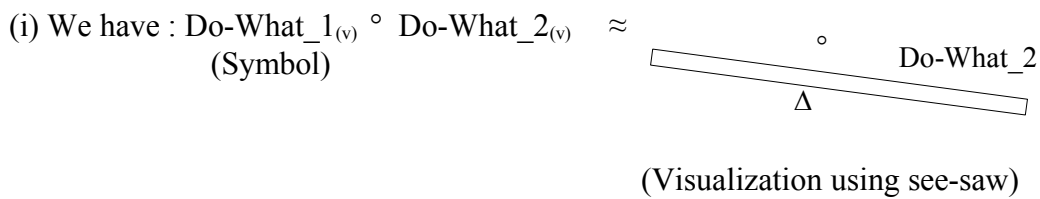
These two very basic questions had prompted us to ponder deeply into another issue at hand. How did we recognize these transformations flow from one type to the other? We go back to our introduction on our object and subject concept in Section 5.3. Readers recall our narrators on how the transformation from object and subjects are mutually shaping one another. Now, we must dissect those notions we have used and make use of them appropriately. Hence, in the remaining section: 5.16, we discuss about modeling the articulation of those predicates using our see-saw representation. In section 5.16, we discuss our modeling about the in-between processes of object-subject, again using the see-saw representation.

### 5.16 Trying to explain the articulations of predicates and observations of the collaborators; the birth of the see-saw representation

The modeling of *see-saw* which shall be used extensively in the next section starts from this moment. The see-saw is based on two observation, the

explanation of the articulation of predicates that we link this idea to “mental reflections” through the observation of the collaboration among group members of the group. We make a conception using the see-saw modeling. We then relate this notion to the idea (Bartlett, 1995; Jamison; 1993) to support our suggestion for the see-saw modeling.

To show the representation of the see-saw, we give values (number) to show that the strength of one part (like generalization) is stronger than (specialization) at that moment. These processes might be both either in foreground or background, nonetheless always in some “activity states”.



is Step (n) → Step (n+1)

(i) is the general formula. It is a very simple formula. We have *Do-What\_1<sub>(v)</sub>* which is the first process of doing something with a value. The value (*v*) is the *strength* of that processing doing something at that particular moment<sup>132</sup>. The “input” corresponds to the (0) level predicate, the utterance whereas the output corresponds to the (1) level predicate. We use the “°” as usual to denote composition.



is Step (0) → Step (1)

Now referring to (ii), we have where we are comprehending P<sub>1</sub> (refer to section 5.3. P<sub>1</sub> corresponds to the information part 1<sup>133</sup>). Now, we compose this with Sy<sub>t</sub> (refer to section 5.13) which is a type of an ACL syntax. Now, the two are being reflected by looking at the values, and that it's almost in a balance on the triangle. In fact, what is always reflected in finding some kind of balance. They have values, where the processes reflecting about P<sub>1</sub> is stronger than the process reflecting Sy<sub>t</sub> by a mere difference. The difference is not so big because we want to show that the syntax of that particular ACL is always in the background. We are always taking it (the pragmatics) into account when “fitting-in” the P<sub>1</sub> into a predicate form following the ACL syntax.

<sup>132</sup>Referring to the work of (Bateson, 1979), the author had suggested the concept of “reflections, working together. Perhaps this is something similar?”

<sup>133</sup>We notice that we have “jumped” from how we distinguish the parts of information. That is something which we don't quite know yet.

$$(iii) \underset{A}{(P_1 \circ Sy_t)_{(0,65)}} \circ \underset{B}{(obj \wedge subj)_{(0,8)}} \approx \begin{array}{c} A \qquad \circ \qquad B \\ \hline \Delta \end{array}$$

is Step (1) → Step (2)

Now, from the previous step (1) we are “transforming” the *coded “information”* into another composition. Here, we denote that first part of composition between reflecting the  $P_1$  in respect to the  $Sy_t$  which is simply denoted by  $A$ . Now, we are considering the definition of object and subject in the sentence, which is denoted by  $B$ . However, at this moment,  $A$  has less strength than  $B$ , because  $B$  is becoming more active as we are more focused on at “that moment” of interpreting and associating our context.

$$(iii) \underset{C}{((P_1 \circ Sy_t) \circ (obj \wedge subj))_{(0,7)}} \circ \underset{(Sm_t)}{(Sm_t)_{(0,85)}} \approx \begin{array}{c} C \qquad \circ \qquad (Sm_t) \\ \hline \Delta \end{array}$$

is step(2) → Step (3)

The steps above from (2) has been encoded carrying more information. Now, the coded information is denoted by  $C$ . At this moment, we compose this with the defined  $Sm_t$ . As usual, the current focus of the moment always becomes more “active”, having more strength than the previous coded information. The *essence* of the see-saw modeling is always making *comparison* on how to go from  $A$  to  $B$ .

### 5.17 Activity states using the notion of see -saw

We shall explain below in detail the see-saw representation which is part of the activity states notion.

The see-saw is the best representation/terminology that we can find (at this moment) to “represent” the mode of transformation that took place while perceiving the text (reading it) and then comprehending it to typing (action) it as a response to what the person had perceived (of the object → subject). In some ways, these can be viewed as being different processes that arise together, at an improvised level, but we cannot say for sure that they are definitely three processes such as perceiving, comprehending, and typing. It involves generalization and specialization of what the current subject is actively conceptualizing. The object and subject are the result of the generalization and

specialization both in respect to the defined syntax and semantics of the agent language and to the analysis of the subject's mind.

The see-saw representation is used to represent these processes (mode of transformations). Even if these two processes are the opposite of one another, there are actually in background of one another. For example, if the person is actively generalizing, the specialization process is in the background. This is where the idea of using the see saw representation comes into place. Two players are cooperating to play with one another, up and down, yet at the same time competing. We give story to illustrate this.

“I am at a playground, in Petaling Jaya, Malaysia, my hometown. When I was young, my brother and me would play see-saw in the evening. It was exciting because we always wanted to maintain a balance between the both of us, him being bigger and weight heavier than me and me being smaller yet we were competing against one another. I had always try to maintain the balance by actively putting my feet firmly on the ground and bouncing the penal (wood board) against the tyre, to bounce on and off so that I won't end up bumping my backside hard on the tyres. The tyres was some kind of a motivation for me not to get myself “bumped” by my brother, that causes me to jump a bit higher. However, that jumped if I am losing this see-saw game was also thrilling yet I wanted to compete against him and we had this tacit agreement to keep on bouncing so that the game can go on and on, to stabilize our weight yet at the same time competing, it was a conflicting game that requires coordinating ourselves, hands, feets on the ground, actively looking at our component movements. We would be yelling, laughing and screaming with one another whenever he or I bouncing hard on our backside and we go back to playing, this see-saw ride.. ultimately just enjoying the “ride”” .

The story illustrates that the see-saw notion is based on two side by side and conflicting components yet balancing one another, because they must exist or not they would be no see-saw “game”.

Like this see saw, it has a different degrees of ups and downs, depending on the weight of the other player at the end, the see saw heavier player will get down quicker to the ground, if the other end is lighter than the other player. This is shown through our representation in Section 5.18 where we gives values (imaginary values) to the parts.

At the same time, the swirling representation of the transformation of the object to subject is like a transformation in liquid.



They are in the background, which has electricity running around it. Those object and subject work together in this liquidized and electrified background. The weights influencing the liquidized background: either is it closely together, like sticking to one another, or loose apart. We draw this imaginary process (yet another one) below.

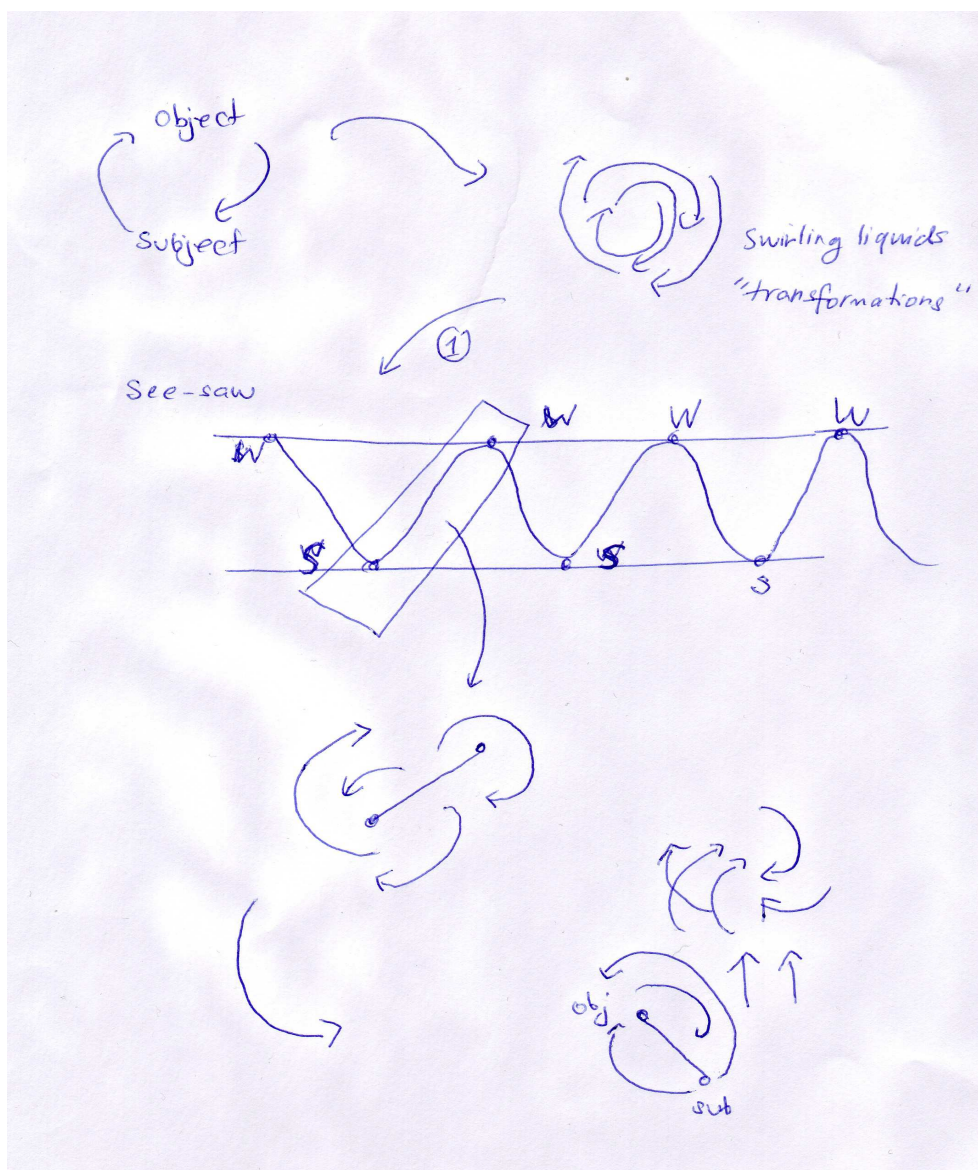


Figure 5.17: Liquidized form circling the swirling liquids that gives rise to object and subject.

Figure 5.17 is to illustrate our imaginary process of the see-saw and how it is related to our object and subject. Firstly, readers translate the images from top down. We have introduced in Chapter 2, Section 2.5 on the notion of object subject that we describe as being a sort of transformation process that can be illustrated as “swirling liquids”. These “swirling liquids” are in the background of our see-saw modeling. Now, going to the next diagram, just below our object, subject notion, we draw a diagram, that is denoted with W and S, going up and down. W denotes weak, and S denotes strong. In just a simple abbreviation to say that S is stronger than W (has greater strength than W) and vice versa. If we transpose this “bar” of drawing a curve line that goes up and down (or back and forth shown in Section 5.18) is working at the foreground of the swirling liquids. In actual fact, the S is related to the notion object and the W is related to the notion subject and it continues in a circular nature. For example, when the object of the moment because our focus at that time, this modeling of see-saw attempts to capture that by showing that it is has greater strength (as we are focusing) yet slowly the referential process is being produced as having a weaker strength (perhaps by a mere differences).

The main idea of using this see-saw approach is that the receiving inputs (i.e. sentences) are evaluated based on the activity states (what is the situation, are the processes very active, not so active?), and those states will determine which processes are selected to select the appropriate communicative acts for the modeling of the markup Acl (in an idealistic view of our modeling). These functions are defined as close as possible to the understanding of situated cognition and activity theory. By representing the processes as functions that changes within themselves, we have related this to both Bateson's work (Bateson, 1972) to some parts on hierarchy of learning and communication and mental processes (Bateson, 1979).

Does any of this see-saw modeling make sense? We attempt to find validation by looking into several literatures by Bartlett (1995) that may validate our own observation of the collaborators communications at the same time an attempt to relate to the underlying neural mechanism of the conceptualization process with our see-saw modeling.

“Even slight changes between figures, the mere omission or addition of a single line, were readily noticed. No doubt, in the present case, this may have been *due largely* to the general *similarity of ground* plan in successive designs More experimental evidence is required as to the precise conditions which facilitate *perceptual reponse* to 'difference', and as to what *exact differences* are most likely to be *responded to*” (Bartlett, 1995) p. 25.

The see-saw modeling is based on difference. Even if the experiments conducted by Bartlett (1995) was on using images, and signs, nonetheless, this was evident during the CONSTEPS performed. The highlighted sentence such as “due largely

to the general similarity of ground plan” for us is relating to the idea of involving a sort of generalizing of the ground plan. Next, Bartlett was hypothesized that each responses to a text, was being rationalized as corresponding to differences. Exactly what sort of differences are most likely to be responded to was the center discussion of problem. On the other hand for us it was what exactly was the rationalism or the mental processes occurring that enable us to response to differences? It was suggested later by, which we quote below.

“When omissions were noticed neither their position nor their precise character was, as a rule, correctly recorded. The readiness of response to other changes out to be more closely studied. *Never once*, in any of these cases, did a *subject fail to note*, when a diagram was *turned round*, or *put upside down*, that it was the *same figure in another position*. Here, once more, we see how, although a given perceptual complex may be *treated as a unit*, or a unitary pattern, nevertheless certain of *its features* regularly play a more *predominat part* in settling what is seen and what is remembered than others” (Bartlett, 1995) p. 25

Recall our modeling of see-saw, now we proposed that in order to fit in a mental processes mechanism for understanding what underlies the comprehending of text and typing it is by relating it moment by moment to the idea of conceptualization. Bartlett in his experiments noted that no matter how the images were turned into different positions, subjects could always identify that it was the same image. He then hypothesized that this “perceptual complex” may be *treated as a unit*, and certain of *its features* regularly play a more *predominat part* in settling what is seen and what is remembered than others. Recall, that we have suggested that the generalization is occurring almost at the same time the specialization is occurring (background/foreground or vice versa). The unitary as a whole in our idea is the generalization, yet that predominant unit for us is an idea of specialization that must occur somewhat on different levels that gives rise to the subject to respond in “differences”.

“Not infrequently the picture presented at once stimulated some vivid visual image. Then the image would *either dominate* and direct the perceptual observation, or occasionally it might be recognized as *conflicting* with the *presented object*. An instance of the latter occurred when one of the subjects, whose home was at a sea-port town, was examining a picture of “Margate Lifeboat on the Slips”. From the first he was troubled. At the eighteenth trial he said: “It is no use going on. All the time I am getting suggestion of the *docks at home*. And they are *what I see*, not the picture in front of me. One of the first things I did when I got a camera some time ago was to take a picture of that spot at home that I was reminded of when I saw this. There was a ship of heavy freight there at the time, just as there is in the picture there. So I am

always *confusing the two*, I shall get, no more out of this”  
” (Bartlett, 1995), p. 80.

Again noted by Bartlett, that even when we are perceiving (hence suggesting even when we are conceptualizing, the underlying mechanism is working at conflicting yet complementary impulses?) that one of the subject (frequently other subjects arrive) that they have in the background of the image of at home, yet facing at the moment, the image of the picture, that they cannot help to associate and perhaps weight between the background and the image at the moment (foreground?) because it is as if the reflection process in conceptualizing his “activity” is aggregated at improvised levels, nonetheless associated to an underlying back and forth mechanisms.

“On the face of it, to perceive anything is one of the simplest and most immediate, as it is one of the most fundamental, of all human cognitive reactions. Yet obviously, in a psychological sense, it is exceedingly complex, and this is widely recognised. Inextricably mingled with it are *imaging*, *valuing*, and those beginnings of judging which are involved in the *response to plan*, order of *arrangement* and *construction* of presented material. It is directed by interest and by feeling, and may be *dominated* by certain *crucial* features of the *objects* and scenes dealt with.” (Bartlett, 1995) p. 81.

Now, notice that in our see-saw modeling, we give values, because we are taking into account of the generalization and specialization occurring at simultaneous levels but with different strength. In Bartlett above, he suggested that the perceiving act at the moment is inextricably mingled with *imaging*, *valuing*. What is exactly valuing? Does it suggests valuing back and forth of what the reflections of our activities? Of what we are engaged in? Of what we are conceptualizing? Further on, Bartlett elaborated that these are some of the rationalism which are involved in the response to plan, where they are arranged and constructed of the presented material and may be dominated by crucial features of the objects. Can we assume from Bartlett's observations that the conceptualization of that person's activity (the presented material and where he is right now) are chains of generalizing and specializing that are processed at different aggregated levels? We continue to discuss.

“A *particular stimulus*, or feature of a *situation*, gives *rise* to a *tendency* to respond in a *specific manner*. At first the tendency is held in check and produces slight or perhaps no manifest results. As *time elapses*, apparently the *unexpressed tendency* may gain *strength*, and so manifestly affect the response; or other tendencies *simultaneously excited* may *lose strength*, and in this way also a *new manifest change of response* may appear” (Bartlett, 1995) p.91

Throughout Bartlett's experiments and observations, he was very particular about specific details, yet the unitary elements that construed it. The see-saw, our proposed “imaginary” model to understand the underlying neural mechanism for the mental processes attempts (at a very primitive level, still) how with specific stimulus (that readers shall encounter in the next Section on the parameters that we associate to each functions) can be associated to time elapses by playing around (subconsciously) changing the values or the strength. The strength or the values that are changing either the first function, for example function associate and memory (Section 5.18, sentence 9) by trying to play out how these strengths are being altered.

“No doubt the net of the result of any process of serial construction, or reproduction is due to the *gradually accumulated effect of a number of slight alterations*, all of which follow along the *same line of change*. (Bartlett, 1995), p. 126.

Finally, this excerpted notes from Bartlett may be related to the idea of Bateson on the criteria of mental processes. We emphasize on the reproduction that may be due to the *gradually accumulated effect of a number of slight alterations* that according to Bartlett all of which follow along the *same line of change*. This is when we use later on in Section 5.18, on what we term as “coded version” is to represent these reproduction of gradually effect of the slight alterations. However, to be more precise in our context of understanding the transformation is to continuously use functions and correspondingly denote its appropriate parameters that is being accumulated as “coded versions” and passed on to different functions at different see-saw aggregated levels.

In the next section, readers will be exposed to this modeling of the see-saw.

### **5.18 The Transformations: In-between Object – Subject**

Readers recall section 5.3, on the annotated sentences. We applied the notion of object and subject. We could not find any real mathematical notations that can best describe the in-between processes. Hence, we have no choice but to introduce new notations. We are quite aware that we have been introducing many notations, we promise that this would be the few last ones. Readers refer to sentence 2 in section 5.3.1 (“tout va bien ,rédaction en cours d'un article pour ITS à poster lundi”). We used a narrator to describe what might have taken place during the “inner occurrences” when reading and comprehending text.

The modeling of the in-between the *object* and *subject* has forced us to consider the multiple ways to explain it. Firstly, the narrator, person 2 was used as a style of consciously interpreting and associating sentences; from 1,2,3 and so on (see section 5.3, part (iii), person 2 narrator). From here onwards, we analyze the commonalities and the sequences of the collaborators (very primitive

assumptions) thoughts when reading and comprehending a context of conversations. Thus, it forms a very long articulation of thoughts analyzed at each moment (continuously) based on *sequences of events*.

Readers are advised to refer again to section 5.3 on the annotated sentences. Particularly, in this section, we model in a very abstract way the in-between transformations from object to subject. It is represented as *functions*. Those functions are our hypotheses for representing the inner occurrences during reading, comprehending and typing. Functions are viewed as having the ability to change within itself (Bateson, 1972) can be influenced by other phenomena. Recall that processes may change and in Bateson's world of abstraction and dynamics of mathematics, perhaps what he wanted to convey in an abstraction view that these processes can be “modeled” as functions. Since processes are subjected to changes, hence these functions may change within itself. Also these functions constitute a hypothesis of what might be taking place during the inner processes that is neural and cognitive. In this section, we model the inner occurrences abstractly, linking them to the work of (Bateson, 1979) on criteria for mental process. We shall speak more about this in the next section.

We introduce some new notations which will be used throughout the modeling:

1. See-saw representation:  $\overline{\Delta}$ . It is used to denote the “reflection process”.
2.  $\overset{\circ(n)}{\rightarrow}$  is for denoting “transformations”. After transformations, the parameters becomes coded version of previous information.
3.  $\downarrow_{st\_b}$  is for denoting the reflection of the person on her “state of being”.
4.  $\rightarrow$  denotes trigger.

Notations such as “transformations”, and “reflection”, are borrowed from (Bateson, 1979) and (Leont'ev, 1978) respectively.

Sentence 1: Q says “Bonjour, ca va?”:

*Part 1: “Bonjour, ca va?”*

$$f^c_{(int, t)} \xrightarrow{\circ(1)} A \xrightarrow{\circ(2)} f^{art}_{(A, t)} \xrightarrow{\circ(3)} B$$

We have function  $f^{c134}_{(int, t)}$ , which is function conceive of person Q with parameters  $(int, t)$ . Person Q is in the action of conceiving his thoughts (*intention*) at that moment, time  $t$ . This is then transformed into a coded version A and is being articulated in  $f^{art}$ , function *articulate*. It is then transformed into coded version B<sup>135</sup>. Recall in Section 5.17, coded version for us means something being accumulated. Referring to Bateson (1979), p. 95 “coded version” what we assume

<sup>134</sup>We use the notion conceive- in a context of what the speaker is actively conceiving his contexts.

<sup>135</sup>Firstly, the concept “coded version” is combined with the work of (Bateson, 1979). We discussed this in the next section. Secondly, readers notice a kind of layers of layers of coding taking place during the thoughts and action. We do not think that it is directly “translated” into a from A to B. See (Clancey, 1997a) on a detailed discussion on these intermediary process between thoughts and actions, from pages 269-326.

he is referring to the organization of triggered events into circuits, coding, and the genesis of hierarchies of meaning. Later on, Bateson (1979), p 102 goes on to describe that the fact of difference between *effect and cause* when *both are incorporated* into an appropriately flexible system- is the primary premise of what he calls as transformation or coding. Later on, Bateson (1979), pp. 106-117 relates it back to genetics. Notice, that we are trapped in a circle. Our discussion is always going back and forth to understanding the aggregation of levels of mental process, yet at the same time the transformations of these processes, and differences, and their combinations. That we may briefly summarize that the underlying neural mechanisms of conceptualization are taking place at opposite yet complementary, in unitary yet being reflected by two “atoms/neurons<sup>136</sup>”. We show below of our own illustration of coding.

---

<sup>136</sup>This is just to simplify our ideas, we do not state that reflection are combining two neurons or atoms yet.

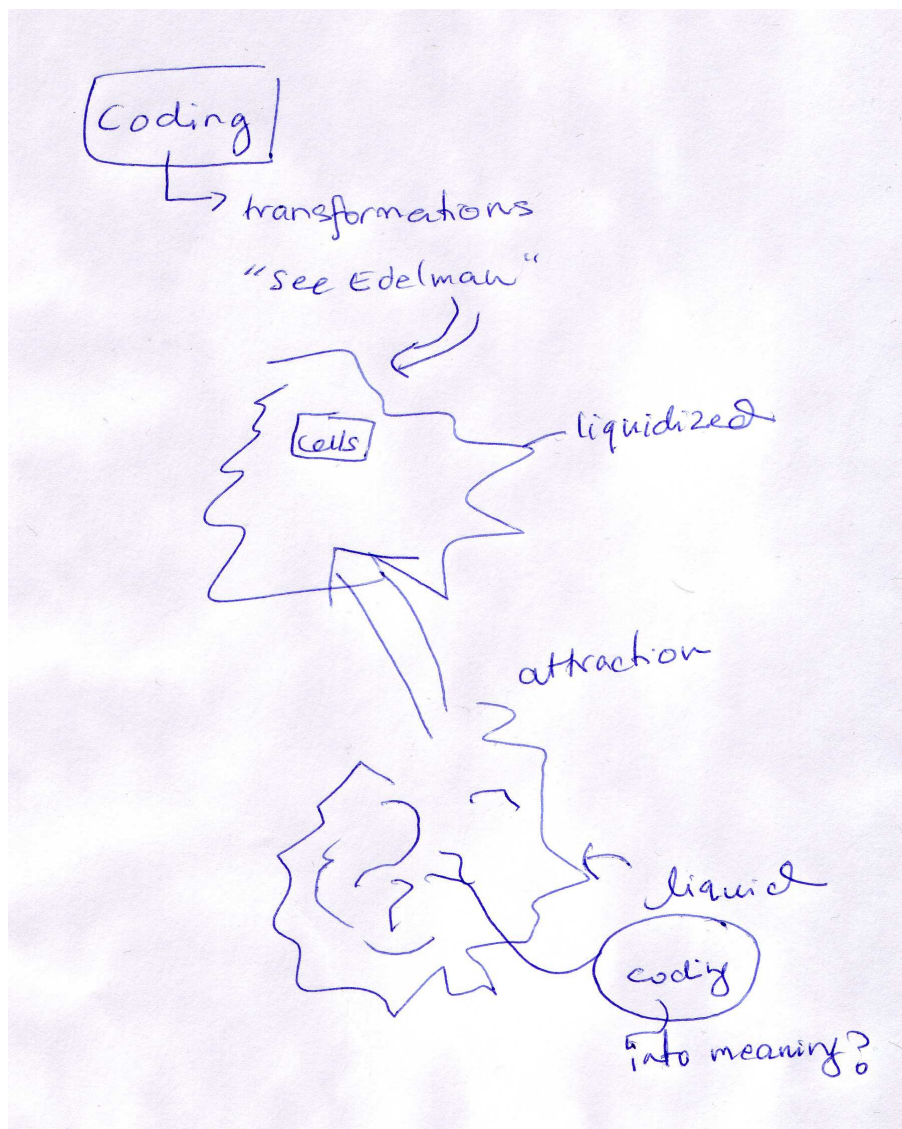


Figure 5.18: Imagining what coding means.


Figure 5.18 is a brief illustration to what we speculate “coding” and our own version of “coding” means for Bateson (1979) and our observations of the mental processes during the collaborators activities. These, yet again imaginary processes to explain what coding means is illustrated as usual from top to down. First of all, coding to Bateson (1979) also means transformation. We refer then to Edelman (1993), Chapter 4, Section 4.6 on learning and memory. We are relating this coding idea to the emergence of cell (but we cannot really point out exactly what we mean by “cell”). These cells or even perhaps neurons/synapses are working always in the foreground of liquids as we imagine it to be sticky. These synapses working causes attraction (chemical substances) (Dowling, 1992). From there onwards, these attractions become like electrified, and is being composed from different aggregation of parts that yields into coding, eventually giving meaning (like grouping members into their respective classes). For now, we leave our imagination on the underlying neural mechanisms to continue with the modeling.



Sentence 2: W says “ tout vas bien, redaction en cours d'un article pour ITS a poster lundi”


Part 1: “tout vas bien”

$$B \xrightarrow{\circ(1)} f^p_{(B',t)} \xrightarrow{\circ(2)} (f^c_{(B',t,0,72)} \circ f^{tsl}_{(B',t,0,65)}) \xrightarrow{\circ(3)} C \quad (1)$$



Look at (1). Now, person W is responding to person Q (in response to sentence 1).  $f^p$  is *function perceive*<sup>137</sup>. Here, the action of Q, “B” is being perceived by person W, but it is perceived as B' (in other words, it's a “subjective” perception of an object). It is being perceived at that moment,  $t$ . Then this become a *coded information* and *transforms* at stage 2 ( $\circ(2)$ ) into a “conceiving act”. Now, it is “being carried” out by function conceive<sup>138</sup>,  $f^c$ . At the same time, person Q is in a “mental reflection” state of where it there is an aggregation of another function,  $f^{tsl}$ .  $f^{tsl}$  is function translate. Function translate is an act of *translating* what *person Q* is *conceiving*. Here, readers will note that we are using the *see-saw notion*. In some ways it represents the act of conceiving as being a part of translating (which we are not quite sure, how or what is exactly being translated) the coded version B on an *aggregate of levels*. Now this, is then transformed into coded version C.

$$C \xrightarrow{\circ(4)} (f^{as}_{(C,t,0,69)} \circ f^c_{(C,t,0,8)}) \xrightarrow{\circ(5)} D \quad (2)$$



Look at (2), now C is being *transformed* (but not in another coded version) into becoming a “parameter” in *function associate* and *function conceive*. In particular this particular moment, function conceive is conceiving C at the same time the

“state of being” denoted by  $\downarrow_{st\_b}$ . Now, this interaction transforms the information into coded version D.

$$D \xrightarrow{\circ(6)} f^{art}_{(D,t)} \xrightarrow{\circ(7)} E \quad (3)$$

Look at (3). Coded version D is now transformed into becoming a parameter into  $f^{art}$ , *function articulate* that is the moment of coordinating it into action, which becomes a coded version E.

<sup>137</sup>Normally, perceiving is considered as the “perceiving act” of the external world. Here, we use function perceive for both perceiving the act of the world at the same time perceiving one's own activity.

<sup>138</sup>As we had mentioned in Chapter 3, to general the process, we simply refer to the idea of conceptualization as conceiving.

Part 2: “redaction en cours”

$$E \xrightarrow{\circ(8)} (f^p_{(E,t,0,84)} \circ f^c_{(v_{rf},t,0,80)}) \xrightarrow{\circ(9)} F_{(0,75)} \circ f^{as}_{(F,env,t,0,76)} \xrightarrow{\circ(10)} G \quad (4)$$

Now, coded information E becomes a parameter in  $f^p$ . Person W is reflecting what he is “perceiving” and “conceiving” in his thoughts. The conceiving process calls a parameter voluntary reflex,  $v_{rf}$ . We call this rather special parameter *voluntary reflex*, because the speaker is “subconsciously” communicating what he is perceiving as his activity to person Q. This information is transformed into coded version F. F is then being reflected together with function associate ( $f^{as}$ ) that is associating what he is doing in respect to his environment. We believe that somehow the composition of function on the right hand side and the left hand side (see-saw representation) is taking place at an aggregation of levels. Then this is coded as information G.

Part 3: “d'un article”

$$G \xrightarrow{\circ(7)} (f^c_{(G,t,0,78)} \circ f^c_{(G,t+1,0,79)}) \xrightarrow{\circ(8)} H \xrightarrow{\circ(9)} f^c_{(H,t\Delta)} \xrightarrow{\circ(10)} f^{Ref}_{(H,subj,t)} \quad (5)$$

In (5), we have G which becomes a parameter in function conceive. There are two different acts of conceiving, one is that person W is conceiving his activity at the moment and what he would like to do at the next moment<sup>139</sup>. Then this becomes an information of coded version H. H becomes a parameter during the conceiving at his pause moment,  $t\Delta$ . Which is then transformed into function referring,  $f^{Ref}_{(H,subj,t)}$ . This function referring is *indexing* the information coded version H to *subject* (which is the article; d'un article).

Part 4: “pour ITS a poster lundi”

$$I \xrightarrow{\circ(11)} (f^c_{(I,t,0,76)} \circ f^c_{(int,t,0,80)}) \xrightarrow{\circ(12)} J \xrightarrow{\circ(13)} f^{art}_{(J,t)} \xrightarrow{\circ(14)} G \quad (6)$$

In (6), now the previous information (refer to 5) is transformed into coded version I which is then transformed as a parameter in function c. I is being conceived in two ways; of person W *reflecting his intentions*. This is then transformed into

<sup>139</sup>In fact, this is also like associating what he is doing currently in respect what he would like to do at another moment. It is actually contextualizing his context of communication, because of taking account of his activity at that current situated context.

coded version J which is then transformed into a parameter for function articulate. This is transformed into information of coded version G.

Let us briefly explain this rather long demonstration. It is a chain of formulas from sentence 2, beginning from label (1) until (6). We modeled each part of the sentences in relationship to the act of “conceiving” moment by moment of the speaker's activity. It is also in respect to the act of “articulating”<sup>140</sup> the action (articulating one's thoughts and action to the context of communication in regard to using, example, the instant messaging). Firstly, the notion of “conceiving” is using the idea of *conceptualization*. Conceptualization is occurring at an *abstract level*, of what the speaker is actively relating of his role, participation in that context of communication, and associating the occurrences happening around him. Now, how he is relating those occurrences is *contextualizing*-in his *situated context*. Those formulas are then just a modeling of *abstraction of an abstraction* of what is actually going on during the general act of conceptualization. Since we are not comfortable abusing the definition of conceptualization (according to Edelman, 1992) throughout our modeling, we use a very general word-*conceiving*. Because our work is at a very beginning stage.

Now, readers refer to section 4.15 on the see-saw representation and the notion of *transformation, coded information* and “*strength*”<sup>141</sup>. Those representation has been applied in this example (and for the rest in this remaining section).

From here onwards, we continue detailing each of the in-between processes of object and subject on the annotated sentences.

Sentence 3: Q says “Aha!”

*Part 1*: Aha!

$$G \xrightarrow{\circ(1)} f^p \xrightarrow{\circ(2)} f^m \xrightarrow{\circ(3)} H \quad (7)$$

The information G which was communicated by person W in sentence 2 is now being perceived by person Q as  $G'$ . This triggers  $f^m$ , function *memory* (which is remembering), where it is retrieving an internal stimulus (a member of a certain class belonging to a “cluster”). Now this remembering of an internal stimulus is then coded into information H.

Sentence 4: Q says “ Would you be interested in using a version map I showed in Barcelona?”

<sup>140</sup>When we use the word *articulating*, we are referring to an idea of “connecting by joint”. In some way, it is like associating what have been contextualized and connecting it to the coordination mechanism.

<sup>141</sup>This is discussed in great detail in the next section.

Part 1: Would you be interested in using

$$\begin{array}{c}
 \text{Categorizing} \\
 \uparrow \\
 \begin{array}{c}
 \circ(4) \quad \circ(5) \quad \circ(6) \\
 H \rightarrow f^p_{(H,t)} \rightarrow I \rightarrow (f^c_{(I,t,0,66)} \circ f^m_{(I,t,0,68)} \circ f^{as}_{(I,t,0,69)}) \rightarrow J \rightarrow (f^{fml}_{(J,t)} \wedge f^{fml}_{(st\_int,t)}) \\
 \begin{array}{c}
 \Delta \\
 \Delta
 \end{array}
 \end{array} \\
 \begin{array}{c}
 \circ(9) \quad \circ(10) \quad \circ(11) \\
 \rightarrow K \rightarrow (f^{art}_{(K,t,0,87)} \circ f^{Ref}_{(K,subj,0,80)}) \rightarrow M
 \end{array}
 \end{array} \tag{8}$$

Look at (8), we have H which is the previous coded version now transformed into becoming a parameter in function perceive at that moment. This is then being transformed into information coded version I which is then transformed as information into *function conceive* and *memory*. Here, we hypothesize this as some kind of *categorization* taking place. Both are being actively reflected at that moment, almost at the same time. This is an *active aggregation of levels* is then being reflected to *function associate* with now coded version I becoming version I'. Now these mental process transforms those coded information into information coded version J. Now J is being transformed into one of the parameters for function formulate, where *function formulate* ( $f^{fml}$ ) is formulating the coded version J together with *internal stimulus*. Now, this coded information is K which then becomes a parameter in *function articulate* and is being reflected together with *function referencing*. The *function referencing* is in respect to the subject. This yields coded information M.

Part 2: a version map

$$\begin{array}{c}
 \circ(12) \quad \circ(13) \quad \circ(14) \quad \circ(15) \\
 M \rightarrow f^c_{(M,t)} \rightarrow N \rightarrow f^{art}_{(N,obj,t)} \rightarrow O
 \end{array} \tag{9}$$

In (9), M is now being transformed into one of the parameters for function conceive. Here, it is being transformed into one of the parameter for function conceive. Then this processing yields coded information N which is then articulated during function articulate in respect to the object, which is referring to a particular “location” in remembering.

Part 3: I showed in Barcelona

$$\begin{array}{c}
 \circ(10) \quad \circ(11) \quad \circ(12) \\
 O \rightarrow f^c_{(O,t)} \rightarrow P \rightarrow f^{Ref}_{(P,subj,t)} \wedge ( \underbrace{f^{as}_{(P,t,0,68)} \circ f^m_{(P,t,0,7)}}_{\Delta} ) \\
 \\
 \circ(13) \quad \circ(14) \quad \circ(15) \\
 \rightarrow Q \rightarrow f^{art}_{(Q,t)} \rightarrow R
 \end{array} \tag{10}$$

In (10), we have O which is the coded information transformed as one of the parameters for function conceive. It is then transformed into coded information P and then transformed into another function referencing coded information O to subject which is at the same time associating coded information P to memory. The subject is being “remembered” at that moment of a specific past event. Now all this is then being transformed into coded information Q. This is now articulated as R.

Sentence 5: W says “Indeed!”

Part 1: Indeed!

$$\begin{array}{c}
 \circ(1) \quad \circ(2) \quad \circ(3) \\
 R \rightarrow f^p_{(R,t)} \rightarrow A \rightarrow ( f^c_{(A,t,0,78)} \circ f^{art}_{(A,t,0,79)} ) \rightarrow B \\
 \underbrace{\hspace{10em}}_{\Delta} \\
 \circ(4)
 \end{array} \tag{11}$$

Look at (11), now R has been perceived by function perceive as R'. And this process yields coded information A. A is now transformed as one of the parameters for function conceive and composed at the same time of function articulate. Then this is being coded into information B.

Sentence 6: Q says “hang on...I should be able to “push” it to the consortium here on BD”

Part 1: hang on

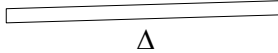
$$\begin{array}{c}
 \circ(1) \quad \circ(2) \quad \circ(3) \\
 B \rightarrow f^p_{(B,t)} \rightarrow R \rightarrow f^c_{(R,t,0,76)} \circ ( f^{fm}_{(R,t)} \wedge f^{ac.m}_{(R,t)} )_{0,079} \rightarrow S \\
 \underbrace{\hspace{10em}}_{\Delta} \\
 \circ(4)
 \end{array} \tag{12}$$

We have B now being perceived by Q as B'. It is then being coded into information version R. Now R is being conceived, at the same time composed with *function formulating* and *active memory* ( $f^{ac.m}$ ). Q is formulating his activity

at the same time *recalling*<sup>142</sup> *active memory* of *how to execute* that *activity* at that moment. This is then transformed into information coded version S.

*Part 2:* I should be able to 'push' it to


$$S \xrightarrow{\circ(5)} (f^{\text{fml}}_{(S,t,0,8)} \circ f^{\text{c}}_{(\text{int},t,0,75)}) \xrightarrow{\circ(6)} T \xrightarrow{\circ(7)} f^{\text{art}}_{(T,t)} \rightarrow U \quad (13)$$



S is now being formulated and conceived together with Q's intention. Q is formulating what he is going to do in respect to reflecting his intentions of doing it which is then transformed into information coded version T. T is then articulated as U.

*Part 3:* the entire consortium here on BD

$$U \xrightarrow{\circ(9)} (f^{\text{ref}}_{(U,\text{subj},t,0,76)} \circ f^{\text{m}}_{(U,\text{loc},t,0,75)}) \xrightarrow{\circ(10)} V \xrightarrow{\circ(11)} f^{\text{art}}_{(V,t)} \rightarrow W \quad (14)$$

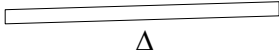


U is now being coded as parameter for function referencing. U is being referenced to subject which is the "location". This is achieved by the composition of function memory which is referencing to the exact location (of Q actively remembering where to execute that activity). Now this is being coded into V which is then being articulated as W.

Sentence 7: Q says "just need 5 minutes"

*Part 1:* just need

$$X \xrightarrow{\circ(1)} f^{\text{rec}}_{(X,t)} \xrightarrow{\circ(2)} (f^{\text{c}}_{(\text{env},t,0,78)} \circ f^{\text{c}}_{(\text{int},t,0,0,77)}) \xrightarrow{\circ(3)} Y \quad (15)$$



$\xrightarrow{\circ(4)} f^{\text{art}}_{(Y,t)} \rightarrow Z$


Now X is being transformed into parameters for *function recall*. Q is recalling his activity that he is engaged in now, in respect to his environment (the context he is

<sup>142</sup>Recalling a previous associated event.

situated) and associating this (composed) with his intentions. This is shown both by the function conceive.

Part 2: 5 minutes

$$Z \xrightarrow{\circ(6)} ( f^{\text{ref}}_{(Z,\text{obj},t,0,79)} \circ f^{\text{m}}_{(\text{int},t,0,8)} ) \xrightarrow{\circ(7)} A1 \quad (16)$$

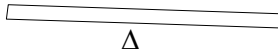


Z is now being referred to by function referencing and composed with *function memory*. Z is being referred to *object* (see 15).

Sentence 8: W says “Please Q, could you explain to me how I can chat with somebody ALREADY registered in BD but not yet in E?”

Part 1: Please Q

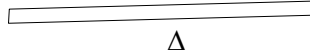
$$A1 \xrightarrow{\circ(1)} f^{\text{p}}_{(A1',t)} \xrightarrow{\circ(2)} ( f^{\text{c}}_{(\text{obj},t,0,78)} \circ f^{\text{m}}_{(\text{subj},t,0,80)} ) \xrightarrow{\circ(3)} B \xrightarrow{\circ(4)} f^{\text{art}}_{(B,t)} \xrightarrow{\circ(5)} C \quad (17)$$



A1 is being perceived by function perceive as A1' at that moment. Q is conceiving his intentions composed; in reflecting it to *function memory* where object and subject are being conceived in a cyclic approach. Then this is being transformed into coded version B and articulated as coded version C.

Part 2: could you please explain to me

$$C \xrightarrow{\circ(6)} ( f^{\text{fml}}_{(C,\text{int\_st},t,0,89)} \circ f^{\text{c}}_{(C,\text{env},t,0,87)} ) \xrightarrow{\circ(7)} D \xrightarrow{\circ(8)} f^{\text{art}}_{(D,t)} \xrightarrow{\circ(9)} E \quad (18)$$



C is transformed as one of the parameters for *function formulate* ( $f^{\text{fml}}$ )<sup>143</sup>. It is being formulated in respect to conceiving the environment (context) that W is situated in. This is then being transformed into information coded version D. D is articulated as E.

<sup>143</sup>It is used to represent that something is occurring to that allows one person to express something in systematic terms and then to convey in a particular form.

Part 3: how can I chat with somebody

$$\begin{aligned}
 & \overset{\circ(7)}{E} \rightarrow \left( \overset{\circ(8)}{f^{as}}_{(E, \text{int}, t, 0, 50)} \circ \left( \overset{\circ(9)}{f^{fml}}_{(E, \text{int}, t)} \wedge \overset{\circ(10)}{f^{Ref}}_{(E, \text{int}, \text{subj}, t)} \right) \right)_{0,51} \\
 & \quad \underbrace{\hspace{15em}}_{\Delta} \\
 & \rightarrow F \rightarrow f^{art}_{(E, t)} \rightarrow G
 \end{aligned} \tag{19}$$

E is now being transformed into one of the parameters for *function associate*. Here, E is being associate to the intentions. At the same time it is being reflected with *function formulate*. It is formulating the intentions in referencing it to the subject (who). It is then being coded into information F which is then articulated into coded information version G.

Part 4: ALREADY registered in BD

$$\begin{aligned}
 & \overset{\circ(11)}{G} \rightarrow \left( \overset{\circ(12)}{f^m}_{(G, t)} \leftarrow f^{ac-m}_{(c\_sl, G, t)} \right) \rightarrow H \\
 & \overset{\circ(13)}{\rightarrow} \left( \overset{\circ(14)}{f^{ref}}_{(H, \text{obj}, t, 0, 67)} \circ \left( \overset{\circ(15)}{f^{act-m}}_{(H, \text{subj}, t, 0, 58)} \circ f^{as}_{(H, \text{env}, t, 0, 67)} \right) \right) \\
 & \quad \underbrace{\hspace{10em}}_{\Delta} \quad \underbrace{\hspace{10em}}_{\Delta}
 \end{aligned} \tag{20}$$

G is now being transformed into one of the parameters for function memory and active memory. G is being referred to in memory and this in respect to active memory of belonging to an active cluster (or like active categorization). Now this processing codes the information into coded version H. H is being referred to the object at the same time is in respect to the process of function active memory of where the subject is located but in associating this to the environment/context that W is situated in.

Part 5: but not yet in E

$$\begin{aligned}
 & \overset{\circ(14)}{E} \rightarrow \left( \overset{\circ(15)}{f^{rec}}_{(E, t+1, 0, 65)} \circ \overset{\circ(16)}{f^{fml}}_{(E, t, 0, 646)} \right) \rightarrow F \\
 & \quad \underbrace{\hspace{15em}}_{\Delta} \\
 & \overset{\circ(16)}{\rightarrow} \left( \overset{\circ(17)}{f^{art}}_{(E, t, 0, 55)} \circ \overset{\circ(18)}{f^{ref}}_{(E, \text{obj}, t, 0, 40)} \right) \rightarrow G \\
 & \quad \underbrace{\hspace{15em}}_{\Delta}
 \end{aligned} \tag{21}$$

Now, E is being coded into function recall of the specific information of the subject. At an aggregation of level, formulating this coded version that is



transformed into F. Which is now being articulated and referenced to the object. This processes transforms the previous information coded version F into G.

Sentence 9: Q says “ok, gonna publish first”

*Part 1*:ok gonna

$$\begin{aligned}
 & G' \xrightarrow{\circ(1)} f^p_{(G',t)} \xrightarrow{\circ(2)} A \xrightarrow{\circ(3)} f^c_{(A,v_{rf},t)} \xrightarrow{\circ(4)} B \tag{22} \\
 & (f^{art}_{(B,t,0,87)} \circ (f^{Ref}_{(B,int,t)} \wedge f^{Ref}_{(G',int,t+1)})_{0,88})_{0,56} \circ f^{as}_{(Ref,t,086)} \xrightarrow{\circ(5)} C \xrightarrow{\circ(6)} f^{art}_{(C,t,0,87)} \\
 & \quad \Delta \qquad \qquad \qquad \Delta \\
 & \qquad \qquad \qquad \xrightarrow{\circ(7)} D
 \end{aligned}$$

G is being perceived by Q as G'. G' is then transformed into A. A is being conceived as a *voluntary reflex* (see previous definition of this) which is then articulated and transformed into coded version B. Now, Q is articulating this in respect to referencing coded version B to G' (that had been previously perceived). At the same time with the intentions (we must assume that Q is referencing to his primary intention of offering to use the map) is now reflected and associated to that (primary intention) which is finally transformed and articulated as information coded version D.

*Part 2*: publish map

$$\begin{aligned}
 & D \xrightarrow{\circ(8)} (f^c_{(D,t,0,76)} \circ f^c_{(actv,D,t+1,0,78)})_{0,76} \circ (f^{as}_{(D,sub-part,t,0,65)} \circ f^m_{(D,loc,t,0,63)})_{0,75} \xrightarrow{\circ(9)} E \tag{23} \\
 & \quad \Delta \qquad \qquad \qquad \Delta \\
 & \qquad \qquad \qquad \Delta
 \end{aligned}$$

Now, D is being transformed as one of the parameters for function conceive. Conceiving of that coded information version D, in respect to conceiving Q's own activity at that moment. Now, here comes the tricky part (we notice, during this point, the task of doing something has evolved into becoming a goal-driven thing),so in some ways, the “activities” within the “conceiving” process *becomes more* connected and associated<sup>144</sup>. But it is connected and associated in respect to the context. Now, this conceiving act is being reflected at another level by associating D to a sub-part of the goal. This is composed with the memory, that is this association is corresponding to a certain location in the memory (of where the

<sup>144</sup>There is exist some kind of stronger “categorization”.

sub-part is). Finally, this composition is transformed into information coded version E.

Sentence 10: Q says “Sorry, had a phone call”

*Part 1*: Sorry

$$\underbrace{(f^c_{(\text{act},t,0,78)} \circ f^{\text{as}}_{(\text{E},\text{act},t-1,0,74)})}_{\Delta} \xrightarrow{\circ(1)} F \xrightarrow{\circ(2)} f^{\text{art}}_{(F,t)} \xrightarrow{\circ(3)} G \quad (24)$$

Q is conceiving and associating his (the speaker) current activity with previous activity in respect to coded information E. This is then transformed into coded version F and articulated finally into information coded as G.

*Part 2*: had a phone call

$$G \xrightarrow{\circ(4)} \underbrace{(f^{\text{rec}}_{(G,t,0,69)} \circ f^{\text{ac}_m}_{(G,t,0,68)})}_{\Delta} \xrightarrow{\circ(5)} \quad (25)$$

$$\underbrace{(H_{(0,56)} \circ f^{\text{as}}_{(\text{H},\text{env},t,0,58)})}_{\Delta} \xrightarrow{\circ(6)} I \xrightarrow{\circ(7)} f^{\text{art}}_{(I,t)} \xrightarrow{\circ(8)} J$$

Now, Q is recalling and associating what he is recalling to active memory (of his previous activity). This is then being transformed into another process where the coded version H is being reflected by associating it to the context. Then this yields information coded version I which is finally articulated as coded version J.

Sentence 11: Q says “ Just publishing now”

*Part 1*: Just

$$\underbrace{(f^c_{(\text{actv-f},t,0,67)} \circ f^{\text{as}}_{(\text{actv-f,t,p-tsk},t-1,0,69)})}_{\Delta} \xrightarrow{\circ(78)} \underbrace{f^{\text{rec}}_{(\text{actv-f},t,0,79)}}_{\Delta} \xrightarrow{\circ(9)} K \xrightarrow{\circ(10)} f^{\text{art}}_{(K,t)} \xrightarrow{\circ(11)} L \quad (26)$$

Now we have Q is conceiving (and perceiving it in a way) his activity at the focus moment. It is also composed with the association of the activity at the focus moment to the task at previous time and at that time. Then Q is again recalling his activity at the focus moment which is then finally articulated as version coded L.

*Part 2: publishing*

$$L \xrightarrow{\circ(12)} (f^{fm}{}_{(L,t,tsk,0,78)} \circ f^c{}_{(Env,actv,t,0,75)}) \xrightarrow{\circ(13)} C \xrightarrow{\circ(14)} f^{art}{}_{(C,t)} \xrightarrow{\circ(15)} D \quad (27)$$

Now, L is being transformed as one of the parameters for function formulate and conceive. Q is formulating together with the task that Q is doing. This is carried out on another level of conceiving (like re-contextualizing) of what Q is doing now in his context. In fact here, conceiving is happening at a different degree, as we noticed at the beginning of the sentence and now at this moment. Then, finally, it is coded as information D.

Sentence 12: W says “I am on the phone too, sorry”

*Part 1: I am on the phone too*

$$D \xrightarrow{\circ(1)} f^p{}_{(D',t)} \xrightarrow{\circ(2)} A \xrightarrow{\circ(3)} \quad (28)$$

$$(f^c{}_{(A,actv,t,0,76)} \circ f^{tsl}{}_{(A,actv,t,0,75)})_{0,67} \circ f^{as}{}_{(actv,t-1,0,79)} \xrightarrow{\circ(3)} B \xrightarrow{\circ(4)} f^{art}{}_{(B,t)} \xrightarrow{\circ(5)} C$$

D is being perceived by W as D'. This is then transformed into coded version A which is then being conceived and translated (by function translate;  $f^{tsl}$ )<sup>145</sup> in respect to the activity of W at that moment. It is like a moment before associating takes place. This composition of conceiving and translating (like a moment of re-adapting to the context, because of carrying two activities at the same time) is then being associated to W's previous activity. This association is being made to his previous situated context. We notice that it is an act of associating it to memory. This is finally articulated as information coded version C.

*Part 2: sorry*

$$D \xrightarrow{\circ(6)} (f^c{}_{(D,actv,t,0,89)} \circ f^{as}{}_{(D,actv,t-1,0,88)}) \xrightarrow{\circ(7)} E \xrightarrow{\circ(8)} f^{art}{}_{(E,t)} \xrightarrow{\circ(9)} F \quad (29)$$

<sup>145</sup>We use the notion translate for a transformation which moves an object to a new location.

Now, W is conceiving coded information D with W's activity. At the same time associating it with his previous activity. Now, this coded information E is yielded from those reflections and is articulated as information coded version F.

Sentence 13: Q says “Heh oh, I have just published the map”

*Part 1*: Heh oh

$$\begin{array}{c}
 \overset{\circ(1)}{F} \rightarrow \overset{\circ(2)}{f^p}_{(F,t)} \rightarrow \overset{\circ(3)}{E} \rightarrow ( \overset{\circ(4)}{f^c}_{(E,t,0,57)} \circ \overset{\circ(5)}{f^{as}}_{(E,actv,t-1,0,55)} ) \\
 \hline
 \Delta \\
 \rightarrow \overset{\circ(4)}{A} \rightarrow \overset{\circ(5)}{f^{art}}_{(A,t)} \rightarrow \overset{\circ(6)}{B}
 \end{array} \quad (30)$$

Now, Q has perceived coded information F as F' and is transformed as coded version E. This is then being conceived and associated to previous activity of W in respect to the coded information E<sup>146</sup>. It is being articulated finally as information version B.

*Part 2*: I have just published the map

$$\begin{array}{c}
 \overset{\circ(7)}{B} \rightarrow ( \overset{\circ(8)}{f^c}_{(B,actv,t)} \wedge \overset{\circ(8)}{f^c}_{(B,subj,t)} ) \rightarrow ( \overset{\circ(8)}{C}_{(0,66)} \circ \overset{\circ(8)}{f^{r-ac-m}}_{(C,t-1,0,69)} ) \\
 \hline
 \Delta \\
 \rightarrow \overset{\circ(9)}{D} \rightarrow ( \overset{\circ(10)}{f^{fm}}_{(D,int,t,0,88)} \circ \overset{\circ(11)}{f^c}_{(D,actv,t,0,86)} ) \rightarrow \overset{\circ(12)}{E} \rightarrow \overset{\circ(13)}{f^{art}}_{(E,t)} \rightarrow F
 \end{array} \quad (31)$$

At this moment, Q is conceiving his activity and the *subject* of his activity which is transformed into information coded version C. This is later composed with function  $f^{r-ac-m}$ , that is a function *re-activating active memory*. This is when Q is actively remembering what he had done in previous moment at that situated context. Now it is transformed into information coded D which is then formulated as his intention in respect to conceiving of his current activity. Finally, this is being articulated as F.

Sentence 14: Q says “Ok, go on the menu maps...Get published maps”

<sup>146</sup>When readers encounter A...Z is being continuously re-used, it is in no way the similar coded version of information, it only use to signify a new chain of information is created.

Part 1: Ok

$$\text{Activity} \xleftarrow{\circ(1)} (f^c_{(F, \text{actv}, t)} \circ f^{\text{fm}}_{(F, \text{goal}, t)}) \xrightarrow{\circ(2)} G \xrightarrow{\circ(3)} f^{\text{art}}_{(G, t)} \xrightarrow{\circ(4)} H$$

Q is conceiving his own activity (shown by Activity  $\rightarrow$ ) at that current moment and formulating it with the information coded F corresponding to his goal. Then this is being transformed into coded version G and finally articulated as H.

Part 2: Go on the menu maps

$$H \xrightarrow{\circ(5)} f^c_{(H, \text{goal}, t)} \xrightarrow{\circ(6)} I \quad (32)$$

$$\begin{array}{c} (f^{\text{art}}_{(I, \text{goal}, t, 0, 87)} \circ f^c_{(I, \text{actv}, t-1, 0, 87.5)}) \xrightarrow{\circ(7)} J \xrightarrow{\circ(8)} f^{\text{tsl}}_{(J, t-1)} \\ \hline \Delta \end{array}$$

$$\begin{array}{c} \rightarrow K \xrightarrow{\circ(9)} (f^{\text{ac}_m}_{(K, \text{subj}, t, 0, 67)} \circ f^{\text{as}}_{(K, \text{obj}, t, \text{goal}, 0, 67.5)}) \xrightarrow{\circ(11)} L \xrightarrow{\circ(12)} f^{\text{art}}_{(L, t)} \xrightarrow{\circ(13)} M \\ \hline \Delta \end{array}$$

Q is conceiving H is together with his goal. It is then transformed into information coded version I. I is now being reflected at a level of being articulated and conceived in composition of goal and activity at that moment to previous moment. This is then being transformed into information coded version J. J is later being translated into coded version K. It is being transformed as one of the parameters for active memory of the subject and associating it to the object and the goal (see sentence: of associating the map to the object of the activity-like a goal). Then, this is being transformed into information coded version L then articulated finally as M.

Part 3: get published maps

$$\begin{array}{c} M \xrightarrow{\circ(14)} (f^c_{(M, \text{goal}, t, 0, 65)} \circ f^c_{(M, \text{actv}, t+1, 0, 65.6)}) \xrightarrow{\circ(15)} N \xrightarrow{\circ(16)} (f^{\text{tsl}}_{(N, \text{goal}, \text{actv}, t, 0, 56)} \circ f^{\text{art}}_{(N, \text{goal}, t+1, 0, 56.6)}) \\ \hline \Delta \qquad \qquad \qquad \hline \Delta \\ (33) \end{array}$$

$$\begin{array}{c} \rightarrow O \xrightarrow{\circ(17)} f^{\text{ac}_m}_{(O, t)} \xrightarrow{\circ(19)} P \xrightarrow{\circ(20)} f^{\text{art}}_{(P, t)} \xrightarrow{\circ(21)} Q \end{array}$$

M is being conceived at a level of conceiving the goal at the moment together with the activity at the future moment. Now, this composition yields information

coded version N. Firstly, during this moment, *function translate* is translating the information coded version N in linking it to the goal and the activity at that moment. At the other level, function articulate is linking the coded N to the goal but at the future moment. This is then being transformed into coded version O which is then being used in function active memory (of recalling what is suppose to be done). Then this recalling yields coded version P which is finally articulated as Q.

### 5.19 Bateson's Criteria of Mental Process

We have discussed at length the abstract modeling of the transformations moment by moment how people are reading text and responding to the text that they read in functions. As promised, we will now explain some of the notions used in our modeling which we have adapted from Bateson's work in *Mind and Nature: A Necessary Unity* (Bateson, 1979).

Readers must be wondering if any of those abstract modeling makes any sense. The modeling has undergone several updates. Firstly, we have tried to exactly map the narration in Section 4.3 into formulas (i.e. functions). We recognize several general occurrences taking place. As an example, function *perceiving* ( $f^p$ ), *conceiving* ( $f^c$ ), *translating* ( $f^{tsl}$ ), *formulating* ( $f^{fml}$ ), *articulating* ( $f^{art}$ ), *memory* ( $f^m$ ), *active\_memory* ( $f^{ac-m}$ ), and a special parameter which we called as “voluntary reflex” ( $v_{rf}$ ). Next, we looked into how one function links to another function a sort of chains of “thoughts” or processes forms. This have brought us looking into the work of (Bateson, 1979). The choice becomes very essential because in the work of (Bateson, 1979), the author specifically looked into criteria of mental processes that is tied back to the hierarchy of learning and communication in (Bateson, 1972). In our modeling, we have not determined the parameters in each functions. This is because we don't know what are the parameters yet.

In a way, this is the first step to “close” the framework<sup>147</sup>. In our modeling of the processes (section 4.17), we found only 4 relationships (criteria) between our work and Bateson's. Thus, we shall only concentrate on those 4 criteria. We explain in this section, how learning and communication are influencing one another. At the same time we derive ideas from (Clancey, 1997a) on modeling *conceptualization* and *contextualism*. Those occurrences (the sentences which had been labeled as object and subject) are actually related to a wider notion of conceptualization.

The next sections are organized as the following: (i) we speak briefly of the 4 criteria on mental processes and relate them briefly to our modelings. (ii) we relate each of the criteria to our modeling.

---

<sup>147</sup>We refer the hierarchy of learning and communication, activity states, and the modeling of the transformation as *framework*.

### 5.19.1 Criterion 1: A mind is an Aggregate of Interacting Parts or Components

In criterion 1, (Bateson, 1979) hypothesized that some parts of such an aggregate may be regarded as minds or *sub-minds*<sup>148</sup>. Bateson believed that *mental process* is always a *sequence of interactions between parts*. The explanation of mental phenomena must always *reside* in the *organization and interaction of multiple parts*.

We shall relate this back to some snap shots of the modeling<sup>149</sup>.

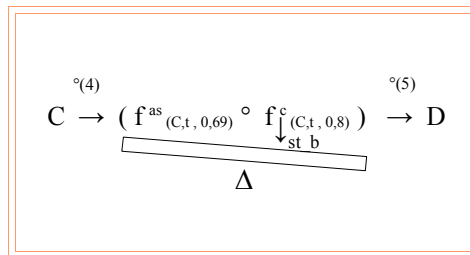


Figure 5.19.1(a): A snap shot of a formula for the modeling.

$f^{as}$  (i.e. function associate) is a function that is *interacting* with  $f^c$  (i.e. function conceive). We are conscious that the  $f^{as}$  could be an actual fact, a *sub part* of  $f^c$ <sup>150</sup>. Nonetheless, they are both interacting but with  $f^c$  having a stronger value than  $f^{as}$  (so maybe  $f^{as}$  is a sub part of  $f^c$  after all?). Let us speak further of Bateson's hypothesis.

Bateson remarked that *without differentiation of parts*, there can be *no differentiation of events or functioning*. We take some examples from Bateson (1979), firstly, according to Bateson, pg 87; if the atomies are not themselves internally differentiated in their individual anatomy, then the appearance of complex processes can only be due to interaction between atomies. Secondly, the “whole” of the present book will be based on the premise that the mental function is immanent in the interaction of differentiated “parts”. Hence, “wholes” are constituted by such combined interaction. So recalling back Chapter 3, events and experiences are also described being made up of whole, where in the dynamics of events around us, seems to be made up of punctuated events. However, punctuated events are in the first place *parts* denoted by *characteristics*. But those characteristics can change when the context is not the same anymore.

<sup>148</sup>This idea had been discussed by Bateson as early as 1979, and was also discussed by Minsky in (Minsky, 1986), on a similar notion.

<sup>149</sup>In section 4.17, modeling of sentence 2, part 1, equation (2).

<sup>150</sup>Does our idea of conceiving correspond to the general notion of conceptualization according to (Clancey, 1997a)? Does  $f^c$  have many sub parts that are in the background? Looking into our own analysis, subconsciously, there are sub-parts in the foreground, that makes up of what conceptualization is all about.  $f^c$  is a global overview of all, and  $f^a$  might be just one of the functions that we are most aware of. Associating in most general view, is not just a stimulus-memory matching, but suggesting associating to the context a person is situated in (is this like contextualizing)? In other words, for us this is similar to contextualism. Since the context is always changing, and “retrieving memory” is not merely a mechanistic input-output process.

These are the important consequences from these observations. Mental process consists of sub-parts. For example, could  $f^{sl}$ , or  $f^{fm}$  also be a sub part of  $f^c$ ? It does seem very likely. Next, mental processes are always a sequence of interaction of sub-parts. This is something which we have modeled, from one interaction of sub-parts generates another type of information which then interacts with another sub-part. Now, we continue with criterion 2.

### 5.19.2 Criterion 2: The Interaction between Parts of Mind is Triggered by Differences

We examine the second criterion. Bateson had listed the second criterion for mental processes as being an *interaction between parts of mind* that is *triggered by difference*. It is looking into the nature of relationship between parts, like *how do parts interact to create mental process*. Bateson gave an example: it takes a relationships, either between two parts or between a part at time 1 and the same part at time 2, to activate some third component which we may call the receiver. What the receiver (e.g., a sensory end organ) responds to is a *difference or change*. Precisely, the mind can receive news only for difference, there is a difficulty in discriminating between a *slow change* and a *state*. Hence, Bateson speculated that there is necessarily a *threshold gradient below* which gradient cannot be perceived. Recall back that we had made some “claims” on the notion of activity states. It is precisely our concern that a state, or activity states- that a person is always somehow in some kind of *state*. Can a state be explained in terms of having a threshold gradient?

Those differences are levels of “mental reflection”. Readers refer again to our previous snap shot, figure 4.18.1(a). We modeled the *function associate* ( $f^{as}$ ) and *function perceive* ( $f^p$ ) as having “an aggregation of levels”, but with *values or strength*. Using the same example from (Bateson, 1979), a whole book is made up of parts, but each part is not made up of the same amount of pages, or the same discussions, but rather there are differences that complement them at the end of the book. So, looking back into Figure 5.19.1(a), Section 5.19.1, we are modeling the mental process as having *different values (or strengths)*. *When these processes have different values or strengths it causes differences between the interaction of sub-parts, hence triggering* information coded version D. Recall section 5.17 where we have previously discussed on the association of our ideas on using the see-saw modeling to Bartlett (1995) hypothesis. For example, if I see something in front of me, a beautiful mug, with flowers, I am noticing the difference of the flowers (yellow, blue, turquoise) that are the details and it triggers my mind to look at the unitary that it is a mug (there is a handle at the side, blue color, it is of a rounded shape, contains chocolate drink with an orange spoon located next to my computer). These differences, details, yet looking at a whole triggers sub-parts of interaction of “what am I conceiving right now? The strengths are different, because at time my eyes are focus on the foreground,



because of the yellow flowers on the mug, but at the same time I can see that the mug contains chocolate milk, that is occurring at the background.

### 5.19.3 Criterion 4: Mental Process Requires Circular (or more Complex) Chains of Determination

We have discussed two mental processes; criterion 1 and criterion 2. Bateson had stressed two matters: (i) interaction of sequences of parts, and (ii) differences. The next criterion 4 (we skip criterion 3<sup>151</sup>) is on circular chains of determination. Specifically, (Bateson, 1979) gave an example of understanding the chains of complex interaction in a machine. The example given in (Bateson, 1979) is excerpted below from page 97:

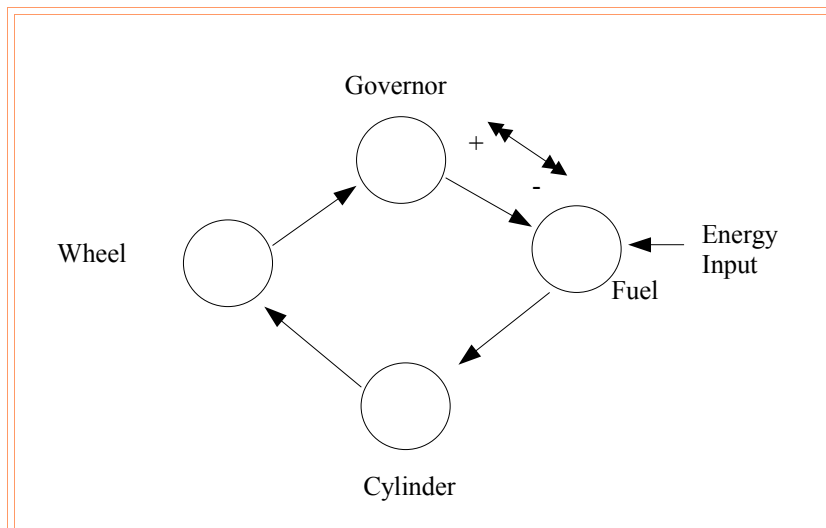


Figure 5.19.3 (a): An example on chains of determination.

Referring to figure 4.19.3(a), representing a machine that has four parts: wheel, cylinder, fuel and governor. The machine is connected to the outside world in two ways, “energy input” and “load”, which is to be imagined as variable and perhaps weighing upon the flywheel (Bateson, 1979). The machine is circular in the sense that the flywheel drives the governor which alters fuel supply which feeds cylinder which, in turn, drives the flywheel. In any diagram, arrows denote the cause and effect, and in this diagram, we noticed cyclic causal chains of determination. The arrows are used to indicate direction from cause to effect, and it is possible to imagine any combination of types of causation from step to step. The *arrows* are supposed to *represent mathematical functions or equations* showing the types of effect that successive parts have on each other.

<sup>151</sup>Criterion 3 is on mental process requires collateral energy, more details may be referred to (Bateson, 1979).

To make this description brief and straight to the point, changes are produced in the behavior of the parts (like from the cylinder to the flywheel and so forth), whose magnitude and timing are determined by *forces* and *impacts* between the *separate components* of the circuit. In order to explain further, Bateson gave another example of how the author himself had used a language to describe the changes (we do realize, that this won't be a very convincing claim for readers, but we will get to the idea momentarily). Bateson noticed that the language that he had used to describe the steps in the circuit had a general form: A change in A determines a change in B. And so on. But when a description reaches the place from which it (arbitrarily) started, there are sudden changes in this syntax. The *description* now must *compare change with change* and use the result of that comparison to account for the next step. In other words, a *subtle change* has occurred in the subject of discourse, which, in the jargon of the last section of this chapter, is called *a change in the logical typing*. When Bateson said that the system exhibits “steady state” (that in spite of variation, it retains a median value), the author is talking about the circuit as a whole, not about the variations within in.

How does this relate to the our modeling? Let us re-examine the sentence. Readers take note that each modeling have been performed by mapping onto each part of the sentences which have been segmented (e.g. sentence 1 has part 1, part 2 and so on). If we put the *functions* in a sequence, we notice that some functions are being *repeatedly formulated*. Hence, forming chains of “articulation” of thoughts and actions. To give an example, we take sentence 6: “hang on..I should be able to 'push it' to the consortium here on BD” However, we represent it differently in this section, like in figure 4.18.3(a).

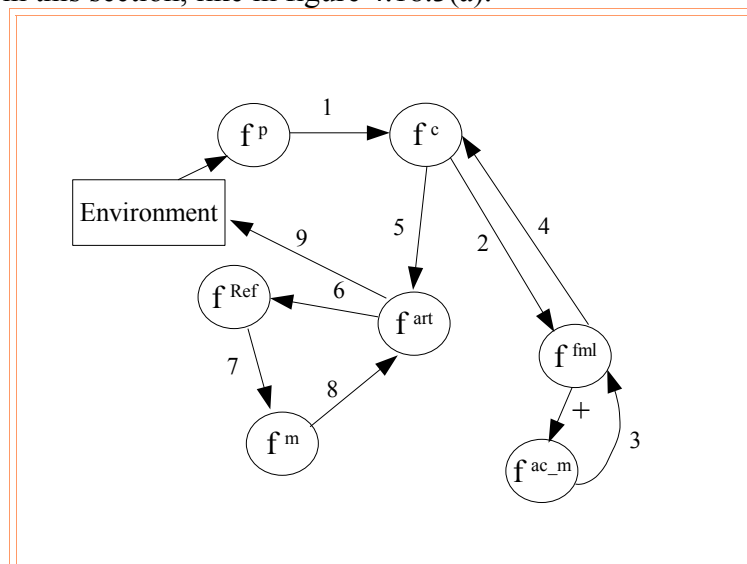


Figure 5.19.3(b): Modeling the functions as chains of determination.

Refer to the figure above. The arrows are labeled with 1,2, and so on to show the direction of the sequences of interactions between the parts. Each function has “parameters” that are evaluated based on some information, coming from the

environment, *external factors* and *internal factors*. On one hand, the external factors can trigger the internal interest. These causes change in the functions, and are working together in a chain of changes. Note also that lastly the  $f^{art}$  is an action situated in the context/environment. Then the response from the environment is again perceived.

We relate this criterion and criterion 2 to our *see-saw representation*. Readers recall Section 5.16 (See-saw representation) and Section 5.17 (Activity States using the notion of see-saw). We have discussed about the essence of the see-saw representation; which is based on making comparison. Relating this terminology to Bateson's own work intersects at several points.

Firstly, as mentioned, our arrows are compounded as “transformation” arrows. These arrows consist of value that has been *differentiated* (by making comparison) in the *see-saw* representation: for function composition. To the question, how it has been differentiated exactly, we have no answer to date. Readers must take note that we are not prescribing the notion of functions to actual human mental process.

Secondly, the see-saw representation was a model of sub-parts interacting with one another. These parts are based on values/strengths. The other obvious question would now be, why did we not model those changes (strengths) upon strength when they are “sequentially” interacting as differentiation/gradient? We transform this question into three questions.

(i) What are those imaginary values which we preliminary given to the functions (see again figure 4.18.3(a))? and; (ii) how can we evaluate this and; (ii) on what supposition have it been evaluated on?

This supposition of attributing values to each of the functions is related back to “contextualism”. There must be a ground basis of the context of one's engaged activity that contributes to those values, that have been differentiated. The differentiated values is related to the active coordination of a person at that moment of her action.

Relating all this with (Bateson,1979) criterion, we can summarize that changes contain variations, or values, that are then related to the matter of coding. This brings Bateson to the 5<sup>th</sup> criterion. These chains of determination must keep these changes that have occurred during the cycles. Then this matter of coding has become like attributes. Hence, answering to our own concerns, it is difficult at the moment to actually point what are those variations, or attributes to model changes as differentiation.

For now, those questions (i,ii, and iii) remains an open question and we do not have the answer.

#### **5.19.4 Criterion 5: In Mental Process, the Effects of Differences Are to Be Regarded as Transforms (i.e. Coded Versions) of the Difference Which Preceded them**

How do the differences examined in the discussion above relate to the criteria of coding? We recall again figure 4.18.1(a). We note that C and D is referred to as “information coded version”. We have also mentioned that the chains of determination must keep those changes. These changes make up some kind of attributes to what we call coded version. This terminology is based upon this fifth criterion. In this criterion, Bateson examines how criterion 2 and sequences of effect in *promoting* other differences become material of information, redundancy, pattern, and so on.

A transformation of coding according to Bateson, is the *fact* (information) of differences between cause and effect. When these differences are incorporated into a flexible system, they become a primary premise in what Bateson refers as transformation of coding. When this notion is incorporated in a flexible system (or alive system), then some regularity in the relation between cause of and effect is assumed. If we assume that there is no existence of regularity or the notion of transformation coding, no mind could possibly guess at cause from effect (Bateson, 1979).

Bateson had also observed that if we are to consider the regularities in those differences, then there is always a partly predictable and therefore rather regular relation between *message* and *referent*, that relation indeed never being direct or simple. We are going to inverse this idea. Let us think of the cause and effect as the following. A is sending a message X which is the cause of a reaction of B *after* “comprehending message of A” as a referent to that previous message, B's reaction is also the effect of that message (the one that A had sent). How does B deal with A's indication of that message? This question brings Bateson to the final criterion, 6.

#### **5.19.5 Criterion 6: The Description and Classification of these Processes of Transformation Discloses a Hierarchy of Logical Types Immanent in the Phenomena**

Finally, we are near to the closing ceremony. This particular criterion 6 (and criterion 3) have not been included in our modeling. For a very simple reason, we don't know yet how to incorporate them in our modeling. Nevertheless, we discuss it briefly, because completing the 6 criteria corresponds to the hierarchy of learning and communication (discussed in Chapter 4 in section “the logical types of learning and communication”).

Let us go back at where we left criterion 5. We are now looking into the *existence* of another *class of information* that *tells* a person how to *encode* the

*coding of messages*. Recall this (mentioned previously). We have A and B communicating with one another. We have left the question on how can B deal with A's indication (of messages). According to (Bateson, 1979) in his final criterion, it is absolutely necessary that B knows what those indications mean. So it is assuming some kind of a priori, that B *must have* the *capabilities* to treat those indications. Hence, this brings forward the existence of another class of information. This class of information which B must assimilate, to tell B about the coding of messages or indications coming from A. Messages of this class will be, not about A or B, but about the *coding of the messages*<sup>152</sup> (Bateson, 1979). They will be of a different logical types, which Bateson calls them as meta-messages.

Beyond messages about simple coding, there are much more subtle messages that become necessary because codes are conditional. The meaning of a given type of action or sound changes relative to context, and especially relative to the changing state of relationship between A and B (Bateson, 1979)<sup>153</sup>.

These criteria (1 until 6) are premised on the hierarchy learning and communication. We recall from Chapter 4, that the basis of the hierarchy of learning and communication is the idea of changes (law of motions). The idea starts with a potential *differentiation* between *action in context* and action or behavior which *defines context* or makes context intelligible. A *function*, an *effect*, of the *meta-message* is in fact to *classify* the *messages* that occur *within its context*. It is at this point that the theory of (Bateson, 1972 & 1979) connects to the work of logical typing of Russel and Whitehead (as discussed in Chapter 3).

Taking a final example, we quote below

“Human “understands” the cat by putting the pieces together as if he really knew what is happening. He forms hypotheses, and these are continually checked or corrected by less ambiguous actions of the animals.”(Bateson, 1979), p.109.

Everything is composed of the “parts” or “criteria” which Bateson had listed “incrementally”. But those parts must not be considered in conventional terms of “frames”. Those *parts change* when contexts are no longer being able to be discriminated.

---

<sup>152</sup>This corresponds to our very own concern about how we got about *about modeling* the CONSTEPS. Later on, we have illustrated that indeed, that the modeling is situated in the context, suggesting “coupling mechanisms” working at hand. Can we solve this puzzle by looking into the “coupling mechanism” suggested by (Clancey, 1997; Maturana, 1999)?

<sup>153</sup> Bateson was building on an inductive level in his idea of meta-message. We suspect that from here onwards, he wanted to relate it to meta-concept, both are not of the same, but if being induced or being read like Bateson's framework on the hierarchy of learning and communication, doesn't meta-message as going through transformations becomes meta-concept?

## 5.20 What we understand about transformations: in-between object and subject

This section describes our intention for future work: understanding communication protocols.

Let us briefly summarize what we have been learning from Chapter 3 until now in Chapter 4. The work has been approached via two ways. The first way is: (i) looking into actual communications; then (ii) validating observations based upon state of the art theories. The second way is: (i) looking into the hypothesis of communications in theoretical foundations; then (ii) searching for those phenomenon in the actual communications. This work has touched several aspects; from human learning to communication, to situated cognition and activity theory. Those theories have been merged together forming a set of concepts and their associated terms.

We have converted the conversations that have eventually allowed us to form sequences of explanation along the way. It has also allowed us to ask more questions and retrieve some readings that had suggested those observations. Firstly, we hypothesized that even the *transformation acts*-mechanisms (such as from the predicates to another level of predicates) are *situated in context*. Hence, we looked into the transformation mechanisms. This has been done in such a way that we can explain how those transformation from one point to the other had been carried out. We found that indeed we got stuck at understanding how one makes a jump from one abstraction to the other abstraction. This same problem goes back to the logical types of learning, where we had raised some specific questions from pages 77-78. This is again encountered in our handicap to solve the last criterion 6 (and 3 as well) at the moment.

The last criterion is important because it helps to close the hierarchy of learning and communication. It contributes to understanding the transformations process. It also holds the key to understanding how “communication protocols”<sup>154</sup> are *punctuated in the first place*. To summarize, our terminology of transformation, is observing how from A one goes to B. What goes from A to B is the in-between processes. We noticed that we were playing around with two terminologies of the in-between processes:

- 1) The in-between notion of jumping from one context of abstraction to another level of abstraction.
- 2) The in-between processes of comprehending the text that one reads and *coordinating the thoughts and action via the tools*.

Are we speaking about the same in-between that goes through some processes? For now, we speculate that it does not seem to be the same. So, in the end, we dispute whether this has anything to do with the *coupling mechanism* suggesting that the in-between processes is indeed *situated in a context*.

---

<sup>154</sup>We replace the notion of “punctuation of events”.

Next, we look into what we know about object and subject:

1) In (Leont'ev, 1978), the author had used the notion inter-changing to describe how consciousness arises in the act of doing an activity. We have described this notion of object and subject and suggested that it applies to how one formulates intentions when engaged in an activity. This was discussed in Chapter 4.

- When a person is focused at a certain moment, then the “subject” of what he is focusing on becomes the object of his pursuit for doing an activity. The object is identified at each parts of the sentences, and has been labeled as object in the first part and subject in the second. We take into account the “near starting” moment of when one is formulating her intentions and how that moment of focus is then transcended into subject. Now, this subject is inter-changing with the object. (This has been described by our narrator).

To summarize the relationship between transformation, in-between, and object and subject. We describe it as:

1. Transformation: It is the *chain of determination* that is taking place during *comprehending*, and *adapting* the thoughts and action in situated context.
2. Object: It is similar to a “marker” denoting the *near-start* of when a transformation is about to take place concerning that particular subject (person) at that particular moment. It is a *moment of focus*.
3. Subject: It is the relationship to the object. It is the *product* within-and transformation.
4. In-between: It is the moment when the marker denoting the near-start is *triggered*, and the transformation takes place with the in-between processes articulating (joining and coordinating) the “mental reflection”.

Referring to our point 1 above, that transformation is the *chain of determination* that is taking place during *comprehending*, and *adapting* the thoughts and action in situated context. we are explaining and relating it to situated cognition. The transformation process is taking place through all all the time. It is taking place as part of the chain of determination. Referring to (2), the notion of object and subject during the CONSTEPS; marks a certain moment of knowing what to say at that moment of communication. The subject is like a referential process to the object. The in-between processes of the chains of reproduction of comprehending and typing text is like the in-between of the object to subject, a mechanism that takes place at the beginning and at the end of the transformation at that moment.

### 5.21 What we are learning from converting conversations into another “language”

The impact of understanding those theories; hierarchy of learning and communication by Bateson (1972) and on mental process (1979); situated cognition by Clancey (1997) as well as activity theory by Leont'ev (1977 & 1978) are very significant for our work. We would like to restate why it is so. Understanding those theories and applying them in our analysis is very important because it provides us with ideas and hypotheses that have allowed us to explain and validate our CONSTEPS. They also provide a basis for further advancement. Without proper understanding of those theories, it would have been rather impossible for us to reflect and model the CONSTEPS. Some of the lessons learned are:

1. The CONSTEPS is an actual exercise to find *differences* between meanings in “natural languages” and to bring them to have a minimum of *common meaning*.
2. Using the CONSTEPS is a “mental exercise” (i.e. modeling as away to develop scientific understanding) for us in order to understand communication. These had been viewed at the beginning from two opposing views- an outsider and an insider. Eventually, we got confused along the way but we discovered later that the two opposing view are only one view. We found that the outsider (i.e. social view) and insider (i.e. private view) are actually complementing one another.
3. It is extremely difficult to model mental processes, and we get mixed up in knowing what comes first before the other process (sub-parts), and what is triggering what.

The analysis is focused on learning and communication in respect to the *theory of memory*. It is a *low level analysis*, working from the very bottom treating the communications with the notion of “contextualism”. This approach we use may seem very “mechanistic” because we are focus on *understanding conceptualization*, in terms of *functions*, for “categorizing” the relations in human experiences and events.

### 5.22 Summary: Activity states based on the see-saw notion

This chapter was aimed at achieving two goals: (i) simplifying the CONSTEPS into simple functions and pseudo-code; (ii) explaining how the CONSTEPS are formulated. The activity states was initially an observation of the actual communications. Later on, we have deployed it to modeling the CONSTEPS which we call it an activity states framework. The CONSTEPS were related to the theory of memory, particularly contextualism.



There are many issues that we have left unanswered in this chapter. For example, we did not give a definition on conceptualization and contextualization (according to our own analysis). Nor did we provide any parameters for the function modeling (section 4.17). In particular we have not make any claims of the theory of memory and conversations. At this stage of work as mentioned, we refer back to the hypothesis of (Edelman, 1992) on some ideas on conceptualization (particularly about categorizations) and to (Clancey, 1997a) on conceptualization and contextualization (in particular on the transactional experience). It is too soon for us to claim how we can make use of Bateson's (1972 & 1979) to Clancey's (1997a) and Leont'ev (1977 & 1978) for developing scientific understanding on cognition process at the neural level for modeling (ideally) what conceptualization, contextualization and their parameters are. Hence, for those reasons we simplified the functions.

This chapter does not signify the ending to this thesis, in fact it is a beginning of our future research direction: concentrating on relating conversations to theory on learning, and memory. The CONSTEPS are related to several analyses. Analysis specifically looking into how the re-enacting and re-sequencing of memory (from looking into blocks of conversations) may allow us to understand how we can further interpret and detail the framework of Bateson's hierarchy of learning and communication (1972) to situated cognition of Clancey (1997) and activity theory of Leont'ev (1977 & 1978) to understand how intentions are formulated moment by moment, thus how protocols are induced by looking into the patterns of the modeling of mental processes. It attempts to explain it in an abstract way by using functions. This chapter primarily attempted to relate the modeling fo the mental process by Bateson (1979) at the neural level. Firstly, as a beginning or what we have outlined the above, we attempted to explain how the communication protocols are induced that are discussed in Chapter 6, attached as published papers.

## Chapter 6

### Preliminary findings on communication protocols

#### 6 Introduction

In this chapter, we attach two publications from our preliminary findings on the analysis of the communication protocols. At the end of this chapter, we summarize the two published findings.

#### 6.1 First paper

##### **Preliminary Analysis On: The Induction of Communication Protocols<sup>155</sup>**

Nik Nailah Binti Abdullah (BINTI@Lirmm.Fr) and Stefano A.Cerri  
(CERRI@Lirmm.Fr)

LIRMM:CNRS & Université Montpellier II,  
161 Rue Ada, Montpellier Cedex 5, 34392 FRANCE.

#### **Abstract**

This paper describes our preliminary analysis on the induction of communication protocols. Our work has two goals: (i) to recognize rules (i.e. protocols) from the communicative behavior of people in daily activities and; (ii) to understand *how a person learns to infer communication protocols*. Our research aim is to conceive an effective Autonomous Agent and Human Agent communication. We record sequences of communication exchanges of computer scientists collaborating online as a benchmark for the analysis of

---

<sup>155</sup>Published in the Proceedings of the 27<sup>th</sup> Annual Meeting on Cognitive Science (CogSci'05). Stesa, Italy.

*regularities* that emerge from the exchanges of those communications. We analyze their *conversation structures* and interaction. We found a particular event where *person A* had applied a similar manner of communicating as *person B* did in a *similar situation* (learning rules as a side effect of communicating). We demonstrate this analysis.

Keywords: Learning and Communication; Situated Cognition; Activity Theory; Agent Communication Language.

## Introduction

The foundation of our work is the investigation of problems of communication protocols encountered in real world scenarios as well as those emerging from the Multiagent Systems domain. In particular, we have considered the communication problems reviewed by (Clancey, 2001) of several scientists collaborating in a joint work carried out during the NASA Haughton-Mars Project. The focus of our work is to study the communication protocols among group members in a virtual joint work environment. We want to investigate *how they behave* in different contexts of communications. We focus on a particular scenario: computer scientists collaborating online to prepare a deliverable before a given deadline. We have kept track of the interaction among the collaborators with their tools and recorded about 40,000 word exchanges, including chat jargon and errors. These natural language conversations were converted into markup agent messages (having equivalent semantics) based on the formal model of the Fipa-Acl communicative acts<sup>156</sup> using the *activity states framework*. We have identified about 4,000 exchanges of communicative acts (i.e. performatives). These *translated conversations* were *analyzed* for identifying *regularities* that emerge from the exchanges; enabling us to identify how communication protocols may be induced. This paper is organized as follows: (i) motivation and related work; (ii) activity states; (iii) observing communications; (iv) preliminary results, and (v) conclusions.

## Motivation and Related Work

We briefly review the motivation and related work in this section on (i) Learning and Communication (Bateson, 1972); and (ii) Situated Cognition and Activity Theory (Clancey, 1997; Leont'ev, 1977).

## Learning and Communication

---

<sup>156</sup> Fipa-Acl communicative acts specification provides a formalism for modeling agent messages. Agent communication languages (ACL) are specification languages for agents to communicate information and knowledge. Link:<http://www.fipa.org/specs/fipa00037/SC00037J.html>

The basis of our work for understanding communication is rooted at the learning and communication theory of (Bateson, 1972). Bateson focused on how *learning* and *communication mutually influence* each other. Learning is categorized into a hierarchy structure following the laws of motion (i.e. rules for describing motion).

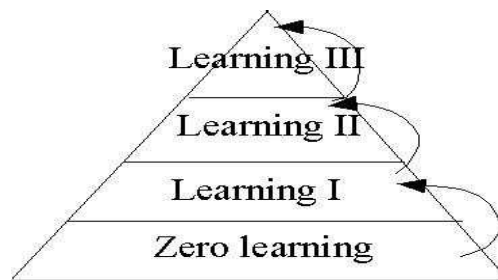


Figure 1: Hierarchy of learning types

Figure 1 illustrates the hierarchy of learning types. The zero learning is the basics of all learning; it is in some degrees stochastic and contains components of trial and error. The curved arrows represent that the one level up in the hierarchy of learning types is described by the motion of change of the level below it. In short, we can summarize it as: (a) zero learning: is described by deciding which response is right or wrong and is not subjected to correction; (b) learning I: is described by the change in the specificity of the response by correction of errors of choice within a set of alternatives; (c) learning II: is described as the change of process of learning I; either a corrective change in the set of alternatives from which choice is made, or a change in how the sequence of *experience* is punctuated (see explanation in the next paragraph); (d) learning III: is described as the change of process in learning II, i.e.,: a corrective change in the system of sets of alternatives from which choice is made. We study only the learning type zero, I and II. (Bateson 1972) also discusses learning type IV; however we do not illustrate it here as it involves a higher level of learning that is tied to evolutionary processes.

The basic *elements* that *distinguish* one *type* of *learning* from the other are characterized by *contexts*. These contexts are *repeatable* but may never be the same, and may have *related classes* of *how* a person may *respond* to it. For example, we may have a case in which a *person's response* at *Time 2* is different from the one of the same person at *Time 1* (Bateson, 1972). From here, Bateson uses the notion of *external event systems* that carry *signals* telling a person *how* to *respond* to *what* and *when*. They might tell the person: (i) from what set of alternatives she<sup>157</sup> should take as her next move (class); and (ii) which member of that set she should choose. Bateson suggests that these *streams* of *events* (sequences of experiences) are somehow *punctuated* into *contexts* which may be *equated* or *differentiated* by the person. The *learning hierarchy* may hold a key to *how* those streams of *events* is *punctuated* in the *first place*. In a similar notion,

<sup>157</sup> We use she for he/she.

(Dewey, 1925) spoke of *events* that “turn into objects turn into meanings”. Here Dewey focused on the aspects of “transformation”: what goes on in-and between the stimulus-action/response which had been discussed by Bateson as “*communication sequence*”. Dewey looked into the aspects of how *meanings* are constructed in *communications* focusing on *events*. Events are replaced by how *each sequence of communication* go through some kind of transformation. Quoting from (Dewey, 1925): “*Events have meanings; recognizing communication becomes an act of merely perceiving them.*” In other words, the ability to *recognize* a certain *communication protocol* goes *through* the *punctuation of context* (learning), *markers* that *mark* them as *events* with *experiences* (having meaning), which are classified as “classes.” We extend the example given by (Bateson, 1972). Let us assume in a sequence of events, person A’s behavior is perceived as a stimulus for person B’s behavior and how person B responds to that behavior is by learning to select from her set of *contexts* (i.e. all the related events) the next alternatives she takes. In these sets of contexts, how does she learn how to know what to respond with and when?

### **Situated Cognition and Activity Theory**

The definition of *situated cognition* is based on the idea that every human thought and action is adapted to the environment that is *situated*. Situated is then defined as consisting of 3 elements which are: (a) What people *perceive* (structural view); (b) *How they conceive* their *activity* (functional view) and (c) What they *physically do together* (behavioral view). It is also concerned with the “representation”, that occurs in the brain like imagining a scene, or speaking to oneself. This process of formulating the representation, from the agent’s perspective involves *intentionality*. Situated Cognition defines intentionality as being about *conceiving*: (a) a categorization as being a thought; (b) categorizations as being about something (referential); (c) the thinking process itself as being part of an activity (Clancey, 1997a). The *Activity Theory* on the other hand, emphasizes on what an *organism* is *doing* in the world and that the *subjectivity* of that *activity* is realized *within* and *constructed* by *interaction* (Clancey, 2002). Situated Cognition serves as a complete research view for understanding the integrated mechanisms of how humans coordinate, and conceptualize their activities. The Activity Theory (Leont’ev, 1977) provides a platform to analyze daily activities of people; how consciousness (e.g., motives, intentions) arise within-and during the coordination and conceptualization of their daily activities. Since our aim is to understand and explain how humans induce communication protocols, it is necessary to relate: (i) Situated Cognition; (ii) Activity Theory; (iii) Learning, and (iv) Communication. So that we can explain how a person *coordinates* (i.e.(i)) as a whole by *conceptualizing* her *context* (i.e.(i),(iii)) of *what* her *activity* is (i.e. (i),(ii)) when communicating (i.e. (iv),(i)) structured by her *internal rules*. (when we speak of *internal rules* <sup>158</sup>, we refer to the *manner* a person *structures* her *learning* and *understanding*).

<sup>158</sup> We cannot give a definite definition of *internal rules* at this moment. Therefore, this definition is used loosely for now.

## Activity States

We have briefly described in the previous sections the state of the art. Now we introduce our own framework: *activity states*, which is inspired by these studies: (i) Transactional Dynamics (i.e. Situated Cognition); (ii) Mental reflections on action and operation (i.e. activity theory); (iii) Mental states (i.e. Beliefs, Desires, Intentions); (iv) Transitional states and phases. The *activity states* framework (Binti Abdullah, 2005) main contribution is to provide for intermediary concepts that map natural language conversations onto an equivalent agent communication language (Fipa-Acl). Fipa-Acl is derived from Speech Acts which were developed as a theory for characterizing human conversations. Speech acts were later employed in Agent Communication. The conversion step is a sort of a full circle by then re-applying the agent language back to human conversations<sup>159</sup>. Therefore, our work is connected to the well-established framework of (Searle, 1983) at the same time extending the notion of *intentionality* of (Clancey, 1997; Leont'ev, 1977). If we separate the CONSTEPS from learning how the communication protocols are induced, we would not be able to understand how intentions arise in the first place within a person's activity. Then we would not achieve our aim to know *how* those *communication protocols* are *punctuated*. So, we must begin by understanding *how intentions arise*, meanings and communications are formulated. The CONSTEPS specifically focus on that.

The center idea of activity states is that *what* a person *wishes* to communicate to others is influenced by her *current mental activity states*. Mental states<sup>160</sup> are generally concerning the beliefs, desires and intentions. We extend the notion to *mental activity states* inspired by the concept of *mental reflections* on action and operation (Leont'ev, 1977). We look into: (i) the current activity the people is engaged in (i.e. what is my current objective world); (ii) the flow of the conversations (i.e. what is my relationship with what I was doing previously, presently and what I would like to do in the future); and (iii) changes of context during conversations (i.e. my process is influenced by external factors that had triggered me to change direction) as guidelines for identifying *beliefs, desires* and *intention*. We also look at it from both views: (i) activity states of the speaker and (ii) activity states of the hearer. The center idea of activity states is that *what* a person *wishes* to communicate to others is influenced by her *current mental activity states*. Mental state are generally concerning the beliefs, desires and intentions. We extend the notion to *mental activity states* inspired by the concept of *mental reflections* on action and operation (Leont'ev, 1977). We look into: (i) the current activity the people is engaged in (i.e. what is my current objective world); (ii) the flow of the conversations (i.e. what is my relationship with what I was doing previously, presently and what I would like to do in the future); and (iii) changes of context during conversations (i.e. my process is influenced by external factors that had triggered me to change direction) as guidelines for identifying

---

<sup>159</sup> In (Searle, 1983), the author explores some connections between Intentional States and Speech Acts in order to answer the question "What is the relationship between the Intentional State and the object or state of affairs that it is in some sense directed at?"

<sup>160</sup> Our definition of mental states is within the study of "activity".

*beliefs, desires and intention*. We also look at it from both views: (i) activity states of the speaker and (ii) activity states of the hearer. A person's *beliefs and desires thus her intention* is a two way relationship with her: (i) inner processes and (ii) the activity that she is engaged in. They are always mutually *conceptualizing* the *context* of her action. Therefore, the *choice* of intention is more likely to be *activity directed* depending on the task that the person has to do. In some cases the activity direction can turn some task, into short term-goals or long-term goals (i.e. persistent goal). We give a scenario below to illustrate why we model the intentions as *activity-directed*:

*I think I want to do C -(1) → I am going to do C -(2) →  
I will do C -(3) → I am doing C -(4) → I have done C -(5)*

As an example, these are representations of some mental states of a person's activity that have been manipulated during time. What manipulates the "states" has direct relationship to the activity states implying what the person is actively conceptualizing. What happens when there is an impeachment to do C during step (3)?

*C can't be done -(6) → I think I can't do C -(7) → I think maybe I won't do C -(8)  
→ I think I really won't do C -(9) → I won't do C -(10) → C won't be done by me -  
(11)*

For this, we argue that not all communication is goal-directed. The way one communicates normally reflects her ongoing activities. These activities may influence the states of beliefs and/or desires and thus her intention. As a consequence, the current activity she is engaged in might make her to change directions during the course of communication. The next question is, how do we study these "*interruptions*" of states? We relate this to the *transactional dynamics* approach. Transactional dynamics is centered on the idea that treats "*events*" as the fundamentals unit of study. Events here are defined as a composition of psychological, temporal and environmental aspects. Although we relate our study to this approach, we do not use this term in our framework for the reason that we look at the different phases of behavior of the subject on the social tool (e.g. instant messaging). We need to know at which point the communication protocols had been induced by the subject, and at that point, what changes had occurred (i.e. interruption or pause). Therefore we replace the term "transactional dynamics" with *transitional states* as a consequence of the observation of the different states (i.e. phases) a person goes through. And also the sequences of events that had contributed to her change of behavior from one state to the other.

### **Observing Communications**

This section illustrates the daily communications scenarios among the collaborators. We have analyzed daily chats between two collaborators (period of 7 months) and minutes of meetings which were held twice a month among five

collaborators (period of 2 months). In particular, we have kept track on two person's communicative behavior on the Web, Pete and Mathew. We show samples of the environments in figure 3 and 4 below.

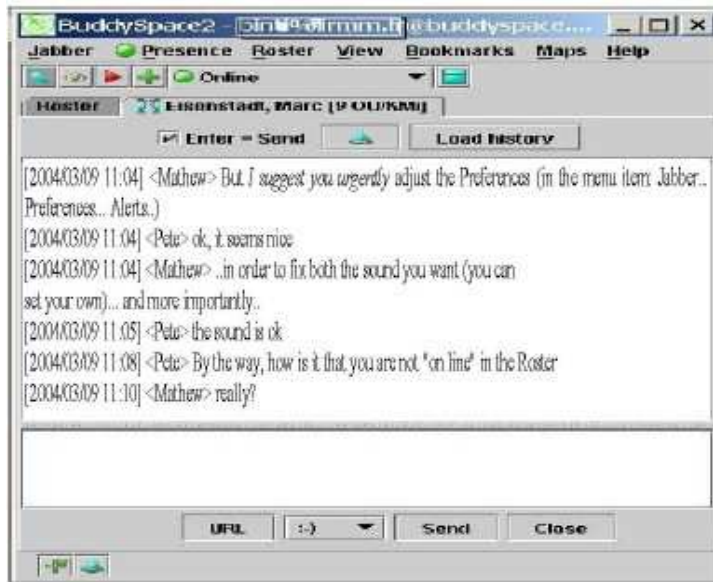


Figure 3: Daily chats between Mathew and Pete.



Figure 4: A typical virtual meeting, held at least once in two weeks among group members.

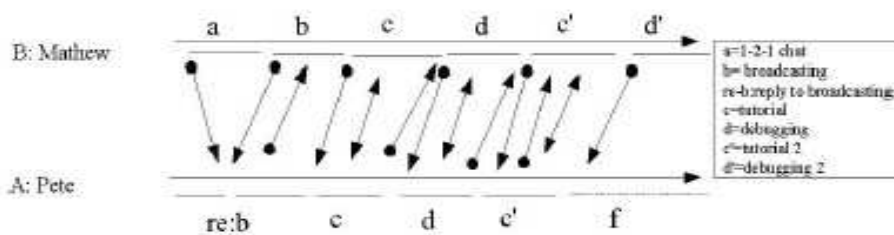


Figure 5: Observing transitional states of Mathew and Pete.



Figure 5 corresponds to figure 3. It is the representation of the transitional states to identify, *where*, and *how* Pete had applied different/new communication protocols. Activities are labeled as *a*, *b*, *c* and *d*. *c'* is a similar type of activity to *c* and so is *d'* to *d*. The arrow (  $\bullet \rightarrow$  ) denotes who changed the context of communication. The double directed arrows denote the exchanges of communication. The horizontal line denotes the time of activity. Hereafter, we illustrate the steps for *identifying changes* that have occurred during the *transitional states*: (i) locate the point of changes of activities; (ii) look at what are the events that had caused the activity to take a change; (iii) locate at which event A's behavior had responded in a way similar to B's; (iv) compare the communication structures (e.g. conversations *or* conversations and interaction with tools) of A (e.g., Pete's) to B (e.g., Mathew's); (v) now, compare the communication structures of A to any of his previous set of related events (i.e. *contexts*); (vi) study the differences and then generalize the changes; (vii) continue for related behaviors of A.

### **Preliminary results**

We illustrate the collaborating scenarios. Pete is the project coordinator for this joint project and he was new to this environment (i.e. instant messaging and video-conferencing). Mathew, on the other hand, is an experienced collaborator and has run many virtual collaborations. Everyday Mathew and Pete go online to chat about the project. Pete's job was to make sure everyone does his/her share of work, and respect the deadlines in order to achieve their shared goals together. So he had a tough job to make sure that everyone stays focused and that the meeting does not run over an hour. Before the FlashMeeting<sup>161</sup> reported hereafter, at the start of the collaboration, Mathew had taught privately Pete how to use the tool. During the first meeting held among some of the collaborating members, Pete carried out his role. We show the excerpted natural language conversations of the two meetings  $M_1$ ,  $M_2$ :

$M_1$ . Excerpted from FlashMeeting 1, Date: 17/09/2004. Duration of meeting: 1 hour 34 minutes 51 seconds

- (1) Pete: Craig, can you hear me?
- (2) Craig: Yes, we hear you but Mathew is not there. Oh we have Mathew and Justine. Hi Mathew.
- (3) Mathew and Justine (M & J): Hi everybody, everybody ok?
- (4) Pete: Yes, good afternoon to everybody. I could see somebody from X, not looking like Iris, maybe he can introduce himself to us.
- (5) Unknown: Hello everybody. I am the colleague of Iris, she's just coming up, and in a few moments she's here.
- (6) M & J: By the way, you all notice, there's a slightly new interface from what we used last time. So, now you notice, down below, if you click on the little chat tab,

---

<sup>161</sup> FlashMeeting is a video-conferencing tool developed by the team at kMi, Open University, The UK.

you should see it highlighted in green, actually makes it a little easier to have a simultaneous chat while others discussion is going on.

(7) Craig: Hi, Iris, how are you doing?

(8) M: Hello iris, welcome to FlashMeeting. Hope the technology is working well for you. You probably work out on the hand button to raise your hand or you click on the interrupt button if you have something urgent to say. It's a strictly push to talk model because that makes the audio simply work a lot more reliably and it also it makes the replay of the meeting well coz we know exactly who's talking at any moment. And you can stop broadcast anytime just by clicking on the..., in fact un-broadcasting or broadcasting again and someone will take the floor.

M<sub>2</sub>. Excerpted from FlashMeeting 2, Date: 22/09/2004. Duration of meeting: 58 minutes

(1) Pete: Good afternoon everybody

(2) Craig: hi you

(3) Pete: Good afternoon Simon. Maybe it is your first time practicing this kind of meeting. So there is 1 button to start and to stop broadcasting and to join the queue. So you have to press to start and to ask for the queue and to stop broadcasting as well.

Two similar events took place during meeting  $M_1$ ,  $M_2$ . Refer to  $M_i$ : at (4), (5) and (8). We can conclude that: (i) Pete knows Iris, but he does not know the colleague of Iris. (ii) On the other hand, Mathew does not know Iris. So, he immediately proceeds to give instructions to her on how to use the tool. Refer to  $M_2$ : Pete re-encountered, a "new face", Simon. However, this time he immediately proceeds to give instructions on how to use the tool which is in a way similar to how Mathew had done it, even if with modified structures. We demonstrate the results of our interpretation of that learned behavior below.

Table 1: Comparing the conversation structures of Mathew and Pete on a similar context.

Mathew's instruction to Iris on the 17/09/04, (context $c_1$ ). Agent Messages in this column correspond to $M_1$ ; sentence label (8) above.	Pete's instruction to Sm on the 22/09/04, (context $c_2$ ). Agent Messages in this column correspond to $M_2$ ; sentence label (3) above.
<sup>162</sup> 30 greet m <sup>163</sup> , iris û	3 greet p <sup>164</sup> , sm û
31 inform-if m,iris (tch)(wk)(wl) = =true	4informp,sm (prc)(mtg)(1stm) ^ (t-is) (1) ( <b>bt</b> <sup>165</sup> )
32 inform-ref m,iris (wk) (hnd)( <b>bt</b> )	5 inform-ref p,sm ( <b>bt</b> )(str)( <b>brdc</b> <sup>166</sup> )

<sup>162</sup> The message format follows partly the Fipa-Acl format which is in this order: message number, communicative act (e.g. greet), sender (e.g. m), receiver (e.g. iris), content (e.g. û, which is an abbreviation used for the sentence or (wk) which abbreviates *work*). In this message, number 30, we denote the sentence simply as û because of the nature of greeting.

<sup>163</sup> m stands for Mathew.

<sup>164</sup> p stands for Pete and sm stands for Simon.

<sup>165</sup> **bt** stands for button.

<sup>166</sup> **brdc** stands for broadcasting.

Mathew's instruction to Iris on the 17/09/04, (context $c_1$ ). Agent Messages in this column correspond to $M_1$ ; sentence label (8) above.	Pete's instruction to Sm on the 22/09/04, (context $c_1'$ ). Agent Messages in this column correspond to $M_2$ ; sentence label (3) above.
33 request whenever m,iris (rs)(hnd)(clk)(hnd)(bt)v	6 inform-ref p, sm (bt)(stp <sup>167</sup> ) (brdc)
34 inform-ref m,iris (clk)(int)(bt) ^	7 inform-ref p, sm (bt)(to)(jn-q)
35 request whenever m,iris (nd-to) (sy)(smtg)(urg)	8 request whenever p, sm (str) (prs)(bt)
36 confirm m,iris (md)(fm)(psh-to)(tlk)	9 request whenever p, sm (as-q) (prs)(bt)
37 inform-ref m,iris (mk)(ad)(rlb)	10 request whenever p, sm (stp) (brdc)(prs)(bt)
38 inform-ref m,iris (mk)(repl) (wl)	
39 inform-ref m,iris (knw)(wh)(tlk)(pt)	
40 inform-ref m,iris (cn)(stp)(brdc)(ayt)	
41 request whenever m,iris (clk)(stp)(ubrdc)(stp)(brdc) v	
42 request whenever m,iris (clk) (brdc)(ag)(stp)(brdc)	
43 inform m,iris fl (sm)(tk)	

We show in table 1, the converted conversations of Mathew and Pete. This is a particular case, where the memory of Pete has allowed him to act in a way similar to how Mathew has acted before by *re-sequencing* and *re-enacting* learned situations (Clancey, 1997a). The words in bold (*stp*), (*brdc*), (*stp*) are the *parameters* that had both appeared in Mathew and Pete's conversation structures. In table 2, we show the comparison of the conversation structures of Pete to his other conversation structures in a *similar context*; where Pete had given instructions to several people on what to start with for the meeting. We had done this in order to locate if there were any changes in the *internal rules* of Pete after he had observed and learned from Mathew during that particular event. To show clearly how the *communicative acts* along with the *parameters* had been re-sequenced, we re-translate column 1 and 2 of table 1 into figure 6 and 7 respectively. Therefore, we now have e=greet; inform-if=h; inform-ref=b; request whenever=f; confirm=q; inform=g; Ls = listener (i.e. sm);  $x_n$ =parameters and  $y_n$  = parameters.

Table 2: A comparison of Pete's conversation structures to his own in a similar context.

Pete giving instruction $t$ to several people on the 17/09/04 (i.e. context $c_2$ )	Pete giving instruction $t$ to Sm on the 22/09/04 (i.e. context $c_1'$ ) .
54 cfp p,all (ag) (str)(ans-q)	4 inform p,sm (prc)(mtg)(1stm) ^ (t-is) (1)(bt)
55 cfp p,all (tk)(us)(csd)	5 inform-ref p,sm (bt)(str) (brdc)
56 inform-ref p,all (qst1)(wht)(t-dv)	6 inform-ref p, sm (bt) (stp) (brdc)
57 inform-ref p,all (qst2) (wht) (is) (av-crt)	7 inform-ref p,sm (bt) (stp) (jn-q)
58 inform-ref p,all (qst3) (cn-be)(dn)(14dys)	8 request whenever p, sm (str) (prs) (bt)
59 inform-ref p,all (qst1) (us)(nclr)	9 request whenever p, sm (as-q) (prs) (bt)
	10 request whenever p, sm (stp) (brdc) (prs) (bt)

<sup>167</sup> **stp** stands for stop.

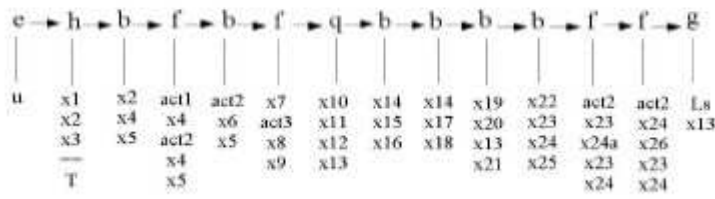


Figure 6: Communication of Mathew at context  $c_1$ .

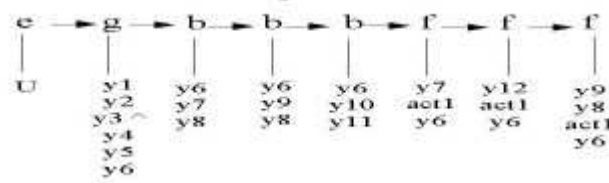


Figure 7: Communication protocol of Pete at  $c_1'$ .

Refer to figure 6: (i) from sequence  $h-b-f-b$  and look at  $q$  and the sequence  $b-f-f$ ; had been re-sequenced into  $g-b-b-b-f-f-f$  which is shown in figure 7. The parameters:  $x5=y6$  (i.e. button);  $x23=y9$  (i.e. stop) and  $x24=y8$  (i.e. broadcast) are the ones that had re-appeared in Pete's structures; (ii) now we look at the interrelationships between the conversation structures of Mathew's and Pete's. We denote  $m_p$ : the message number of Pete's and  $m_m$ : the message number of Mathew's. The *Lhs* and *Rhs* respectively are to denote the causality relationship of messages.

Referring to table 3, at the beginning of Pete's instructions, he had generalized all the instructions previously given by Mathew starting from message 31 until 43, then specialized the functions of the features from message 5 to 7. Whereas from message 8 to 10, he had related the functions with its actions by indexing his messages in reference to his previous messages 5, 6 and 7. Now we compare these findings to table (2). We found what still remains as his internal rules: (i) whenever the context is *to only explain*; start communication

Table 3: Causality relationships between Mathew's and Pete's messages (i.e. context  $c_1$  and context  $c_1'$ ).

Lhs	Rhs
$4_p$	$\leftarrow 31_m, 36_m, 40_m, 42_m$
$5_p$	$\leftarrow 36_m, 40_m, 42_m$
$6_p$	$\leftarrow 40_m, 42_m$
$7_p$	$\leftarrow 32_m, 33_m$
$8_p$	$\leftarrow 5_p$
$9_p$	$\leftarrow 7_p$
$10_p$	$\leftarrow 6_p$

with the object (i.e. inform-ref) and follow by the description in a pre-order relationship. Now, *what* had taken place during this event? We notice that: (i) the protocol of Mathew has been *re-sequenced* by Pete and improvised by induction; generalizing and then conceptualizing the description and functions of object *w* (i.e. *w* is button) to the context; and (ii) the learned rules are then adapted to his own experience, (Pete remembered that he had seen how Mathew had encountered that context and had handled in a way similar to the one of Mathew). The communication protocol of Mathew was an efficient one as Pete had remembered well the functions of the objects and what to execute in order to make use of those functions. Pete had re-sequenced them to the way his *internal rules* remember them best. When there are *changes*, we know that there are *differences*. The differences trigger the interaction between parts in the mind. By recognizing those differences in *internal rules*, we can recognize the *learning operators* that have been responsible for those alterations in the internal rules that had enabled Pete to induce communication protocols. We need to consider other aspects. Firstly, when Mathew was giving the instructions, what did he “perceive” from the user interface? (See figure 4). We make an assumption that most probably *that moment* when he begun by describing the *hand button*, corresponds to the current state of the user interface. On the other hand, Pete had not mentioned the hand button but the *broadcasting button* because the current state of the user interface was not similar to Mathew’s. Secondly, *how* did Pete recognize a *similar context* of situation (is the “new face” a part of the stimulus/signal in the *external event system* as mentioned by (Bateson, 1972))? How did he *recognize* the “instructions” of Mathew as a set of communication protocols? Is “giving instruction to use the tool” a member of the class context of “instructions”? How was the communication protocol *punctuated*? Did he *induce* the *sameness* of *context*; then recognize that *particular way* as a set of communication protocols? In other words, are we correct to a-priori assuming this: Pete had *induced* a *sameness* of *context* (Mathew said “Welcome to FlashMeeting”. Later, Pete said “Hi Simon, maybe this is your first time using”) and looking that the *context* was about “using the tool for the first time” for new users, Pete had remembered how Mathew had handled that situation.

## Conclusions

Our overall analysis has been based on the conversation structures of five people. In this particular example, we show the analysis of two person’s conversation structures. We generalize for now that humans: (i) have *internal rules*; (ii) *learn* from experience; (iii) internal rules and learning may be monitored, modelled and used in real contexts (Learning Agents in Multiagent System). We outline several points from our observations and work. Firstly, people learn from their experiences by observations. Secondly, they remember and adapt the communication protocols as how they remember them best. This is then influenced by their internal rules. Thirdly, when they re-encounter similar situations, they remember to how they have observed others handle the situations, and proceed to handle them in a similar way. They had merged and adapted the communication protocols of others into their very own. Fourthly, observing transitional states of human activities allows us to trace *where* changes in communication protocol takes place. Fifthly, allowing

the conversations to be in a more or less formalized framework has enabled us to know *how* the changes had taken place by looking into the *re-sequencing* and the *re-enacting* of the communicative acts and parameters. The *re-sequencing* and *re-enacting* had happened by *learning* through *experience*. In summary, the activity of learning and communicating has faculties such as imagination, conceptualization, reasoning, comparing, remembering, confirming and conviction. Our next stage consists in further analyzing more corpuses. From these findings, it can help us to understand how to design effective communication among Autonomous Agents and Human Agents that are able to infer each other's communicative behaviour.

## References

- Binti Abdullah, N.N. (2005). The induction of communication protocols. To appear in the proceedings of the *Fourth International Joint Conference on Autonomous Agents and Multiagent Systems, AAMAS'05*, ACM Press, Utrecht, The Netherlands.
- Bateson, G. (1972). *Steps to an ecology of mind*. Chandler and Publications Co.
- Clancey, W.J. (1997). *Situated Cognition: On Human Knowledge and Computer Representations*. Cambridge University Press.
- Clancey, W.J. (2001). *What we are learning about communication protocols*. Link: <http://www.spaceref.ca/news/viewstr.html?pid=3280>
- Clancey, W.J. (2004). *Simulating Activities: Relating Motives, Deliberation, and Attentive Coordination*. In *Cognitive Systems Research*, special issue "Situated and Embodied Cognition" 34(2) 125-137.
- Dewey, J. (1925). Nature, Communication and Meaning. *The Essential Dewey: Volume 2, Ethics, Logic, Psychology*. (Eds)Hickman, L.A., and Alexander, M, Indiana University Press.
- Leont'ev, A.N. (1977). *Activity and Consciousness*. Psychology in the USSR, Problems of Dialectical Materialism. Progress Publishers.
- Searle, J.R (1983). *Intentionality: An Essay in the Philosophy of Mind*. Cambridge University Press.

## 6.2 Second paper

# Analysis and Synthesis of Learning Agent's Communicative behavior<sup>168</sup>

Nik Nailah Binti Abdullah and Stefano A. Cerri  
LIRMM: CNRS & Université Montpellier II  
161 Rue Ada, Montpellier Cedex 5, 34392, France  
{binti, cerri} @ lirmm.fr

**Abstract** This paper is about people. It is about understanding how learning and communication mutually influence one another; allowing people to infer each other's communicative behavior. In order to understand how people learn to communicate, we refer to existing theories. They are the *logical theories of learning and communication*, *situated cognition* and *activity theory*. Thus, this paper is about applying existing theories of analyzing conversations, human learning, and memory to a range of scenarios of actual human conversations. It is also introducing a new way of analyzing conversations. We have recorded and observed actual human communications on the web. We have applied those theories to analyze these communication scenarios. We describe the preliminary results on the analyses of the communication scenarios. In particular, we show our analysis of the recorded conversational structures. We illustrate how the *re-enacting* and *re-sequencing* of conversational structures is *adapted to the context* (i.e. environment) *moment by moment*. From our analyses, we found that people have *internal rules* (e.g., a combinatorial rule system). These *internal rules* can be related to how a person learn, adapt and merge protocols situated in their context of communication. Our long term goal is to make use of these analyses to improve human communication on the GRID.

## 1 Introduction

Our study is centered on understanding how people learn to communicate. We have narrowed the study to analyzing communication protocols among group members on the web. These group members are Computer Scientists collaborating online to prepare a deliverable<sup>169</sup> before a given deadline. All communications among collaborating members were carried out over the instant messaging (i.e. BuddySpace) and video conferencing (i.e. FlashMeeting) tools<sup>170</sup>.

Our approach for observing communications is motivated by the approach and analysis of (Clancey 2001, 2005). The author had analyzed actual daily activities

---

<sup>168</sup>(in-press) in the Towards the Learning GRID: advances in Human Learning Services. Edited by P.Ritrovato et al. Frontiers in Artificial Intelligences and Applications. Taylor and Francis. New York, USA.

<sup>169</sup>The deliverable was to be submitted for the EleGI European Union project (IST, VI Framework). Website: [www.EleGI.org](http://www.EleGI.org).

<sup>170</sup>BuddySpace and FlashMeeting are social tools developed by the team at the KMi, Open University, the UK.

(Clancey, 2002) and scenarios of communication protocols and their problems (Clancey, 2001, 2005). This approach of observing actual communications allows us to understand how *communication protocols* are *punctuated*<sup>171</sup> in the *first place*. And what *type of learning* (which will be discussed in section 2.1) had occurred that may *allow* one to *improve* his/her *next communication transactions*.

This approach to analyzing the communications (in particular the conversational structures) stems from the social cognitive theory (SCT) analysis. The SCT considers the role of personal factors (e.g., beliefs, attitudes, expectations, memory) in addition to the environmental and behavioral aspects of learning (Plucker, 1999). It is also known as the “triadic reciprocity model of causality”. Through feedback and reciprocity, a person's own reality is formed by the interaction of the environment and one's cognition. In addition, cognitions change over time as a function of maturation and experience (i.e. attention span, memory, ability to form symbols, reasoning skills) (Plucker, 1999). Through the understanding of the processes involved in one's construction of reality that enables human behaviour to be understood, predicted, and changed.

This paper is not focused on “replicating” human learning for agent-based communicative behavior. Our inspiration is different. Our long term goal is to be able to give *comprehension* of *how* humans are *able* to *infer* each other *communicative behaviors*. Thus, this involves understanding how people *learn* to *punctuate events*. Understanding this requires us to look into: (i) how people adapt their actions to their situated context; (ii) how people learn to adapt and merge communication protocols of others; (iii) how *miscommunications* become a ground of learning for further improvement in communications; and (iv) how people gradually learn to communicate better when re-encountering similar contexts of communication. In this paper will only discuss (i) and (ii). We do hope that our ways of formalizing what is happening during human learning and communications will be useful for building tools for the GRID.

To summarize, our work involved two stages; (i) *translating* natural language conversations into agent communication messages (following the Fipa-agent communication language ACL<sup>172</sup> specifications) and (ii) manually inspecting how *learning* had occurred from the regularities that had emerged from these conversations. The natural language conversations of people collaborating online (about 40,000 words, including chat jargon) had been manually translated into markup ACL messages<sup>173</sup>. We have identified about 4,000 communicative acts from these exchanges (Binti Abdullah, 2005).

---

<sup>171</sup> The term “punctuated” is used by (Bateson, 1972), an example for denoting the ways an organism acquires the habit of apperceiving the infinitely complex stream of events (including his own behavior) so that this stream appears to be made up of one type of short sequences rather than another.

<sup>172</sup> Agent communication languages are specification languages for agents to communicate information and knowledge. Website: <http://www.fipa.org/specs/fipa00037/SC00037J.html>

<sup>173</sup> We have extended the formal model of the Fipa-Acl communicative acts using the activity states framework (Binti Abdullah et al., 2005; Binti Abdullah, 2005).



Thus, the paper is organized as follows. Section 2 states the general problem of designing agent communication protocols. Section 3 gives a brief theoretical background, including the work related to analyzing conversations. Section 4 illustrates the analyses of the conversational structures. Section 5 discusses the interpretation of the analyses. Section 6 concludes the paper.

### **1. Statement of the general problem**

Our study was initially looking into agent communication in Multiagent systems (MAS). In MAS<sup>174</sup>, communication is the basis of interaction and social organization. A modeling is needed to allow agents that can “talk” to each other. Its function should be to enable the agents to decide what action to take and how this action can be coordinated with others’ action (Draa et al., 2002). The main objective of ACL is to model a framework that allows heterogeneous agents to interact, to communicate with meaningful statements that convey information about their environment or knowledge (Draa et al., 2002). The key concept in agent is interoperability and autonomy. Due to this autonomy of modeling the agents, several researchers such as (Greaves et al., 2002; Draa et a 2002; Cohen et al., 2003; Van Eijk et al., 2003; Huget et al., 2003; Singh et al., 2003) have focused on how to model a sophisticated system of agent communication.

Speech acts theory is used to model conversations for agent based communication. Prescribing this notion of speech acts assumes agents to be sincere when communicating. It also pre-supposes the ability that the agents can “read each others mind”. In order to simplify the complications of defining how these agents can infer each others mental states, (Draa et al., 2002; Dignum 2003; Huget et al., 2003) have *designed decision procedure*. These procedures must take into consideration the context of prior ACL messages and other agents’ events. They are specified either with: (i) conversational policies (CPs) or (ii) communication protocols.

In (Greaves et al., 2000), the authors modeled conversational policies in such a way that they can handle the “*basic problem*”. *Basic problem* states that for powerful ACLs, there is a many-to-many mapping between externally visible messages an agent produces and the possible internal states of the agent that would result in the production of the message. Due to this *basic problem*, it is nearly impossible for an agent to reliably infer the intentions and goals underlying another agent’s use of a particular ACL message (Greaves et al., 2002). In (Greaves et al., 2000), the authors suggest that one way to solve this problem is *reestablishing the shared context* of facts and *inference mechanisms*. However (Greaves et al., 2000), noted that agents lack both “human” inferential skills and the rich shared contexts” of human interaction. Hence, they cannot overcome *miscommunication* in the way humans do. Following this notion of “basic

---

<sup>174</sup> A MAS according to (Ferber, 1996) is a modeling of several located agents (that could be heterogeneous) in an agent/environment duality. This is the focus of the located MAS. In acting on the basis of its perception of physical space and of direct communication it receives, the agent defines itself as the dual image of its environment. The author (Ferber, 1996) suggests that the creation of located MAS requires the simultaneous definition of the structure of the agents and that of the environment, and the actions of the agents having to be carried out within that environment.

problem”, it may lead to *breakdowns*<sup>175</sup>. The authors suggest an ad-hoc measurement simplifying assumptions by *conversational policies (CPs)*.

CPs of (Greaves et al., 2000) is a way to attack the basic problem by providing fine-grained policies so that different conversations will be governed by different clusters of policies. On the other hand, most communication protocols are devised as a set of public rules that is imposed on all heterogeneous agents where they must abide these protocols when entering the current “context of communication”. It specifies which agent is allowed to say what in a given situation. In short, these agents, using either CPs or communication protocols to govern their communication must have an internal structure that can help them to *behave contextually*. The major concerns of using either one of this modeling is centered on *how to model* an agent that can *adapt* to such *sudden changes* in their *environments* by *dynamically improvising*<sup>176</sup> in order to fit the context of communication. These are not complete analysis of the specific case, but are a vehicle for suggesting possibilities and clarifying the clues pointed out in the introduction on studying actual communication activities.

Hence, how can our analysis contribute to solve this “basic problem”? Our feeling for now is that from the understanding of actual human communication scenarios, it will allow us to study precisely how the *flow of communication is punctuated*<sup>177</sup>, how people gradually adapt to handle the “basic problem”. And when a breakdown occurs, how people *learn* from those occurrences and what they learn from it.

Understanding those concerns, makes it necessary for us to look at both circumstances; specific communication events (decision making), and daily communication events (like chatting just so say hello, introducing oneself to one another, browsing the web together). In summary, our analysis of the conversational structures is a start towards reaching this goal: “How do people learn to know what to take as their next communication action and with whom in which context of communication?”

---

<sup>175</sup> In (Winograd et al., 1986), the authors had used the notion of breakdown in designing tools (Winograd, 1988). Assume (Winograd, 1988), that problems always arise for human beings in situations where they live-in, in other words, it arises in relation to a background. Different interpreters will see and talk about different problems requiring different tools, potential actions, and design solutions. Here, the authors prefer to term these problems as “breakdowns” following the notion of Heidegger (Heidegger, 1927). A breakdown refers to the interrupted moment of our habitual, standard, comfortable “being in the world”. It serves as extremely important cognitive function, revealing the nature of our practices and equipment.

<sup>176</sup> In this notion of “improvising”, we are interested in the *improvisation* on the *states of classes*.

<sup>177</sup> In (Bradshaw, 1996), agents have been proposed as one way to help people better cope with the increasing volume and complexity of information and computing resources. Here, we try to imagine how our work can possibly help us (and others) to construct useful tools. Let us assume that an agent can *recognize* (recognizing in some ways requires learning of that event before recognizing that event as being that *event*) that the sequence of events the agent is located in is that the user is “debugging” a tool (my webcam is not functioning during FlashMeeting). This agent can anticipate that whenever such similar notion of debugging a tool is re-encounter, it will know what to specifically select from the conversation policy/protocols during communication. The agent also learns gradually from the breakdown occurrences what is the most effective message/policy composition to send to other communicating agents.

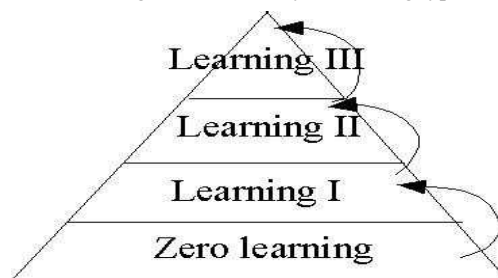
### 3 Theoretical Background and Related Work

Hereafter, we review the theoretical background of these existing theories: (i) logical theories of learning and communication of (Bateson, 1972); (ii) situated cognition of (Clancey, 1997a); and (iii) activity theory of (Leont'ev, 1977 & 1978). We put forward the reasons and motivations behind the choices of these theories as our fundamentals for the analyses of conversations. In section 3.3, we discuss the related work.

#### 3.1 Logical Theories of Learning and communication

The foundation for us to understand learning and communication is rooted at the theory of (Bateson, 1972). The communication theory of Bateson, deals with the basic understanding of how *learning* and *communication mutually influence* each other. Bateson's principle in human learning is that the word learning itself "denotes" changes of some kind. Change "denotes" process. These considerations had initiated Bateson to begin the ordering of his ideas about learning in a hierarchy structure following the laws of motion. Figure 1 below is our own summary of the hierarchy of learning of (Bateson, 1972) which had been summarized from pages 287-305.

Figure 1: Hierarchy of learning types



Referring to figure 1 above; zero learning is the basics of all learning. It is in some degrees stochastic and contains components of trial and error. The curved arrows represent that the one level up in the hierarchy of learning types is described by the motion of change of the level below it. In short, we can summarize it as (i) *zero learning*: is described by which response is right or wrong and is not subject to correction; (ii) *learning I*: is described by the change in the specificity of response by correction of errors of choice within a set of alternatives; (iii) *learning II*: is described as the change of process of learning I; a corrective change in the set of alternatives from which choice is made, or it is a change in how the sequence of experience is punctuated; (iv) *learning III*: is described as the change of process in learning II; a corrective change in the system of sets of alternatives from which choice is made. We look only at learning type zero, I and II. Bateson (1972) also discusses learning IV, however we do not illustrate it here as it involves a higher level of learning type that is tied to evolutionary processes.

The basic elements that distinguish one type of learning from the other are characterized by *contexts*. As an example, we may have a case in which a person

gives at Time 2 a different response from what she<sup>178</sup> gave at Time 1. These *contexts* may never be the same, but may have *related classes* of how a person may *respond* to it. From here, Bateson uses the notion of *external event systems* that carry *signals* telling a person how to *respond* to *what* and *when*. There are *two major points* of Bateson's analysis that we use as the basis for our investigation. They are, from this *external event system*; (i) how does a person know from what set of alternatives she should take her next move (class); and (ii) which member of that set she should choose. We could re-phase this as: in a sequence of events, let say person A's behavior is perceived as a stimulus for person B's behavior and how person B responds to that behavior is by learning to select from her set of *contexts* (i.e. all the related events) the next alternatives she takes. In these sets of contexts, how does she learn how to know what to respond with and when?

### 3.2 Situated Cognition and Activity Theory

In the previous section, we have discussed the general statement of the problem. The main contribution is to tackle the "basic problems" or the notion of "breakdown". We have also briefly reviewed the theory of learning and communication of (Bateson, 1972) in section 3.1. In this section, we discuss two other major existing theories; *situated cognition* and *activity theory*. These two theories provide us as a fundamental framework for answering the two major points mentioned in section 3.1.

Firstly, *situated cognition* by (Clancey, 1997a) is based on the idea that every human thought and action is adapted to the environment that is *situated*. The term "situated" means that people are not just located a social-physical setting. Rather the context for the people is also categorical through perception and conception. That is the context/environment for a person is a mental construction. Hence, situated cognition looks into: (i) What people perceive (structural view); (ii) How they conceive their activity (functional view) and (iii) What they physically do together (behavioral view). It is also concerned with representing, e.g. an object, that occurs in the brain (like imagining a scene, or speaking to oneself). Having this representation from an agent's perspective involves *intentionality* (Clancey, 1997a).

On the other hand, *activity theory* of (Leont'ev, 1978) is concerned about how consciousness (e.g., motives, intentions) arise within-and during the coordination and conceptualization of their daily activities. It emphasizes that internal activities cannot be understood if they are analyzed separately, in isolation from external activities. It also emphasizes that the organism is doing something all the time (the essence of the word "activity") and that subjectivity is realized within and constructed by *interaction* (Clancey, 2002). The basic components of separate human activities are the actions that realize them. *Action* is regarded as the *process* that corresponds to the notion of the *result* which must be *achieved*.

---

<sup>178</sup> We use she for he/she.

Referring to Bateson (see section 3.1), change denotes processes, and learning signify change. Behaving is an action (and behaving is a response). In the scope of activity theory, action is regarded as the process that corresponds to what is to be achieved and the process which obeys to what are the conscious goals of the object. We try to simplify the connection in both theories into equation Eq.(1) and Eq.(2) shown below. We denote: CH that denotes changes; PR denotes process; LR denotes learning; BH denotes behavior and ACT denotes action. WHT denotes what (what is being carried out) and CS\_Goal denotes the conscious goal. These abbreviations: (=) denotes “transforms”;  $\wedge$  is the “and” operator;  $\leftrightarrow$  denotes the “equivalence”; and  $\rightarrow$  denotes “coupled to”.

$$(CH \rightarrow PR) \leftrightarrow (LR) = BH \leftrightarrow ACT \quad (1)$$

$$ACT \rightarrow (WHT \wedge PR) \leftrightarrow (CS\_Goal) \quad (2)$$

Let us label equation Eq.(1) as a summary of Bateson’s logical theories of the learning and communication. We label equation Eq.(2) as a summary of the activity theory of (Leont’ev, 1978) on action and process. From equation Eq.(1), we have that change is coupled to process. At the same time, when there is a change, there is learning. This suggests that learning is a process of changes. This process of changes “transforms” as behavior, which is an equivalent to doing an act which is a behavior. From Eq.(2), act is coupled to “what”, “what” is the existence of what the subject is doing. And the “what” with the process of achieving the act, is a conscious goal of achieving the act from the beginning. Those changes correlate: *changes* taking place during an *activity*, *learning* and *communication*. In other words, to explain our equation Eq.(1) and Eq.(2): these “changes” take place in the process that is influenced from the objective world (an environment, or what I “perceive”). These changes occur as an intermediary process that is somehow responsible in behaving, learning, doing something to achieve a goal (in activities). And how one is learning when doing something changes what one is doing in the objective world and the response of that subject in that objective world is a behavior that is communication.

In a nutshell, the *situated cognition* theory sits on the activity theory; using it as a framework for relating how actions in daily activities can explain how human thoughts is situated and adapted (Clancey, 1997b & 2002). On the other hand, the logical theories of learning and communication sit in-and between these two theories. To summarize this section, situated cognition provides us with a backbone framework for understanding the mechanisms that can be fitted in-it to explain *how human thought* and *action* is *adapted* to the *environment* moment by moment in a context/environment. This research approach considers the human mechanisms from multiple perspectives. These multiple views of association of mechanisms are crucial for the complete understanding of our own notion of how communications protocols are *learned*, *punctuated*, *induced*, *merged* and *adapted* to the *situated context/environment*.

Therefore, to summarize, these existing theories are necessary for us to take on, so that we can explain:

- how a person *coordinates* (i.e. situated cognition) as a whole;
- by *conceptualizing* her *context* (i.e. situated cognition, learning and communication);
- of *what* her *activity* is (i.e. situated cognition, activity theory) when communicating (i.e. learning and communication, situated cognition) structured by her *internal rules*.

When we speak of *internal rules*, we refer to the manner a person is structuring her learning and understanding. This will be discussed in section 6.

### 3.3 Related Work

Our approach to the analysis of conversations is a rather different way of looking into languages. In this section, we discuss the speech act theory (Searle, 1969; Searle et al., 1985). The theory of speech acts aims to do justice to the fact that even though words (phrases, sentences) encode information, people do more things with words than just to convey information. And that when people do convey information, they often convey more than their words encode. The main idea is that a sentence describes some state of affairs, rather than just “state some fact”, which can only be either true or false. The focus of speech acts has been on utterances, especially those made in conversational and other face-to-face situations. Because of its clear framework, speech act theory has been well integrated into agent communication languages such as Fipa-Acl, and KQML.

In (Searle, 1983), the author had extended this representation of *speech acts* to the notion of *intentionality*. In this notion of intentionality, the author explores the connection between intentional states and speech acts in order to answer “What is the relationship between the intentional state and the object or state of affairs that it is in some sense directed at?” As an example, a statement of someone that it is raining is a representation of a certain state of affairs, so the belief of that person that it is raining is a *representation* of a *certain state of affairs*. However, speech act theory only consider: (i) isolated acts, the initial utterance, with its condition of application, and the local effects which it can have on the interlocutors (Ferber, 1997); and (ii) the sequence of interactions which is established between the interlocutors during their communications or their reciprocal expectations in conversations (not the in-between sequences).

On the other hand, the notion of intentionality considers a strict mind-to-world and world-to-mind fit. That is to say, it does not consider the multiple features existing in the world to mind fit, like the activity a person is engaged with, for instance using a tool. Actions are analyzed based on the act of “perceiving” of an object or doing an *action at a moment*. The analysis (both speech acts and intentionality) does not include the act of using a tool as a mediator for accomplishing an action. Secondly, it suggests that neither memory nor the prior

intention (like motivations, deliberation) is essential to the visual perception of a person or the intentional action respectively (Searle, 1983)<sup>179</sup>.

In section 6.1 onwards, we show that somehow memory does play a role to the visual perception of a person and that this must be considered when analyzing conversational structures. A visual perception is not merely an act of seeing a flower, an “objectified” image (like cars, tree). Instead, visual perception includes reading a text. When reading a text, there is an act of coupling the sentences with how one is understanding and remembering. Thus, we prefer to adopt the notion of intentionality by (Clancey, 1997a). The representation of intentionality is influenced by the behavior and the context of action. The behavior and response (and even speech and reading a text) of a person is articulated and adapted in the context she is situated in. It is influenced by the current activity she is engaged in.

#### **4 Preliminary results on analysis of the conversational structures**

We review the collaborating scenarios. Pete is the project coordinator for this joint project and he was new to this environment (i.e. instant messaging and video-conferencing). Mathew, on the other hand, is an experienced collaborator and has run many virtual collaborations. Everyday Mathew and Pete go online to chat about the project. Pete’s job was to make sure everyone does his/her share of work, and respect the deadlines in order to achieve their shared goals together. Before the FlashMeeting reported hereafter, at the start of the collaboration, Mathew had taught privately Pete how to use the tool. During the first meeting held among some of the collaborating members, Pete carried out his role. In this section, we focus on one of the collaborators, Pete. We look into his conversational structures. In the remaining subsections, we shall illustrate three findings from our analyses. Section 4.1 is on the reshuffling/re-sequencing of the conversational structures. Section 4.2 is on the merging of the protocols of Mathew’s into Pete. Section 4.3 is on the adaptation of the protocols of Pete’s situated in context/environment.

##### **4.1 The re-shuffling/re-sequencing of memory in re-enacting communication protocols**

This section will discuss the reshuffling/re-sequencing of the conversational structures coupled to memory. We illustrate a particular scenario. During one of the meetings that took place on the FlashMeeting, Pete had re-enacted a set of communication protocol in a way similar to Mathew<sup>180</sup>. Below, we show the excerpted natural language conversations.

---

<sup>179</sup> Of course, this is not to say that we reject the notion of speech acts and intentionality. Indeed we do not, because using Fipa-Acl as our formal model for agent language goes back to the *speech act theory*. In our CONSTEPS (Binti Abdullah et al., 2005) we have incorporated (using speech act theory as basic units) a different kind of perspective inspired by those three existing theories discussed in section 3 for analyzing conversations. We must consider this because currently tools are beginning to play a significant role in our daily web communications.

<sup>180</sup> The complete communication scenarios and detailed analyses may be referred to (Binti Abdullah et al., 2005).

$E_1$ . Excerpted from FlashMeeting 1, Date: 17/09/2004. Duration of meeting: 1 hour 34 minutes 51 second

Mathew: Hello iris, welcome to FlashMeeting. Hope the technology is working well for you. You probably work out on the hand button to raise your hand or you click on the interrupt button if you have something urgent to say. It's a strictly push to talk model because that makes the audio simply work a lot more reliably and it also it makes the replay of the meeting well coz we know exactly who's talking at any moment. And you can stop broadcast anytime just by clicking on the..., in fact un-broadcasting or broadcasting again and someone will take the floor.

$E_2$ . Excerpted from FlashMeeting 2, Date: 22/09/2004. Duration of meeting: 58 minutes

Pete: Good afternoon Simon. Maybe it is your first time practicing this kind of meeting. So there is 1 button to start and to stop broadcasting and to join the queue. So you have to press to start and to ask for the queue and to stop broadcasting as well.

Two similar events took place during the meetings;  $E_1$ ,  $E_2$  where we label them as context  $c_1$  and  $c_2$  respectively. Both were about *how to give instructions* on using FlashMeeting. It also took place at the beginning of the meetings. Below, are the conversations in agent communication messages format. This is the first level of abstraction.

Table 1: Comparing the conversation structures of Pete and Mathew in a similar context.

<sup>181</sup> Mathew's instruction to Iris on the 17/09/04, (context $c_1$ ). Agent messages corresponds to Mathew in $E_1$	Pete's instruction to Sm on the 22/09/04, (context $c_2$ ). Agent messages corresponds to Pete in $E_2$
30 greet m <sup>182</sup> , iris u	3 greet p <sup>183</sup> , sm u
31 inform-if m,iris (tch) <sup>184</sup> (wk)(wl) = =true	4 inform p,sm (prc)(mtg)(1stm)
32 inform-ref m,iris (wk) (hnd)(bt)	5 inform-ref p, sm (t-is) (1) (bt <sup>185</sup> )
33 request whenever m,iris (rs)(hnd)(clk)(hnd)(bt)v	6 inform-ref p,sm (bt)(str)(brdc <sup>186</sup> )
34 inform-ref m,iris (clk)(int)(bt)	7 inform-ref p, sm (bt)(stp <sup>187</sup> ) (brdc)
35 request whenever m,iris (nd-to) (sy)(smtg)(urg)	8 inform-ref p,sm (bt)(to)(jn-q)
36 confirm m,iris (md)(fm)(psh-to)(tlk)	9 request whenever p, sm (str) (prs)(bt)
37 inform-ref m,iris (mk)(ad)(rlb)	10 request whenever p, sm (as-q) (prs)(bt)
38 inform-ref m,iris (mk)(repl) (wl)	11 request whenever p, sm (stp) (brdc)(prs)(bt)

<sup>181</sup> The names are not the real names of the collaborators.

<sup>182</sup> m stands for Mathew.

<sup>183</sup> p stands for Pete and sm stands for Simon.

<sup>184</sup> An example of abbreviation used, in this message: (tch) abbreviates technology.

<sup>185</sup> bt stands for button.

<sup>186</sup> brdc stands for broadcasting.

<sup>187</sup> stp stands for stop.



Mathew's instruction to Iris on the 17/09/04, (context c <sub>1</sub> ). Agent messages corresponds to Mathew in E <sub>1</sub>	Pete's instruction to Sm on the 22/09/04, (context c <sub>2</sub> ). Agent messages corresponds to Pete in E <sub>2</sub>
39 inform-ref m,iris (knw)(wh)(tlk)(pt)	
40 inform-ref m,iris (cn)( <b>stp</b> )( <b>brdc</b> )(ayt)	
41 request whenever m,iris (clk)( <b>stp</b> )(ubrdc)( <b>stp</b> )( <b>brdc</b> ) v	
42 request whenever m,iris (clk) ( <b>brdc</b> )(ag)( <b>stp</b> )( <b>brdc</b> )	
43 inform m,iris fl (sm)(tk)	

The message format follows partly the Fipa-Acl format. Refer to table 1, column 1, row 1: message number (i.e. 30), communicative act (e.g. greet), sender (e.g. m which is Mathew), receiver (e.g. iris), and content (e.g. *u*, which is an abbreviation used for the sentence). For a greeting sentence like “Good Afternoon” or “Hey” the content of the communicative act is simplified and abbreviated as *u*. The *content* will be referred as a *parameter* in the remaining of the section.

The words in bold like *bt*, *brdc* are the words that had re-appeared in the conversational structures of Pete. They are particular parameters that Pete had remembered well. We illustrate in figure 2 below, of how the re-sequencing/re-shuffling of the re-enacting of Mathew’s communication protocol by Pete had taken place.

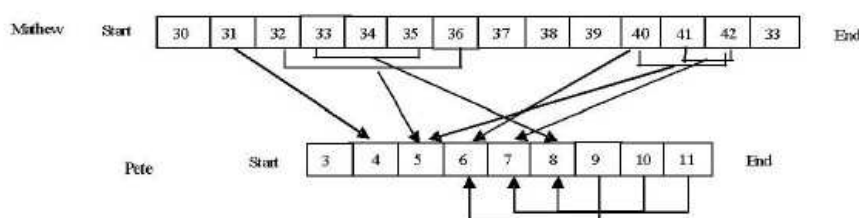


Figure 2: The re-sequencing of Pete’s communication protocols of Mathew’s.

In figure 2, we represent the conversational structures as *blocks*. The first block refers to the conversational structures of Mathew and the second to Pete. We refer this as blocks, because it represents a sort of punctuated “experience” of Pete.

The conversational block has been labelled with a “start” and an “end”<sup>188</sup> (Bateson 1972; Maue 1979; Richards 1965; Jackendoff book in-progress). The start and the end represent the start and the end of the communication protocols

<sup>188</sup> For now we use simply the notion *start* and *end* (some literature, suggests a start, *pause* and end) as labels of “punctuated events”. The *start*, *end* notion have been referred to as different terms. The terms such as: frames by (Jackendoff book in-progress), procedures by (Maue, 1979), communication structures by (Richards, 1965) and “punctuation” by (Bateson, 1972). The shared idea is there is some kind of an opening, pause and ending to a certain “punctuated event”. In (Clancey, 2004), the author had suggested that this idea is general in how people organize a variety of their joint behavior.

of Mathew and Pete respectively. From a different perspective, it also represents the beginning of Pete remembering the “experienced event”, and the ending of how he ends the “remembering of that event”. But we are not suggesting that the memory “halts” abruptly just after that. This will be discussed properly section 5.

We discuss figure 2. First of all, readers notice that message 31 of Mathew corresponds to message number 4 of Pete. When we say the term “corresponds” we are referring to the idea that the content of this block (message number 31) of conversation has similar meanings. Messages 32 until 36 and number 40 until 42 had been re-sequenced as message number 5. Further elaborating, from message 32 until 36, Mathew (see again table 1) had begun to describe the button to Iris. He had described it in an *incremental manner*. Incremental in the sense that he had *imagined* (or is he remembering/recalling?) step by step what a person would normally do when she first uses the tool, and how a person is getting use to the new environment. On the other hand, messages number 40 until 42 specifically focus on *how to use the button*. Now, these descriptions are mostly speaking the function of the button. As a result, these chunks of information are composed (or rather generalized) as the tool has one main button that has multiple uses to it.

Now, message number 40 of Mathew re-appeared again and had been re-sequenced as message number 6 of Pete. Message number 41 until 42 had been re-sequenced as message number 7. Finally message number 33 until 35 had been re-sequenced as message number 8. Message 9, 10 and 11 are referential to previous messages; 6, 8, and 7 respectively. If we look at the blocks of the conversational structures above, the blocks are “re-sequenced” which demonstrates some kind of conceptualization (like some kind of generalization)<sup>189</sup> of what Pete had learned himself from Mathew’s communication protocols by remembering.

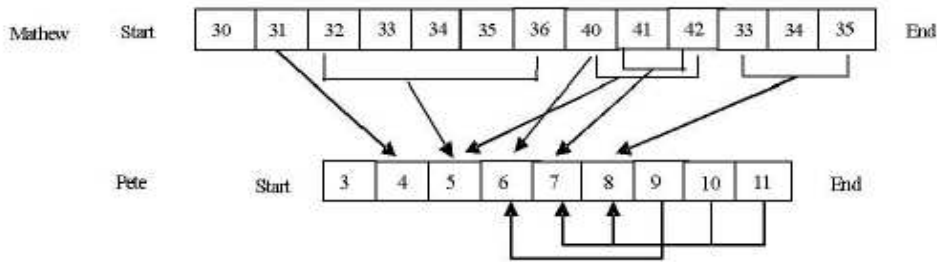
#### **4.2 Looking for the merging of communication protocols**

Continuing from the previous section, we now look into the next level of detail: if there is any merging of communication protocols. The difference between figure 3 below and 2 in the above section, is that we eliminate the middle blocks (messages number 37 until 39). Thus, we focus only on those messages of Mathew that had re-appeared in the conversational structures of Pete.

Figure 3: The only “left blocks” that had re-appeared in Pete’s conversation structures.

---

<sup>189</sup> In (Clancey, 2000), the author had discussed whether “abstraction” is some kind of an idea of how conceptualization works. In particular, from page 3, the author had given a scenario of scientists reasoning by analogy from their general understanding. From the author’s observation, these scientists have gone from the particular (observable features on Mars) to the abstract (theories about liquids) and back to the specific (a causal story about ice dams on Mars). According to the author, this is an abstraction at work. For now, we use the notion generalization in our analysis, but it does seem similar to the author’s notion of abstraction.



Refer to figure 3; the *start* and the *end* of Mathew's and Pete communication protocols are not the same. In fact, we can see how the re-shuffling of the communication protocols of Mathew had been modified by Pete (messages 30 until 36, then 40 until 42, then going back to 33 to 35 of Mathew). Below, is a microscopic view of some selected conversations blocks.

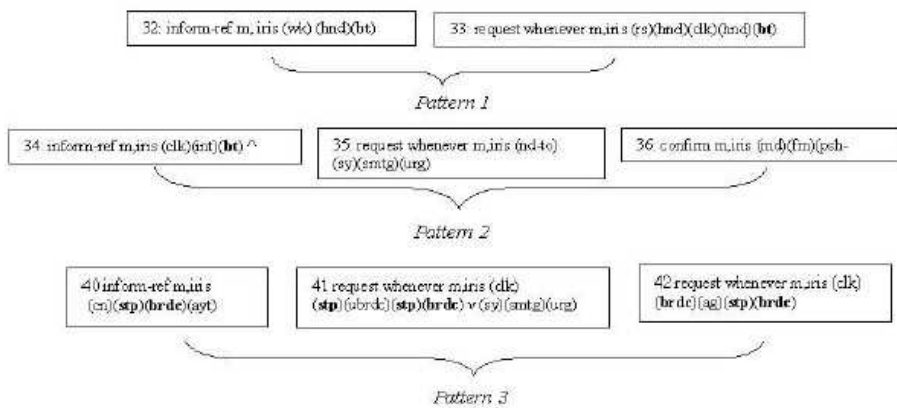


Figure 4: Patterns of the conversational structures of Mathew.

Refer to figure 4, compare pattern 1, to 2, and 3 of Mathew. We can note that in each pattern 1, 2, and 3 the communicative acts; *inform-ref* is communicated before the *request-whenver* or *confirm* acts. Now, we compare this pattern of Mathew to Pete's very own pattern. He had informed first of the button (features of the button) and then requested to Iris on how to make use of the functions of that button.

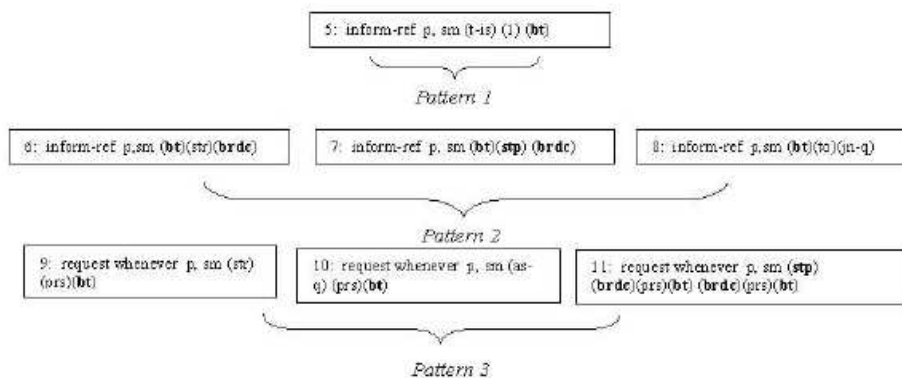


Figure 5: Patterns of the conversational structures of Pete.

Refer to figure 5. Looking at pattern 1 and 2, Pete had communicated *consecutively* with inform-ref. It is communicated in an *incremental* way about describing the buttons. In each of the pattern communicated, Pete had made *references* to the *button* (*bt*). We also notice, that he had merged the communication protocols (i.e., describe first then inform of the function of the button) into Pete’s own manner of communicating. In a way, Pete had communicated like how Mathew had: incrementally, then making reference to the button, and then requesting the user how to perform those actions. The merging can be observed two ways:

1. The arrangements of the communicative act (patterns) of what comes between, and after.
2. Those regularities of pattern arrangements along with the re-sequencing of the parameters.

Taking these into consideration portray *some kind of structures* or *articulation of thoughts*. It demonstrates some kind of “active organization”. In order to support our suppositions; we move on to the next section. The next section focuses on the adaptation of the communication protocols in *situated contexts*. This is a two way illustration. To validate if the communication protocols of Mathew had somehow merged into Pete’s communication protocols, at the same time validating that the communication protocols is adapted in different contexts of communications.

### 4.3 Looking for the adaptation of communication protocols in situated context

Now, in order to carefully identify the patterns of the communication protocols of Pete, we look into a different context of communication. Readers recall section 3.1 on the logical theory of learning and communication of (Bateson, 1972). This section will focus specifically on the two main points mentioned previously; the presence of “a new face” as being one of the “start” signals in the *external event system* (which had been mentioned in section 3.1). This “new face” is perceived as

a stimulus for Pete’s behavior. And how Pete responds to that behavior is by learning to select from his set of *contexts* (i.e. all the related events) the next alternatives he takes. Firstly, we look into similar events (similar contexts of communication). This can shed some light into how Pete adapts and selects his behavior/adapt his communication protocols situated in similar contexts. Below, we show an excerpted natural language conversation of Pete.

E<sub>3</sub>. Excerpted from FlashMeeting 1, Date: 17/09/2004. Duration of meeting: 1 hour 34 minutes 51 second

**Pete:** Good afternoon everybody. I am Pete from A.... and we are sized together online, maybe we could just start the meeting. So I shall start..well, today’s meeting is of course about our deliverables, .. It is important to know what we are going to do after .. and as collection of different teams in different laboratories and maybe I can just ask the question to everybody....<sup>190</sup>.

E<sub>3</sub> is an event where Pete had given guidelines on what to start with for the meeting. This event is compared to E<sub>2</sub> (i.e. c<sub>2</sub>) that had been illustrated in section 4.1. We replace E<sub>3</sub> with c<sub>3</sub>. We assume both events to be similar<sup>191</sup> in the sense that both demonstrate some kind of pattern in which Pete gives instructions. Below, are the converted natural language conversations of the above E<sub>3</sub> in c<sub>3</sub> (see Annex for complete sample).

Table 2: A sample of the converted conversations of Pete during two similar contexts.

Pete’s instruction to the group member on the 17/09/04, (context c <sub>3</sub> ). Agent Messages in this column correspond to E <sub>3</sub> .	Pete’s instruction to Iris on the 22/09/04, (context c <sub>2</sub> ). Agent Messages in this column correspond to E <sub>2</sub> .
20 greet p, all, u	3 greet p, all u
21 inform p,all (am)(ph)(lirmm)	4 inform p,sm (prc)(mtg)(1stm) ^ (t-is) (1)(bt)
22 inform-ref p,all (szd) (us)(online)(nw)	5 Inform-ref p, sm ^ (t-is) (1)(bt)

For simplicity reasons, we abbreviate the communicative acts, shown in table 3 below.

Table 3: Symbols used to represent the communicative acts.

g = greet	c=confirm	cfp=call for proposal	ir=inform-ref	i=inform
rw=request when	rwv=request whenever			

Since we will only illustrate the conversational structures of Pete’s, we represent the messages as a second-level abstraction, abbreviating only the communicative act and the parameters (eliminating the message number, sender and receiver).

Table 4: The abstract representation of the conversation structures.

Converted conversations	Abstract representations
30 greet m, iris u	g u
32 inform-ref m,iris (wk) (hnd)(bt)	ir (y1)(y2)(y3)

<sup>190</sup> The complete conversations are not shown to protect the privacy of the individuals and the ongoing project.

<sup>191</sup> We use this notation to represent the *sameness* of context of y at time 1 and context of y at time 2. The context y cannot be the same at time 1 and time 2 (Bateson, 1972).

Refer to table 4. For example, look at message number 30. Here, *wk*, *hnd* and *bt* are both represented simply as *y1*, *y2*, *y3*. Figure 6 and 7 below, illustrates the flow of sequences of the conversation structures of Pete.

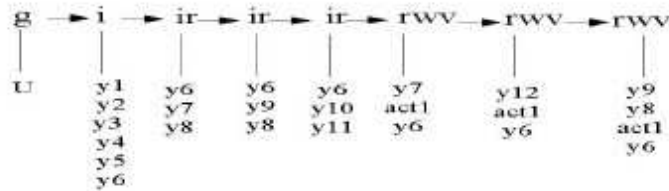


Figure 6: The sequences of the conversation of Pete during context  $c_3$ .

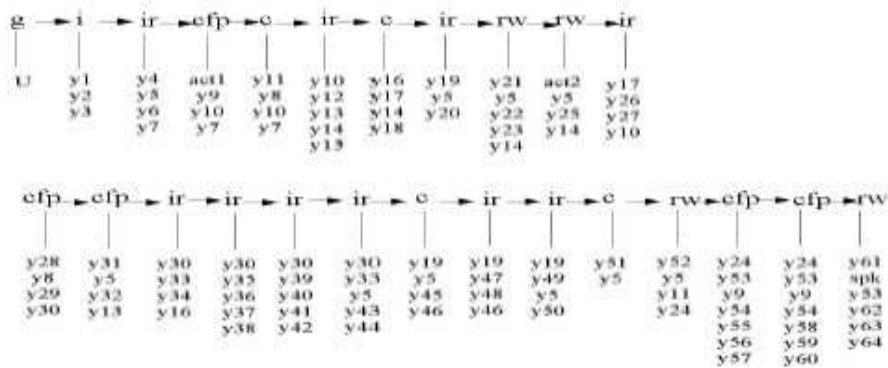


Figure 7: The sequences of the conversations of Pete during context  $c_2$ .

Refer to figure 6 and 7, and again to table 2 the first and second column. They correspond to figure 6 and figure 7 respectively. They are the illustrations of the conversation sequences of Pete's during two similar *contexts*. Please note that for example, *y1*, *y2* are not similar parameters.

First, we illustrate the *differences*. The communicative act *rw* (i.e. request when), *cfp* (i.e. call for proposal) and *c* (i.e. confirm) is not communicated during context  $c_2$ . The communicative act *rwv* (i.e. request whenever) is not communicated during context  $c_3$ .

We illustrate the *similarities*: both communications begin with the communicative act *g* (i.e. greet), has *ir* (i.e. inform-ref).

We illustrate the *flow of the sequences*. The communicative acts *ir* (i.e. inform-ref) does not precede *i* (i.e. inform), and follows immediately after *i*, *cfp*, *rw* and *c*; in  $c_3$ .

Firstly, from the *differences*; we make a hypothesis that the selection of communicative acts is *contextualized* and influenced by the mental states (and

mental states are influenced by the activity one is engaged in) of the speaker. For example *A) request when* (i.e. *rw*) is communicated to request the listener to perform an action as soon he believes in having to do it. On the other hand, *B) the communicative act request whenever* (i.e. *rwv*) is communicated to request the listener to perform it whenever she re-encounters similar situations. *A)* is a *context* that request temporary respond during that ongoing discussion (i.e. inform me during this meeting what we must do). *B)* is a *context* such that it requests that at anytime a similar context appears, the partner should respond in a similar way (i.e. whenever you have something to say when using this tool, please take this action).

Secondly, from the *flow of the sequences* of both  $c_2$  and  $c_3$ , we notice the following. The sequences are *re-sequenced* and then *re-enacted* accordingly to how the individual is *contextualizing*. *Inform-ref* (i.e. *ir*) is used frequently to give description to an object. It is also communicated to give description of the request made and to give description of support for the call for proposal. Finally, it is also communicated to give description of support to the uncertainty of certain knowledge of an object. This is quite an obvious analysis. There could be two possibilities why Pete had used this communicative act in this context. First, it demonstrates the *reflection* of the reasoning of the speaker. This reflection again is dependent on the subject that the speaker wishes to communicate about; or of his learned experiences.

Refer again to section 4.2 on the merging of the communication protocols. We had made an assumption that Pete had merged the communication protocol of Mathew into his own. Later, this merging had been adapted when he had re-encountered a similar situation. Readers note that the arrangements of the communicative acts and its parameters differ from Pete's ways of communicating in *similar* context. Comparing  $c_3$  to the other context of communication (see Annex); so far we notice that Pete normally gives direction of what to do first, and then followed by description on why to do it. Mathew normally gives description first (explaining first), then requesting to do it. In that particular context  $c_2$  (see figure 7) of Pete, he had for the first time, communicated in that similar way (like Mathew, give description first). It may not seem like a very strong support, thus we shall discuss it in the next section.

### **5 Re-sequencing, re-enacting, merging and adaptation: Some explanations**

In sections 4.1 until section 4.3, we have reviewed four types of occurrences: *re-sequencing*, *re-enacting*, *merging*, and *adaptation*. It is quite hard to clearly separate these analyses, because they seem to be associated to one another either at the *same level* or *lower-higher level*. The *lower-higher level* refers to specialization-generalization of the context of communication. We have only bits and pieces of information to explain the occurrences. We had focused on those occurrences that may exhibit some kind of articulation of thoughts; like the conceptualization and contextualization of the speech, moment by moment. The arrangements of the communicative acts with its associated parameters

demonstrate a kind of organization (“an active organization”) of processes. An active organization which we refer to as “what is the attention at that given moment -- which is “what is the focus of the subject at that moment” the activity of speaking and/or typing texts.

In order to better understand those occurrences; it is important to relate our analyses back to section 3. We review some of the terms described in (Clancey, 1997a).

(i) Context: Is a conception of what a person is doing, and hence the *context* of her actions. It is always social.

(ii) Experience: Is related to contextualism<sup>192</sup> that experience consists of *events*. The interaction of the person and the physical relations provide support for the experiences. The relations are then analyzed into textures, these textures “lying” in a *context*. *Time* is involved in shaping this experience.

(iii) Events: Is defined as having a quality as a whole. Quality is defined as the total meaning of the event.

(iv) Situations: Situations is a pointer for re-encountering the set of contexts and is partially constructed within the interpretation process.

(v) Learning zero, I and II: The *unidentified* operators responsible for the *changes* of the learning types (i.e. refer to figure 2, section 2.1) as reported by (Bateson 1972).

First we discuss the *learning of an experience*. An experience is learning of an event, and remembering this event when re-encountering situations resembling the previous learned events. This process changes in time. Thus, context is not a simple variable that is manipulated. It is constructed by the subject, in an ongoing manner (Clancey, 1997a). We use the notion contextualizing and context inter-dependently. Contextualizing is a whole process of coordination (i.e. from the social and biological perspective). Context is then the lying ground of events. A set of contexts is thus defined as set of events having a certain degree of similarity among one another. Refer again to the logical theories of (Bateson, 1972) which we briefly described in section 3.1. We take the *external event systems* as our primary source for investigation. How can the logical theories of learning and communication be traced to the conversational structures which we had analyzed? Looking into the arrangements of conversational structures may show us dynamic changes of sentences constructions which can demonstrate some kind of changes of process. Learning denotes change of some kind. Refer again to figure 1 in section 3.1, which level of learning had taken place? We can only speculate for now that during the event where Pete had communicated similar like Mathew in a similar context; learning II had taken place for Pete. Learning II can also be described as a *change in how the sequence of experience*

---

<sup>192</sup> Contextualism involves a shift in emphasis from traditional learning theory approach and from a traditional process-modeling approach, to a description of knowing in terms of the situational and task variables which define experimental situations and which constrain subjects into behaving “as if” they possess a particular form of knowledge (Hoffman, 1983). Contextualists reject the Cartesian doctrine that learning results in static mental copies of things in the world, they reject the representation/process *dualism* that is inherent in mechanistic and information processing views (Hoffman, 1986).



is punctuated. Pete had somehow correctly “punctuated” that *event* as being that event for *giving instructions to newcomers* (Binti Abdullah et al., 2005). Pete *recognized* it as a *context* to *give instructions*. Now, if we refer again to (Bateson, 1972), learning II is described as a change of process in learning I. However, for now, we cannot figure out how learning 0/I had “jumped” to II.

Refer again to the Annex on some samples of the converted conversations. In these samples, we label the set of converted conversations as *contexts*  $c_1, c_2, c_3, c_4, c_5, c_6, c_7$ . These contexts of communication are selected based on *similar events*. For example, we refer again to section 4.1 on the comparison of the conversations structures of Mathew and Pete. Situation is referred to the moment that Pete had re-encountered this familiar of context (giving instructions to newcomers). Pete had experienced an event of how to handle newcomers to FlashMeeting. He re-encountered this situation, and recognized that as being that particular event. He proceeded to give instructions to this newcomer. We then generalize these similar contexts that can be roughly described belonging to a context class “giving instructions”. However, giving instructions can be a variety of sort. We can have giving instructions on how to use a tool, or how to prepare document or what to do when giving a talk. This had been elaborated in section 4.

Now we more or less assume that then this “context” may be what (Bateson 1972) used as a term for describing the set of alternatives that a person chooses when making her next move. We have to then relate what sort of members then belong to  $c_1, c_2, c_3, c_4, c_5, c_6, c_7$ , which will allow us to understand learning I. This requires us to understand *what had taken place* during learning I. For now, we can only speculate that it may likely correlate to section 4.3, where we had illustrated how the choice of communicative acts. That is in some ways reflects the perceiving, and acting upon what he perceived and at the same time upon the transformation of the perceived acts. This suggesting that perhaps memory consist of the re-sequencing and re-enacting of these perceived acts. All those occurrences that we had observed until now, has linkages to *situated cognition*. The author (Clancey, 1997a), (from page 344) states that the very nature of *memory-actions* are always at *some level improvised*. This *improvisation* is *situated* with respect to *perceptual coupling*, and also with respect to *conceptual coupling*. The activity of Pete, clicking on the FlashMeeting button whenever he wants to say something, sending an URL link via the FlashMeeting or from time to time checking if the sound is working, is communicating with respect to using the situated tools. The communication is also with respect to what Pete is actively doing/engaged in. His communication actions are a “dynamic activity” of coordination. This goes back to *activity theory*, which had been discussed in section 3.2. Finally, to summarize this rather long section, we make two assumptions from these analyses:

(i) Contextualizing involves multiple processes that *discriminate* and *generalize*. So we need to find out what are the processes involved for discriminating and generalizing. As an example; I learn that this situation is similar to the previous one based on my previous experiences (i.e. remembering). I shall respond in this way (i.e. apply this communication protocols).

(ii) Learning new communication protocols involves the *merging* and *adaptation* of others (i.e. from experiences or individuals when re-encountering similar situations) to our own internal rules.

## 6 Conclusions and perspectives

We have noticed two phenomenons from the analysis: (i) inherent in individual, there are internal rules (e.g., combinatorial rule systems); (ii) the adaptation and merging of protocols; is improvised by induction. Induction is one of the characteristics of human reasoning, that we form generalizations based on our experience or observations. Through observations and experiences one learns. When humans experience certain situations, they learn and keep that in memory. These experiences are learned over time. People apply their own protocols and induce, merge and adapt new ones when communicating with one another in a new environment when they re-encounter similar contexts; adapting to experience (i.e. *learning*). When they re-encounter similar situations, they are in fact inducing situations which are to them similar to the previous ones by *remembering*. How those internal changes of process of merging and adapting is influenced by their *internal rules*. However, for now, we cannot give a solid definition of internal rules. The closest meaning we can derive from this notion, is in relationship to the *manner* how a person is constantly adapting her action and thoughts to the context of her communication. For example, she can tell if context 1 is similar to context 2 and so on. If she re-encounters a situation that reminds her of context 1, she can readily perceive or recognize what is a correct way to behave. On the other hand, when she re-encounters context 3 that is not in any way similar to context 2, she resumes to another manner of communicating. But the way she *improvises* her communications is done in the manner how she learns. Her internal rules suggest how she articulates her actions and thoughts to the adapted context. Our particular observation of this phenomenon reminds us of the theory of (Jackendoff, book in-progress) on what he calls as a “combinatorial rule system in mind of language user”. The author (Jackendoff, book in-progress) (from page 4-3) discussed that learning must involve creation of organization in the mind/brain of the learner. He further remarked that it may or not involve “active teaching” on the part of those with whom the learner interact. Since these inner resources are by definition not learned, thus must be a consequence of the inherent structure of human.

Does the combinatorial rule systems have linkages to (Bateson, 1972) logical theory of learning and communication? Since, from our observation, we have noticed that there is some kind of “semi-constant” manner to how the person re-sequences, re-enacts, merge, and adapts her choice of actions in a situated context.

Thus, there are two major points which we will further look into: *events* and *context*. They both suggest some kind of central role for the adaptation and merging of communication protocols. We would also like to find out how does the learning *operators* operate that had enabled a person to *discriminate* and

*generalize* her context of communications. And if those operators are in relation with how humans merge and adapt communication protocols. Understanding that particular mechanism might inform us further how a person recognizes that one context is “similar” to the another context. We also wish to comprehend the in-betweens that allow one to know to communicate with what, and when. At this moment, we only have some clues to classify contexts of communication and the patterns of communication.

The potential impact of our work with respect to GRID’s development has to be shown and demonstrated. For the moment, a few intuitions do not allow us to make strong claims, even if the trends in GRID research are for us extremely promising:

- GRID and Agent’s technology (and social models) seem to show synergies and perhaps confluences (Foster et al., 2005; Cerri, 2005).
- Within the current GRID research, there is a strong need for including the Human in the loop, i.e. considering Humans as part of Virtual Organization/Communities and therefore designing specifications that enable Humans to become service providers and consumers by respecting rules associated to these specifications.
- While previous generations of GRID related activities, were mainly concerned with distributed computations, current GRID applicative scenarios specifically address the use of GRIDs for facilitating and enhancing human to human collaboration at a distance.

For all those reasons, our quite preliminary results may indeed feed into the evolution of technologies such as those of Semantic GRIDs, for instance the specifications of virtualized interfaces to humans, as proposed by (Dugenie, 2005; Dugenie et al., 2005).

### **Acknowledgments**

We would like to thank our colleague Sylvain Degeilh of the Computational Linguistic Department, LIRMM:CNRS & Université Montpellier II, France; for his contribution in commenting on the formalism of the conversations. Finally, we would like to extend our sincere thanks to the collaborating group members of the Workpackage 6 (WP6) of the project EleGI; Professor Marc Eisenstadt of KMi, the Open University, UK and Philippe Lemoisson of LIRMM:CNRS & Université Montpellier II, France, for their constant moral support and assistance from the start of the project.

### **References**

- Binti Abdullah, N.N., and Cerri, S.A. 2005. "Some preliminary results on the: The induction of communication protocols." Poster paper to be presented at the Cognitive Science 27<sup>th</sup> Annual Meeting, July 20-23, in Stresa, Italy.
- Binti Abdullah, N.N. 2005. "The induction of communication protocols." Paper to be presented at the Doctoral Mentoring Program at The Fourth International Joint conference on Autonomous Agents and Multiagent Systems. Doctoral Mentoring Program, July 24-29, in Utrecht, The Netherlands.
- Bateson, G. 1972. *Steps to an ecology of mind*. Chandler and Publications Co.
- Bradshaw, J. M., Dutfield, S., Benoit, P., & Woolley, J. D. 1996. KAoS: Toward an industrial-strength generic agent architecture. in J.M Bradshaw (ed). *Software Agents*, pp:375-418, Cambridge, MA: AAAI/MIT Press.
- Cerri, S.A. 2005. "An integrated view of GRID services, Agents and Human Learning. Towards the Learning GRID: Advances in Human Learning Services." To appear in the *Towards the Learning GRID: advances in Human Learning Services*. Edited by P. Ritrovato et al. Frontiers in Artificial Intelligence and Applications. IOS Press.
- Clancey, W.J. 1997a. *Situated Cognition: On Human Knowledge and Computer Representations*. Cambridge University Press.
- Clancey, W.J. 1997b. The conceptual Nature of Knowledge, Situations and Activity. In P.Feltovich, R.Hoffman & K.Ford. (eds). *Human and Machine Expertise in Context*, pp: 247-291. Menlo Park, CA: The AAAI Press.
- Clancey, W.J. 2000. Is Abstraction a kind of idea of how conceptualization works? *Cognitive Science Quarterly*. vol 1, nrs 3-4, pp: 389-421. Abstraction in Context, special issue, Spring/Summer.
- Clancey, W.J. 2001. What we are learning about communication protocols. <http://www.spaceref.com/news/viewsr.html?pid=3280>
- Clancey, W.J. 2002. Simulating Activities: Relating Motives, Deliberation, and Attentive Coordination. *Cognitive Systems Research, special issue "Situated and Embodied Cognition"*, vol 34, nrs 2, pp: 125-137.
- Clancey, W.J. 2005. Communication. Log Book for April 6, 2005, Commander's Journal. Bill Clancey Reporting. <http://www.marssociety.org/MDRS/fs04/0406/cmdr.asp>.
- Chaib-draa, B. and Dignum, F. 2002. Trends in Agent Communication Language. *Computational Intelligence*, vol 18, nrs 2, pp: 89-101.
- Cohen, P.R., and Perrault, C.R. 2003. Elements of a Plan-Based Theory of Speech Acts. In Marc-Philippe Huget (ed). *Communications in Multiagent Systems, Agent Communication Languages and Conversation Policies*, LNAI 2650, pp:1-36, Springer Verlag Publications.
- Dugenie, P. 2005. "GSD: a conceptual framework for the future GRID Shared Desktop". Submitted to the 6<sup>th</sup> *IEEE/ACM International Workshop on GRID Computing*. Seattle, Washington.
- Dugenie, P., and Lemoisson, P. 2005. "A bootstrapping scenario for eliciting CSCL services with GRID virtual communities." Presented at the 1<sup>st</sup> *International Conference on Advanced Technology for Enhanced Learning*. Napoli, Italy.

- Foster, I., Jennings, N. R., and Kesselman, C. 2004. "Brain meets brawn: Why Grid and agents need each other," To appear in the *Towards the Learning GRID: advances in Human Learning Services*. Edited by P. Ritrovato et al. Frontiers in Artificial Intelligence and Applications. IOS Press.
- Ferber, J. 1996. *Multi-Agent Systems: An Introduction to Distributed Artificial Intelligence*. Addison-Wesley Publications.
- Eijk, R.M.V., Boer, F.S.D., Hoek, W.V.D., and Meyer, J-J.Ch. 2003. Process Algebra for Agent Communication: A General Semantic Approach. In Marc-Philippe Huget (ed). *Communications in Multiagent Systems, Agent Communication Languages and Conversation Policies*, LNAI 2650, pp:113-128, Springer Verlag Publications.
- Greaves, M., Holmback, H., and Bradshaw, J. 2000. What Is a Conversation Policy.. In Frank Dignum and Mark Greaves (eds), *Issues in Agent Communication*, pg: 118-131, *Springer Lecture Notes in Computer Science*.
- Heidegger, M. 1954. *The Basic Problems of Phenomenology*. Indiana University Press.
- Huget, M.P., & Koning, J.L. 2003a. Interaction Protocol Engineering. In Marc-Philippe Huget (ed). *Communications in Multiagent Systems, Agent Communication Languages and Conversation Policies*. Springer Verlag Publications. LNAI 2650, pp:179-193
- Hoffman, R.R. 1983. General Contextualism, Ecological Science and Cognitive Research. *The Institute of Mind and Behavior, Inc. The Journal of Mind and Behavior*. 4:4, pg: 507-560.
- Hoffman, R.R. 1986. Context and Contextualism in the Psychology of Learning. *Cahiers de psychologie Cognitive*. 6:2, pg: 215-232.
- Huget, M.P (2003b) Design Agent Interaction as a Service to Agents. In Marc-Philippe Huget (ed). *Communications in Multiagent Systems, Agent Communication Languages and Conversation Policies*, LNAI 2650, pp:209-222. Springer Verlag Publications.
- Jackendoff, R. (book in-progress). *Language, Culture, Consciousness: Essays on Mental Structures*. MIT Press. <http://people.brandeis.edu/~jackendo/>
- Mazouzi, H., Seghrouchni Amal.E.F., Haddad S. 2002. International Conference on Autonomous Agents and Multiagent Systems Part 2. Bologna, Italy. Pp:512-528. ACM press, New York.
- Maue, K. 1979. *Water in the Lake, Real Events for the Imagination*. Harper and Row Publishers.
- Leont'ev, A.N. 1977. "Chapter 4: Activity and Consciousness." In the *Activity, Consciousness, and Personality. Psychology in the USSR*, Problems of Dialectical Materialism. Progress Publishers.
- Leont'ev, A.N. 1978. "Chapter 2: Psychic Reflection." In the *Activity, Consciousness, and Personality. Psychology in the USSR*, Problems of Dialectical Materialism. Progress Publishers.
- Plucker, J. 1999. Social Cognitive Theory. [http://www.indiana.edu/~edpsych/p540/lectures/sct/index\\_files/v3\\_document.htm](http://www.indiana.edu/~edpsych/p540/lectures/sct/index_files/v3_document.htm)

- Richards, I.A. 1965. "Structure and communication." In Gyorgy Kepes (ed). *Structure in art and in science*, pp:128-136, Braziller, New York.
- Searle, J. 1969. *Speech Acts: An Essay in the Philosophy of Language*. Cambridge University Press.
- Searle, J. 1983. *Intentionality: An Essay in the Philosophy of Mind*. Cambridge University Press.
- Searle, J., and Vanderveken, D. 1985. *Foundations of illocutionary logic*. Cambridge, England: Cambridge University.
- Sierhuis, M., Clancey, W.J., Hoof, R.V. 2001. Brahms: A Multiagent Modeling Environment for simulating social phenomenon. Presented at the *1<sup>st</sup> Conference of the European Social Simulation Association*, Gronigen, The Netherlands.
- Singh, M.P. 2003. Agent Communication Languages: Rethinking the Principles. In Marc-Philippe Huget. *Communications in Multiagent Systems, Agent Communication Languages and Conversation Policies*, LNAI 2650, pp: 37-50, Springer Verlag Publications.
- Winograd, T.A., and Flores, F. 1986. *Understanding Computers and Cognition. A New Foundation for Design*. Addison-Wesley Publishing.
- Winograd, T. 1988. A language/action Perspective on the Design of Cooperative Work. In *Computer-supported cooperative work: a book of readings*, pp: 623 – 653, Morgan Kaufmann Publishers Inc.

### 6.3 Summary: preliminary findings on communication protocols and its relationship to the CONSTEPS

Firstly, the two papers focused on a particular event. The project coordinator in the EleGI *learned how* to conduct a *similar communication protocols* in a *repeatable context*. We have attempted to illustrate how those communication protocols were situated and adapted through the modeling of conversation structures as conversation blocks. The first paper was focused on explaining how we found a particular event where *person A* (the project coordinator) had applied a similar manner of communicating as *person B* (the project executive) did in a *similar situation* (giving instructions on using the FlashMeeting tool).

The second paper was focused on the illustration of how the *re-enacting* and *re-sequencing* of those conversational structures is *adapted* to the *context* (i.e. environment) *moment by moment*.

From these preliminary analysis, we found that people have *internal rules* (e.g., a combinatorial rule system). These *internal rules* can be related to how a person learns, adapt and merge protocols situated in their context of communication. We cannot claim what is exactly an internal rules because of our primitive analysis.

Let us relate this back to Chapter 1,2,3 and 4. We did mentioned in the very beginning how we have proposed to understand the “moment of thrownness”. From those motivations, we went into understanding how intentions arise, and then how events are being punctuated into being that particular event (punctuation of events). Next, we have also claimed using this notion “punctuation of events” is *similar* to understanding how people induce communication protocols. So how do we relate the activity states framework to this analysis? We give several perspectives:

1. The CONSTEPS seek to look into moment by moment of how learning and communication is taking place. Specifically, the idea of conceptualization and contextualization (in “remembering”, see (Clancey, 1997a)) was being related back to the function modeling on how we have converted the conversations (section 4.14 onwards). The CONSTEPS is like an analysis of “putting oneself in the framework” where much focus is on the past, present and future experiences during mental reflections while communicating. It does not however, explain really how the re-sequencing and re-enacting of memory during the function modeling is taking place that can further suggest how those categorization is being constructed.
2. The converted conversations which became formalized messages was re-structured as *conversation blocks*. This analysis on communication protocols is like “putting oneself as an outside observer” where much focus is on the re-enacting and re-sequencing of the conversation blocks. We have attempted to observe both the communicative acts along with its content. It is aimed at recognizing how those re-enacting and re-sequencing of memory can help us

determine how we can explain the induction nature of the hierarchy of learning and communication (Bateson, 1972).

Hence, point 1) and 2) involve first focusing on how intentions arises, and then going back to see how these re-sequencing and re-enacting of conversation structures can provide clues to the induction of communication protocols.



## Chapter 7

### Conclusions

#### 7.1 Activity states framework: how it was developed

The activity states framework is first and foremost a framework for converting natural language conversations into marked up agent communication messages. The activity states framework was further enriched with a side goal to understand how the activity of reading, and comprehending the text that one reads, is in relationship to that person's activity on the web (Chapter 2, Section 2.3). At the same time understanding how *intentions arise* when people are *speaking* and *doing activities*. We modeled the activity of "reading and comprehending" one reads as functions; going back to concepts such as the hierarchy of learning and communication (Bateson, 1972 & 1979); situated cognition (focusing on "remembering"/memory (Clancey, 1997a); and Leont'ev (focusing on mental reflections on object-subject) (Leont'ev 1977 & 1978).

The activity states framework differs from current approaches in analyzing communications because of its emphasis on directly understanding memory in respect to the hierarchy of learning and communication. The idea of studying it in a rather narrow context of "reading and comprehending text" was mainly due to the nature of the work practice. The group members of the EleGI joint project (own experimental scenarios) used web communication tools to facilitate their work .

When analyzing the communications, we took into consideration the settings of the environment. What we refer to as environment is rather a default understanding. As an example, consider that the project coordinator is equipped with his personal computer. Furthermore, this personal computer is equipped

with communication tools; such as instant messaging, video conferencing, e-mail, word processing and so on. This is what we mean by a default understanding of environment. Since the project is made up of members coming from different countries<sup>193</sup>, the collaborators rely on a daily basis on the communication tools, in particular chatting on the instant messaging to ask some quick questions, or resolve some problems. To restate, we have modeled the functions for understanding text and comprehending, because the recorded conversations were based on the text messaging. Nonetheless, the online meetings was a mixture between text messaging and verbal communications.

Hence, studying this narrow context, we aimed to model what the collaborators are actively “perceiving”, which is the text. During the analysis of the communication protocols, we then related this active “perceiving” images, particularly relating it to what one sees on the tool functions layout. Readers may refer again to Chapter 2, for the illustration of the web communication tools user interface. The analysis in the published paper attached Chapter 6 attempts at explaining at each moment the subject studied (project coordinator and project executive) response. Both the CONSTEPS and the communication analysis considers what the “speaker” is actively conceptualizing. The conceptualization is a wider understanding of the notion of “context”. For example when I say that I am conceptualizing my role even if alone in my room writing this thesis I am situated in a this context (a small bedroom, with a fan next to me, a radio located in front of my notebook, a mug consisting of my painting brushes, and just behind my study table is my two single bed). This is the situated context where I am, actively conceptualizing my role as a student past midnight. However, when a person comes over to my apartment, my conceptualization as a hostess to show my guest around involves a wider context, of showing the kitchen, the sink is located next to the stove, the dinner table in the middle. The notion of conceptualization is a wider notion of “context”, it covers perhaps moment by moment yet “situated” context of a person's activity.

For those reasons, our modeling in Chapter 5, section 5.17, models the functions step by step; beginning from *function perceive*. Our reference to *function perceive* is again a default and very basic understanding of it, for example, when we say that the perceiving act is at that moment of active focus. We may have the project coordinator, for example has many pop up windows on his computer running. At that time, the pop up window of chat messages from his project executive caught his eye because of a very important question he had put to the project coordinator. Perhaps before, his focus was using the word processing program (typing a personal document) and now he is focused on reading the text messages of the project executive.

The communication analysis is not complete because even while we have raised the concern about how a person coordinates her non-procedural and procedural content, we are unable to justify this. Specifically, giving our example of the above, looking into idea of actively perceiving (the moment of focus) is

---

<sup>193</sup>The environment is the one of a “laboratory without walls”.

something for which we are unable to strongly make claims and give explanations. Therefore, the analysis on the communication protocols is far from completion.

However, there is technology that is undergoing development known as Brahms promising to make this kind of analysis (Clancey, 1998; Sierhuis et al, 2000). The Brahms language is developed with an aim to represent people, things, and places relevant to the domain. It represents behavior of people, second by second, over time. It is a tool for social modeling and simulation of environment (Clancey 2004a & 2005). Brahms is a modeling and simulation environment for analyzing human work practice, and for using such models to develop intelligent software agents to support the work practice in human organization (Sierhuis et al, in-submission).

In modeling the CONSTEPS, we have referred to the hierarchy of learning and communication of (Bateson, 1972). In this work, we have not demonstrated yet how the hierarchy of learning in respect to a breakdown situation is resolved by people in a “thrownness situation”. We have suggested that in order to understand this: one first and foremost has to understand how events are punctuated. This notion came from (Bateson, 1972). It describes the opposite of the “thrownness” situation by (Heidegger, 1972). In the notion of “punctuation of events” (Bateson, 1972), the author used the term “punctuated” to denote the ways a person *acquires the habit* of apperceiving the complex streams of events (including the person's own behavior) so that this stream appears to be made up of one type of short sequences rather than another. We assume that what perhaps Bateson (1972) meant that the “streams appears to be made up of one type of short sequences is corresponding to parts of events that may be combined and form into related or associated sequences (that is transformation of re-production). If we start from understanding this, whenever there is a moment of “thrownness”, but using Bateson's term, suggested that a person's member of a class<sup>194</sup> may become a class itself in another upper layer. Those punctuated events shuffles (members and classes) into different events when a person encounters a “thrownness” situations. The hierarchy of learning and communication model can be interpreted as being both an induction and deduction model depending on either looking at it on a bottom-up or top-down perspectives. We illustrate in a diagram the work chronology. Most importantly, we simplify how the different theories are related to one another. Below, is an illustration of the first initial work (Chapter 1) that inspired us to go into our chosen approach.

---

<sup>194</sup>A person's member of class may be related to what the person is perceiving that Bateson did not clearly mentioned whether it was a concept. We hypothesize that it is these grouping of members into their respective classes during learning and communication (using the framework of hierarchy of learning and communication) may suggest that they form events that may become object or event concepts.

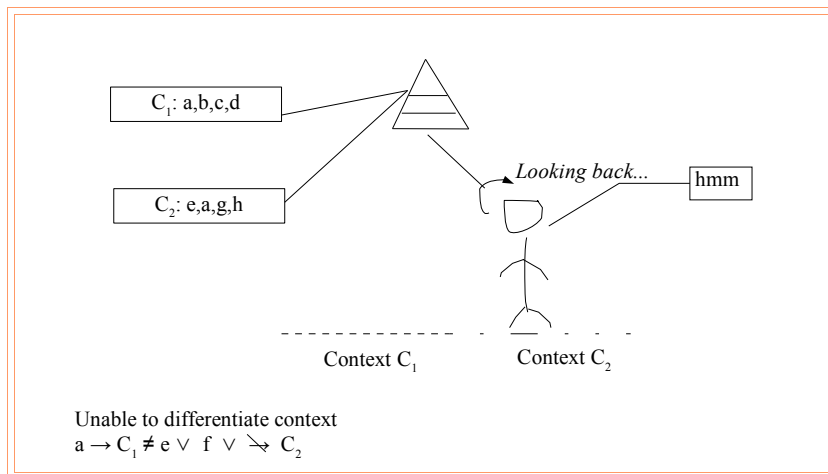


Figure 7.1(a): What we are learning about communication protocols- human learning, communications, and tools.

This illustration (figure 7.1(a)) is specifically referring to the HMP work practice during year 1999 and 2001. Let us give the skeleton figure a name, we call it Ranger. Ranger is one of the members during the HMP joint project, perhaps a commander or a mission support. Recalling the previous scenarios that we have illustrated in Chapter 1, a significant event had “thrown” Ranger in an utterly confused state. Ranger is now reflecting on the current context he is situated in with the previous context. If we imagine that during this mental reflection, on what he is reflecting, we link this to the hierarchy of learning and communication (Bateson, 1972). Ranger thought that in this context, he should select member *a*, that is belonging to  $C_1$ ; that contributes to making up that context. However he reflected that in fact context  $C_2$  isn't similar at all to  $C_1$ . He was unable to differentiate that context. He had “selected” a right member but turned out to be in the wrong class classification (i.e. set of alternatives, see page 71). In actual fact, he had in fact made a wrong choice class ( $C_1$ ). If we refer to the figure, the member of this class contains signals of having the tool “e-mail” as a part of making up that context, where Ranger had actually choose a class that has common members. There is a relation between learning I to learning 0 in this context (like being both inductive and deductive). It is from this event, that we are interested to learn how the learning had “jumped” from one level to the other. During another time, Ranger had managed to “correctly” discriminate repeatable contexts of communication.

From then onwards, we have referred to hierarchy of learning and communication by Bateson (1972), situated cognition by Clancey (1997a) and activity theory by Leont'ev (1978 & 1977) theories analyzing communications facilitated by tools, because the context of those web activities between the EleGi group members are mediated by the web tools.

This point brings us to chapter 2. In Chapter 2, we briefly reviewed the current approaches to analyzing communications for tool designing. We relate the theories to existing tools to make illustrate that existing theories (i.e.,

conversational analysis, speech act theory) may not be able to capture the dynamic context of human activities at work practice.

We illustrate Chapter 2 in a diagram below:

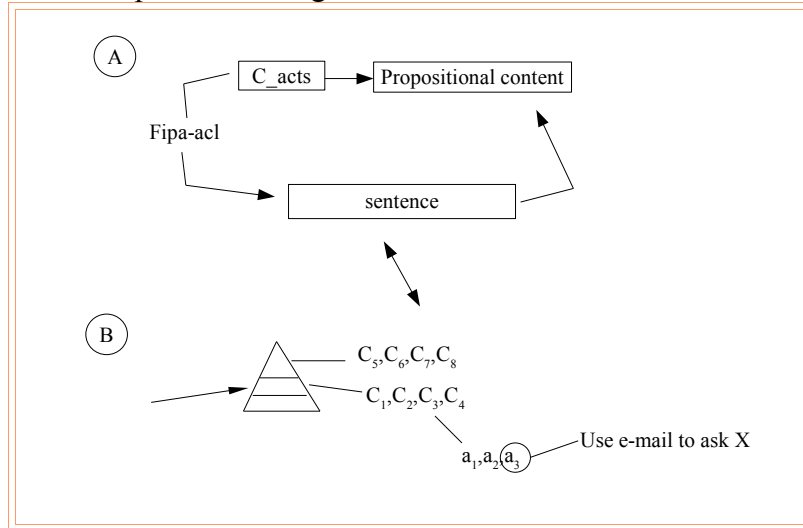


Figure 7.1(b): How do we relate the learning and communication to Speech Acts theory?

Refer to Figure 7.1(b), we relate the analysis of speech acts to the hierarchy of learning and communication. The figure shows two parts: A and B. In part A, speech act theory already defines the communicative acts (i.e. C\_acts) and a propositional content (which consists of topic and comment) (Breuker et al, 2005). Fipa-Acl is based on speech act theory (Sadek, 1997). Our analysis is applying the speech act theory back to the sentences following the Fipa-Acl formal model guidelines. In part B, we show exactly how we apply follows these theories: hierarchy of learning and communication of (Bateson, 1972), situated cognition (Clancey, 1997a) and activity theory (Leont'ev 1977 & 1978). These theories later became a part of explaining our *activity states framework*.

Now, with this idea in mind, we go further into the theories (Bill's remark, you need a better name “ X theories” or “ theories of X” to help validate our analysis and claims.

Chapter 3 is summarized in the illustration below:

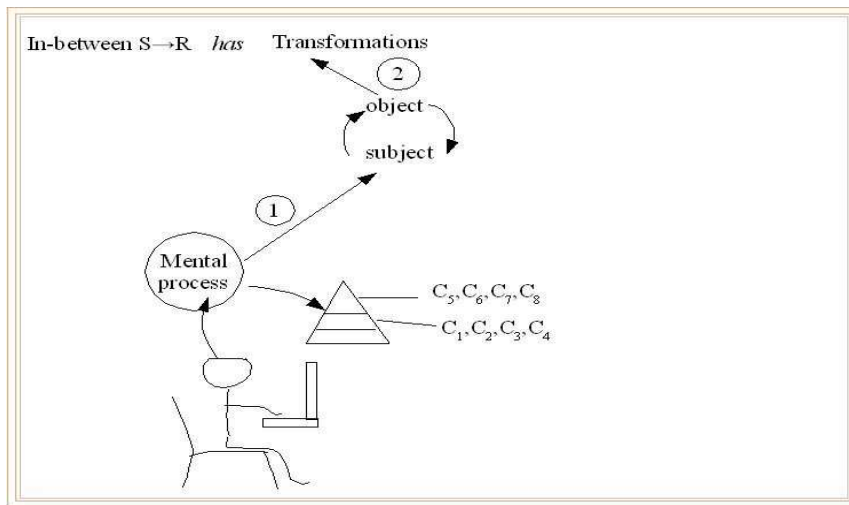


Figure 7.1(c): Hierarchy of learning and communication, situated cognition and activity theory: Reading and comprehending “text and images”.

Figure 7.1(c) illustrates in a nutshell the related theoretical foundations that we. For example, Ranger is actively doing his work in front of his computer. He has BuddySpace always in the background, and from time to time, he does go online meetings. Ranger is actively reading the text messages while coordinating his other activities. He is always in some kind of an active state of learning and communicating. Fundamentally, the mental process is referring to (Bateson, 1979). In studying how the mental process are inter-changing and transforming into chains of interaction, we refer to (Leont'ev, 1978) on mental reflections (primarily on the notion of object and subject) which is labeled with (1). Secondly, we relate this to (Dewey 1896) to the notion of “transformation” of what is taking place during the nature of communication and in between  $S \rightarrow R$ . The mental process (Bateson, 1979) is obviously related back to the hierarchy of learning and communication (Bateson, 1972) (shown as a pyramid in the above figure).

This sits in-and between the communication in abstract modeling of (Bateson, 1972). The theory of situated cognition can be seen as the whole frame. For example, actively “remembering” or “actively doing something all the time” are notions related to “contextualism”. On the other hand, the modeling of the functions is indeed an attempt by us to understand the nature of situated cognition, particularly the concepts of categorization and representation.

Chapter 4 illustrates the activity states. It is based on the analysis of the actual web communications. In the figure below, we combine chapter 4 and 5: CONSTEPS and formulating activity states for our analysis of communication protocols.

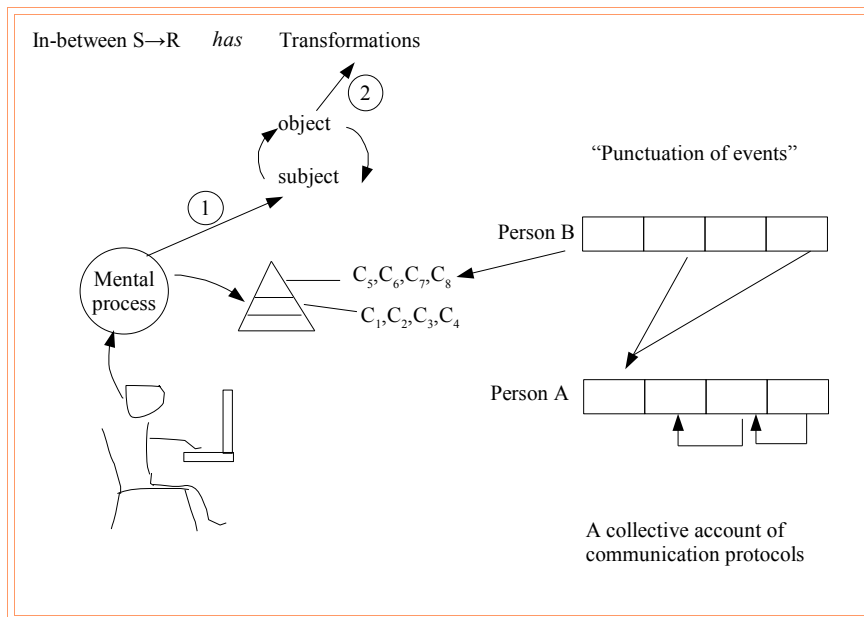


Figure 7.1(d): Activity states back to communication protocols.

Our approach to this work is kind of a dual perspectives approach. Abstracting, and detailing. For example, the left hand side of the illustration in figure 7.1(d) reflects the previous figure (7.1(c)). Now, we added the right hand side: the illustration reflects the analysis of the communication protocols. The analysis (refer to Chapter 5, paper 2) is now abstracting the converted conversations as *conversation blocks*. During this analysis, we are *looking at both* the *communicative acts* and their *propositional content* to specifically look for any merging and adaptation of communication protocols. Why all this? We can only hypothesize that through this we can go back to identify how one person makes a “jump” in the hierarchy of learning and communication in breakdown situations.

The analysis of communication protocols for understanding how a person “punctuates” or “forms” activities then goes back to the work of understanding the criterion 1 (Bateson, 1972). In order to understand how one knows to communicate with what (content to send) through with medium or tool and when involves several issues:

- Recognizing an event as being that particular event. When breakdown occurs (see again the NASA scenarios), what is changing within us (which is a neural issue) allowing us to recognize that context of communications as no longer being appropriate to communicate in such a way?
- Is the idea of shared context really based on the idea of “sharing the same ontology”? Could it be a tacit agreement of a person with others that recognizing that context of communication as a “joint context” is due to the ability to learn to come to an agreement to label that context as being: this is context A: “you behave in such a way and we do this

in this context”. Hence, can we hypothesize that the learning hierarchy may allow us to understand how over time, two persons are able to differentiate from one context to the other that they are now entering a context of “agreement”?

- The hard to pinpoint notion of object and subject. Since by nature it is always transforming, we are unable at the moment to capture exactly how the object transforms neurally that is ongoing with the behavior of that person during her construction of her experiences into subject during our function modeling. It is simply because it is actually quite hard at the moment to capture the aggregation of levels of activities-bringing the focus back to referential of the object.

## **7.2 What this thesis is and what it is not; and why it is not**

To summarize our thesis, firstly we shall list down what the activity states framework is :

1. It is a guideline to recognize intentions for converting actual conversations into marked up agent communication messages.
2. It is a framework that attempts to understand the existing theory on memory, learning and communication in relationship to conversation analysis.
3. It is also a framework that works in a cyclic approach in all aspects theory and actual data and observation. The CONSTEPS (i.e activity states) is working in a cyclic approach based on the analysis of the communication protocols. We hypothesized that we cannot properly understand how communication protocols are merged and adapted in situated context if we do not understand how intentions arise in the first place.
4. It seems promising to use as a model for solving the agent communication language problem that is to define the semantics for agents and enabling agents to infer each other's communicative behavior especially when one of the agents are humans.
5. It is a contribution to the existing theories: situated cognition to learning and communications in activities aimed at modeling some of these ideas as functions.

What this thesis omits and why are the following.

1. It has not provided any conclusions so far on how people learn from “breakdown” situations (the actual scenarios in Chapter 1). Even if there are theoretical foundations for this, we have not yet able to model this as functions like those in Chapter 4. Why it is so: We do not know yet what is exactly the external event systems that tells people what next alternatives they should take. For example, there could be many external stimuli. This is due to the nature of the person's active conceptualization of a his/her role in a situated context.



2. The activity states framework has not modeled the parameters in the functions. Why it is so: Again we are not sure of what are the attributes of a context?

### 7.3 Perspectives and future directions

First of all, the framework needs to be tested, and validated by the scientific community. Secondly, the analysis is not complete because of some missing knowledge, such as not knowing what the person had done before going online to chat and so on. Thirdly, we have only managed to find one set of conversation structures that can be traced to see the re-sequencing and re-enacting of memory. We have the ambitious goal of wanting to preserve the “articulation of thoughts”, by making sure we preserve how the predicates are structured to show how the indexing and referential process is taking place during the CONSTEPS. At the same time, there are several syntax issues that we need to consider (because the formal guidelines in Acl specify what the content layer should be like, see (Fipa-Acl, 2002)). It is quite hard to provide a formalized conversations that can retain the raw sense of the articulation of thoughts, also, at the same time, maintaining a coherent structure of predicates.

Our work is still at a primitive stage, this thesis does not come up with very definitive definitions of the terms we have used, for example, activity states, conceptualization, context, transformations and in-between processes. This is because we are trying to be careful with what we are defining because we believe that our analysis is far from completion. In order to finally come up with a definitive definition, we certainly must continue to analyze our corpus and to look into the fine grained details of other conversation structures. Our future direction is concerned with fulfilling what this thesis omits:

1. continuing annotating sentences like in section 5.4, Chapter 5.
2. Continuing modeling the rest of the 50,000 words as transformation functions as in Section 5.17 (on mental criterion) to look into incoherency and ambiguities. We would like to do this to understand why there are ambiguities so we can understand regularities.

Much of the future work will be devoted to continue with analyzing the corpus.

Finally, the framework's name “activity states” perhaps does not carry the ideal meaning of our approach. We anticipate to find a richer name for it, as the framework remains quite open that needs much discussion and direction in the future.

## References

- Abbot, K.R., and Karin, S. S. 1994. Experiences with Workflow management: Issues for the next generation. In the Proceedings of the ACM 1994 Conference on *Computer-Supported Cooperative Work (CSCW'94)*. Chapel Hill, Nc, USA. ACM Press. pp: 113-120.
- AC. 2005. Workshop 3: Agent Communication. The Fourth International Joint Conference on Autonomous Agents and Multi-Agent Systems. Van Eijk, R., Flores, R., Huger, M.P (Eds). Universiteit Utrechth, The Netherlands. 25-29 July.
- Allwood, J. 1977. A Critical Look at Speech Act Theory. In *Logic, Pragmatics and Grammar* . Ö. Dahl (Ed). Studentlitteratur, Lund. pp: 53-99.
- Akhtar, S.W. 2005. Al-Tawhid. The concept of knowledge in Islam. *Al-Tawhid. A Journal of Islamic Thought and Culture*. Vol. XII No. 3.
- Al-Farabi, A.N. (c870-950) 1969. *Kitab Al-Huruf (The Book of Letters)*. M. Mahdi (Ed). Beirut: Dar al-Mashriq.
- Amble, T. 2004. The Understanding Computer. Natural Language Understanding in Practice. Link:[www.idi.ntnu.no/emner/tdt4275/NOTES/tulip.pdf](http://www.idi.ntnu.no/emner/tdt4275/NOTES/tulip.pdf)
- AT-Wikipedia. 2005. Link: [http://en.wikipedia.org/wiki/Activity\\_Theory](http://en.wikipedia.org/wiki/Activity_Theory)
- Auramäki, E., Lehtinen, E. & Lyytinen, K. 1988. A Speech-Act-Based Office. Modeling Approach, *ACM Transactions on Office Information Systems*, 6, 2, 1988, pp. 126-152.
- Auramäki, E., Hirschheim, R. & Lyytinen, K. 1992. Modelling Offices Through Discourse Analysis: The SAMPO Approach, *The Computer Journal*, 35, 4, 1992, pp. 342 - 352.
- Artimis. 2002. Artimis, a machine with a mind of its own. Released by *France Telecom on the June 2002 under the R&D Innovation Galery*.  
Link:[http://www.francetelecom.com/sirius/rd/en/galerie/dialogue\\_intelligent/pdf/doc.pdf](http://www.francetelecom.com/sirius/rd/en/galerie/dialogue_intelligent/pdf/doc.pdf)
- Austin, J.L. 1962. *How to Do Things with Word*. Harvard University Press.
- Bateson, G. 1972. *Steps to an ecology of mind*. The University of Chicago Press.
- Bateson, G. 1979. *Mind and Nature: A Necessary Unity (Advances in Systems Theory, Complexity and the Human Sciences)*. Hampton Press, Incorporated.
- Bannon, L. 1997. Activity Theory. Link: <http://www-sv.cict.fr/cotcos/pjs/TheoreticalApproaches/Activity/ActivitypaperBannon.htm>
- Bara, B.G. 2005. Communicative Intentions: the Extreme Case of Shared Intentionality. In the *Proceedings of the 27<sup>th</sup> Annual Meeting in Cognitive Science (CogSci'05)*. Stresa, Italy. Symposia session. Sheridan Publisher.

Link: <http://www.psych.unito.it/csc/cogsci05/frame/symposia/td01-colle.pd>

- Bartlett, F.C. (1932) 1995. *Remembering, A study in Experimental and Social Psychology*, with new introduction by Walter Kintsch. Cambridge University Press.
- Bickhard, M.H., and Terveen, L. 1995. *Foundational issues in artificial intelligence and cognitive science: Impasse and solution*. Advances in Psychology 109. Elsevier Scientific.
- Bickhard, M.H. 1997. Is cognition an autonomous subsystem? In *Two Sciences of Mind*. S. O'Nuallain, P. McKevitt, E. MacAogain (Eds.). John Benjamins Publishing Company. Pp:115-131.
- Bußler, C., Jablonski, S. 1994. An Approach to Integrate Workflow Modeling and Organization Modeling in and Enterprise. Proceedings of the Third IEEE International Workshop on Enabling Technologies: Infrastructure for Collaborative Enterprises (WET ICE). Morgantown, West Virginia. April 1994. Pp: 81-95.
- Bucciarelli, L., 1988. An Ethnographic Perspective on Engineering Design. In *Design Studies*. Butterworth & Co Publisher Ltda, UK. Vol. 9. pp. 159-168.
- Breuker, J., Cerri, S.A., Eisenstadt, M., and Lemoisson, P. 2005. D20-Conceptual and Organisational Framework for Conversational and Collaboration Processes. For the European Learning GRID Infrastructure (EleGI). Sixth Framework Programme. EleGI Portal.
- Broad, C.D. 1923. *Scientific Thoughts*. Routledge & Keagan Paul Ltd. London :
- Castelfranchi, C. 2001. Modelling motivational representations. *Cognitive Science Quarterly*, No. 2. pp.233-247.
- Chang, M. & Woo, C., 1994. A Speech-Act-Based Negotiation Protocol: Design, Implementation and Test Use. In the *ACM Transactions on Information Systems*. ACM Press. Vol. 12. No. 4. pp: 360-382.
- Clancey, W.J. 1986. Review of Winograd and Flores' Understanding Computers and Cognition: A Favorable Interpretation. *Report No. STAN-CS-87-1173*. Department of Computer Science, Stanford University.
- Clancey, W.J. 1997a. *Situated Cognition: On Human Knowledge and Computer Representations*. Learning in doing: social, cognitive and computational perspectives. Cambridge University Press.
- Clancey, W.J. 1997b. The Conceptual Nature of Knowledge, Situations, and Activity. *Expertise in Context: Human and Machine*. Feltovich, P.J., Ford, K.M., and Hoffman, R. (Eds). AAAI Press/MIT Press.
- Clancey, W.J., Sachs, P., Sierhuis, M., and van Hoof, R. 1998. Brahms: simulating practice for work systems designs. *International Journal Human-Computer Studies*. Vol.49. pp: 831-865.

- Clancey, W.J. 2000. Is Abstraction a kind of idea of how conceptualization works? *Cognitive Science Quarterly*. vol 1, nrs 3-4, pp: 389-421. Abstraction in Context, special issue, Spring/Summer.
- Clancey, W.J. 2001. *What we are learning about communication protocols*. Personal essay. Link: <http://homepage.mac.com/WJClancey/HMP2001CommunicationProtocols.html>.
- Clancey, W.J. 2002. Simulating Activities: Relating Motives, Deliberation and Attentive Coordination. *Cognitive Systems Research, special issue on Situated and Embodied Cognition*. Vol. 3 No. 3. pp:471-499.
- Clancey, W.J. 2004a. Roles for Agent Assistants in Field Science: Understanding Personal Projects and Collaboration. *IEEE Transaction on Systems, Man and Cybernetics-Part C: Applications and Reviews*. Vol. 34.No 2. pp:125-137.
- Clancey, W.J, Sierhuis, M., Damer, and B., Brodsky, B. 2005. Cognitive Modeling of Social Behaviors. *Cognition and Multi-Agent Interaction: From Cognitive Modeling to Social Simulation*. Pp 151-184. New York. Cambridge University Press.
- Clancey, W.J. 2005. Communication. Log Book for April 6, 2005, Commander's Journal. Bill Clancey Reporting.  
<http://www.marssociety.org/MDRS/fs04/0406/cmdr.asp>
- Cost. R.S , Chen, Y., Finin, T., Labrou, Y., and Peng, Y. 1999. Modeling agent conversations with colored petri nets. In *Working Notes of the Workshop on Specifying and Implementing Conversation Policies*, pages 59–66, Seattle, Washington.
- Chaib-Draa, B., and Dignum, F. 2002. Trends in Agent Communication Language. *Computational Intelligence*. Vol 18. No.2. Pp: 89-101. Blackwell Publishers.
- Chen, Y., Peng, Y., Finin, T., Labrou, Y., Cost,S. 1999. A negotiation-based Multi-Agent for supply chain management. In *Working Notes of the ACM Autonomous Agents Workshop on Agent-based Decision-support for Managing the Internet-enabled Supply-chain*.  
Link:<http://scholar.google.com/url?sa=U&q=http://www.flacp.fujitsulabs.-com/~yannis/publications/agents99supplychain.pdf>
- Colkins, J. & Begeman, M., 1988. "gIBIS: A Hypertext Tool for Exploratory Policy Discussion", *ACM Trans. on Information Systems*, Vol. 6. No. 4. pp: 303-331
- Cohen, P. R. and Levesque, H. J. 1990. Intention is Choice with Commitment. In: *Artificial Intelligence*. Vol.42. Is:2-179 . Pp 213-262.
- Cnm. 2005. Centre for New Media. Link: <http://www.flashmeeting.com/>
- Cronholm, S. 2004. Information Systems Evaluation-adding process descriptions to six evaluation types. In the *Proceedings of the 11th European Conference*

- on *Information Technology Evaluation (ECITE '04)*. Royal Netherlands Academy of Arts and Sciences, Amsterdam 11-12 November 2004.
- Dewey, J. 1896. Reflex Arc Concept in Psychology. *The Essential Dewey: Volume 2, Ethics, Logic, Psychology*. Hickman, L.A., and Alexander, M. (Eds). Indiana University Press.
- Dewey, J. 1925. Nature, Communication and Meaning. *The Essential Dewey: Volume 2, Ethics, Logic, Psychology*. Hickman, L.A., and Alexander, M. (Eds) Indiana University Press.
- De Cindio, F., De Michelis, G., Simone, C., Vassalo, R., and Zanaboni, A. (1986) CHAOS as a Coordinating Technology. In *Proceedings of Computer-Supported Collaborative Work (CSCW'86)*. Austin: Texas.
- Dowling, J.E. 1992. *Neurons and Networks. An Introduction to Neuroscience*. Harvard Publications. The Belknap Press of Harvard University Press.
- Fodor, J.A. 1983. *The Modularity of Mind*. Cambridge, MA: MIT Press.
- Edelman, G.M. 1992. *Bright air, brilliant fire: On the matter of the mind*. New York: Basic Books.
- Ericsson, K.A., and Simon, A.H. 1984. *Protocol Analysis. Verbal Reports as Data*. The MIT Press.
- EleGI. 2004. *European Learning GRID Infrastructure*. Link: <http://www.EleGI.org/>
- Eisenstadt, M., Dzbor, M. 2002. BuddySpace: Enhanced Presence Management for Collaborative Learning, Working, Gaming and Beyond. In the *Proceedings of the JabberConference 2002 Europe (JabberConf 2002)*. Munich, Germany. Link: <http://kmi.open.ac.uk/projects/buddyspace/docs/jabberconf02-eisenstadt-dzbor.pdf>
- Eisenstadt, M., Komzak, J., Cerri, S. 2004. Enhanced Presence and Messaging for Large-Scale e-Learning. In the *Proceedings of the 3<sup>rd</sup> International Conference Symposium on the Tele-Education and Life Long Learning (Teleduc'04)*.
- Fakhry, M. 2002. *Al-Farabi. Founder of Islamic Neoplatonism. His Life, Works and Influence*. Oneworld Oxford Publisher.
- Ferber, J. 1996. *Multi-Agent Systems. An introduction to Distributed Artificial Intelligence*. Addison-Wesley Publications.
- Feng Wan, Sudhir K. Rustogi, Jie Xing, and Munindar P. Singh. 1999. Multi-agent Workflow management. In the *Proceedings of 17<sup>th</sup> International Joint Conference on Artificial Intelligent Workshop on Intelligent Workflow and Process Management (IJCAI'99): The New Frontier for AI in Business*, Stockholm, Sweden. 1999. Link: <http://www.csc.ncsu.edu/faculty/mpsingh/papers/databases/ijcai-99-wf.pdf>
- Fipa-Acl. 2002. *Foundation for Intelligent Physical Agent. Agent Communication Language: Communicative Acts Specification Library*.

- Link: <http://www.fipa.org/specs/fipa00037>
- Flores, T., Graves, M., Hartfield, B and Winograd, T. 1988. *Computer Systems and the Design of Organizational Interaction*. *ACM Transactions on Information Systems (TOIS'88)*. ACM Press. Vol.6 No.2. pp: 153-172.
- Garfinkel, H. 1967. *Studies in ethnomethodology*. Englewood Cliffs, NJ: Prentice-Hall.
- Gries, 2002. Equational Logic Introduction. Link: <http://www.cs.cornell.edu/Info/People/gries/Logic/Equational.html>.
- Goldkuhl, G. 1982. Human-infological research - framework and strategy. In *Towards tools for transition system design methodologies*. Björn-Andersen N (Ed). IFIP 8.2, Köpenhan
- Goldkuhl, G. 2003. Conversational Analysis as a Theoretical Foundation for Language Action Approaches? In the *Proceedings of the 8<sup>th</sup> International Working Conference on the Language Action Perspective (LAP'03)*. Tilburg, The Netherlands.  
Link: <http://www.vits.org/publikationer/download.asp?pubId=334>
- Goldkuhl, G. 2005. Beyond Communication Loops-Articulating the Principle of Multi-Responsiveness. In *Proceedings of the 10<sup>th</sup> International Working Conference on the Language Action Perspective on Communication Modeling (LAP'05)*. Kiruna, Sweden.
- Gurevich, Y. 1999. The Sequential ASM Thesis. *Bulletin of the European Association of Theoretical Computer Science*. Vol. 67 (Feb) pp. 93-124.
- Gurevich, Y. 2000. Sequential Abstract State Machines. *ACM Transactions on Computational Logic*. Vol.1. No.1. July 2000. pp. 77-111
- Heidegger, M. 1962. *Being and Time*. (translated by John Macquarrie and Edward Robinson). Harper and Row Publisher.
- Huget, M.P, and Koning, J.L. 2003. Interaction Protocol Engineering. *Communications in Multiagent Systems. Agent Communication Languages and Conversation Policies. State-of-the-Art-Survey*. LNAI 2650. pp: 179-193. Springer-Verlag.
- Huget, M.P. 2003. Design Agent Interaction as a Service to Agents. *Communications in Multiagent Systems. Agent Communication Languages and Conversation Policies. State-of-the-Art-Survey*. LNAI 2650. pp: 209-222. Springer-Verlag.
- HMP 2001. *NASA Haughton-Mars Project*.  
Link: <http://www.marsonearth.org/about>
- Hoffman, R.R. 1983. General Contextualism, Ecological Science and Cognitive Research. *The Institute of Mind and Behavior, Inc. The Journal of Mind and Behavior*. Vol. 4. No. 4. pp: 507-560.

- Hoffman, R.R. 1986. Context and Contextualism in the Psychology of Learning. *Cahiers de psychologie Cognitive*. Vol. 6 No.2. Pp: 215-232.
- Hölldobler, S. 2004. *Computational Logic, Working Material*. Artificial Intelligence Institute. Technische Universität Dresden. Link: [www.cl.inf.tu-dresden.de/computolog/lectures/winter04/scl/icl-manuscript.pdf](http://www.cl.inf.tu-dresden.de/computolog/lectures/winter04/scl/icl-manuscript.pdf)
- Idris, J.S. 1997. Islamic Answers to Philosophical Questions. Part 1. *Manar As-Sabeel*. Vol.5 No.8. pp:3-7. Shawwal 1417.
- Intercultural Studies. 2001. Margaret Mead (1901-1978) An Anthropology of Human and Freedom. *The Institute for Intercultural Studies*. New York. Link: <http://www.interculturalstudies.org/Mead/biography.html>
- Jamison, K.R. 1993. *Touched with Fire. Manic Depressive Illness and The Artistic Temperament*. Simon & Schuster Publisher.
- Jamison, K.R., and Wyatt, R.J. 1991. Van Gogh: Meniere's disease? Epilepsy? Psychosis? In the *Journal of the American Medical Association*. Vol.264. pp.723-224. American Medical Associations.
- Jenkins, J. J. 1974. Remember that old theory of memory. Well, forget it! *American Psychologist*. Vol 11. pp: 785-795.
- Kappel, G., Lang, P., Rausch-Schott, S., Retschitzegger, W. 2000. A Framework for Workflow Management Based on Objects, Rules, and Roles. ACM Computer Surveys (CSUR). Vol.32. Is.1. March 2000. Article No. 27. ACM Press Publisher.
- Weske, M. 1998. Flexible Modeling and Execution of Workflow Activities.
- Kaplan, S.M., Tolone, W.J., Bogia, D.P., and Bignoli, C. 1992. Flexible, Active Support for Collaborative Work with ConversationBuilder. In the *Proceedings of the 1992 ACM conference on Computer-supported cooperative work (CSCW'92)*. Toronto, Ontario, Canada. pp: 378-385.
- Kaplan, S.M., A.M.Carroll, and MacGregor, K.J. 1991. Supporting Collaborative Processes with ConversationBuilder. In the *Proceedings of the Conference on Organizational Computing Systems (COOCS'91)*. Atlanta, Georgia, USA. pp: 29-79. ACM Press.
- Labrou, Y., Finin, T. and Peng. Y. 1999. Agent Communication. The Current Landscape. *IEEE Intelligent Systems*. Vol. 14 No.2. pp:45-52.
- Labrou, Y., and Finin, T. 1997. *Comments on the Specification for the FIPA'97 Agent communication language*. Link: <http://www.cs.umbc.edu/kqml/papers/fipa/comments.shtml>  
Link:<http://www.csee.umbc.edu/pub/ARPA/kqml/papers/fipa/comments.shtml>
- Langer, S.K. 1951. *Philosophy in a New Key, A Study in the Symbolism, Rite and Art*. Harvard University Press.
- Linell, P. 1998. *Approaching dialogue. Talk, interaction and contexts in dialogical perspectives*. John Benjamins Publishing.

- Lindberg, D.C. *Theories of Visions. From Al-Kindi to Kepler*. University of Chicago Press.
- Lyytinen, K. 2004. The struggle with the Language in the IT- Why is LAP not in the mainstream. Proceedings of the 9<sup>th</sup> International Working Conference on the Language-Action Perspective on Communication Modeling (LAP'04). M.Aarkhus and M.Lind (Eds). Link: [www.scils.rutgers.edu/lap04/lap04.htm](http://www.scils.rutgers.edu/lap04/lap04.htm).
- Levinson, S. 1983. *Pragmatics*. Cambridge University Press.
- Leont'ev, A.N. 1977. "Chapter 4: Activity and Consciousness." In the *Activity, Consciousness, and Personality. Psychology in the USSR*, Problems of Dialectical Materialism. Progress Publishers.
- Leont'ev, A.N. 1978. "Chapter 2: Psychic Reflection." In the *Activity, Consciousness, and Personality. Psychology in the USSR*, Problems of Dialectical Materialism. Progress Publishers.
- Ljungberg, J., and P. Holm. 1997. Speech Acts on Trial. *Scandinavian Journal of Information Systems*. Vol. 8 No.1. pp:29-52.
- N-Wikipedia. 2005. Link: <http://en.wikipedia.org/wiki/Name>
- Nowostawski, M., Purvis, M., and Cranefield, S. 2001. Modeling and Visualizing agent conversations. International Conference on Autonomous Agents. Montreal, Quebec, Canada. Pp: 234-235. ACM press, New York.
- Mary Bateson. 1984. *With a daughter's eye, a memoir of Margaret Mead and Gregory Bateson*. HarperPerennial.
- Maturana, H. 1999. *Autopoiesis, Structural Coupling and Cognition*. A draft version: Link: <http://www.iss.org/maturana.htm>
- Maue, K. 1979. *Water in the Lake: Real Events for the imagination*. Harper and Row.
- Maudet, N., and Draa, C..B. 2002. Commitment based and dialogue-game based protocols. new trends in agent communication language. In the *Knowledge Engineering Review*. Vol.17 No.2. pp:157-179. Cambridge University Press.
- Merriam-Webster Online Dictionary. 2005.. Link: <http://www.m-w.com/>
- Medina-Mora, R.M., T. Winograd., R.Flores., and F.Flores. (1992). The Action Workflow Approach to Workflow Management Technology. In the *Proceedings of the ACM 1992 Conference on Computer-Supported Cooperative Work (CSCW'92)*. Toronto, Ontario, Canada. ACM Press. pp: 281-288.
- Medterm. 2005. Link: <http://www.medterms.com/script/main/art.asp?articlekey=21819>
- Minsky, M. 1986. *The Society of Mind*. Touchstone Book. Simon and Schuster Publications.
- Parunak, V.D.H. 1996. Visualizing Agent Conversations: Using Enhanced Dooley Graphs for Agent Designs and Analysis. In the *Proceedings of the 2<sup>nd</sup> In-*



*ternational Conference on Multi-Agent Systems (ICMAS'96)*. Pg: 275-282.

Link:

<http://scholar.google.com/url?sa=U&q=http://erim.org/~yparunak./doold-esn.pdf>

- Pacherie, E. 2005. From Mirror Neurons to Shared Intentionality. *In the Proceedings of the 27<sup>th</sup> Annual Meeting on Cognitive Science (CogSci'05)*. Stresa, Italy. Symposia session. Sheridan Publishing.
- Pitt, J., and Mamdani, E. 1999. A protocol-based semantics for an agent communication language. In *Proceedings of the International Joint Conference on Artificial Intelligence*. Pp: 486-491.
- Plucker, J. 1999. *Social Cognitive Theory*. Link: [http://www.indiana.edu/~ed-psych/p540lectures/sct/index\\_files/vs\\_document.htm](http://www.indiana.edu/~ed-psych/p540lectures/sct/index_files/vs_document.htm)
- Pepper, S.C. 1942. *World Hypotheses*. Berkeley: University of California Press.
- Ryle, G. 1949. *The Concept of Mind*. Barnes and Nobles Books.
- Raeithel, A. 1992. Activity theory as a foundation for design. In Floyd C, Zullighoven, H., Buddem R., & Keil-Slawik, R (Eds) *Software development and reality construction*, 391-415. Berlin, Germany: Springer-Verlag.
- Rittel, H. 1984. Second-Generation Design Methods. In *Developments in Design Methodology*. N. Cross (Ed). John Wiley & Sons Publisher.
- Sacks, H., Emanuel, A., Schegloff, and Jefferson, G. 1974. A Simplest Systematics for the Organization of Turn-Taking for Conversations. *JSTOR, Language*, Vol.50, N0.4, Part 1, December 1974, pp: 696-735.
- Sadek, M.D., Bretier, P., and Panaget, E. 1997: ARTIMIS: Natural Dialogue Meets Rational Agency. In the *Proceedings of 15<sup>th</sup> International Joint Conference on Artificial Intelligence (IJCAI'97)*. Pp:1030-1035.
- Serano, J.M., and Ossowski, S. 2003. An Organizational Approach to the Design of Interaction Protocols. *Communications in Multiagent Systems. Agent Communication Languages and Conversation Policies. State-of-the-Art-Survey*. LNAI 2650. pp: 146-178. Springer-Verlag.
- Searle, J., and Vanderveken. D. 1985. *Foundations of illocutionary logic*. Cambridge, England: Cambridge University.
- Searle, J. 1969. *Speech Acts: An Essay in the Philosophy of Language*. Cambridge University Press.
- Searle, J. 1983. *Intentionality: An Essay in the Philosophy of Mind*. Cambridge University Press.
- Schäl, T. 1996 *Workflow Management Systems for Process Organizations*. Berlin: Springer.
- Schiffirin, D. 1994. *Approaches to discourse*. Blackwell Publisher.

- Sierhuis, M., Clancey, W.J., van Hoof, R., and de Hoog, R. 2002. Modeling and simulating human activity. In M. Freed (editor), *AAAI Fall Symposium on Simulating Human Agents*. AAAI Press, North Falmouth, MA. pp: 100-110.
- Sierhuis, M., Clancey, W.J., and van Hoof, R. (in submission). Brahms: A multi-agent modeling environment for simulating work practice in organizations.
- Singh, M.P. 1998. Toward a model theory of actions: how agents do it in branching time. *Computational Intelligence*. Vol. 14. No.3. Pp: 287-305.
- Singh, M.P. 2000. A social semantics for agent communication languages. F. Dignum and M. Greaves (Eds). *Issues in Agent Communication*. LNAI 1916, Springer-Verlag. Pp:31-45.
- Singh, M.P. 2003. Agent Communication Languages: Rethinking the Principles. *In the Communication in Multiagent Systems*. Marc Philippe Huet (Ed). LNAI 2650. pp:37-50.
- Smith, I.A and Cohen, PR. 1996. Towards a semantics for an agent communications language based on speech acts. In the *14<sup>th</sup> Annual Meeting of the American Association for Artificial Intelligence (AAAI'96)*. Portland, Oregon.  
Link:  
[http://www.cse.ogi.edu/CHCC/Publications/toward\\_semantics\\_agent\\_communications\\_smith\\_96.pdf](http://www.cse.ogi.edu/CHCC/Publications/toward_semantics_agent_communications_smith_96.pdf)
- Suchman, L. A. 1987. *Plans and situated actions: The problem of human-machine communications*. Cambridge University Press.
- Suchman, L.A. 1994. Speech Acts and Voices: Response to Winograd et al. *Computer Supported Cooperative Work*. Vol. 3 No.1. Pp: 85-95.
- Stowe, B. 2004. The State of Social Tools. Link:  
<http://www.darwinmag.com/read/060104/boyd.html>
- Tuomela, R. 2005. *We Intentions Revisited*.  
[http://www.valt.helsinki.fi/staff/tuomela/papers/We-Intentions\\_Revisited.htm](http://www.valt.helsinki.fi/staff/tuomela/papers/We-Intentions_Revisited.htm)
- Turchin, V. 1977. *The Phenomenon of Science*. Columbia University Press. New York.
- Van Eijk, R.M., de Boer, F.S., Van der Hoek, W., and Meyer, J.J.Ch. 2003. Process Algebra for Agent Communication: A General Semantic Approach. *Communications in Multiagent Systems. Agent Communication Languages and Conversation Policies. State-of-the-Art-Survey*. LNAI 2650. pp: 113-128. Springer-Verlag.
- Verharen, E., Dignum, F., and Weigand, H. 1997. *Communication modeling, the language/action perspective*. In the *Proceedings of the Language Action Perspectives (LAP-97)*. Electronic Workshops in Computing (eWiC).  
Link <http://ewic.bcs.org/conferences/1996/comms/papers/paper12.pdf>
- Wan, F., and Singh, M. 2004. Mapping Dooley Graphs and Commitment Casuality to the- Calculus. . In the *Proceedings of the 3<sup>rd</sup> International Conference*

- on Autonomous Agents and Multiagent Systems (AAMAS'04).Pp:412-419. July 19-23 2004, New York, USA. IEEE Society Publisher. Link:[http://www.aamas2004.org/proceedings/052\\_wanf-mapping.pdf](http://www.aamas2004.org/proceedings/052_wanf-mapping.pdf)
- Watzlawick, Beavin & Jackson. 1967. *Pragmatics of Human Communication*. W. W. Norton.
- Wallace, R.A., and Wolf, A. 1998. *Contemporary sociological theory, expanding the classical tradition*. Prentice Hall.
- Weske, M. 1998. Flexible Modeling and Execution of Workflow Activities. Proceedings of the 31<sup>st</sup> Annual Hawaii International Conference on System Sciences. Vol. 7. pp: 713-723. January 06-09.
- Weigand, H., den Heuvel., W-J., and Dignum, F. 1998. Modeling Electronic Commerce: A Layered Approach. In the *Proceedings of the 3<sup>rd</sup> International Workshop on Language/Action Perspective Communication Modeling (LAP'98)*. Stockholm, Sweden. Link:<http://www.cs.uu.nl/people/dignum/papers/lap98.ps>
- Weigand, H. 2005. LAP: 10 years in retrospect. In the *10<sup>th</sup> Anniversary Working Conference on the The language Action Perspective on Communication Modeling*. Kiruna, Sweden. Link: <http://www.vits.org/konferenser/lap2005/Paper%201-LAP.pdf>
- Winograd, T., and Flores, F. 1986. *Understanding Computers and Cognition. A New Foundation for Design*. Addison-Wesley Publishing Company.
- Winograd, T. 1988. A language/action perspective on the design of cooperative work. (Reprint). *Computer-supported cooperative work: a book of readings*. pp: 623-653.
- Whitaker, R. 1992. *Venues for Contexture*. Ph. D. Thesis, Umeå University, Umeå.
- Yolum, P., and Singh, M.P. 2001. Synthesizing Finite-States Machines For Communication Protocols. Proceedings on the International Autonomous Agents and Multi-Agent Systems (AAMAS'01). Vol. 3, No. 2, June 2000, pp: 107-132.
- Yu Lei and Munindar P. Singh. 1996. A Comparison of Workflow Metamodels. In the *ER'97 Workshop on Behavioral Models and Design Transformations: Issues and Opportunities in Conceptual Modeling*. Los Angeles, CA, USA. Link :<http://osm7.cs.byu.edu/ER97/workshop4/ls.html>

## APPENDIX

### A Fipa-Acl Communicative Acts Specifications

<i>Fipa -Acl Formal Model: Communicative Acts Specifications</i>
<p><b>Inform-ref</b></p> <p><u>Summary:</u> A macro action for sender to inform the receiver the object which corresponds to a descriptor, for example, a name. The macro acts can be planned and requested, but not directly performed.</p> <p><u>Content structure:</u> An object description (referential expression)</p> <p><u>Syntax:</u> <math>\langle i, \text{inform-ref}(j, \text{Ref } x\delta(x)) \rangle \equiv</math> <math>\langle i, \text{inform}(j, \text{Ref } x\delta(x) = r_1) \rangle \mid \dots \mid</math> <math>(\langle i, \text{inform}(j, \text{Ref } x\delta(x) = r_k) \rangle)</math></p> <p><u>Preconditions for Agent i:</u></p> <ol style="list-style-type: none"><li>1. Agent i believes that the object or set of objects that corresponds to the reference expression is the one supplied.</li><li>2. Agent i does not believe that agent j already knows which object or set of objects corresponds to the reference expression.</li></ol> <p><u>Formal representation:</u> FP: <math>\text{Bref}_i \text{Ref } x\delta(x) \wedge \neg \text{Bref}_j (\text{Bref}_j \text{Ref } x \delta(x) \vee</math> <math>\text{Uref}_j x\delta(x))</math> RE: <math>\text{Bref}_j \text{Ref } x\delta(x)</math></p>
<p><b>Inform-if</b></p> <p><u>Summary:</u> A macro action for the agent of the action to inform the recipient whether or not a proposition is true</p> <p><u>Content structure:</u> Proposition</p> <p><u>Syntax:</u> <math>\langle i, \text{inform-if}(j, \phi) \rangle \equiv</math> <math>\langle i, \text{inform}(j, \phi) \rangle \mid \langle i, \text{inform}(j, \neg \phi) \rangle</math></p> <p><u>Preconditions for Agent i:</u></p> <ol style="list-style-type: none"><li>1. If Agent i believes the proposition, it will inform agent j that <math>\phi</math>.</li></ol>

***Fipa -Acl Formal Model: Communicative Acts Specifications***

2. If Agent i believes the negation of the proposition, i will inform agent j that  $\neg \phi$ .

Formal representation:

FP:  $B_i \phi \wedge \neg B_i (B_i \phi \vee U_i \phi)$

PE:  $B_i \phi$

Agent j will inform agent i that either i believes that  $\phi$  or; that it believes that  $\neg \phi$

**Agree**

Summary: The action of agreeing to perform some action, possibly in the future.

Content structure:

A tuple consisting of an action expression denoting the action to be done, and a proposition giving the conditions of the agreement.

Syntax:

$\langle i, \text{agree} (j, \langle i, \text{act} \rangle, \phi) \rangle \equiv$   
 $\langle i, \text{inform} (j, I_i \text{Done} (\langle i, \text{act} \rangle, \phi)) \rangle$

Preconditions for Agent i:

1. Agent i intends to perform the action in the future but not until;
2. the given precondition is true.

Formal representation

FP:  $B_i \alpha \wedge \neg \beta_i (B_i \alpha \vee U_i \alpha)$

RE:  $B_j \alpha$

where  $\alpha = I_i \text{Done} (\langle i, \text{act} \rangle, \phi)$

Note: the differences between agree and accept proposal rests on which agent is performing the action.

**Call for proposal**

Summary: The action of calling for proposals to perform a given action.

Content structure

A tuple containing the action to be done, a referential expression defining a single proposition which gives the precondition on the action.

Syntax:

$\langle i, \text{cfp} (j, \langle j, \text{act} \rangle, \text{Ref } x \phi (x)) \rangle \equiv$   
 $\langle i, \text{query-ref} (j, \text{Ref } x (I_i \text{Done} (\langle j, \text{act} \rangle, \phi (x))) \rangle$

***Fipa -Acl Formal Model: Communicative Acts Specifications***

(I<sub>j</sub> Done (<j, act>, φ (x)))>

Preconditions for Agent i:

1. Agent i intends to initiate a general purpose negotiation process or
2. Agent i may intend to only check the availability of another agent to perform a certain action.

Formal representation:

FP:  $\neg \text{Bref}_i(\text{Ref } x \alpha (x)) \wedge \neg \text{U Ref } x \alpha (x) \wedge$   
 $\neg \text{B}_i \text{I}_j \text{ Done } (<j, \text{inform-ref } (i, \text{Ref } x \alpha (x)) >)$   
RE: Done (<j, inform (i, Ref x α (x) = r<sub>1</sub>)>|...|  
    <j, inform (i, Ref x α (x) = r<sub>k</sub>)>)

**Confirm**

Summary: The sender informs the receiver that a given proposition is true, where the receiver is known to be uncertain about the proposition.

Content structure:

A proposition

Syntax:

<i, confirm (j, φ) >

Preconditions for Agent i:

1. Agent i believes that some proposition is true.
2. Agent i intends that the receiver also comes to believe that the proposition is true.
3. Agent i believes that the receiver is uncertain about the truth of the proposition.

Formal representation:

FP:  $\text{B}_i \phi \wedge \text{B}_i \text{U}_j \phi$   
RE:  $\text{B}_j \phi$

**Disconfirm**

Summary: The sender informs the receiver that a given proposition is false, where the receiver is known to believe, or believe it likely that, the proposition

***Fipa -Acl Formal Model: Communicative Acts Specifications***

is true.

Content structure:

A proposition.

Syntax:

<i,disconfirm (j,φ)>

Preconditions for Agent i:

1. Agent i believes that some proposition is false.
2. Agent i intends that the receiving agent also comes to believe that the proposition is false.
3. Agent i believes that the receiver either believes the proposition, or is uncertain about the proposition.

Formal representation:

FP:  $B_i \neg \phi \wedge B_i (U_j \phi \vee B_j \phi)$

RE:  $B_j \neg \phi$

**Failure**

Summary: The action of telling another agent that an action was attempted but the attempt failed.

Content structure:

A tuple consisting of an action expression and a proposition giving the reason for failure.

Syntax:

<i, failure (j, a, φ)> ≡

<i, inform (j, (∃e) Single (e) ^ Done (e, Feasible (a) ^  
I<sub>i</sub> Done (a))

Preconditions for Agent i:

1. Agent i intends to inform the receiver that i had then intention to do action *a* and that action *a* was feasible.
2. Agent i intends to also inform the receiver that agent i performed the action of attempting to do *a* but *a* has not been done;
3. Agent i does not intend to do *a* any longer and φ.

Formal representation:

FP:  $B_i \alpha \wedge \neg B_i (B_i f_j \alpha)$

RE:  $B_j \alpha$

***Fipa -Acl Formal Model: Communicative Acts Specifications***

**Not understood**

Summary: The sender (i.e. *i*) of the act, informs the receiver that it perceived that *j* performed some action, but that it did not understand what *j* just did. A particular common case is that *i* tells *j* that *i* did not understand the message that *j* has just sent to *i*.

Content structure:

A tuple consisting of an action or event, for example, a communicative act, and an explanatory reason.

Syntax:

$\langle i, \text{not-understood} (j, a, \phi) \rangle \equiv$   
 $\langle i, \text{inform} (j, \alpha) \rangle$

Where  $\alpha = \phi \wedge (\exists x) B_i ((i \in \text{Done} (e) \wedge \text{Agent} (e,j) \wedge B_j (\text{Done} (e) \wedge \text{Agent} (e,j) \wedge (a = e)) = x)$

**Propose**

Summary: The action of submitting a proposal to perform a certain action, given certain preconditions.

Content structure:

A tuple containing an action description, representing the action that the sender is proposing to perform, and a proposition representing the preconditions on the performance of the action.

Syntax:

$\langle i, \text{propose} (j, \langle i, \text{act} \rangle, \phi) \rangle \equiv$   
 $\langle i, \text{inform} (j, I_j \text{Done} (\langle i, \text{act} \rangle, \phi) \wedge I_i \text{Done} (\langle i, \text{act} \rangle, \phi)) \rangle$

Preconditions for Agent i:

1. Agent *i* intends to make a proposal or
2. Agent *i* intends to respond to an existing proposal during negotiation process and,
3. Agent *i* intends to perform a given action subject to certain conditions being true.

Formal representation:

FP:  $B_i \alpha \wedge \neg B_i (B_i I_j \alpha \vee U_i I_j \alpha)$



***Fipa -Acl Formal Model: Communicative Acts Specifications***

RE:  $B_j \alpha$  where:

$$\alpha = I_j \text{ Done } (\langle i, \text{act} \rangle, \phi) \quad I_i \text{ Done } (\langle i, \text{act} \rangle, \phi)$$

**Query-ref**

Summary: The action of asking another agent for object referred to by a referential process.

Content structure

A description (a referential expression)

Syntax:

$$\langle i, \text{query-ref } (j, \text{Ref } x \delta(x)) \rangle \equiv \langle i, \text{Request } (j, \langle j, \text{inform-ref } (i, \text{Ref } x \delta(x)) \rangle) \rangle$$

Preconditions for Agent i:

1. Agent  $i$  is doing the act of asking another agent to inform  $i$  of the object identified by a descriptor.
2. The agent  $i$  intends agent  $j$  to perform an inform act, containing the object that corresponds to the descriptor.

Formal representation:

$$\text{FP: } \neg B_{ref_i} (\text{Ref } x \delta(x)) \wedge \neg U_{ref_i} (\text{Ref } x \delta(x)) \wedge \neg B_i I_i \text{ Done } (\langle j, \text{inform-ref } (i, \text{Ref } x \delta(x)) \rangle)$$

$$\text{RE: Done } (\langle i, \text{inform } (j, \text{Ref } x \delta(x) = r_1) \rangle \mid \dots \mid \langle i, \text{inform } (j, \text{Ref } x \delta(x) = r_k) \rangle)$$

Note:  $\text{Ref } x \delta(x)$  is one of the referential expressions:  $\text{tx}\delta(x)$ ,  $\text{any } x \delta(x)$  or  $\text{all } x \delta(x)$

**Refuse**

Summary: The action of refusing to perform a given action, and explaining the reason for the refusal.

Content structure:

A tuple consisting of an action expression and a proposition giving the reason for the refusal.

Syntax:

$$\langle i, \text{refuse } (j, \langle i, \text{act} \rangle, \phi) \rangle \equiv$$

### ***Fipa -Acl Formal Model: Communicative Acts Specifications***

$\langle i, \text{disconfirm} (j, \text{Feasible} (\langle i, \text{act} \rangle)) \rangle;$   
 $\langle i, \text{inform} (j, \phi \wedge \neg \text{Done} (\langle i, \text{act} \rangle) \wedge \neg I_i \text{Done} (\langle i, \text{act} \rangle)) \rangle$

#### Preconditions for Agent i:

1. Agent i intends to inform that it denies that an act possible for the agent to perform and
2. Agent i intends to inform why the reason for the failure.

#### Formal representation:

FP:  $B_i \neg \text{Feasible} (\langle i, \text{act} \rangle) \wedge B_i (B_j \text{Feasible} (\langle i, \text{act} \rangle) \vee U_j \text{Feasible} (\langle i, \text{act} \rangle)) \wedge B_i \alpha \wedge \neg B_i (B_i \text{if } \alpha \vee U_i \text{if } \alpha)$

RE:  $B_j \neg \text{Feasible} (\langle i, \text{act} \rangle) \wedge B_j \alpha$

#### Viewpoint of Agent j:

1. Agent j believes that action has not been done.
2. Agent j believes that action is not feasible.

Note: The (casual) reason for the refusal is represented by the  $\alpha$  proposition which is the second element of the message content tuple (which may be constant true). There is no guarantee that the reason is represented in a way that the receiving agent will understand. However, a cooperative agent will attempt to explain the refusal constructively.

### **Reject Proposal**

Summary: The action of rejecting a proposal to perform some action during a negotiation.

#### Content structure:

A tuple consisting of an action description and a proposition which formed the original proposal being rejected., and a further proposition which denotes the reason for the rejection.

#### Syntax:

$\langle i, \text{reject-proposal} (j, \langle j, \text{act} \rangle, \phi, \psi) \rangle \equiv$   
 $\langle i, \text{inform} (j, \neg I_i \text{Done} (\langle j, \text{act} \rangle, \phi) \wedge \psi) \rangle$

#### Preconditions for Agent i:

1. Agent i intends to inform that it rejects a previously submitted proposal.
2. Agent i intends to say that because of proposition  $\psi$ .

#### Formal representation:

***Fipa -Acl Formal Model: Communicative Acts Specifications***

FP:  $B_i \alpha \wedge \neg B_i (B_i f_j \alpha \vee U_i f_j \alpha)$   
 RE:  $B_j \alpha$   
 where  $\alpha = \neg I_i \text{Done} (\langle j, \text{act} \rangle, \phi) \wedge \psi$

**Request**

Summary: The sender requests the receiver to perform some action. One important class of use of the request act is to request the receiver to perform another communicative act.

Content structure:

An action expression.

Syntax:

$\langle i, \text{request} (j, a) \rangle$

Preconditions for Agent i:

1. Agent i intends to perform some action.
2. Agent i believes the action is capable to be performed.

Formal representation:

FP:  $FP (a) [i|j] \wedge B_j \text{Agent} (j, a) \wedge \neg B_i I_j \text{Done} (a)$   
 RE:  $\text{Done} (a)$

FP (a) [i|j] denotes the part of the Fps of a which are mental attitudes of i

**Request when**

Summary: The sender wants the receiver to perform some action when some given proposition becomes true.

Content structure:

An action expression.

Syntax:

$\langle i, \text{request-when} (j, \langle j, \text{act} \rangle, \phi) \rangle \equiv$   
 $\langle i, \text{inform} (j, (\exists e') \text{Done} (e') \wedge \text{Unique} (e') \wedge$   
 $I_i \text{Done} (\langle j, \text{act} \rangle, (\exists e) \text{Enables} (e, B_j \phi) \wedge$   
 $\text{Has-never-held-since} (e', B_j \phi)) \rangle$

***Fipa -Acl Formal Model: Communicative Acts Specifications***

Preconditions for Agent i:

1. Agent i intends agent j to perform a certain action as soon as given precondition, expressed as propositions, becomes true.
2. Agent i intends to perform act when j comes to believe  $\phi$ .

Formal representation

FP:  $B_i \alpha \wedge \neg B_i (Bif_j \alpha \vee Uif_j \alpha)$

RE:  $B_j \alpha$

where  $\alpha = (\exists e') \text{ Done } (e') \text{ (Unique } (e') \wedge$   
 $I_i \text{ Done } (\langle j, \text{act} \rangle, (\exists) \text{ Enables } (e', B_j \alpha) \wedge$   
 $\text{Has-never-held-since } (e', B_j \alpha))$

**Request whenever**

Summary: The sender wants the receiver to perform some action as soon as some proposition becomes true and thereafter each time the proposition becomes true again.

Content structure:

A tuple of an action description and a proposition.

Syntax:

$\langle i, \text{request-whenever } (j, \langle j, \text{act} \rangle, \phi) \rangle \equiv$   
 $\langle i, \text{inform } (j, \forall e (\text{Enables } (e, B_j \phi) I_i \text{ Done } (\langle j, \text{act} \rangle))) \rangle$

where  $\alpha = \forall e (\text{Enables } (e, B_j \phi) I_i \text{ Done } (\langle j, \text{act} \rangle))$

Preconditions on Agent i:

1. Agent i intends to inform another agent j that a certain action should be performed as soon as given preconditions (expressed as propositions) becomes true.
2. If the preconditions subsequently becomes false, agent i intends that the agent will repeat the action as soon as it becomes true again.

Formal representation

FP:  $B_i \alpha \wedge \neg B_i (Bif_j \alpha \vee Uif_j \alpha)$

RE:  $B_j \alpha$

## B Fipa-Acl Semantic Language

The semantic language (SL) is the formal language used to define the semantics of the FIPA ACL.

### B1 Basic of the Semantic Language Formalism

In SL, logical propositions are expressed in a logic of mental attitudes and actions, formalised in a first order modal language by David Sadek (Sadek et al, 1997). The components that Sadek used are the following:

- $p, p_1, \dots$  are taken to be closed formulas denoting propositions,
- $f$  and  $y$  are formula schemas, which stand for any closed proposition,
- $i$  and  $j$  are schematic variables which denote agents, and,
- $|= f$  means that  $f$  is valid.

The mental model of an agent is based on the representation of three primitive attitudes; 1) belief; 2) uncertainty and 3) choice (or to some extent goal). They are respectively formalised by the model operators B, U and C. Formulas using these operators can be read as:

- $B_i p$   $i$  (implicitly) believes (that)  $p$ ,
- $U_i p$   $i$  is uncertain about  $p$  but thinks that  $p$  is more likely than  $\neg p$ , and,
- $C_i p$   $i$  desires that  $p$  currently holds.

To enable reasoning about action, the universe of discourse involves, in addition to individual objects and agents, sequences of events; a sequence may be formed with a single event. This event may be also the void event. The language involves terms (in particular a variable  $e$ ) ranging over the set of event sequences.

To talk about complex plans, events (or actions) can be combined to form *action expressions*:

- $a_1 ; a_2$  is a sequence in which  $a_2$  follows  $a_1$
- $a_1 | a_2$  is a nondeterministic choice, in which either  $a_1$  happens or  $a_2$ , but not both.

Action expressions will be noted as  $a$ . The operators *Feasible*, *Done* and *Agent* are to enable reasoning about actions, as follows:

- Feasible ( $a, p$ ) means that  $a$  can take place and if does  $p$  will be true just after that,
- Done ( $a, p$ ) means that  $a$  has just taken place and  $p$  was true just before that,
- Agent ( $i, a$ ) means that  $i$  denotes the only agent that ever performs (in the past, present or future) the actions which appear in action expressions  $a$ ,
- Single ( $a$ ) means that  $a$  denotes an action expression that is not a sequence. Any individual action is *Single*. The composite act  $a ; b$  is not *Single*. The composite act  $a | b$  is *Single* iff both  $a$  and  $b$  are *Single*.

From a belief, choice and events, the concept of persistent goal is defined. An agent  $i$  has  $p$  as a persistent goal, if  $i$  has  $p$  and is self-committed toward this goal until  $i$  comes to believe that the goal is achieved or to believe that it is unachievable. Intention is defined as a persistent goal imposing the agent to act.

- $PGip$  “ $i$  has  $p$  as a persistent goal”
- $LiP$  “ $i$  has the intention to bring about  $p$ ”

Intention generates a planning process.

## B2 Abbreviations

1. Feasible ( $a$ )  $\equiv$  Feasible ( $a$ , True)
2. Done ( $a$ )  $\equiv$  Done ( $a$ , True)
3. Possible ( $\phi$ )  $\equiv$  ( $\exists a$ ) Feasible ( $a, \phi$ )
4.  $B_i \phi \equiv B_i \emptyset \vee B_i \neg \phi$   
 $B_i \phi$  means that either agent  $i$  believes  $\phi$  or that it believes  $\neg \phi$
5.  $Bref_i \iota x \delta(x) \equiv (\exists y) B_i (\iota x \delta(x) = y)$   
 where  $\iota$  is the operator for definite description and  $\iota x \delta(x)$  is read “the ( $x$  which is)  $\delta$ ”.  $Bref_i \iota x \delta(x)$  means that agent  $i$  believes that it knows the ( $x$  which is)  $\delta$ .
6.  $U_i \phi \equiv U_i \phi \vee U_i \neg \phi$   
 where  $U_i \phi$  means that either agent  $i$  is uncertain (in the sense defined above) about  $\phi$  or that it is uncertain about  $\neg \phi$ .
7.  $Uref_i \equiv (\exists y) U_i (\iota x \delta(x) = y)$   
 $Uref_i \iota x \delta(x)$  has the same meaning as  $Bref_i \iota x \delta(x)$ , except that agent  $i$  has an uncertainty attitude with respect to  $\delta(x)$  instead of a belief attitude.
8.  $AB_{n,i,j} \phi \equiv B_i B_j B_i \dots \phi$   
 introduces the concept of alternate beliefs,  $n$  is a positive integer representing the number of B operators alternating

“Knowledge” is used as an abbreviation for “believes or is uncertain of”.

## B3 Underlying Semantic Model

The communicative act (CA) components are involved in planning process that characterize both

1. the reasons for which the act is selected and; referred as rational effect or RE
2. the conditions that have to be satisfied for the act to be planned; referred as feasibility preconditions or Fps

For the properties of the underlying semantic model, please refer to (Fipa-Acl, 2002)

## C

A sample of the actual recorded and transcribed conversations with their converted messages.

<p>Meeting WP6: 21/09/2004</p> <p>P : Good afternoon everybody</p> <p><i>(1) (greet sender p receiver all content ( utterances ( "good afternoon everybody" ) ) ) reply with r01)</i></p> <p>S : hi you</p> <p><i>(2) ( greet sender s receiver p content ( utterances ("hi you" ) ) ) in reply to r01)</i></p> <p>P: Good afternoon Simon. Maybe it is your first time practicing this kind of meeting. So there is 1 button to start and to stop broadcasting and to join the queue. So you have to press to start and to ask for the queue and to stop broadcasting as well.</p> <p><i>(1) (greet sender p receiver s content ( utterances ("good afternoon simon") ^ (4) inform sender p receiver s content ( practicing (s,meeting(first-time)) (5) inform-ref sender p receiver s content (there-is(button (start-broadcasting)) (6) inform-ref sender p receiver s content (there-is (button(stop-broadcasting)) (7) inform-ref sender p receiver s content (there-is (button (join-queue)) ^ (5) request whenever sender p receiver s content (press (s, button(start-broadcasting)) (6) request whenever sender p receiver s content (press (s, button (join-queue)) (7) request whenever sender p receiver s content (press (s, button(stop-broadcasting) )</i></p> <p>Clement : Hi everybody</p> <p><i>(6) (greet sender c receiver all content ( utterances ("hi everybody" ) ) ) in reply to r01)</i></p> <p>P: Well, so we have 5 or rather 7 connected now for 1 hour meeting. Of course, the major point is to make a point concerning deliverable D12. As I have already in mails, everything should go well, because.marc and jiri have already sent us the new version of scenario. Simon has... should be on the phone..that it was ok to telindus to do the job in one weeks time. It is kind of re-formatting the analysis they have done. So, the one point, maybe we can check part of the document by part of the document. So, I am going to open it in another window.</p> <p><i>(7) (confirm sender p receiver all content ( present (7-people,1-hr-meeting) ^ majoir-point(meeting ( deliverable-D12) ) ^ (8) inform sender p receiver all content ( should-go(deliverable, well) ^ is(simon, on-phone(now)) (9) confirm sender p receiver all content ( sent (marc+, new-version(scenarios)) ^ agreed (telindus, do-job-x(1week)) ^ (10)inform sender p receiver all content ( done (telindus, reformatting(document)) ^ done (telindus, analysis-in (document)) ^ (11) propose sender p receiver all content ( check (us, part-by-part (document)) ^ (12) inform sender p receiver all content ( open ( p, documents (another-window) ) )</i></p>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

P: For instance, a question to marc I have purpose that you will be the writer of the executive summary. Does ..is it allright with you?

(13) (query-ref sender p receiver m content ( agree (m, write (executive summary) ) ) reply with r01)

P: yes, I think so, most of the document, we should have so..well..maybe by the end of this week so I think if telindus confirms that it's ok for this end of week. I shall broadcast something on friday and so that well..of course maybe it's a bit short time, but maybe it's still ok to produce summary between..I mean before next tuesday for instance.

(14)(inform-ref sender p receiver all content ( have (document (telindus),end-of-week))

(15)inform-if sender p receiver all content ( confirms(telindus, this-week (end)) → broadcast (p, something(all)) ^

(16) inform sender p receiver all content ( still-ok(produce,summary (between-us)) ^

(17) request sender p receiver all content ( do (summary, before (next-tuesday) ) reply with r02)

J and S : Ok

(18) (agree sender j and s receiver p content ( utterances ("ok") ) in reply to r02)

J: About answering your question. I have a new issue. Yes..I've been reading very carefully this scenario and indeed this scenario contains a lot a lot of interesting issues and questions. In fact, I have 2 remarks about it, the first one is that is something that has to do with in fact the framework that I have to construct. What I discovered is, there can't be 1 framework there will be a number of framework because what the scenario show are stages . They are different stages.

(19) (inform-ref sender j receiver all content ( answering (j, question (x) ) → have (j, new-issue) ^

(20) confirm sender j receiver all content ( studied (k,scenarios) ^ has( scenarios (issues, questions) ) ^

(21) inform-ref sender j receiver all content ( have (j, 2-remarks) ^ remark-1 (constructed (j), framework-x) ^ will-have(frameworks,many) → shown (scenarios,stages) ) ^

(22) confirm sender j receiver all content ( there-are(stages, different)

For instance, in organizing co-operation, and services..the kind of discourse is kind of difficult than doing co-operation. And most of the scenario is about organizing co-operation. In fact in 2 steps, so what I... what I think that we need are a number of stages or situations, this is the 1<sup>st</sup> thing and the 2<sup>nd</sup> thing is the kind of terminology that is at the end of the scenario is very useful but it is a little bit difficult for me to map it on the terms that I have used in the terminology.



- (23) *inform-ref sender j receiver all content ( has (organization (cooperation, services)) ^ discourse (services, difficult) ^ scenario-is(organizing, cooperation) ) ^*
- (24) *inform sender j receiver all content ( has (organization, steps(two) ) ^*
- (25) *propose sender j receiver all content ( need ( stages, n-numbers) Ú need (scenarios, n-numbers) ) ^*
- (26) *confirm sender j receiver all content ( this-is (remark-1) ) ^*
- (27) *inform-ref sender j receiver all content ( remark-2(terminology,scenario) ^ terminology-is(useful) ^ to-map(terminology-of(marc),terminology(joos)) → to-do (difficult) )*

A number of things can easily be matched. But the major problem I have in terms like presence. There is a nicest thing in presence, covers more or less the dynamic situation while the user profile is another extreme, a persistent issue, so not rather static issues that only grows. But first of all , I am not so sure whether things in these are sharp, the user profile I can easily place in let say conversations analysis, the terminology for conversations. The presence is much more difficult. It is rather fluid.

- (28) *inform sender j receiver all content ( can-be (matched (some-things) ) ) ^*
- (29) *confirm sender j receiver all content ( have(j,problem(presences)) ^*
- (30) *inform sender j receiver all content ( covers (presence, situation(dymanic)) ^ user-profile-is (persistent-issue) ^ not-only (grows (static-issues)) → grows (dynamic-issues) )*
- (31) *propose sender j receiver all content ( place ( user-profile, conversational-analysis) ^*
- (32) *inform sender j receiver all content ( to-do (presence (difficult)) ^ it-is (presence (fluid) ) ^*
- (33) *inform-if sender j receiver all content ( covers (presences, many-things) → ^*

And if the presence covers a lot and lots of things so, what I want to ask of open university ..whether they can specify somewhat further presence or whether they are able to make some mapping more explicit in this terminology of course I will do the same and maybe we come to an agreement or maybe this agreement. But at least this is one of the things we should do. To make the deliverables rather coherent.

- (34) *request sender j receiver all content ( specify ( open-university, further (presences)) Ú make (open-university, mapping-terminology (explicit) ) ^*
- (35) *confirm sender j receiver m+ content ( do(j, mapping (terminology)) ^*
- (36) *propose sender j receiver m+ content ( make (us, agreement (terminology)) ^*
- (37) *inform sender j receiver m+ content ( should-do(us, agreement) → deliverables-is(coherent) )*

J: Ok, oh sorry..I am not sure about this gap. I don't know how big it is. At least I want to have the type what presence means. The definition is that I find in the scenario is a little bit too short probably I don't exactly what you have in mind, more or less I can guess, if you can specify a little bit further..that may help me at least to map it onto it. The gaps are not so big, that is my impression, and the reason is and there are 2 reasons.

(38) *inform sender j receiver m content ( Øsure (j, of-gap) ^ Øknow (j, how-big(gap)) ^*

(39) *request sender j receiver m content ( want (j, type (presences)) ^*

(40) *inform-ref sender j receiver m content ( definition ((presences, scenarios) → is (short) ^*

41) *query-ref sender j receiver m content ( Øknow (j, have-in -mind (m+)) ^*

(42) *inform-if sender j receiver m content ( specify(m, further (presence)) → know (j, idea-of (presence) ) →*

(43) *inform sender j receiver m content ( map (j, possible)) ^ thinks (j, gap (-big) ) → there-are (reasons, 2) )*

1 of the reason is that the scenario is a rather realistic account of a number of issues. The first is most of it concerns exchange of information and in with the object to work together , so it's for setting up co-operation and goals and some data exchange about let's say what we call user profile.

(44) *confirm sender j receiver all content ( reason-1 (scenarios, realistic-acc (issues) ) ^*

(45) *inform sender j receiver all content ( concerns (exchanges- information, objects) → they (work (together) ) → for (setting-up (cooperation,goals,data-exchange) ) ^ is (user-profile))*

Now this is not new at all. Let's say in all kinds of conversations that concerns group, oh yeah..btw, that's one of the things I missed out..is the dialog document...looks like now... it is rather a scenario of only 2 persons. So

(46) *confirm sender j receiver all content ( this-is ( Ønew) ) ^ document-dialog-is (scenario, 2 people)*

person to person direct conversations however the scenario in group processes and things like this, the building of user model (what they are called here user profiles) is much more elaborate. So in particularly in this scenario, so a lot of data exchange about interest potential common goals, skills..experiences..etc..of the participants, that is not something very very new, if at least we have to analyse it easily. The same applies to let say..the cooperation aspect itself and the looking for services.. I am not so afraid that there is a big gap. The only thing is that the terminology in the scenario and the terminology in that I used, is not aligned but I think the alignment is not a huge work. We may post pone it but it will look more powerful even if we do a little bit of hand writing and let say something like term matching that is not perfect..that is not let say a very precise definition but at least we should try to do a little bit of breaching...

(47) inform sender j receiver all content ( there-are (group, conversations (types)) ^ j, gap ) ^  
 (48) inform-ref sender j receiver all content ( in-group (building, user-model ( more-elaborate ) ^ has-scenario-x ( data-exchanges (common goals, skills, experience)) ^  
 (49) confirm sender j receiver all content ( this-is (∅ new)) ^  
 (50) inform-if sender j receiver all content ( have (us, analyze(this)) ^  
 (51) inform sender j receiver all content ( applies (cooperation, looking-for-services)) ^ ∅  
 afraid (j, gap(big) ) ^  
 (52) confirm sender j receiver all content ( alignment (terminology-x, terminology-y) → afraid  
 (53) inform sender j receiver all content ( -huge-work (alignment)) ^ may (us, postpone(alignment)) ^  
 (54) inform-if sender j receiver all content ( do(us, alignment) → ^ deliverable ( more-powerful) ^  
 (55) propose sender j receiver all content ( do (us, hand-written(term-matching) ) ^  
 (56) inform sender j receiver all content ( ∅ be ( definition (perfect)) ^  
 (57) propose sender j receiver all content ( do (us, at-least (breaching) ) )

J: I got here ur paper. At least I read a paper that was in this...

(58) confirm sender j receiver m content ( got (j, paper (m)) ^  
 (59) inform sender j receiver m content ( read (j, paper (in-this) ) reply with r03)

S: he's not talking about this paper, it's yesterday..

(60) disconfirm sender s receiver j content ( ∅ talking (m, this-paper) ^  
 (61) inform sender s receiver j content ( this-paper (yesterdays) )  
 in reply to r03)

J: ohh ok ..no..I didn't see..I just got it..So this will help me

(62) ( ack sender j receiver s content ( utterances ("ohh ok..") ) ^  
 (63) apologize sender j receiver m content ( utterances "I didn't see") ) ^  
 (64) inform sender j receiver m content ( got(j, new-paper (recently)) ^  
 (65) confirm sender j receiver all content ( new-paper (help, j) ) )

P: yes, I will just not of cause answer to those difficult questions but just to make a proposition as a responsible to the deliverable. I think we have very few days to produce that. And I am afraid we won't be able to do the alignment in terminologies in such a short delay. So, in what I would suggest is that before the end of this week, each part produces 2 types of content, let us say the positive content, what u think can be a contribution to the terminology to the framework.

To the scenario, also to the state of the art concerning the pedagogical guidelines and the technical guidelines and another type is interrogative contributions. And in the questions remain without answers and there is a special chapter in the document who will accept these kind of questions and if I have all these elements on friday , I can produce a document during monday and broadcast it. I am afraid we have..no other choice in a very short term. This means that in the beginning of the next step of course will be with a very high priority to beach this gap we are aware of.

(66) *inform sender p receiver all content ( Øanswer-now (p, questions (difficult)) ^ as-a (p, responsible(deliverable)) ^*

(67) *disagree sender p receiver all content ( to-produce(us, new-paper) ^*

(68) *inform sender p receiver all content ( have (us, few-days (produce-x) ) ^*

(69) *disagree sender p receiver all content ( to-do (alignment, short-delay)) (document)) ^*

(70) *propose sender p receiver all content ( produce (x, content (2type))*

(71) *inform-ref sender p receiver all content (produce (y, content (2type)) ^*

(72) *inform-ref sender p receiver all content (example-type (positive)*

(73) *request sender p receiver all content (tell (what, contribution(framework))*

(74) *request sender p receiver all content (tell (what, contribution(scenario)) )*

(75) *inform-ref sender p receiver all content (tell (what, contribution (sta-pedagogical-guidelines)))*

(76) *inform-ref sender p receiver all content (tell (what, contribution ( technical-guidelines)))*

(77) *request sender p receiver all content (tell (what, contribution (interogative) ))*

(78) *confirm sender p receiver all content ( questions (without-answers) → will-have(special-chapter , document) ^for (anyone, accept (these-questions ) ) ^*

(79) *inform-if sender p receiver all content ( have (p , elements (all)) → can (p, produce*

(80) *propose sender p receiver all content ( produce-on (document, monday) ^ broadcast (p, document)) ^*

(81) *inform sender p receiver all content ( Ø choice (do-others) → Ø have (us, time)) ^*

(82) *confirm sender p receiver all content ( breach-gap(us, next-week) ^ this-is (high-priority))*

S: hi, it's me who raise the hand at the moment. First of all, I want to announce that we took the initiative , maybe it's philippe who should say it, to invite somebody from canada. I leave the word to philipe for announcing that and then again I take again my word.

(83) *confirm sender s receiver all content ( it-is(s, raise-hand (at-moment)) ^*

(84) *inform sender s receiver all content ( announce (s, invitation-x(canada)) ^*

(85) *propose sender s receiver all content ( do-announcement(p,invitation-x(canada)) ^*

(86) *inform sender s receiver all content ( after ( s, take-floor) ) )*

P: Yes, for me it is fine, of course I accept with much pleasure this contribution of yours marc.  
And I shall the weekend and the monday to make the whole as coherent as possible.

\*Note: Marc's record was strangely missing from the FlashMeeting memo

(87) *(agree sender p receiver m content ( accept (p, contribution-of(m)) ^*  
(88) *confirm sender p receiver m content ( make (p, document (coherent ) )*

S: yes, it's me now. Ok..i think..

(89) *inform sender s receiver p content ( is (s, now)) reply with r04*

J: I am after...

(90) *request sender j receiver all content ( talk (j, after (s)) in reply to r04*

## D

### Curriculum Vitae

Name: Nik Nailah BINTI ABDULLAH

Nationality: Malaysian

Affiliations: LIRMM (Laboratoire d'Informatique, de Robotique et de Microelectronique de Montpellier):CNRS & Université Montpellier II

161, rue Ada, 34392 Montpellier Cedex 5, France

Tel: (33)4 67 41 85 83, Fax: (33)4 67 41 85 00

*also can be reached at*

No: 39, Jalan SS 22/38, Damansara Jaya, Petaling Jaya, Selangor Darul Ehsan,  
Malaysia

Tel: (603) 77221979, Fax: (603) 77221979

E-mail: [binti@lirmm.fr](mailto:binti@lirmm.fr), [bintister@gmail.com](mailto:bintister@gmail.com)

Webpage: [www.lirmm.fr/~bintiabd](http://www.lirmm.fr/~bintiabd)

#### • RESEARCH INTERESTS

Situated Cognition, Logical Theories of Learning and Communication, and Activity Theory (*Cognitive Science*)

Agent Communication (*Multi-Agent Systems*)

Genetics and Evolutionary Computation (*Machine Learning*)

#### • EDUCATION

2002-2005: **Université Montpellier II**, Montpellier, France.

Ph.D. Computer Science, Informatics Department. Obtained PhD with mention "very honourable".

Dissertation: *Activity States: A theoretical framework for the analysis of actual human communications on the web*

Keywords: Agent Communication, FIPA-ACL, Logical theories on Learning and Communication, Situated Cognition, Activity theory

Advisors: Professor Stefano A.Cerri and Dr. Michel Liquière.

06/2001-06/2002 : **Université Montpellier II**, Montpellier, France.

Msc. Computer Science, Informatics Department. Obtained Masters with mention "good"

Dissertation: *Structural Rule Extraction: A Formal and Experimental Approach*.

Keywords: Galois Lattice, Genetic Algorithm, Data Mining, Machine Learning.

Advisors: Professor Stefano A.Cerri and Dr. Michel Liquière.

06/1996-06/2000 : **University Technology of Malaysia**, Johor, Malaysia.

Bsc Computer Science, Department of Software Engineering.

Dissertation: *Neural Networks for User Authentication*.

Keywords: Artificial Neural Networks, Biometrics, Keystroke Dynamics.  
Advisor: Professor A. Manan.

### 3 REFEREES

1. Professor Stefano A.Cerri, Deputy Director of the LIRMM:CNRS & Universite Montpellier II, France. Homepage:<http://www.lirmm.fr/~cerri/>

Contact: [cerri@lirmm.fr](mailto:cerri@lirmm.fr)

(Masters thesis co-supervisor and PhD thesis supervisor)

2. Dr. William J.Clancey, Chief Scientist, Human Centered Computing, Computational Division NASA/Ames Research Center, also as Senior Research Scientist at Institute Human and Machine Cognition, University of West Florida, United States. Homepage: <http://bill.clancey.name/>

Contact: [william.j.clancey@nasa.gov](mailto:william.j.clancey@nasa.gov)

(PhD thesis examiner/external supervisor and member of jury for oral defence)

3. Dr Michel Liquière, Assistant Professor at the LIRMM:CNRS & Universite Montpellier II, France. Homepage: <http://www.lirmm.fr/~liquiere/>

Contact: [liquiere@lirmm.fr](mailto:liquiere@lirmm.fr)

(Masters thesis supervisor and PhD thesis co-supervisor)

4. Professor Amal Seghrouchni El-Fallah, Research Scientist at the Artificial Intelligence Laboratory (LIP6), University of Paris 6 and Professor at University of Paris 10, France. Homepage:<http://www-poleia.lip6.fr/~elfallah/>

Contact: [amal.Elfallah@lip6](mailto:amal.Elfallah@lip6)

(PhD thesis examiner and Doctoral Mentoring Program Mentor, AAMAS 2005)

5. Professor Joost Breuker, Professor of the Social Informatics Department, University of Amsterdam, the Netherlands.

Homepage:<http://www.lri.jur.uva.nl/~breuker/>

Contact: [breuker@science.uva.nl](mailto:breuker@science.uva.nl)

(PhD thesis external examiner and member of jury for oral defence)

### 4 RESEARCH AND PROFESSIONAL EXPERIENCES

02/01/02-02/06/02 **Program for Research Into Intelligent System**, Computer Department, National University of Singapore, Singapore.

Organization background: The PRIS program is a 3 year schedule program between the Ministry of Education, Singapore and School of Computing, National University of Singapore in developing technology under a single stream, namely Hybrid System to handle problems from fields of Finance, Education and Logistics, areas of particular importance to the domestic economy.

*Research Assistant* to Professor Rudy Setiono. Collaborated with Mr. Yong Chern Han, Ph.D candidate of the Neural Networks Research Group of University of Texas at Austin, US for the implementation of the rule extraction neural networks algorithm.

26/06/01-30/12/01 **Pivota.com** a company that implements e-commerce platform for business and strategic partners for the B2B and B2C e-business, Petaling Jaya, Malaysia.

Organization background: The company performs e-commerce platform for business and strategic partners to be involved in the B2B and B2C e-business.

*Marketing and E-Commerce executive* for the SkyBonus.com e-commerce platform. Defined and conceptualized e-commerce strategy for marketing partners, valued added partners and technology partners. Research and worked with the internal development fraud prevention system for SkyBonus.com platform.

14/06/99-14/09/99 **AISDEL (Artificial Intelligence System Development Laboratory-HITACHI)** of JICA, Japan and SIRIM (Standards and Industrial Research Institute of Malaysia), Malaysia.

Organization background: The laboratory is developed under the transfer technology of Japanese Artificial Intelligence experts from the HITACHI Laboratory and under the collaboration between SIRIM and Japan International Cooperation Agency (JICA).

*Research Assistant* to Senior Researcher, Dr. Ariff. Investigated the radial basis function architecture and implemented back-propagation algorithm for the training of user's data for the laboratory face recognition system.

## **5 PUBLICATIONS**

1. Binti Abdullah, N.N, and Cerri. S.A, 2005. "Analysis and Synthesis of Agent Communicative Behaviors". To appear in the *Towards the Learning GRID: advances in Human Learning Services*. Edited by P. Ritrovato et al. Frontiers in Artificial Intelligence and Applications. 19: (9-10), p: 1015-1041. Taylor and Francis. New York, USA.
2. Binti Abdullah, N.N., Liquiere, M., and Cerri, S.A (in-press) "Inducing Communication Protocols from conversations in a multi agent system" CISI-04 Conferenza Italiana sui Sistemi Intelligenti (Biological and Artificial Intelligence Environments). Edited by: Bruno Apolloni et al. Kluwer Academics. Amsterdam, The Netherlands.
3. Binti Abdullah, N.N, and Cerri, S.A, (2005) " Some preliminary results on : The induction of communication protocols". CogSci'05: Proceedings of the 27<sup>th</sup> Annual Meeting on Cognitive Science. Stresa, Italy.



4. Binti Abdullah, N.N (2005) "The induction of communication protocols". AAMAS '05: Proceedings of the fourth international joint conference on Autonomous agents and multiagent systems. pp:1381—1381. Utrecht, The Netherlands ACM Press. New York, USA.
5. Binti Abdullah, N.N, Liquiere, M., and Cerri, S.A, (2004) "GRID Services as Learning Agents: Steps towards the induction of communication protocols". ITS'04: First International Workshop on GRID Learning Services Proceedings. pp:64-77. Maceio, Brazil.
6. Binti Abdullah, N.N, and Cerri, S.A, (2004) "Conversion steps of human conversation into an agent language". Oral paper. CLIN'04: The 15<sup>th</sup> Meeting of Computational Linguistic in the Netherlands. Leiden University, The Netherlands.
7. Binti Abdullah, N.N, and Cerri, S.A, (2003) "GAsRule for Knowledge Discovery" Applied Artificial Intelligence Journal. Edited by S.Zhang, C.Zhang and Q.Yang. 17: (5-6), pp: 339-417. Taylor and Francis. New York, USA.
8. Binti Abdullah, N.N, and Liquiere, M, and Cerri, S.A (2003) "Discovering Propositionalised Rules Via GAsRule", Gecco'03: Genetic and Evolutionary Computation Conference Late Breaking Papers. Edited by Bart Rylander. pp:31-38. Chicago, USA.
9. Binti Abdullah, N.N, and Liquiere, M., (2003) "Genetics Algorithms for Rule Extraction". DCAP: IEEE First International Workshop on Data Cleaning and Preprocessing. Maebashi City, Japan.
10. Ahmad, and N.Nailah (2000) "User Authentication via Neural Network". AIMSA '02: 9th International Conference on Artificial Intelligence: Methodology, Systems, and Applications. Vol. 1904 ,pg:310-32. Lecture Notes In Computer Science. Springer-Verlag, London, UK.
11. Nik Nailah Abdullah, (2000) "Verifying user authentication". Oral paper. Biomed'02" First International Conference on Biomedical Engineering. University of Malaysia. Petaling Jaya, Malaysia

## **6 INVITED TALKS AND PRESENTATIONS**

- Binti Abdullah, N.N. (2004). "GRID Learning Agents: Steps towards the induction of communication protocols" Invited by Professor Marc Eisenstadt, Chief Scientist and Founder of the Knowledge Media Institute, Open University, United Kingdom. 27<sup>th</sup> September.
- Binti Abdullah, N.N. (2004). "Induction of Communication Protocols, Some preliminary results". Invited by Professor Christian Bessiere, CNRS: LIRMM for the Coconut Seminar, 15<sup>th</sup> December.

## **7 SERVICE**

Volunteer for the AAMAS 2005, 4<sup>th</sup> International Joint Conference on Autonomous Agents and Multi-Agent Systems, Utrecht University, The Netherlands, 2005.

Reviewer for the IEEE Transactions on Knowledge and Data Engineering, 2005.

Reviewer for the IEEE Special Issue on Intelligent Systems, 2004.

Program Committee for the IEEE Special Issue on Intelligent Systems on Web Mining, 2004.

Program Committee for the ALCAA 2004, Colloque Agents Logiciels, Coopération, Apprentissage, Activité humaine Conference, Montpellier, 2004.

Organizer of the social informatics seminars at the CNRS:LIRMM, 2<sup>nd</sup> February until 6<sup>th</sup> July, 2003.

Organizing Committee for the First Proceedings on the First National Conference on Artificial Intelligence in Industry, Malaysia, 1999.

## **8 MEMBERSHIPS**

Member of the Cognitive Science Society

Member of the EvoWeb (European Network of Excellence in Evolutionary Computing)

Member of the ISGEC (International Society of Genetic and Evolutionary Computation)

## **9 PROFESSIONAL ACTIVITIES**

Participant of the Doctoral Mentoring Program in Autonomous Agents and Multiagent Systems (AAMAS), Utrecht, The Netherlands, 2005.

Participant of the 27<sup>th</sup> Annual Cognitive Science Meeting, Stresa, Italy, 2005.

Participant of the Intelligent Tutoring Systems (ITS) Conference, Brazil, 2004.

Participant of the Genetic Algorithms and Evolutionary Computation Conference in Chicago, United States, 2003.

Participant of the National Conference on Biomedical Engineering, Malaysia, 2000.

Participant of the First Proceedings on the First National Conference on Artificial Intelligence in Industry, Malaysia, 1999.

Participated for a one week course in New World Intelligence, A New Paradigm of AI conducted by Prof. Dr Noboyuki Otsu, Director of Machine Understanding Division, Electrotechnical Laboratory, Japan, in Malaysia, 1999.

## **10 PROGRAMMING LANGUAGES**

Java (Advanced)

C++ (Advanced)

LISP (Beginner)

## **11 LANGUAGES**

English: Fair both oral and writing

Malay: Mother tongue, excellent both oral and writing

French: Good in oral, average in writing

## **12 OTHER PROFESSIONAL ACTIVITY**

01/01/97-01/01/98 Theatre Performer. Professional trained for one year and a half under Miss Janet Pillai of Five Star Academy for a fund raising theatre performance. "We are not puppets" is a charity theatre play co-sponsored by the Malaysia Arts and Languages Organization.

## **13 EXTRA CURRICULAR ACTIVITIES**

Mountain hiking, travelling, cooking, learning to understand music, analyzing daily communications and human behaviour to understand myself, people and life.