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QUEL APPORT DES TECHNOLOGIES DE L'INFORMATION ET DE LA COMMUNICATION (TIC) A L'IMPROVISATION ORGANISATIONNELLE DURANT LA REPONSE A LA CRISE ?

WHAT SUPPORT DOES INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) OFFER TO ORGANIZATIONAL IMPROVISATION DURING CRISIS RESPONSE ?

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WHAT SUPPORT DOES ICT (Information and Communication Technology) OFFER TO ORGANIZATIONAL IMPROVISATION DURING CRISIS RESPONSE?

BY

Anouck Virginie Vanessa ADROT

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

Of

Doctor of Philosophy

In the Robinson College of Business

Of

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ABSTRACT

WHAT SUPPORT DOES ICT (Information and Communication Technology) OFFER TO ORGANIZATIONAL IMPROVISATION DURING CRISIS RESPONSE?

BY

Anouck Virginie Vanessa ADROT

7th of December 2010

Committee Co-Chair: Dr. Daniel Robey & Dr. Pierre Romelaer

Major Academic Unit: Computer & Information Systems

While evidence of the exceedingly important role of technology in organizational life is commonplace, academics have not fully captured the influence of Information and Communication Technology (ICT) on crisis response. A substantive body of knowledge on technology and crisis response already exists and keeps developing. Extensive research is on track to highlight how technology helps to prepare to crisis response and develop service recovery plans. However, some aspects of crisis response remain unknown.

Among all the facets of crisis response that have been under investigation for some years, improvisation still challenges academics as a core component of crisis response. In spite of numerous insights on improvisation as a cognitive process and an organizational phenomenon, the question of *how improvisers do interact together while improvising* remains partly unanswered. As a result, literature falls short of details on whether crisis responders can rely on technology to interact when they have to improvise collectively. This dissertation therefore brings into focus ICT support to organizational improvisation in crisis response in two steps: We first address this question from a general standpoint by reviewing literature. We then propose an in depth and contextualized analysis of the use of a restricted set of technologies – emails, faxes, the Internet, phones - during the organizational crisis provoked by the 2003 French heat wave.

Our findings offer a nuanced view of ICT support to organizational improvisation in crisis response. Our theoretical investigation suggests that ICTs, in a large sense, allow crisis responders to improvise collectively. It reports ICT properties - graphical representation, modularity, calculation, many-to-many communication, data centralization and virtuality – that promote the settling of appropriate conditions for interaction during organizational improvisation in crisis response. In the empirical work, we provide a more integrative picture of ICT support to organizational improvisation in crisis response by retrospectively observing crisis responders' interactions during the 2003 French heat wave. Our empirical findings suggest that improvisation enables crisis responders to cope with organizational emptiness that burdens crisis response. However, crisis responders' participation in organizational improvisation depends on their communicative genres. During the 2003 French heat wave crisis, administrative actors who had developed what we call a "dispassionate" communicative genre in relation to their email use, barely participated in organizational improvisation. Conversely, improvisers mainly communicated in what we call a "fervent" communicative genre. Therefore, our findings reveal that the ICT support to organizational improvisation in crisis response is mediated by the communication practices and strategies that groups of crisis responders develop around ICT tools.

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« Intelligence is what you use when you don't know what to do »

Jean PIAGET,1952,
The origins of intelligence in children

L'apport des Technologies de l'Information et de la Communication (TIC) à l'improvisation organisationnelle durant la réponse à la crise : Un résumé en Français de notre travail doctoral

Les organisations font face à des crises de plus en plus fréquentes et de nature très diverses: crises financières ou politiques, catastrophes naturelles, accidents industriels et technologiques, …

Pour répondre à ces risques, les organisations développent des systèmes de prévention et prédéfinissent des plans d'actions. Ce mode de gestion des crises n'est pas suffisant. En effet, suivre aveuglément les procédures préétablies de réponse aux crises n'est pas toujours pertinent. Chaque crise est unique et ne correspond jamais à un scénario pensé *a priori* (Billings *et al.*, 1980; Quarantelli, 1988; Waugh, Streib, 2006). L'improvisation est donc une pratique clef de la réponse à la crise. Cependant, elle reste parfois difficile à cerner pour les managers et les chercheurs, notamment du fait de la diversité de la littérature sur ce sujet. De nombreuses études empiriques montrent toutefois des cas d'organisations qui n'ont pas d'autre choix que d'improviser pour répondre à une situation critique (Ciborra, 1996b; Holden, 2005; Hutchins, 1991; Weick, 1993).

Dans ces situations, les organisations utilisent intensément les Technologies de l'Information et de la Communication (TIC) pour rapidement mettre en place et coordonner des solutions innovantes. En 2005, par exemple, les proches des victimes de l'ouragan Katrina ont spontanément utilisé l'application GoogleMaps pour identifier les dommages de leurs proches (Palen *et al.*, 2007). Lors de la réponse au tremblement de terre en Haïti, le personnel humanitaire a intensément utilisé les GPS et Smartphones pour répertorier les ressources potentiellement reconvertibles dans la construction d'abris *ad hoc*. Malheureusement, une large proportion de ces organisations ne parvient pas toujours à utiliser de manière efficace les TIC dont elles disposent lorsqu'il s'agit d'improviser en situation de crise. Dans certains cas, des redondances informationnelles peuvent créer des malentendus (Dawes *et al.*, 2004; Jaeger *et al.*, 2007). Dans d'autres cas, comme celui de la réponse à la crise provoquée par la canicule de 2003 en Île-de-France, les acteurs ne parviennent pas à improviser ensemble lorsqu'ils interagissent par communication électronique.

On peut émettre plusieurs hypothèses pour répondre à ce questionnement. Tout d'abord il se pourrait que l'utilisation des TIC empêche l'émergence de l'improvisation. On peut également penser que le design des outils technologiques de communication n'est pas adapté aux besoins des acteurs lorsque ceux-ci doivent improviser. Enfin, on peut se poser la question de l'impact des variables individuelles et organisationnelles sur l'utilisation des TIC durant l'improvisation de crise. Toujours est il que les managers manquent de repères sur les tenants et les aboutissants de l'utilisation des TIC lors d'une improvisation de crise. Cette difficulté managériale est corrélée à notre manque de connaissance sur l'improvisation et les TIC. Cette thèse explore donc la question suivante:

Quel est l'apport des Technologies de l'Information et de la Communication (TIC) à l'improvisation organisationnelle en situation de crise ?

Nous avons décliné cette question générale en quatre questions de recherche:

I. Comment comprendre la diversité de la littérature sur l'improvisation ?

II. Dans quelle mesure les TIC, de par leurs propriétés, offrent-elles la possibilité d'improviser lors d'une réponse à une crise ?

III. Dans quelle mesure les TIC répondent-elle aux besoins des acteurs qui participent à l'improvisation organisationnelle en situation de crise ?

IV. Dans quelle mesure les acteurs profitent-ils de l'utilisation des TIC pour improviser lors d'une réponse à une crise ?

Nous avons tout d'abord effectué une analyse préliminaire de la diversité de la littérature sur l'improvisation. Cette étude nous a permis de clarifier notre positionnement conceptuel relatif à l'improvisation. Nous avons ensuite examiné les trois autres questions par une étude théorique puis une étude empirique. Le résumé détaille la façon dont chaque étude répond aux questions de recherche.

Ce document est structuré de la façon suivante. Dans une première partie, nous présentons les objectifs et la structure de la thèse. Dans un premier temps nous définissons rapidement les termes clefs de la problématique de recherche puis les questions de recherche qui ont découlé de cette problématique. Dans une deuxième partie, nous présentons un résumé des trois études sur lesquelles se fonde ce travail doctoral. Enfin la dernière partie fait office de conclusion à ce résumé. Dans un premier temps nous confrontons les résultats issus des différentes études pour en déduire le modèle final de la thèse. Nous en présentons ensuite les implications théoriques et managériales. Enfin nous concluons cette partie par une discussion sur les limites de notre travail et proposons de nouvelles perspectives de recherche pour y répondre.

Section 1.   Les objectifs et la structure de la thèse

La problématique de recherche fait référence à un ensemble divers de réalités organisationnelles. C'est pourquoi nous définissons dans un premier temps les trois concepts clefs de notre problématique de recherche, représentés par la Figure 1. Nous déduisons de cette analyse les quatre questions de recherche qui ont guidé notre travail.
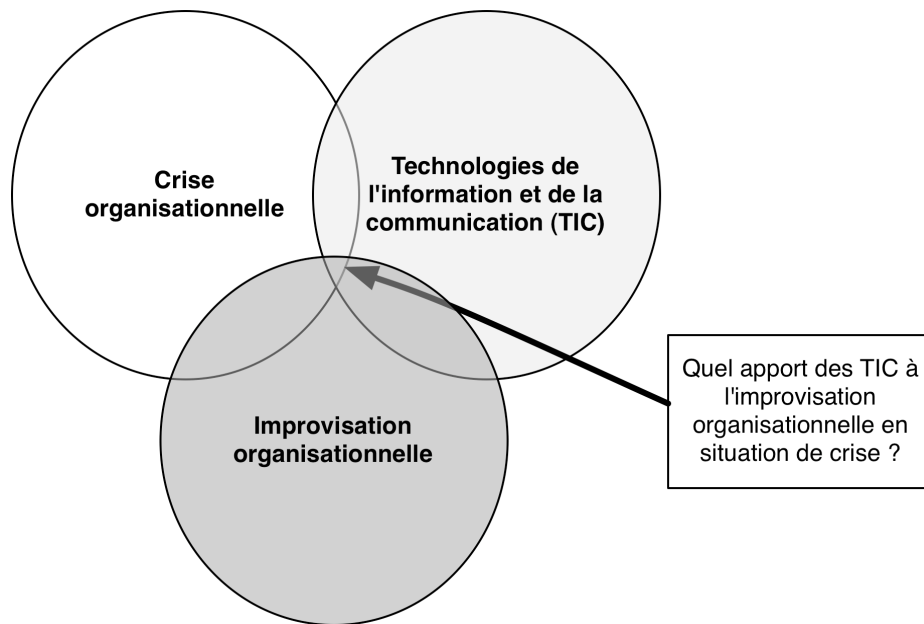
Figure 1. Les trois concepts clefs de la problématique de recherche

1.I. La crise organisationnelle

La littérature sur la crise se caractérise par un certain nombre de désaccords. D'une part, les auteurs divergent sur les conditions d'émergence de la crise. D'autre part, certaines études privilégient une définition objective de la crise, tandis que d'autres présentent la crise comme une expérience avant tout subjective.

Dans notre travail, nous nous appuyons sur les approches d'Hermann (1963) et Shrivastava (1993) pour définir ce que nous entendons par crise. Nous voyons en effet la crise comme une série d'états que l'organisation traverse. La crise se déclenche par la rencontre de deux phénomènes, d'une part un événement ou une situation rares et donc non anticipés par l'organisation (Pearson, Claire, 1998), d'autre part le développement de dysfonctionnements organisationnels (Perrow, 1999; Weick, Sutcliffe, 2001). L'exemple de l'entreprise ferroviaire *Union Pacific*, Weick et Sutcliffe (2001) met évidence que la vie organisationnelle est routinière et peut s'accompagner d'une perte de vigilance qui mène progressivement à des dysfonctionnements organisationnels. L'incapacité de réaction de l'organisation à l'accident ferroviaire d'Octobre 1982 en Californie résulte pour les auteurs d'un *slack* organisationnel croissant sur la maintenance et le contrôle. En particulier, si l'organisation concentre son attention sur des évènements majeurs comme des fusions ou des remaniements organisationnels, elle est d'autant moins en mesure de gérer ses propres dysfonctionnements.

Dans un premier temps, la crise est donc est un phénomène latent, dont les signes avant-coureurs ne sont perçus que par une minorité d'acteurs. Dans un deuxième temps, l'état de crise est avéré par un *événement déclencheur* qui met évidence l'incapacité organisationnelle à répondre à la nouvelle situation. Aussitôt se mettent en place des mécanismes individuels et collectifs de réaction à la crise, souvent émotionnellement forts (Pauchant, Mitroff, 1992).

Dans un troisième temps, l'organisation formule une réponse collective à la crise. Enfin, une fois la crise passée, l'organisation fait également l'expérience de réactions et de processus organisationnels post-crise, que nous ne développons pas dans ce travail.

Tableau 1 détaille les caractéristiques des quatre étapes de la crise organisationnelle mises en évidence par Shrivastava (Shrivastava *et al.*, 1988a) et que nous reprenons dans notre recherche.

Tableau 1. Les étapes de la crise

Étapes de la crise	Caractéristiques
Développement de dysfonctionnements organisationnels	Dysfonctionnements internes (Cameron *et al.*, 1987) qui interagissent entre eux (Perrow, 1984). Tendance à la rétention d'information (Beamish, 2002). Manque de vigilance (Weick, Sutcliffe, 2001) et apparition d'accidents (Beamish, 2002).
Réaction immédiate de l'organisation aux évènements déclencheurs	Choc émotionnel proche de la mort psychologique (Pauchant, Mitroff, 1992) Tendance à nier la crise (Fink *et al.*, 1971) et rigidités organisationnelles (Staw *et al.*, 1981 Vertinsky, 1977). Importante incertitude (Milburn *et al.*, 1983b 1980). Risque d'une renversement politique (Pauchant, Mitroff, 1992).
Période de réponse	Mise en place de la cellule de crise (Mitroff *et al.*, 1996 1996; Smart, Vertinsky, 1977). Tendance à la centralisation (Hermann, 1963 1981) ou faible direction (Weick, 1988). Structures redondantes (Roberts, 1990b). Actions désespérées sans être certain de son effet sur la crise (Starbuck *et al.*, 1978, cited by Fiol, Lyles, 1985). De nouveaux processus informationnels (Osborn, 1998). Besoins informationnels croissants (Smart, Vertinsky, 1984). Remise en question de l'utilité des plans (Pauchant, Mitroff, 1988), l'improvisation peut alors apparaître. Adaptation des processus organisationnels (Fink *et al.*, 1971; Leifer, Huber, 1977).
Période post crise	Apprentissage post-crise (Fauchart, 2006; Roux-Dufort, 2007). Incertitude de l'impact sur le long-terme de la crise (Pauchant, Mitroff, 1992).

1.II. L'improvisation organisationnelle

l'improvisation en tant que phénomène organisationnel est difficile à observer (Crossan *et al.*, 2005). Pour mieux approcher le concept d'improvisation et la problématique de recherche, nous proposons d'analyser les interactions qui composent l'improvisation organisationnelle. Ces interactions peuvent être concrètes ou virtuelles. Nous nous référons dans cette thèse à la définition des interactions par Bales (1950).

Avant même que l'improvisation ne concentre l'attention d'une partie de la communauté de recherche en gestion, elle avait déjà été évoquée en stratégie (Mintzberg, McHugh, 1985) et dans le contexte des crises (Hutchins, 1991). Le numéro spécial dans *Organization Science* en 1998 marque l'intérêt croissant des chercheurs pour ce concept. Toutefois, il existe un nombre important de définitions de l'improvisation. Au gré de ces définitions, cinq caractéristiques de l'improvisation se distinguent. Nous nous sommes appuyés sur ces dernières pour identifier l'improvisation dans notre étude empirique. L'improvisation correspond à i) une recombinaison des ressources ii) de façon créative, iii) dans un délai court entre la décision et l'action, permettant iv) une adaptation de l'organisation v) par l'innovation. Ces dimensions de l'improvisation sont présentées dans le Tableau 2.

Tableau 2. Les dimensions de l'improvisation

Définitions de l'improvisation	Dimensions de l'improvisation				
	Contradiction temporelle	Innovation	Créativité	Recombinaison de ressources	Adaptation
"A process of introducing changes to an initial model while maintaining continuity in the performance" (Preston, 1987)					X
"Thinking and action emerge simultaneously and on the spur of the moment" (Ciborra, 1996a)	X				
"Convergence between acting and planning, and reworking of pre-composed material in relation to unanticipated ideas" (Vendelø, 2009)	X	X			
"Organizational improvisation refers to the convergence of conception and execution" (Moorman, Miner, 1998a)	X				
"Composing and performing extemporaneously, conception as action unfolds" (Berliner, 1994, cited by Bansler, Havn, 2003)	X	X			
"Unexpected practices, deviation from routines, puzzling or random behaviors calling for interpretation" (Lanzara, 1999)		X		X	
"Action is taken in spontaneous and intuitive fashion"	X				

(Crossan, 1998)					
"Action that fills the gap between routine organizational procedures and events in the course of daily work" (Suchman, 2007)	X			X	X
"To cope or ingeniously adapt to a set of circumstances" (Preston, 1991, cited by Vera, Crossan, 2005)			X		X
"Decision as action unfolds". (Moorman, Miner, 1998a)	X				
"Devising resourceful solutions to intractable problems". (Meyer, 1998).				X	X
"The conception of action as it unfolds by an organization and/or its members drawing on available material, cognitive, affective and social resources" (Cunha *et al.*, 1999c 1999)	X		X	X	
"Improvisation is the ability to recombine chunks of past experience into new patterns of action" (Rerup, 2001)			X	X	X

Comme l'illustre la variété des définitions de l'improvisation, le concept d'improvisation a fait l'objet d'analyses et de conceptualisations variées. De plus l'improvisation a été étudiée dans des contextes empiriques différents, allant de la réponse à la crise (Mendonça *et al.*, 2006; Webb, F-R., 2006), au processus de certification des chirurgiens (King, Ranft, 2001), ou encore au fonctionnement de l'administration Israélienne (Sharkansky, Zalmanovitch, 2000). Du fait de cette diversité, nous proposons dans le premier temps de la thèse d'explorer la question de recherche suivante :

I. Comment comprendre la diversité de la recherche sur l'improvisation ?

1.III. Les Technologies de l'Information et de la Communication

Dans cette thèse, nous développons trois niveaux d'analyse des TIC. Tout d'abord nous nous intéressons aux TIC en tant qu' un même objet dont les propriétés intrinsèques sont reconnues socialement (Orlikowski, Iacono, 2001). Une analyse plus précise de la technologie consiste à examiner les fonctions auxquelles la technologie répond dans les organisations, telle que la coordination ou l'aide à la décision (Carver, Turoff, 2007). Nous nous intéressons alors à l'ensemble des fonctionnalités technologiques qui permettent les interactions entre utilisateurs, tels que la communication électronique, la messagerie instantanée, les fonctionnalités de participations aux forums ou la transmission de documents par fax. Enfin, nous observons les TIC au travers l'utilisation d'outils de communication électronique.

Au fil des questions de recherche, nous abordons les trois niveaux d'analyse des TIC. Notre progression conceptuelle de la question II à la question IV suit un degré croissant de précision d'analyse de la technologie. Elle suit également une prise en compte croissante du contexte de l'utilisateur dans notre réflexion. En effet la question II implique un examen de la technologie comme un objet distinct des ses utilisateurs. La question III examine l'adéquation d'une fonctionnalité technologique à un besoin organisationnel. Enfin, la question IV analyse la technologie au travers des pratiques. Figure 2 récapitule la structure de la thèse.

Figure 2. Structure de la thèse

Hypothèses et études théoriques

Hypothèses de départ sur la crise (chapitre 2.1)

Trois niveaux d'analyse des TIC (chapitre 1.2)

Question de recherche I: *Comment comprendre la diversité de la littérature sur l'improvisation ?* (chapitre 2.2)

Question de recherche II:*Dans quelle mesure les TIC, de par leurs propriétés, offrent-elles la possibilité d'improviser lors d'une réponse à une crise ?* (chapitre 2.3)

Etude empirique

Question de recherche III: *Dans quelle mesure les TIC répondent-elle aux besoins des acteurs qui participent à l'improvisation organisationnelle en situation de crise* (chapitre 3.3)

Question de recherche IV: *Dans quelle mesure les acteurs profitent-ils de l'utilisation des TIC pour improviser lors d'une réponse à une crise ?* (chapitre 3.3)

Considérations finales

Résultats théoriques

Résultats empiriques

Section 2.   Présentation des trois études qui composent la thèse

Notre première étude répond à la question de recherche I et consiste en l'analyse de la littérature sur l'improvisation par la mobilisation des techniques d'analyse factorielle et typologique sur un échantillon de 105 articles. A partir de cette analyse, nous mettons en évidence quatre aspects de la diversité de la littérature sur l'improvisation et nous proposons une première description des approches de l'improvisation.

La deuxième étude explore d'un point de vue théorique la question de recherche II et consiste en la proposition d'une nouvelle définition de l'improvisation organisationnelle inspirée de l'approche des capacités dynamiques (Teece *et al.*, 1997; Zollo, Winter, 2002). A partir de cette nouvelle définition, nous faisons une revue de littérature aboutissant à des propositions théoriques sur l'apport des TIC à l'improvisation organisationnelle pendant la réponse à la crise.

Enfin la troisième étude explore les questions de recherche III et IV et consiste en une analyse enracinée du cas de la réponse à la crise provoquée par la canicule de 2003 en Ile de France. Un modèle intégrateur a ainsi émergé de notre analyse. Il articule les concepts de technologie, improvisation, crise et *vide organisationnel*.

Dans l'ensemble de la thèse, nous adoptons un positionnement pragmatiste (Cherryholmes, 1992) qui appelle à un positionnement ontologique et épistémologique réaliste, ou *depth realist* (Blaikie, 2007; Outhwaite, 2003).

Le Tableau 3 présente un résumé des besoins qui ont motivé les différentes études et les résultats issus de notre travail doctoral.

Tableau 3. Résumé des études

Titre en Anglais de l'étude	Besoins	Résultats
1. Coping with diversity in research on improvisation	1) Un moyen de comparer les études existantes sur l'improvisation 2) Une vision claire des différentes approches de l'improvisation	La diversité de la recherche sur l'improvisation provient de divergences entre les études sur quatre points clefs du processus de recherche i) Mise en évidence conceptuelle et empirique de l'improvisation ii) Les aspects de l'improvisation observés iii) La contextualisation de l'improvisation iv) La création de connaissances sur l'improvisation
2. ICT, Crisis, and Organizational Improvisation: Some theoretical reviews and a literature review	1) Manque de compréhension du rôle des interactions dans l'improvisation organisationnelle 2) Une analyse de l'influence des TIC sur le déroulement de l'improvisation organisationnelle	1) 5 mécanismes organisationnels composent l'improvisation organisationnelle en situation de crise 2) 6 propriétés des TIC ont un effet positif sur l'improvisation organisationnelle en situation de crise
3. ICT, communicative genres, organizational improvisation and emptiness during the 2003 French heat wave crisis response	1) Évaluer l'adéquation des TIC à l'improvisation organisationnelle en situation de crise 2) Comprendre quelle était l'influence de l'utilisation des TIC sur l'improvisation organisationnelle durant la réponse à la crise de la canicule de 2003.	1) L'application directe des théories du fit ne permet pas d'apporter une réponse à la question de recherche III 2) Le genre de communication *dépassionné* a pesé sur le développement de l'improvisation organisationnelle 3) Au contraire, le genre de communication *fervent* a facilité le développement de l'improvisation organisationnelle.

Section 3.   Présentation des études

3.I. Première étude: Une analyse structurée du travail académique sur l'improvisation

La première étude de notre travail doctoral consiste en une analyse systématique du traitement du concept d'improvisation par les chercheurs en management. Notre interrogation part du constat d'une apparente diversité parmi les travaux sur l'improvisation.

La diversité des approches d'un même concept est une préoccupation centrale dans le monde de la recherche. Mais qu'est-ce que la diversité ? Benbasat et Weber ont mis en évidence quatre facteurs de diversité au sein de la littérature en management (1996). Selon ces auteurs, la diversité en sciences de gestion provient de i) de l'hétérogénéité des fondements théoriques mobilisés, ii) de la variété des sujets ou des problèmes étudiés et iii) de l'utilisation de différentes méthodologies.

L'approche réaliste que nous adoptons dans la thèse admet une forme de relativisme ontologique : la diversité provient non seulement de conceptualisations différentes mais également du fait qu'un même concept peut évoquer de multiples réalités. La manipulation des concepts par les auteurs favorise une diversité des approches encore plus grande (Anderson, Ortony, 1975).

La diversité d'un champ contribue sans aucun doute à sa pertinence. Selon nous, elle doit tout de même être analysée les chercheurs. En effet, le risque de clivages entre approches d'un même concept croît quand les chercheurs ne prennent pas en compte les différences et les points communs entre les études qui traitent des mêmes sujet. Or il est difficile de discuter de la diversité d'un champ sans une grille d'analyse prédéfinie. Pour cette raison, notre étude propose une grille de classification des articles sur l'improvisation.

Pour analyser la diversité de la littérature sur l'improvisation, nous avons effectué des analyses factorielle et typologique (Aldenderfer, Blashfield, 1984; Durrieu, Valette-Florence, 2005; Jolibert, Jourdan, 2006) sur un échantillon de 105 articles. Des requêtes sur les bases de données EBSCO, ABI et Scholar Google nous ont permis de regrouper près de 200 articles mentionnant le terme improvisation dans leur titre ou leur abstract. Une première lecture nous a permis d'exclure les articles dont les abstracts mentionnaient l'improvisation mais sans fournir une définition ou de description. Nous avons eu également recours à une échantillonnage boule de neige pour compléter l'échantillon.

Pour élaborer cette grille d'analyse des articles de l'échantillon, nous nous sommes appuyés sur les théories existantes sur la diversité. L'élaboration de la grille d'analyse et la définition des modalités pour chaque catégorie ont suivi un processus itératif de discussions entre les auteurs et de double codage. Le taux de convergence sur le double codage de la classification est de 57%. Nous fournissons ici quelques explications des intitulés de certaines variables.

Nous avons tout d'abord segmenté la variable temps en trois périodes. La période 1 s'étend de l'apparition des premiers articles à la date de parution du numéro spécial de la revue

Organization Science sur l'improvisation. La période 2 s'étend alors de 1999 à 2003, date de parution du numéro spécial de la revue *International Journal of Management Studies* sur l'improvisation. Enfin la période 3 commence en 2004 et finit en 2010.

Nous retenons dans notre classification deux dimensions de la création de connaissance provenant des deux questionnements suivants : la connaissance créée complète-t-elle ou remet-elle en question les travaux antérieurs ? La connaissance créée sur l'improvisation est-elle centrée sur le concept d'improvisation ou porte-t-elle sur des concepts connexes à l'improvisation ?

Enfin nous distinguons deux niveaux de description de l'improvisation. Par le premier niveau nous entendons une description du processus d'improvisation, par le second niveau nous entendons une description de l'improvisation plus exhaustive qui prend en compte les aspects d'innovation et d'apprentissage. Le Tableau 4 présente les variables de notre classification.

Tableau 4. Les variables et leurs catégories

Variables	Catégories
Période	Période 1(1992-1998), période 2 (1999-2004), Période 3 (2005-2010)
Le mode de réflexion sur l'improvisation	Déductif, Inductif, Abductif
L'approche épistémologique de l'improvisation	Fonctionnaliste, Interprétativiste, Radical
L'unité d'analyse	Individus, Groupes, Organisation(s)
Contribution à la connaissance sur l'improvisation	Accumulation centrée sur l'improvisation Accumulation non centrée sur l'improvisation Renouvellement centré Renouvellement non centré
Le design de recherche	Étude empirique quantitative, Étude empirique qualitative, Étude conceptuelle
Analyse des activités liées à l'improvisation	Design, Utilisation
Richesse de la description de l'improvisation	Premier niveau, Second niveau
Conditions d'émergence de l'improvisation	Exogène, Endogène, Mixte
Contexte de l'improvisation	Critique, Turbulent, Normal
Statut hiérarchique des individus qui improvisent	Bas, Moyen, Élevé, Mixte

La Figure 3 présente les différentes étapes au sein de notre analyse de la littérature sur l'improvisation.

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┌─────────────────────────────┐
│  Analyses typologiques sur les │
│   coordonnées des catégories   │
└─────────────────────────────┘
              ↑
┌─────────────────────────────┐
│  Extraction des coordonnées    │
│  des catégories dans le        │
│  référentiel formé par les     │
│  composantes                   │
└─────────────────────────────┘
              ↑
┌─────────────────────────────┐
│   ACP sur les variables        │
│   transformées et analyse      │
│   multidimensionnelle          │
└─────────────────────────────┘
              ↑
┌──────────────┐         ┌──────────────┐
│ Double codage │ ←─────→ │  Discussion   │
│               │         │ informelle entre les│
│               │         │    auteurs    │
└──────────────┘         └──────────────┘
       ↘                      ↙
┌─────────────────────────────┐
│  Définition des variables et   │
│   de leurs catégories          │
└─────────────────────────────┘
              ↑
┌─────────────────────────────┐
│   Selection des articles       │
│   pertinents et intégration    │
│   d'articles supplémentaires   │
│   par échantillonage boule de  │
│   neige                        │
└─────────────────────────────┘
              ↑
┌─────────────────────────────┐
│    Requêtes sur EBSCO,         │
│    Scholar Google, ABI         │
└─────────────────────────────┘
```

Figure 3. Les différentes étapes de l'analyse de la littérature sur l'improvisation

Nous interprétons nos résultats statistiques de la façon suivante. Selon nous les études sur l'improvisation divergent à quatre étapes clefs du processus de recherche. A chaque étape de recherche, les auteurs adoptent une parmi les deux principales approches que nous avons identifiées.

Tout d'abord les auteurs mettent en évidence l'improvisation par des raisonnements et des méthodes distincts. Un premier groupe d'articles se caractérise par des déductions à partir d' opérationnalisations de l'improvisation et par l'utilisation de méthodes quantitatives. Une démarche alternative consiste à faire émerger une conceptualisation originale de l'improvisation, sous forme d'inductions ou d'abductions à partir de cas concrets d'improvisation. Dans ce cas, les auteurs s'appuient sur des méthodes qualitatives pour développer leur réflexion.

Ensuite, les auteurs observent des aspects différents de l'improvisation. Deux approches principales coexistent. Certains auteurs s'intéressent à l'improvisation comme phénomène collectif au sein du top management lors d'activités de design. D'autres auteurs analysent l'improvisation des individus au cœur des organisations, sans distinction des niveaux hiérarchiques.

La contextualisation de l'improvisation diffère également d'un articlée à un autre. Un premier groupe d'articles traite de l'improvisation comme réponse à un événement inattendu et critique. Un deuxième groupe d'articles explore l'improvisation comme mode d'organisation favorisant le développement de nouvelles capacités.

Enfin, les ambitions des auteurs en termes de création de connaissance divergent. Un premier groupe d'auteurs contribue à accumuler des connaissances autour d'une représentation uniforme de l'improvisation. Au contraire, d'autres auteurs visent le développement de nouvelles perspectives sur l'improvisation, soit par la discussion des conceptualisations précédentes de l'organisation et de l'improvisation, soit en connectant le concept d'improvisation à d'autres notions en management.
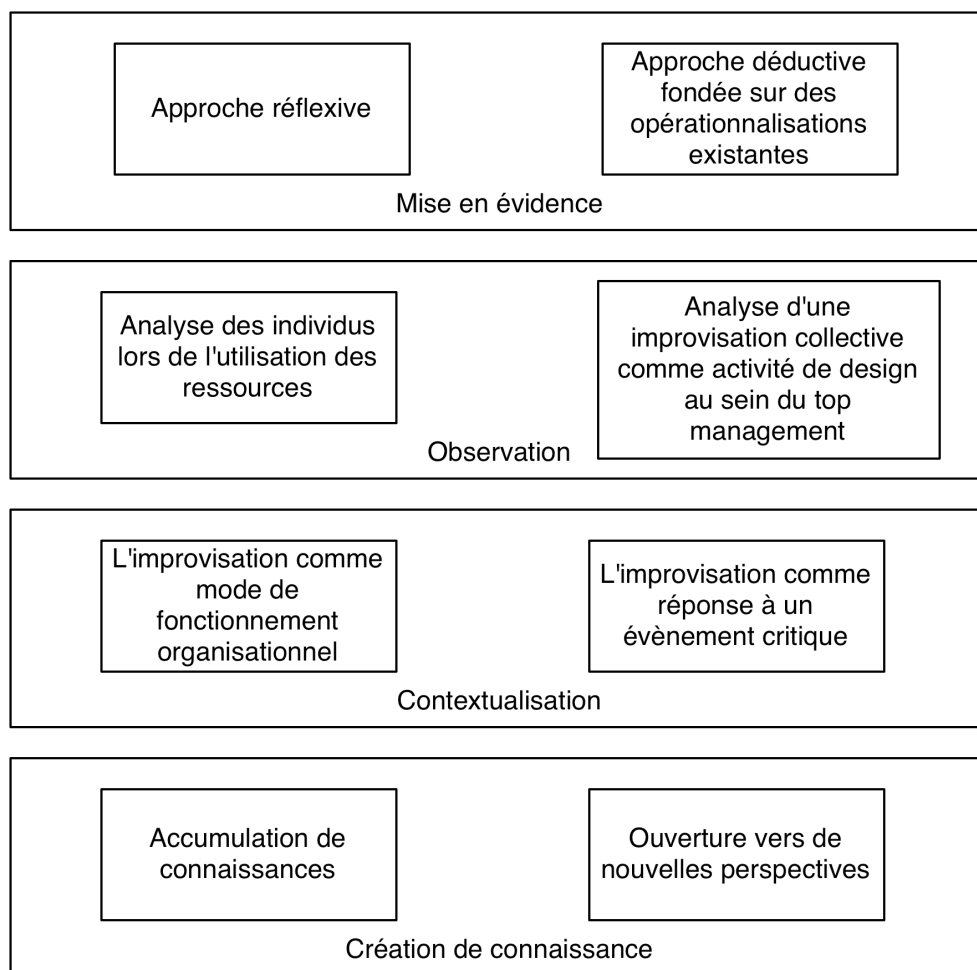
Figure 4. Les principales approches de l'improvisation en management

Nous nous appuyons sur les résultats de cette première étude pour spécifier notre approche de l'improvisation.

Nous adoptons tout d'abord une démarche réflexive sur l'improvisation. Nous menons dans un premier temps une discussion sur les limites des théories sur l'improvisation organisationnelle et formulons ensuite des propositions théoriques sur les interactions qui composent l'improvisation organisationnelle. Dans la partie empirique de la thèse, nous suivons les principes de la théorie enracinée et faisons émerger des données nouveau modèle pour répondre aux questions de recherche.

Notre observation de l'improvisation se démarque des deux principales approches. En effet, nous observons les interactions entre les individus impliqués dans l'improvisation organisationnelle dans des activités d'utilisation des ressources.

Nous étudions l'improvisation dans un contexte de crise. L'improvisation apparaît alors comme une réponse à une série d'évènements critiques et inattendus.

Finalement notre recherche a pour objectif de proposer de nouvelles perspectives théoriques sur l'improvisation. La partie empirique de la thèse met en évidence les liens conceptuels entre l'improvisation et d'autres concepts comme le *vide organisationnel* et les genres de communication *dépassionné* et *fervent*.
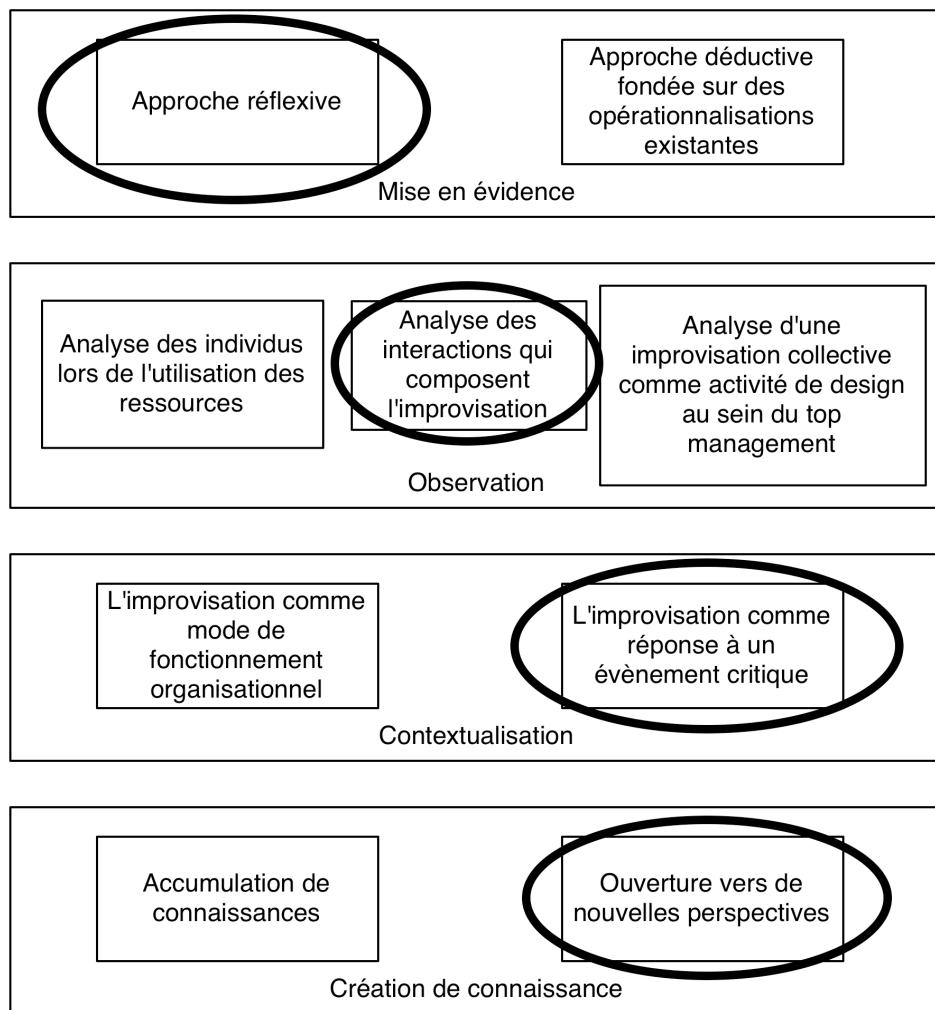
Figure 5. Notre approche de l'improvisation dans la thèse

3.II. Deuxième étude: Propositions théoriques et revue de littérature sur l'improvisation organisationnelle et les TIC

De nombreux auteurs soulignent l'importance des interactions lors d'une improvisation collective (Chelariu *et al.*, 2002). Weick (1993) et Ciborra (1996b), dans leurs analyses respectives du désastre de Mann Gulch[1], montrent qu'une mauvaise gestion des interactions peut plonger les acteurs d'une improvisation dans le doute et faire échouer cette dernière. Pourtant, force est de constater qu'il n'existe pas encore de description exhaustive des interactions composant l'improvisation.

Il est en effet intéressant de noter que les définitions actuelles de l'improvisation n'intègrent pas la notion d'interaction. Par exemple si on considère la définition de l'improvisation de Moorman et Miner (1998a) - « *decision as action unfolds* » - on se rend alors compte que la

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[1] Durant le désastre de Mann Gulch la majorité des membres d'une équipe de pompiers moururent dans des incendies de forêt. Le seul survivant, Dodge, a pu éviter les flammes en improvisant un feu de protection. Malheureusement ses collègues crurent qu'il s'immolait, s'enfuirent et périrent.

définition n'explicite pas comment les acteurs disposent d'un temps ou de ressources suffisants pour se coordonner durant l'improvisation.

Pour cette raison, la première partie de notre deuxième étude a pour objectif d'expliciter les caractéristiques de l'improvisation organisationnelle en situation de crise. Nous proposons que l'improvisation organisationnelle est le fruit d'une déviation collective et spontanée par rapport à l'utilisation habituelle des ressources. De plus, les interactions entre les acteurs permettent aux groupes d'ajuster leurs actions durant l'improvisation. Trois mécanismes ont été identifiés dans la littérature, comme partie intégrante du maintien de la cohérence de l'action collective : le *boundary spanning*, le leadership par l'expertise, et le raisonnement dialogique.

Tout d'abord, le *boundary spanning* (Kapucu, 2006; Tushman, Scanlan, 1981) ou interaction de traduction permet la coordination entre des groupes d'acteurs divers (Wenger, 1999). Cette interaction se caractérise par des processus de traduction permettant la mise en place d'un référentiel commun d'actions (Kapucu, 2006). La mise en place de ce référentiel permet la mise en place d'un leadership fondé sur l'expertise (McKinney, 2008; Weick, Sutcliffe, 2001). Le leadership par expertise caractérise l'écoute et l'alignement des actions d'un groupe sur l'interprétation d'une personne experte sur une problématique précise (Weick, Sutcliffe, 2001). L'improvisation résulte également d'interactions dites de raisonnement dialogique entre acteurs (Faraj, Xiao, 2006). Ces trois types d'interactions sont structurés par des structures minimales de connaissance (Kamoche, Cunha, 2001) qui consistent en un ensemble de règles simples. Le Tableau 5 donne davantage d'éléments sur les composants de l'improvisation organisationnelle de crise.

Tableau 5. Les composants de l'improvisation organisationnelle en situation de crise

Composant de l'improvisation organisationnelle	Spécificités
Spontanéité	La capacité des individus ou des groupes à formuler une réponse à un événement dans un bref délai (George, 1997).
Déviation par rapport à l'utilisation habituelle des ressources	Fait référence à la notion de bricolage – *make do with resources at hand* (Baker *et al.*, 2003), présenté comme un composant de l'improvisation (Kamoche *et al.*, 2003).
Interactions de traduction	La capacité de certains individus ou objets à collecter, interpréter et sélectionner les informations partagées par plusieurs groupes d'individus (Kapucu, 2006).
Structures minimales	Règles élémentaires de fonctionnement d'un groupe de travail (Kamoche, Cunha, 2001).
Leadership fondé sur l'expertise	Leadership émergent des personnes expérimentées ou légitimes aux yeux de plusieurs collaborateurs (Weick, Sutcliffe, 2001).

Notre deuxième étude consiste, tout comme la première, en une analyse de la littérature. Le point de départ de notre analyse a été la recherche d'articles sur plusieurs bases de données dont EBSCO, ABI et Web of Science. Plusieurs recoupements entre les bases de données nous ont permis de récolter environ 150 articles, issus de la requête suivant : *Technology + response + crisis* dans l'abstract. Nous ne mentionnons pas l'improvisation parmi les termes clés de recherche. En effet, dans certains articles, l'improvisation est décrite sans être explicitement mentionnée dans l'abstract.

Nous avons ensuite retenu les articles qui mentionnaient les éléments clés de l'improvisation organisationnelle récapitulés dans le Tableau 5, ce qui a réduit l'échantillon à 12 articles. Pour chaque article classé, nous avons analysé comment les auteurs décrivaient l'apport des TIC à chaque composant de l'improvisation organisationnelle que nous présentons dans les paragraphes précédents.

Notre analyse nous a permis de faire émerger 6 caractéristiques de la technologie que nous interprétons comme des sources potentielles d'aide à l'improvisation organisationnelle en situation de crise. En effet, la combinaison de ces caractéristiques permet l'expression des composants de l'improvisation organisationnelle.

Dans ce paragraphe nous présentons les propriétés des TIC que nous avons identifiées dans ce travail. La Figure 6 représente chaque propriété et son impact sur l'improvisation organisationnelle en situation de crise.
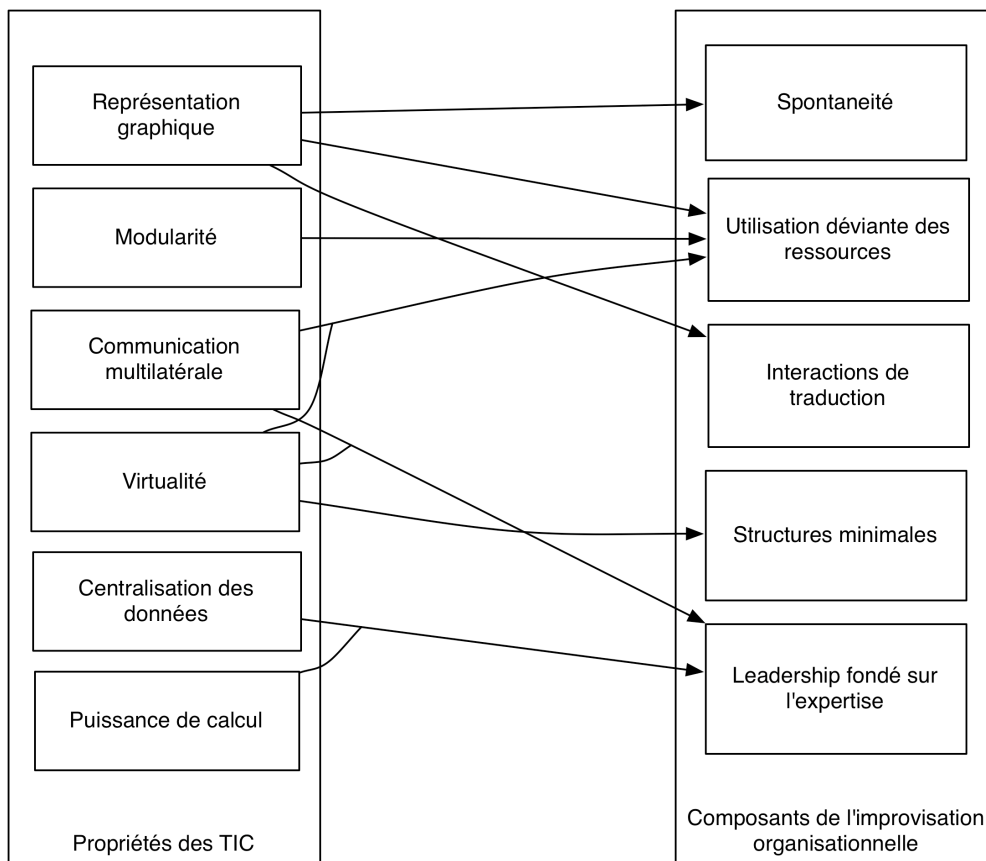
Figure 6. L'influence des propriétés des TIC sur les composants de l'improvisation organisationnelle en situation de crise

La représentation graphique, qui fait référence à une cartographie conceptuelle ou géographique, permet l'uniformisation du format des données dans un référentiel unique (Comfort, 1993). La technologie joue dans ce cas le rôle d'agent d'interface en forçant l'harmonisation des informations échangées sur un même format. De plus, la représentation graphique, par exemple sous forme de cartes, permet de concentrer diverses informations sur un même support et d'utiliser des couleurs et des formes pour favoriser la génération spontanée de nouvelles idées (Dantas, Seville, 2006)

La modularité des applications permet la mise en place rapide de canaux de communication pendant la crise. Elle facilite la mise en forme de pratiques innovantes.

La puissance de calcul, la communication multilatérale et le caractère virtuel des informations facilitent la déviation de l'usage des ressources. Par exemple, les systèmes experts comme le Control & Command System, permettent de repérer quand le cours de l'action collective dévie des procédures établies, ce qui facilite l'émergence de nouvelles idées pour répondre à ces différences (Ntuen *et al.*, 2006). Le raisonnement dialogique et la déviation par rapport aux schémas préétablis d'action sont alors facilités.

La centralisation des données favorise la création d'une narration indispensable aux interactions d'interface, de raisonnement dialogique et au leadership par expertise. Au travers

d'une même interface, les acteurs peuvent élaborer une unique narration qui remplit la fonction de traduction et facilite l'émergence de règles communes (Majchrzak *et al.*, 2007). Il est techniquement aisé de retrouver l'historique des échanges entre les acteurs ou ses propres échanges avec les collègues. L'accès aux interactions précédentes permet de maintenir un référentiel commun d'actions. Ce résultat confirme les conclusions des travaux précédents, qui mettent en évidence l'importance des logs dans les échanges entre les acteurs d'une crise (Turoff *et al.*, 2004)

Enfin les interactions sont facilitées par le caractère virtuel des données. Les interactions de traduction, de raisonnement dialogique et de leadership par expertise ne pourraient pas se développer sans l'échange immédiat des informations (Comfort, 1993; Quarantelli, 1997; Yuan, Detlor, 2005). En effet, l'échange rapide des données permet aux acteurs de la réponse à la crise d'avoir accès à une information mise à jour presque en temps réel. Ainsi ils peuvent concentrer leurs efforts sur la résolution des problèmes présents. Les échanges rapides facilitent la transmission rapide des règles de coordination à tous. Ainsi les structures minimales nécessaires à l'improvisation sont rapidement mises en place grâce aux TIC.

Sur la base de notre compréhension théorique de l'improvisation organisationnelle, nous formulons des liens de causalité entre des propriétés des TIC et les composants de l'improvisation organisationnelle. Nos résultats ne s'appliquent pas uniquement à un cas particulier de réponse à une crise mais à l'ensemble des cas possibles d'improvisation en situation de crise. L'étude met sur un même plan des approches très variées de la technologie, qu'elles soient purement conceptuelles ou fondées sur l'analyse d'une réalité empirique, qu'elles soient normatives ou purement descriptives.

Ce travail présente toutefois des limites qui appellent un examen approfondi des pratiques liées aux TIC dans le cadre de l'improvisation organisationnelle en situation de crise. Nos résultats ne décrivent qu'un apport *potentiel* de la technologie, qui élude l'effet de la contingence de l'utilisateur ou de la culture organisationnelle sur les liens entre les TIC et l'improvisation organisationnelle.

3.III. Troisième étude: Les TIC, l'improvisation, le vide organisationnel : L'influence des genres de communication sur l'improvisation de crise.

Ce chapitre consiste en une étude détaillée des interactions qui ont participé à l'improvisation organisationnelle durant la réponse à la canicule de 2003. En Août 2003, une vague de chaleur s'est étendue sur l'Europe et a provoqué la mort de 14802 personnes en France. Ainsi, le taux de mortalité en Île-de-France a doublé entre le 4 et le 20 Août 2003. Les personnes âgées et les nourrissons ont été les plus touchés. Durant le mois d'août 2003, le réseau formé par les organisations chargées de la protection civile et sanitaire d'Île-de-France a fait face à une surmortalité et s'est retrouvé dans l'impossibilité de mener à bien sa mission : protéger et sauver les vies de citoyens de la région parisienne. Les hôpitaux ont alors cruellement manqué de ressources, les médecins assistant impuissants à l'augmentation progressive du nombre de morts. Enfin, les sapeurs-pompiers et les services de police ont été dans l'incapacité d'empêcher les nombreux malaises sur la voie publique ou dans les domiciles des

personnes âgées. Des défaillances organisationnelles ont été mises en avant pour expliquer ce nombre élevé de décès (Lalande *et al.*, 2003), comme le manque de communication entre les organismes publics de contrôle et les groupes opérationnels (services hospitaliers, médecins, personnel des maisons de retraites, collectivités territoriales). Pour autant, certains groupes qui n'ont pas disposé de l'information nécessaire ont dû improviser pour répondre aux accidents et malaises croissants ainsi qu'à l'afflux de malades dans les services d'urgence. Aussi, notre étude se concentre sur ce que nous appelons *le réseau de réponse,* constitué de 23 types d'organisations, tous impliqués dans la réponse à la crise provoquée par la canicule

Cette étude a pour objectif de répondre à deux des quatre questions de recherche qui structurent notre travail doctoral, soit les questions suivantes :

III. Dans quelle mesure les TIC répond-elle aux besoins des acteurs qui participent à l'improvisation organisationnelle en situation de crise ?

IV. Dans quelle mesure les acteurs profitent-ils de l'utilisation des TIC pour improviser lors d'une réponse à une crise ?

3.III.1. L'adéquation de la technologie à l'improvisation et les théories du fit

Dans un premier temps, nous proposons une réflexion sur la question de recherche III qui porte sur l'adéquation entre la technologie et les besoins des acteurs qui doivent improviser ensemble lors de la réponse à une crise. Dans la littérature anglo-saxonne, la question de l'adéquation entre une fonction technologique et l'utilisation d'une technologie a mobilisé un nombre conséquent de chercheurs. Une partie de cette réflexion s'inscrit dans la continuité des travaux sur la contingence des organisations, telle que définie par Drazin et Van de Ven (1985). Ces théories partent de l'idée suivante : il faut un minimum de cohérence entre les structures d'une organisation et son contexte pour atteindre un certain niveau de performance (Drazin, Van de Ven, 1985). Plus précisément, de nombreuses théories qui relèvent de *l'approche interactionnelle* du fit ont examiné l'effet du degré d'adéquation entre les ressources technologiques et le contexte d'utilisation sur la performance de l'organisation (Drazin, Van de Ven, 1985; Zigurs, Buckland, 1998). Ces théories prennent en compte différents aspects du contexte de l'utilisation d'une technologie, tels que les tâches de l'utilisateur, les besoins en termes d'interactions, la stabilité environnementale, etc.

Depuis quelques années, la recherche en gestion des crises pose elle aussi la question de l'adéquation entre les technologies utilisées et les spécificités d'une réponse à la crise (Mendonça, 2007; Mendonça *et al.*, 2003). Les avis divergent fortement sur le sujet. Pour certains auteurs, les TIC constituent un apport fondamental à la résilience. Pour d'autres la technologie ne répond pas aux besoins les plus cruciaux et risque même de peser sur l'improvisation en situation de crise (Dawes *et al.*, 2004; Hiltz, Turoff, 1985; Quarantelli, 1997). Les théories du fit permettent à première vue de départager les avis et de résoudre l'incertitude concernant l'apport d'un ensemble des TIC à l'improvisation en situation de crise. En effet elles offrent une grille d'analyse englobant l'ensemble des variables organisationnelles et environnementales susceptibles d'interagir avec les caractéristiques technologiques. De cette façon elles intègrent la contingence de l'utilisateur à la réflexion en

comparant précisément les besoins des utilisateurs avec les fonctionnalités d'une ou plusieurs technologies. Pour mettre en évidence les construits susceptibles d'être intégrés à notre réflexion sur l'adéquation entre la technologie et l'improvisation et l'improvisation de crise, nous nous sommes inspirés de la récente revue de littérature de Zigurs et Khazanchi (2008). Nous déduisons de cette revue de littérature les construits à prendre en compte dans l'analyse de l'adéquation entre la technologie et l'improvisation en situation de crise.

Nous déduisons de cette analyse la difficulté d'appliquer les théories du fit au cas particulier de l'improvisation en situation de crise. Tout d'abord, l'improvisation consiste en une déviation spontanée et innovante des schémas d'action préétablis (Crossan, 1998; Rerup, 2001). Il est donc impossible de prédéterminer en quoi l'improvisation va consister ni les individus qu'elle va impliquer dans l'organisation. Certes, l'improvisation peut impliquer une complexité et une équivocité accrues. A cause de la spontanéité des acteurs et de la quasi-absence de délai entre la décision et l'action, les acteurs ont besoin de davantage de mises à jour régulières et détaillées sur les actions des uns et des autres. Sans aucun doute, la gestion des interventions impromptues de bénévoles a complexifié la gestion de la sécurité et a impliqué une redéfinition continue des flux de tâches lors du désastre du 11 septembre (Jaeger *et al.*, 2007). Même si la complexité et l'équivocité découlent certainement de l'improvisation, cette dernière revêt d'autres caractéristiques qui ne sont pas prises en compte par les théories du fit. De plus, la réponse aux crises organisationnelles causées par des désastres se caractérise par une diversité d'organisations, de tâches et d'individus. La Figure 7 qui présente les acteurs de la réponse à la canicule de 2003 donne une idée de la diversité des cultures organisationnelles en jeu. Les crises causées par les désastres comme les attentats du 11 septembre ou l'ouragan Katrina impliquent parfois plus de 50 organisations différentes, incluant parmi elles des entreprise, des administrations et parfois des associations (Eisenberg, 2006). Au sein d'une même interaction, il n'est pas improbable que la technologie ne soit pas appropriée à l'un des deux acteurs.

Tout ceci implique la nécessité d'une observation des pratiques des utilisateurs, qui est l'objet de l'analyse de notre étude de cas. La Figure 7 présente les différents groupes d'acteurs composant le réseau de protection civile et sanitaire d'Île-de-France : elle présente les organisations chargées de la protection civile, les organisations chargées de la protection sanitaire et les « outsiders », organisations qui ont développé des liens forts de coopérations au sein du réseau de réponse durant la canicule. Les flèches en gras mettent en évidence des liens de coopération intense entre certaines organisations. Chaque membre du réseau possède une culture et une appréhension de l'information spécifique. Leur utilisation des systèmes d'information et des TIC varie également : alors que les acteurs administratifs et institutionnels privilégient l'email pour communiquer entre eux, les opérationnels interagissent plus volontiers par téléphone. Enfin les échanges entre les sphères opérationnelles et administratives se font relativement souvent par fax.
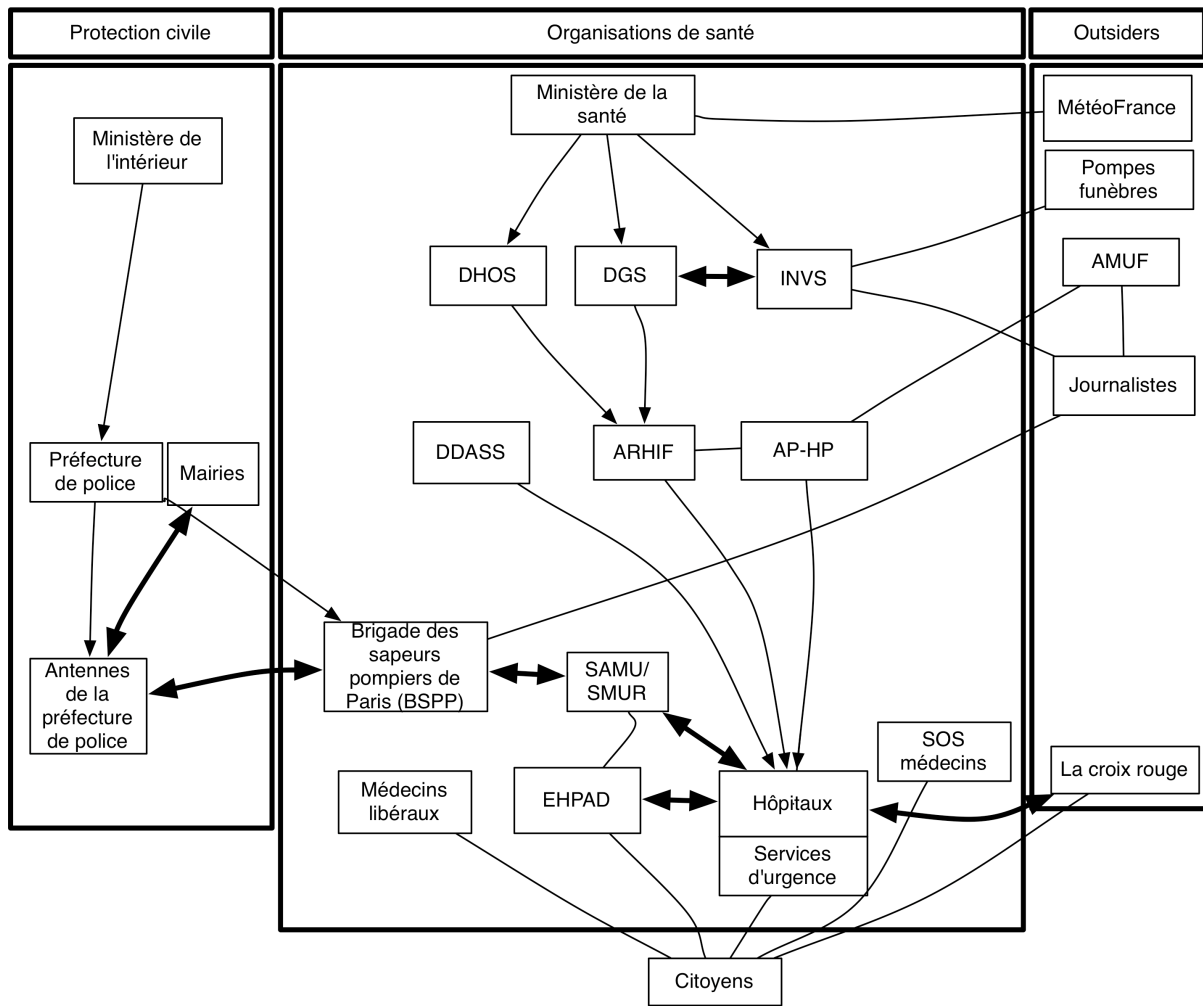
Figure 7. Les groupes d'acteurs composant le réseau de protection civile et sanitaire en Île-de-France

Notre analyse a porté sur les interactions qui ont eu lieu au sein et entre les organisations qui composent le réseau de réponse. Les limites d'une application directe des théories du fit nous ont conduit à suivre l'approche de la théorie enracinée pour analyser ces interactions (Locke, 2001), tel que décrit par le Tableau 6.

Tableau 6. Les limites de l'application des théories du fit et les motivations d'une approche enracinée

Limites d'une application des théories du fit	Raisons du recours à la théorie enracinée
L'absence de définition de certains des construits empêche l'application des théories du fit à l'improvisation de crise. On doit alors observer l'improvisation sur le terrain.	Les théories existantes sont incomplètes pour expliquer les phénomènes. Un enrichissement du corpus théorique passe par une observation des pratiques
Les théories du fit ne prennent pas en compte les interdépendances entre la technologie et l'improvisation.	Les connexions théoriques entre les concepts sont inexistantes ou ambigües.
Il est nécessaire de prendre en compte les pratiques des utilisateurs pour enrichir la réflexion sur l'adéquation d'une technologie.	Un enrichissement du corpus théorique passe par une observation des pratiques ou des acteurs

Le choix du cas à étudier s'est fait selon la technique de l'échantillonnage théorique (Mason, 2002). Dans cette perspective, nous avons sélectionné le cas d'une crise organisationnelle impliquant une improvisation fréquente des individus. Une première comparaison entre les données et nos hypothèses de départ sur la réponse à la crise nous a permis de reconnaître la pression émotionnelle, la contrainte temporelle, le manque de ressource et la remise en question des valeurs fondamentales (Hermann, 1963; Pearson, Claire, 1998). Ensuite nous avons utilisé la technique du *reality check* (Harris, 2001) pour nous assurer que le cas constituait bien un exemple d'improvisation collective. Nous nous sommes alors référés aux cinq dimensions de l'improvisation évoquées par les différentes définitions que nous avons trouvées dans la littérature (pour plus de détail se référer au Tableau 2). Nous avons systématiquement comparé ces dimensions avec les différents épisodes de la réponse à la canicule de 2003 par le personnel administratif et hospitalier du réseau. Nous avons pu alors constater que non seulement les individus improvisaient mais que cette improvisation était organisée à l'échelle de plusieurs groupes d'acteurs. Enfin, lors du codage des données, nous avons suivi le principe de l'échantillonnage théorique tel que décrit par la méthode de la théorie enracinée (Strauss, Corbin, 2008). Pour cela, nous avons élaboré des dictionnaires des thèmes en vue de la réduction des données pour le codage.

Le cas de la réponse à la canicule de 2003 est un exemple d'improvisation organisationnelle limitée : si certains groupes d'acteurs ont improvisé ensemble, d'autres n'ont pas participé à l'improvisation, empêchant son développement à l'échelle du réseau. Les groupes d'acteurs opérationnels représentés en bas de l'arborescence de la Figure 7 ont improvisé intensément et ont utilisé les téléphones pour se coordonner. Les groupes d'acteurs administratifs représentés en haut de l'arborescence sont, pour la plupart, restés hors de l'improvisation. Enfin, certains acteurs administratifs ont improvisé leur utilisation du fax pour transmettre les informations aux opérationnels.

La théorie enracinée a pour objectif de faire émerger des catégories conceptuelles de la réalité empirique, puis de les organiser.

Pour mener notre analyse, nous avons mobilisé quatre sources de données :

les entretiens publics menés lors des commissions d'enquêtes et des commissions d'informations des chambres parlementaires,

les emails, fax et communications internes qui ont été transmises par les acteurs durant la réponse à la crise,

les témoignages des différentes expériences de la crise, via des ouvrages ou les archives des quotidiens,

les données secondaires provenant de travaux préliminaires sur la réponse à la canicule de 2003, sous forme de rapports nationaux et internationaux ou de travaux académiques.

3.III.2.   Les résultats

Nous commençons par présenter le modèle global qui a émergé de l'analyse des données empiriques. Nous détaillons ensuite chaque composant du modèle pour préciser notre propos.

Le modèle empirique, représenté dans la Figure 8, a émergé de l'analyse enracinée et a pour vocation une explication holistique des rapports entre l'improvisation, le *vide organisationnel* et les TIC. Nous démontrons en effet que l'improvisation a permis de combler le vide organisationnel qui a pesé sur la réponse à la crise provoquée par la canicule de 2003. Toutefois, la participation des individus à l'improvisation organisationnelle a été influencée par les genres de communication qu'ils avaient développés. Nos résultats nous permettent de répondre tout d'abord à la question de recherche IV : *Dans quelle mesure les acteurs profitent-ils de l'utilisation de la technologie pour improviser lors d'une réponse à une crise ?* Nos résultats permettent également d'apporter quelques éléments de réponse à la question de recherche III.
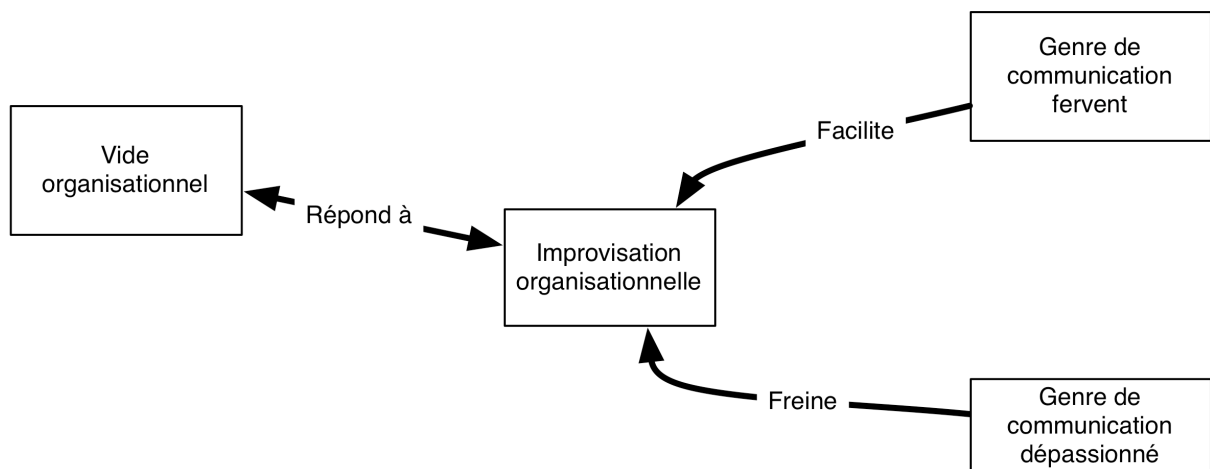
Figure 8. Modèle empirique

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3.III.2.1. Le vide organisationnel et l'improvisation organisationnelle comme réponse

Notre analyse de la canicule de 2003 suggère que les organisations peuvent faire l'expérience d'un vide organisationnel lors de la réponse à la crise. Dans ce travail, nous avons fait émerger le concept de *vide organisationnel*. Le vide organisationnel caractérise *une situation dans laquelle des ressources et/ou des moyens ne peuvent pas être intégrés à un ensemble d'actions, empêchant leur déroulement*. Les acteurs font l'expérience du vide au travers du manque de ressources (matérielles ou immatérielles) telles que définies par Barney (1991) et le manque de moyens, tels que définis par Mintzberg (1979). Le concept de vide organisationnel a émergé de l'analyse enracinée, mais de nombreux auteurs y font référence plus ou moins explicitement dans leurs travaux. Alter, par exemple, met en évidence l'effort de réflexivité font preuve les acteurs pour faire face au manque de définition des procédures (2000). Auparavant Crozier et Friedberg ont montré comment les acteurs intègrent les zones d'incertitude dans leur travail (1977). Weick évoque la capacité des organisations à développer une nouvelle organisation *ad hoc* à partir de situations chaotiques (2001c). De manière plus explicite, la théorie des vides structurels met en évidence l'émergence des comportements innovants à partir de manques informationnels (Burt, 1992, 2004).

Le vide organisationnel appelle les acteurs à faire preuve d'ingéniosité et d'esprit d'initiative pour mener à bien leur mission. Ils improvisent alors ensemble, en se coordonnant pour développer des nouvelles pratiques collectives.

Parmi les données empiriques, nous avons identifié les composants de l'improvisation organisationnelle que nous proposons dans le volet théorique de la thèse. La réponse à la crise de la canicule de 2003 illustre en effet de nombreux cas d'improvisation collective. Certaines de ces improvisations ont été spontanément orchestrées par des individus chargés de traduire les besoins des uns aux autres et réciproquement. L'exemple d'un cadre infirmier qui s'est spontanément chargé d'appeler les différents services pour réguler les flux de patients entre les hôpitaux avoisinants illustre l'importance des interactions de traduction. Dans d'autres cas, les acteurs ont spontanément mis en place une ou deux règles de conduite pour orchestrer l'utilisation déviante des ressources. De cette façon les acteurs ont pu trouver les moyens de mener à bien leurs tâches, malgré le manque de ressources, comme des lits, ou de moyens, comme des processus ou des règles de gestion appropriés. Par exemple, les groupes d'intervention d'urgence sanitaire ne savaient pas comment identifier et soulager l'hyperthermie au début de la crise. En réponse à cela, un médecin chef de la Brigade des Sapeurs Pompiers de Paris (BSPP) a proposé d'introduire la température des victimes comme code d'intervention pour la BSPP, les SMUR et SAMU. Tout en utilisant une seule donnée – la température, les acteurs ont pu facilement distinguer les interventions directement dues à la chaleur et se coordonner pour le transfert des victimes dans les services d'urgence.

L'improvisation organisationnelle apparaît donc comme une réponse possible à l'expérience d'un vide organisationnel. Nous allons maintenant décrire comment l'improvisation organisationnelle a été influencée par les genres de communication existant au sein du réseau de réponse à la canicule de 2003.

3.III.2.2.   Les genres de communication

Durant le processus d'intégration décrit précédemment, des allers et retours systématiques entre la théorie et les données ont alimenté un rapprochement des concepts avec les théories existantes. C'est ainsi que nous avons identifié deux genres de documentation et leurs effets sur l'improvisation organisationnelle.

Les genres de communication ont été identifiés par Yates et Orlikowski (1992). Un genre de communication correspond à un ensemble de pratiques et de stratégies rhétoriques progressivement développées et reconnues au sein d'une communauté d'interlocuteurs (Orlikowski, Yates, 1994; Yates, Orlikowski, 1992). Un genre de communication résulte d'une structuration de pratiques de communications et de l'appropriation d'un moyen de communication. En effet, un genre de communication peut être associé à un ou plusieurs supports, comme les rapports internes ou mémos. Il peut également être associé à un média de communication, comme l'email (Ducheneaut, 2002; Zucchermaglio, Talamo, 2003). Le genre de communication se caractérise par un ou plusieurs objectifs et par des éléments de forme, allant de la structure des messages au langage adopté par les interlocuteurs (Zucchermaglio, Talamo, 2003).

Au sein du réseau formé par les organisations impliquées dans la réponse à la crise de la canicule de 2003, nous identifions deux principaux genres de communication. Nous les présentons dans les paragraphes suivants, ainsi que leurs effets sur l'improvisation organisationnelle durant la réponse à la crise. La Figure 9 présente les caractéristiques des genres de communication dépassionnés et fervents.

Figure 9. Comparaison des genres de communication

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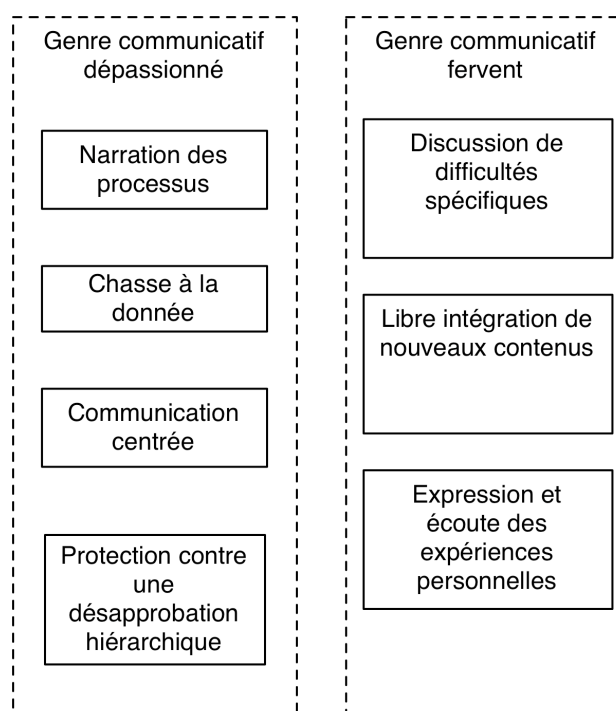
Un premier genre de communication, que nous appelons le genre *fervent,* prédomine parmi les groupes d'acteurs opérationnels qui interagissent en face à face ou par téléphone durant la réponse à la crise. Il se caractérise par une stratégie de discussion ou de persuasion, ainsi que l'expression des émotions et opinions personnelles. Dans la forme, les objets, comme les lits ou les brancards, sont couramment mentionnés, ce qui enrichit les discussions et favorise l'émergence de nouvelles idées. Les émotions, telles que la colère ou la peur, ou encore les sensations comme la soif sont exprimées sans détour et le plus souvent écoutées avec empathie. En s'exprimant librement sur leurs émotions, les acteurs émettent leurs avis et les idées spontanément. Ce genre de communication coïncide avec des valeurs professionnelles orientées vers l'action, propres aux professionnels de la santé.

Le deuxième genre de communication que nous qualifions de *dépassionné* est plus répandu parmi les membres du réseau en charge de tâches administratives qui échangent des emails ou des fax. Ce genre répond à une stratégie de protection des interlocuteurs contre le risque d'être mis à défaut par la hiérarchie ou les collègues, qui est perceptible dans le milieu médical (Morgan, Krone, 2001). L'objectif pour les acteurs est de mettre en évidence leur professionnalisme, notamment par leur réactivité, ainsi que leur volonté de partager les informations. Dans la forme, les interactions par email et fax se caractérisent par une neutralité du ton, une faible dispersion des acteurs qui restent concentrés sur le sujet de départ. La donnée étant perçue comme une ressource objective et donc légitimant le raisonnement des acteurs, il s'ensuit une chasse à la donnée. Ceci limite les discussions sur l'improvisation en cours et les objets impliqués dans l'improvisation. Les échanges sont consensuels et impliquent les personnes en fonction de leur statut dans l'organisation, ce qui limite l'implication de personnes expérimentées mais statutairement inférieures ou marginales, aux dépens l'émergence du leadership par expertise. Enfin, l'improvisation étant peu mentionnée et le vocabulaire avant tout procédural, il est difficile de développer un référentiel commun avec les acteurs qui ont improvisé durant la réponse à la crise. La Figure 10 résume nos résultats et récapitule l'influence des genres de communication sur l'improvisation organisationnelle durant la réponse à la crise provoquée par la canicule de 2003. Les flèches (+) représentent les effets positifs tandis que les flèches (-) représentent les effets négatifs.
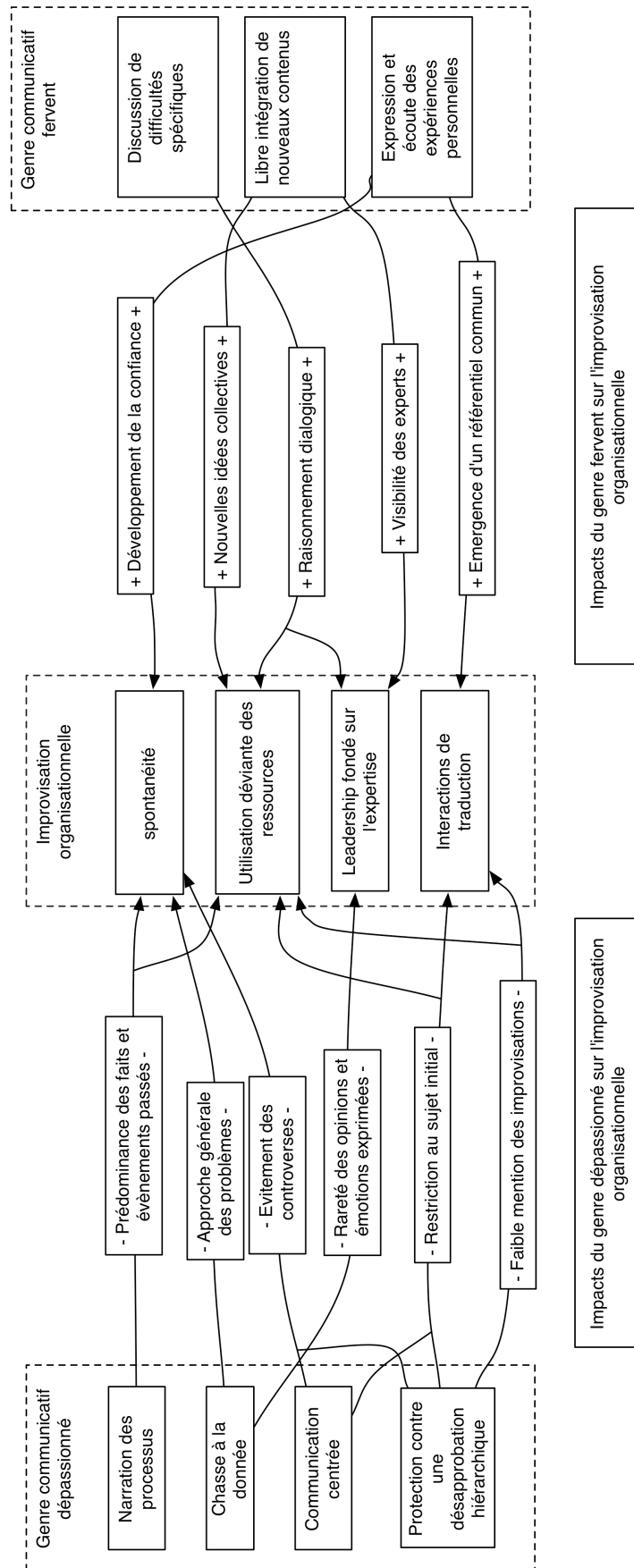
Figure 10. Impacts des genres de communication sur l'improvisation organisationnelle

Ainsi, les interlocuteurs administratifs qui ont avant tout échangé par email ont éprouvé des difficultés à participer à l'improvisation en cours durant la réponse à la crise. Si l'improvisation est pratiquement restée étrangère aux utilisateurs des emails, il est intéressant de noter que l'utilisation du fax a permis une évolution du genre de communication dépassionné. En effet, quelques exemples de fax annotés à la main, exprimant une émotion de l'interlocuteur, montrent que le genre de communication dépassionné a évolué durant la crise en ce qui concerne le fax.

3.IV. Discussion des résultats empiriques

Le modèle que nous proposons met en avant les limites de l'utilisation de l'email lors de la réponse à la crise provoquée par la canicule de 2003 en Île-de-France. Toutefois, il est important de noter que l'objet de notre propos n'est pas de critiquer la technologie, mais plutôt de mettre en avant que dans certaines organisations, les habitudes développées autour de l'email peuvent freiner l'improvisation organisationnelle. En effet, de nombreux exemples d'utilisations inattendues d'emails, comme lors des attaques du 11 septembre, prouvent que les TIC ne sont pas un frein systématique à l'improvisation (Jefferson, 2006b).

L'utilisation des emails a également permis de développer une narration par le suivi des messages de par la capacité de stocker, citer ou transmettre les propos des interlocuteurs sans effort. Notre analyse suggère que les acteurs ont intensément utilisé cette fonctionnalité de l'email, ce qui a permis de faire remonter certaines informations et d'assurer une continuité des thèmes abordés entre les interlocuteurs. Cette analyse confirme les résultats théoriques de la deuxième étude, selon lesquels la centralisation des données et la virtualité de l'information propres aux TIC permettent une narration entre les acteurs qui doivent improviser en situation de crise (pour plus d'éléments sur la centralisation des données et la virtualité de l'information, se référer au chapitre 2.3). Pour autant, notre analyse suggère que les utilisateurs d'emails et de fax ne sont pas parvenus à participer à l'improvisation organisationnelle, du fait de leurs genres de communication.

Section 4.   Les considérations finales de la thèse

4.I. Confrontation des résultats empiriques et théoriques : le modèle final de la thèse

Cette thèse a pour objectif d'expliciter l'apport des TIC à l'improvisation organisationnelle en situation de crise. Une première exploration théorique nous a permis de mettre en évidence que certaines propriétés des TIC facilitent l'improvisation organisationnelle. Étant collective, l'improvisation suppose une coordination particulière, notamment grâce au raisonnement dialogique entre experts, aux interactions de traduction et aux structures minimales de connaissance.

Certes, la technologie facilite certaines interactions spécifiques à l'improvisation organisationnelle. Toutefois, les groupes d'acteurs développent également des genres de communication autour des média qui peuvent influencer l'effet des TIC sur l'improvisation organisationnelle. La faculté de certains groupes d'acteurs à improviser dépend également de

leur capacité à faire évoluer leurs genres de communication pendant la crise, ou du moins à rendre leurs genres de communication compatibles avec ceux des autres participants de la réponse à la crise. La Figure 11 décrit le modèle final de la thèse qui récapitule les concepts abordés et sert de point de départ à un affinement des propositions théoriques.
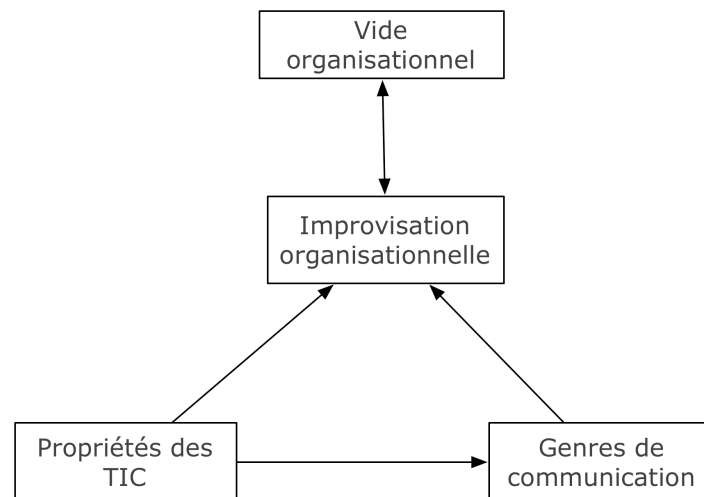
Figure 11. Modèle final de la thèse

4.II. Discussion des propriétés des TIC à l'aune de l'analyse empirique

Nous proposons ici une discussion des résultats théoriques à partir notre analyse empirique. Notre réflexion met en évidence que les propriétés des TIC ne sont pas seulement des traits essentiels de l'artefact technologique mais sont également perçues et interprétées par les utilisateurs. Notre propos se concentre ici sur la technologie de l'email.

Le cas de la canicule de 2003 n'illustre pas d'utilisation de représentation graphique dans les emails ou les fax. Les données, tout de même, mettent en évidence que certains acteurs se sont mis à improviser par un contact proche avec la réalité de la crises, autrement dit après avoir vu, pour de vrai, les personnes étendues sur les brancards et en manque de soin. On pourrait alors faire l'hypothèse que les images faciliteraient les échanges sur les émotions, les opinions ou les objets en jeu lors de l'improvisation organisationnelle. Ces propositions nécessitent un examen approfondi du rôle des images durant l'improvisation organisationnelle.

La centralisation des données permet la traçabilité des emails. Or la traçabilité a contribué au genre de communication dépassionné. Nos résultats empiriques nous incitent donc à faire preuve de prudence à l'égard de cette propriété technologique. D'un certain côté, la centralisation des données permet une narration et le développement d'un référentiel commun indispensable à l'improvisation. D'un autre, elle peut impliquer une certaine appréhension ou

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frilosité des acteurs à l'idée de discuter de problèmes, de partager leurs expériences ou de prendre le risque de soumettre de nouvelles idées.

Les emails n'incluent pas une puissance de calcul, mais permettent de récolter des données afin d'alimenter des bases de données et des algorithmes de calcul. En ce sens, la technologie de l'email peut être associée à cette propriété technologique. Nos résultats empiriques nous conduisent toutefois à nuancer nos propos concernant l'effet de la puissance de calcul sur l'improvisation organisationnelle. La puissance de calcul implique des transmissions fréquentes de mesures entre les acteurs de la crise. Or, en privilégiant la communication autour de chiffres, l'utilisation de la technologie peut entraver l'échange d'informations informelles, non chiffrées, d'opinions et d'émotions. Le phénomène de chasse à la donnée qui a caractérisé le genre de communication dépassionné durant la canicule de 2003 illustre le risque d'une attention disproportionnée aux données, laissant de connecter des occasions de discussion entre les interlocuteurs.

En fonction du genre de communication que les acteurs ont développé autour de la technologie, la virtualité, la centralisation des données et la communication multilatérale peuvent représenter des outils de contrôle. En effet, les acteurs de la réponse à la canicule de 2003 ont perçu ces propriétés comme une potentielle menace professionnelle, ce qui les a conduits à privilégier durant la communication électronique la narration des processus afin de se protéger d'éventuelles désapprobations. Les calculs stratégiques des acteurs et le genre de communication se sont cristallisés autour de cette propriété, limitant la mise en confiance des acteurs, leur spontanéité et l'expression dialogique autour de l'improvisation.

Enfin, la virtualité permet de recopier et transmettre un contenu sans coût et sans délai (Schultze, Orlikowski, 2001). Elle renforce également le caractère intangible de l'information dans la mesure où il n'y pas a de lien matériel évident entre l'information et l'objet qui le contient ou le transmet. Le volet théorique de la thèse a présenté l'apport potentiel de la virtualité à l'improvisation en situation de crise. Par une transmission sans effort, les interactions sont plus nombreuses et permettent un partage harmonieux des informations et des connaissances. La discussion est également fluidifiée, ce qui facilite l'interaction entre les experts. En facilitant la transmission de la voix et des images, la technologie permet également une plus grande richesse de l'interaction (Fitrianie *et al.*, 2007; Thomas *et al.*, 2009).

Toutefois, la virtualité implique l'utilisation d'une même interface pour communiquer, limitant ainsi l'utilisation de supports de communications supplémentaires comme du papier. Durant la réponse à la canicule de 2003, les utilisateurs des emails ont rarement utilisé d'autres médias de communication. Or la matérialité d'un média, comme le fax, permet la représentation parfois innovante de l'information sur de nouveaux supports. Par exemple l'utilisation du papier a favorisé l'intégration manuscrite d'avis personnels ou de nouvelles idées, signe de l'adaptation du genre de communication *dépassionné*. En somme les médias les plus « matériels » ont été l'objet d'improvisation. Ce résultat reflète l'importance du rôle des objets dans l'improvisation, comme le suggèrent les travaux de Claude Lévi-Strauss sur le bricolage (1962).

La Figure 12 représente les liens conceptuels entre la technologie, le genre de communication *dépassionné* et l'improvisation organisationnelle.
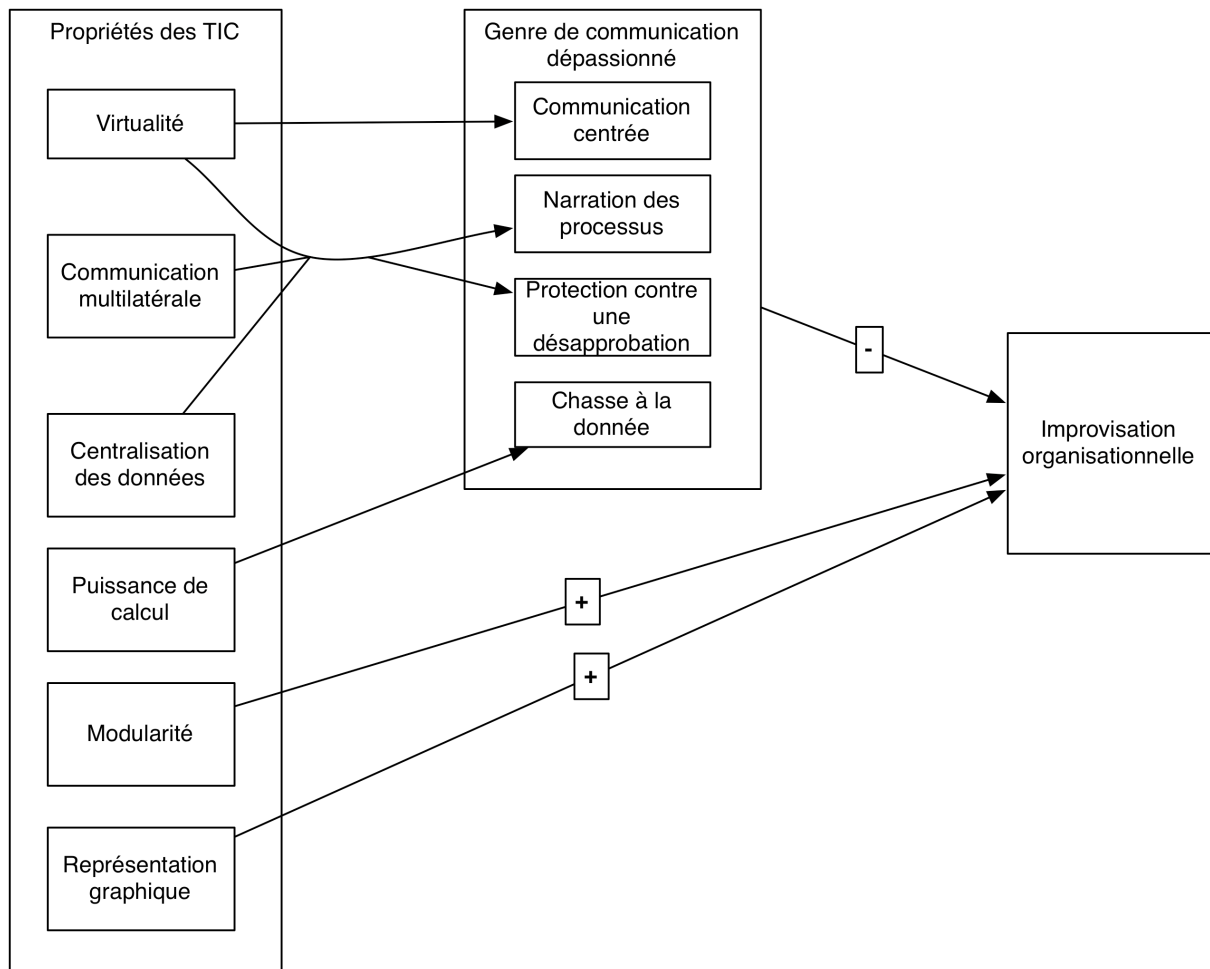
Figure 12. Confrontation des résultats théoriques et empiriques

4.III. Implications managériales de nos résultats

La thèse s'inscrit dans une approche pragmatique et réaliste. Il s'ensuit la nécessité de formuler des recommandations concrètes à destination des praticiens.

Notre première suggestion est une plus ample reconnaissance de l'improvisation dans les organisations. La difficulté du management de l'improvisation est qu'on ne peut pas prévoir comment, avec qui, et quand l'improvisation va se dérouler. Il est donc nécessaire que les managers reconnaissent l'improvisation *in situ*. Ils peuvent s'appuyer sur la grille d'analyse que nous proposons dans cette thèse pour reconnaître dans quelles mesures le flux de travail dévie par rapport aux routines. Cette démarche nécessite le développement d'une culture organisationnelle de la communication qui dédramatise les erreurs, ce qui a déjà été recommandé par de nombreux chercheurs spécialisés dans le domaine de l'improvisation (Vera, Crossan, 2004). On peut par exemple faire des *brainstormings* par email afin d'introduire un nouveau genre de communication.

Enfin, nous suggérons l'ouverture d'un espace de communication propice au développement de genres de communication compatibles avec l'improvisation dans les organisations. On peut tout d'abord créer des espaces libres parmi les outils de communication utilisés en situation de routine, comme un forum sur un Intranet. Par exemple, on peut proposer un espace de controverse dans lequel les utilisateurs peuvent faire part de leurs opinions. De même se pose la nécessité d'ouvrir les canaux de communication à un réseau d'interlocuteurs potentiels, contrairement aux recommandations de Turoff et ses collègues, selon lesquels il faut structurer et prédéterminer les privilèges de chaque utilisateur des TIC (Turoff *et al.*, 2004, p. 17). On peut également multiplier les canaux de communication pour diversifier les genres de communication. Multiplier les canaux de communication implique toutefois un risque de dispersion et va à l'encontre des recommandations de Jennex (2008) selon lequel les mises à jour d'information sur la réponse à la crise doivent se faire via un seul média sécurisé.

Nous sommes conscients de la difficulté d'appliquer ces suggestions. D'une manière générale, les recommandations que nous formulons dans cette thèse impliquent des arbitrages entre sécurité et liberté. En effet, l'improvisation apparaît dans notre étude comme une pratique pertinente en situation de crise mais peut semer le trouble dans l'organisation tout en lésant des parties prenantes. L'ouverture de la culture organisationnelle à l'improvisation n'est donc bénéfique que si les managers suivent avec attention le déroulement de l'improvisation. De plus, l'ouverture d'espaces de communication supplémentaires peut peser sur le respect des contraintes de sécurité de l'information ou mettre en danger la cohérence de l'action collective.

Section 5.   Contribution et opportunités de recherche

5.I. Contributions de la recherche

Premièrement notre travail propose une explicitation de l'improvisation organisationnelle par l'analyse des interactions. Nous avons identifié les spécificités des interactions qui composent l'improvisation organisationnelle lors d'une première analyse du terrain. L'ensemble de nos propositions théoriques sur l'improvisation est validé par notre étude empirique et d'autres études (Adrot, Garreau, 2010). Nos résultats permettent également d'enrichir le lien conceptuel entre les notions de *vide organisationnel* et l'improvisation organisationnelle. Enfin, les résultats illustrent également l'importance du rôle des genres de communication dans le développement de l'improvisation organisationnelle. D'un point de vue théorique nos résultats enrichissent les études actuelles sur l'improvisation en situation de crise. La littérature a mis en évidence que la difficulté des acteurs de développer un sens commun de l'urgence ou du moins une perception commune de la situation de crise (Roux-Dufort, Vidaillet, 2003a) pouvait compromettre l'émergence de l'improvisation. Nos résultats font écho à ces travaux et suggèrent que les genres de communication développés dans les organisations peuvent expliquer la difficulté des acteurs à interagir et développer un sens commun de l'improvisation.

Deuxièmement, notre recherche vise la compréhension des effets possibles des TIC sur l'improvisation organisationnelle, qui suscite encore un intérêt restreint dans le domaine des systèmes d'informations. Nous mettons en évidence que l'impact des TIC sur l'improvisation organisationnelle diffère d'un outil à un autre. De plus, il semble que l'évolutivité d'un genre de communication dépend du caractère virtuel ou matériel de la représentation des données par le média associé au genre de communication. Cependant cette hypothèse nécessite de plus amples recherches. Enfin nous proposons quelques recommandations à destination des managers pour gérer l'investissement technologique dédié à la réponse à crise et gérer les aspects de l'utilisation des TIC liés à l'improvisation de crise.

Enfin, notre travail suggère la nécessité d'enrichir le cadre conceptuel des théories du fit pour évaluer l'adéquation entre une technologie et les pratiques d'improvisation d'une organisation. Nous proposons que, pour évaluer l'adéquation d'une technologie, il faut prendre en compte le genre de communication comme caractéristique organisationnelle. L'opérationnalisation d'un tel construit requiert de plus amples recherches. Nos résultats suggèrent également qu'un genre de communication et l'utilisation d'une technologie peuvent évoluer au fil d'une crise. Nous en déduisons la nécessité d'une approche dynamique du fit technologique en fonction du développement de l'improvisation.

5.II. Quelques pistes de recherche

Tout d'abord, certains liens entre les TIC et l'improvisation organisationnelle en situation de crise nécessitent de plus amples recherches. Notre étude théorique ne nous a pas permis de mettre en évidence comment la technologie peut empêcher l'improvisation organisationnelle car plus d'éléments positifs que négatifs ressortaient des articles de l'échantillon. De même,

notre étude empirique se concentre sur les limites du genre de communication dépassionné sur l'improvisation organisationnelle en situation de crise. On pourrait par exemple imaginer que ce dernier permet aux acteurs de garder leur calme et de ne pas tomber dans l'écueil d'actions désespérées ou de la panique (Starbuck *et al.*, 1978).

De plus amples recherches permettraient de clarifier le lien entre le *vide organisationnel* et les genres de communication, ainsi l'effet de l'improvisation sur les genres de communication. Une étude approfondissant l'influence de l'improvisation sur les pratiques et les structures organisationnelle sur le long terme permettrait de faire le lien entre les notions ici explorées et d'autres concepts tels que l'innovation ou l'apprentissage organisationnel.

Research questions and document overview

Crisis has increasingly become a subject of extensive research for several years (Boin, Lagadec, 2000; Dayton, 2004; Pearson, Claire, 1998) and a major concern for managers, due to increasing organizational and technical complexity (Perrow, 1984) and the emergence of new unavoidable threats (Perrow, 2006). The contribution of ICT to crisis response has been discussed in an extensive manner for decades.

One can easily find vivid illustrations of the increasing ubiquity of technology in crisis response, which makes it necessary to refine our knowledge on ICT support to crisis response. Since the very beginning of the 21st century, ICTs have become accessible, on occasion free and easy-to-use means to communicate and interact during crisis response. Blogs that provide recommendations on how to participate in hurricane social networks[2] illustrate that point. As another example, Google Maps was extendedly used during the 2009 swine flu pandemic to mark and share knowledge about victims all over the world. The 2010 Haiti earthquake provided a vivid picture of technology's potential contribution to crisis response. As Daniel Stauffacher reports on his blog in 2010[3], platforms including SMS, Web and Mail content were leveraged just after the earthquake struck. The extensive use of social media and Web 2.0 demonstrates how the Internet gathers communities of citizens whose actions can significantly impact crisis response.

Undeniably planned procedures are useful during crisis response (Pearson *et al.*, 1997) but should be adjusted as necessary because every crisis is unique and prevention can never be completely adequate to the situation (Billings *et al.*, 1980; Waugh, Streib, 2006). More than ever, improvisation is a core dimension of crisis response (Joffre *et al.*, 2006; Roux-Dufort, Vidaillet, 2003b; Weick, 1993). There is no doubt that crisis response becomes more complex as it involves a wider range of means and actors whose action potentially deviates from the framework of established crisis response plans and procedures response (Kreps, Bosworth, 1993; Liu *et al.*, 2008; Palen *et al.*, 2007). In addition, technology significantly influences actors' tendency to improvise (Moorman, Miner, 1998a). Given such an evolution, further knowledge is required on improvisation in crisis response and its connection with technology.

Thanks to a substantive body of work, researchers have documented the cognitive and behavioral aspects of improvisation (Mendonça, Wallace, 2007; Webb, 2004; Weick, 1993). They have also proposed integrative definitions and conceptualizations of (Cunha *et al.*, 2003; Miner *et al.*, 2001; Moorman, Miner, 1998b). However, researchers can experience difficulties to cope with diversity in research on improvisation. First of all, improvisation has been studied in radically diverse settings, making it difficult to establish conceptual connections between findings. Additionally, the mystic aura of improvisation due to its

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[2] http://inventorspot.com/articles/ten_social_media_methods_fight_hurricane_season_31574
[3] *Daniel Stauffacher is Chairman of ICT4Peace Foundation. To read his post, please copy and paste this link : http://www.regards-citoyens.com/article-haiti-and-beyond-getting-it-right-in-crisis-information-management-by-daniel-stauffacher-49182141.html*

artistic echo (Mendonça *et al.*, 2010), contributes to the coexistence of divergent interpretations of the concept.

Regardless of the divergences between authors' understandings of improvisation, specific questions remain unanswered about crisis improvisation. Mendonça, Webb and Butts (2010), who provide a comprehensive review of the various aspects of improvisation in relation to crisis response posit the necessity to shed more light on the processes involved in crisis improvisation, such as crisis responders' interactions. Given the extemporaneity of improvisation, how do actors find time to adjust to each other? What information do they exchange to coordinate effectively? Are there critical factors of success regarding the interactions that compose organizational improvisation? Literature does provide insights on these questions (Chelariu *et al.*, 2002; Kamoche, Cunha, 2001; Weick, 1993, 2006; Weick, Roberts, 1993). However, researchers miss an integrative explanation of how crisis responders interact and use ICT when improvisation is needed. This dissertation is therefore designed to answer the following primary research question:

What support does Information and Communication Technology ((ICT)) offer organizational improvisation during crisis response?

To respond to the primary research question, we address the four following questions:

    I.   How to cope with diversity in research on improvisation?

    II.   What possibilities does ICT offer for organizational improvisation in crisis response?

    III.   Does ICT fit users' needs with respect to organizational improvisation during crisis response?

    IV.   How do users benefit (or not) from ICT when they improvise collectively in crisis response?

To respond to these research questions, we completed three studies. We address research question I in the first study. We rely on statistical techniques to confirm that research on improvisation is diverse. In addition we identify divergent academic perspectives on improvisation, which can help researchers to understand similarities and dissimilarities between studies on improvisation. We then respond to research question II from a theoretical standpoint. We suggest some ICT properties that potentially support organizational improvisation to occur in crisis response. Finally, we focus on a narrower aspect of technology and develop an in-depth analysis to respond to questions III and IV from an empirical perspective. We adopt a practice-based view of technology, as advocated by Orlikowski (1996), and focus on crisis responders' use of four technologies - the Internet, emails, faxes and phones – during the 2003 French heat wave crisis. We then put into perspective our theoretical and empirical findings to propose a final framework.

This document is divided into four parts. First we make a general presentation of our project (**part 1**). We then define the concepts we use and make some theoretical propositions (**part 2**). Then we present our empirical work (**part 3**). In the final part of the dissertation is our

conclusion. We present our final findings, discuss the implications of our work and propose new research perspectives (**part 4**).

The introductory part (part 1) presents our project globally. We first argue our motivation for this research (**chapter 1.1**). We then argue our choice for *interaction* as our unit of analysis, detail the research questions that direct our work and present an overview of the dissertation structure (**chapter 1.2**). Finally, we present our rationale for following pragmatist and realist principles in this work (**chapter 1.3**).

The theoretical part (part 2) presents our conceptual effort that was necessary to provide a minimum of clarity to our work. First, we present some basic theoretical assumptions we extracted from literature about crisis and crisis response in large-scale disasters (**chapter 2.1**). We then tackle diversity in research on improvisation so as to propose that 8 different academic perspectives on improvisation (**chapter 2.2**). The final chapter of the second part aims to research question II (**Chapter 2.3**). In this chapter, we first examine literature on improvisation to make theoretical propositions about the role that interactions play in organizational improvisation during crisis response. On the basis of these propositions, we review literature so as to uncover 6 ICT properties that could potentially support organizational improvisation in crisis response.

In the empirical part (part 3) we propose to go beyond the limits of our theoretical findings. We first describe the 2003 French heat wave crisis case and its response network (**Chapter 3.1**). Furthermore, we propose a research design to lead a qualitative and retrospective case study of the 2003 French heat wave crisis. (**Chapter 3.2**) presents our research design. Finally, in (**Chapter 3.3**) we respond to research questions III and IV by proposing an integrative framework in relation to ICT use during the 2003 French heat wave crisis response.

The final part of the dissertation (part 4) aims to put in perspective our theoretical and empirical findings. We first summarize the findings of each study. We then reflect on these findings and present avenues for future research.

Part 1. The dissertation basic features: Rationale, structure, ontology

This part is an introduction to our work and presents its basic features, the raison d'être and the structure of the dissertation, as well as the type of knowledge we intend to produce. This part is structured as follows:

Chapter 1.1 details our rationale for this dissertation work. The center of our interest can be represented as the union of three concepts: crisis response, organizational improvisation and communication technologies. Our research addresses ten managerial and theoretical issues that are related to each intersection between two or three of these concepts. In this chapter, we detail each concern as a motivation for our research.

Chapter 1.2 provides an overview of the structure of the dissertation. The dissertation is also articulated in three studies that address four research questions. Each study includes theoretical or empirical findings that we view valuable enough for publication.

Chapter 1.3 presents our ontological and epistemological position. We adopt a pragmatist approach to research in general. By doing so, we assume that the value of knowledge resides in its capacity to change practices. We therefore adopt a realist ontology and epistemology.

Chapter 1.1 Our rationale for this research

Introduction

This chapter aims at explaining our motivation to investigate the primary research question. We present the theoretical challenges and managerial needs that motivate our work.

The primary research question, entitled *"What support do ICTs bring to organizational improvisation in crisis response?"* corresponds to the union of three main concepts: crisis response, communication technologies and organizational improvisation. We primarily based the formulation of our motivation for this research project on some exploration of the literature and informal exchanges with experts.

By doing so, we identify managerial and theoretical concerns that our research is likely to address. We present them in the following order: from the most general to the most specific. For instance, we start by examining the need for further research on the concepts of crisis and improvisation. We then present more specific issues in relation to the interconnections between the three core themes of our research that we represent in Figure 13: crisis response, communication technologies and organizational improvisation.

Figure 13. Organizational crisis, ICT, organizational improvisation
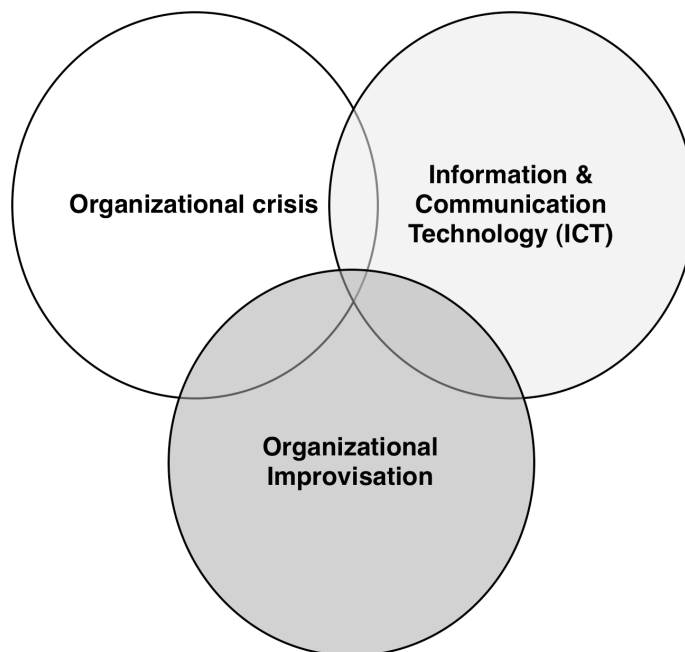
Our rationale for addressing managerial and theoretical challenges related to the primary research questions and its core concepts is twofold. First of all, it comes from our pragmatist posture (see chapter 1.3). Dewey (1908) argues that the relevance of scientific activities depends on its practical significance and therefore recommends anticipating how knowledge

production is likely to influence practice. Secondly, this reflection settles the boundaries of our research interest, which is an essential preliminary to any research (Mason, 2002).

The section is structured as described in the following paragraph and reported in Figure 14. First of all, we examine why additional research on crisis is needed (section 1). Secondly, we focus on ICT use during crisis response (section 2) and on the theoretical challenges related to organizational improvisation (section 3), particularly in the context of crisis (section 4). Then we will present the factors of a growing attention on the ties between improvisation and information technology from the MIS research community (section 5). Finally, we will justify our focus for the dissertation topic: organizational improvisation and ICT use for crisis response (section 6).

Figure 14. Managerial and theoretical motivations
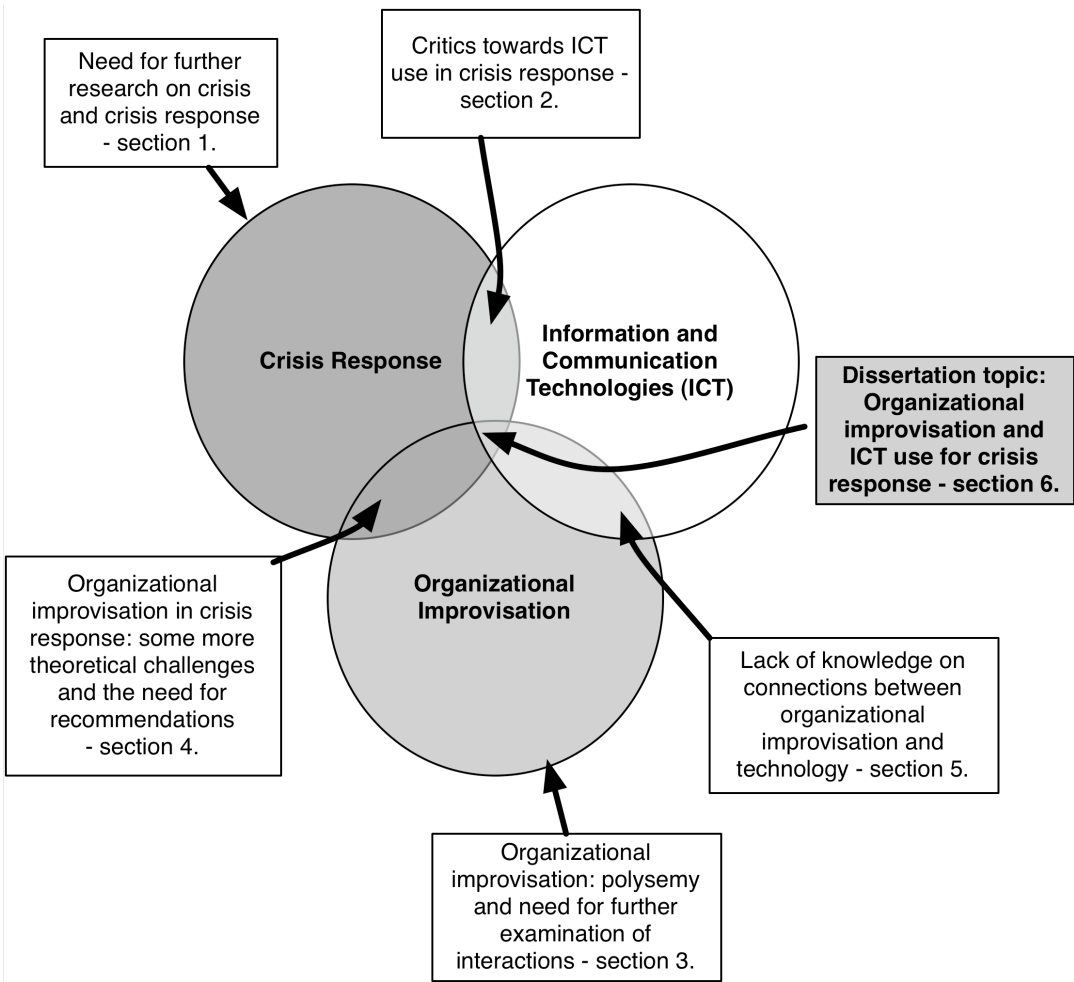
Section 1.   Needs for further research on crisis response

Growing environmental uncertainty and technological complexity make crisis more likely to occur (Perrow, 1984, 2006; Robert, Lajtha, 2002; Shrivastava, 1988). In the nineties, Richardson (1994) was already alerting that our society was *"increasingly becoming crisis-*

ridden". Similarly, Rosenthal and Kouzmine (1993) reported a governmental declaration that nations were *"at risk".* As a result, more attention to crisis preparation and crisis management is now required in organizations (Barnett, Pratt, 2000).

It is safe to assert that research on crisis is promoting new managerial practices and that its practical significance is developing. However research on crisis is facing major challenges (Quarantelli, 2000). From the theoretical perspective, the ongoing debates attest to the need for further research on the concept of crisis (Roux-Dufort, 2007). Research communities fall short of a unified conceptualization of crisis in spite of the considerable amount of work (Pauchant, Douville, 1993; Shrivastava, 1988). Futhermore new practical vulnerabilities emerge. Metropolitan areas are increasingly impacted and urban populations are not well suited for coping with disasters (Quarantelli, 2000). This means that practitioners are still lacking resources, techniques and recommendations to face crisis management challenges (Robert, Lajtha, 2002). Researchers need to address these challenges by exploring overlooked dimensions of crisis response, such as improvisation.

Section 2.   Some uncertainties about ICTs support to crisis response

ICT support to crisis response has been discussed already. In spite of extensive evidence that virtual communication is a necessity in crisis response, ICTs have been criticized for burdening coordination and information transmission (Comfort, 1993; Quarantelli, 1997) (Katz, Kahn, 1966; Quarantelli, 1988; Ren *et al.*, 2008). Therefore one can question the relevance of massive investing in infrastructures devoted to respond to turbulences and disruptions (Lin, Carley, 1997).

The crisis management literature reports at least six organizational functions, e.g. set of processes that rely on ICT use during crisis response. ICT allows crisis responders to build communicational bridges, by locating and tracking crisis responders on the field and providing updated information. For example, Geographic Information Systems (GIS) instantaneously provide information from distant locations. Content Management Systems are also extensively used to keep track of the experts and the other persons who should be contacted, which supports information and knowledge sharing. Recently, ad hoc usage of the Internet has enabled citizens to take part in crisis response and to collaborate by exchanging information, comments, photos and more (Liu *et al.*, 2008; Majchrzak *et al.*, 2007; Palen *et al.*, 2007). In addition, researchers are beginning to recognize the importance of researching on-line activities for decision making, including studies on information seeking behavior during the 9/11 attacks and Hurricane Katrina Blogs (Palen *et al.*, 2007; Palen, Liu, 2007b). Finally, ICTs help to resolve the problem of data accuracy that usually slows down crisis response (Chan *et al.*, 2004). They also maintain continuous and relevant contact by information sharing between groups who are only available virtually (Calloway, Keen, 1996; Mathew, 2005; Mork, 2002). Then, data centralization enables organization to keep in touch with experts, which helps to avoid over-simplistic decisions that could be disastrous (Carrel, 2005). Table 1 presents some organizational functions and ICT tools that are commonly used

in crisis response and Annex 1 provides some examples of ICT tools and undergoing projects related to these functions in crisis response.

Table 1. ICTs in crisis response

Function	Information Technologies	Most recent authors
Location and tracking	Geographic Information Systems	Comfort, Sungu, Johnson, Dunn (2001), Dawes et al., (2004).
	Geo-Collaborative tools (Geo-CSCW)	Cai, MacEachren, Brewer, McNeese, Sharma, Fuhrmann, (2005).
Risk identification and management	Threat assessment and management tools	Van de Walle, Rutkowski (2006)
	Simulation tools	Mendonça, Wallace (2004)
Coordinating and feedback	Multimodal data fusion tools	Fitrianie and colleagues (2007)
	Common operating picture tools	Landgren (2007)
	Internet response grid	Palen, Liu (2007a), Palen, Hiltz, Liu (2007), Jaeger *et al*. (2007), Majchrzak, Jarvenpaa, Hollingshead (2007).
	Collaborative virtual workplaces	Russo, Raposo, Fernando, Gattass, Karlsson (2006) Collins, Powell, Dunford, Mane, Martinez (2008).
	Adaptive ontologies	(Malizia *et al*., 2005) (Segev, 2008)
Decision making during response	Decision support systems (Edvardsson *et al*.)	Comfort (1993), Mendonça (2007), French Turoff, (2007), Carver, Turoff (2007).
	Intelligent Agents/Systems	Yuan, Detlor (2005)
Information and knowledge sharing	Shared databases	Larson, Metzger, Cahn (2006); Carver, Turoff (2007).
	Content Management Systems & Knowledge Systems	Collins *et al*. (2008).
	Emergency alerting & alert notification tools	(Van de Walle, Turoff, 2007)
External communication	Internet	Perry, Taylor, Doerfel (2003)

However, existing discourse about crisis response occasionally conveys a deceptively simple image of ICT use. A more realistic and integrative explanation of ICT support is still needed due to this simplistic picture. For example, ICTs have been generally depicted as a means for organizations to learn how to respond intelligently when threats put organizational functioning in danger. However, this view assumes the existence of specific skills for an effective use of technologies in crisis (Nunamaker Jr *et al.,* 1989), which do not always exist

in the real world. Practically speaking, technology is problematic in that some users tend to rely on it to provide solutions rather than on their own competencies and good sense. In such cases, technology finally alters the organizational resilience that we corresponds to the organization's ability to deal with its vulnerabilities (McManus, 2008).

Other criticism targets technology functionalities and characteristics. In fact, some of them may obstruct crisis response given users' practices (Dawes *et al.*, 2004; Fischer Iii, 1996). For example, many-to-many communication, which is a core functionality of technology (Quarantelli, 1997), may require that users permanently stay connected to each other during crisis. Such a constraint may slow down local action (Jaeger *et al.*, 2007). Likewise, this functionality also creates a dependence on technology that may be risky: lack of data or loss of access to information can bewilder organizations during a crisis (Hutchins, 1991). Another criticism targets ICT design. In times of emotional distress and time constraints, technological tools do not represent information in the most appropriate way. For instance, immediate feedback from a distant location can serve as a support to coordination during disasters but it also means actors will have to deal with large amounts of information without enough time to filter it, jeopardizing crisis response due to information overload (Hiltz, Turoff, 1985). ICT does not facilitate reflection on alternative inputs and processes that may be necessary to respond to a crisis (Mendonça *et al.*, 2004a; Quarantelli, 1988; Suchman, 2007). ICTs may also fail at providing an appropriate representation of information exchanges, which may puzzle users individuals who have to assume ad hoc responsibilities and tasks in disasters (Mendonça, 2007).

Support from ICTs to crisis response is not fully explained and therefore uncertain. In addition, because of our lack of knowledge on how and why technology supports or constrains crisis response, managers lack guidelines on proper practice. Given the importance of information in modern organizations, managers need a clear outlook on potential technological fallouts associated with crisis response. For managers, this implies the need for practical guidelines to avoid technological pitfalls and to improve information management in crisis response. From a theoretical standpoint, it promotes more reflection on what makes ICT an obstacle for crisis response.

Section 3.   Organizational improvisation: some theoretical challenges

The concept of improvisation is progressively attracting researchers from various fields such as MIS, marketing, entrapreneurial activities and human resources. There have been various approaches to this concept. For example, improvisation has been seen as a cognitive process that involves spontaneity, creativity and intuition (Vera, Crossan, 2004). Improvisation has also been conceptualized as problem solving in various circumstances, such as product innovation (Moorman, Miner, 1998b) and strategy formulation in a high velocity environment (Brown, Eisenhardt, 1997).

Researchers have led great efforts to define improvisation. Cunha, Cunha and Kamoche have classified more than one hundred papers that use the concept of improvisation (1999c).

Similarly Moorman and Miner shed light on the concept of organizational improvisation by defining a measurement scale of organizational improvisation (1998a). Mendonça and Wallace, on their side, have provided theoretical foundations for computerized simulation and support to the cognitive phenomena that entails improvisation (2007).

Although these authors have provided significant insights on organizational improvisation, they fall short of details on the dynamics underlying its development. By relying on an incomplete conceptualization of improvisation researchers risk providing over-simplified and unreliable recommendations to managers, impeding organizational efforts to improvise successfully (Gauthereau, Hollnagel, 2005; Vera, Crossan, 2005). More information is needed on individuals' participating in improvisation. In particular, interaction is a crucial dimension of organizational improvisation that requires further investigation. Both the content and the nature of interactions between improvisers remain unclear. The literature on crisis response has partially addressed this issue. Weick (1993) and Ciborra (1996b) present the Mann Gulch disaster as a vivid example of the irreversible consequences of miscommunication during improvisation. As everyone's astonishment when Dodge lit a fire illustrates, improvisers can disconcert their colleagues by their apparent behavior, all the more in critical situations where emotional and time pressures are at their climax. Researchers have provided additional insights on individuals' ability to share their intuition and moods (Ciborra, 1999) and to develop a collective mind (Weick, Roberts, 1993). However, theories that mention the importance of interactions between improvisers fail at opening the "black box" of interactions and at providing an integrative view on interactions and their role in improvisation. The need to determine what interactions do or do not occur during improvisation and whether interactions are specific or similar to any other process in organizations still exists.

Finally, improvisation remains conceptually challenging in that it provides divergent meanings. Even though some authors view improvisation as an alternative to planning, some others conceive it as a complementary approach. For this reason, further study is required on improvisation as not only an interactive process, but also as a polysemous concept.

Section 4.   *The rationale for studying improvisation in crisis response*

From a practical perspective, it is necessary for managers to prepare for crisis improvisation. Contrasting with this need, managers are reluctant to mindfully monitor improvisation or even admit improvisation might occur within their organization. Most of the time, such a lack of awareness makes the perception of improvisation retrospective (Weick, 1993). Consequently, it prevents managers from effectively reacting to the ongoing improvisation in crisis response.

From a theoretical perspective, studying improvisation in crisis settings is an opportunity to develop knowledge on improvisation. As Roux-Dufort explains (2007), crisis exposes organizations to extreme situations in which uncertainty, emotional pressure and time constraints are higher, which provides the opportunity to observe some organizational phenomena more easily: "*In organizational studies, crisis usually serves as an amplification chamber for research*" (Starbuck, Farjoun, 2002, cited by Roux-Dufort, 2007). That being said, one cannot directly extrapolate the findings from an observation of a specific crisis response to any routine context.

While, researchers have commonly admitted improvisation refers to a unique phenomenon, they also depict crisis improvisation and routine improvisation as similar phenomena. In crisis response, improvisation seems to be triggered by contingency and actors are compelled to improvise. Conversely, actors seem to have the choice to improvise in routine. Improvisation emerges as an endogenous deviation from established patterns of actions. However the specificities of crisis improvisation require further investigation.

Finally, it is necessary to discern the benefits of improvisational behavior from its fallouts. The Mann Gulch disaster illustrates how a single improvisation can have both positive and negative outcomes. Dodge's survival proves that actors can experience improvisation in an overall positive manner. However Dodge's colleagues were disturbed by his improvisation and were killed by the fire. This dissertation addresses the first of the conceptual ties mentioned above: the factors of improvisation in crisis response.

Section 5.   *The IS researchers' perspective on improvisation*

Organizations' likelihood to improvise increases with information flows (Chelariu *et al.*, 2002). However research on ICT and improvisation remains scarce.

In the last decades, there have been calls for more attention in the MIS field on unexplored concepts such as improvisation. Nowadays, researchers have been increasingly turning to concepts of emergence and improvisation to explain new ways of organizing and using technology (Orlikowski, 1996; Orlikowski, Hofman, 1997). However the fundamental role of technology in daily reality, such as in Internet use, has been overlooked. Researchers have focused on system methodologies and designs such as CASE tools, BPR and CMM because they are easier to conceptualize (Ciborra, Hanseth, 1998). On the contrary, daily life is full of bricolage, improvisation, or serendipity (Latour, 2004). Even though these themes have been neglected, they are core components of individual and collective action and therefore highly

significant for research in MIS fields. There is the need for IS research to focus its attention on notions such as improvisation even if these notions are difficult to conceptualize and observe.

At the same time, organizations are currently experiencing changes that make improvisation an even more relevant topic. Improvisation is increasingly necessary for managers because of a higher level of environmental complexity, uncertainty (Vera, Crossan, 2005) and velocity (Brown, Eisenhardt, 1997). The widespread access to technology has created additional opportunities for improvisation (Moorman, Miner, 1998a). First of all, organizations have to improvise when technological designs are inadequate to their needs and processes. Users are likely to develop new practices to adapt to information systems that do not meet their needs (Heeks, 2002b). Secondly, by providing direct access to informational resources, technology provides more autonomy for decision makers and encourages them to develop ideas more extemporaneously (McKnight, Bontis, 2002; Moorman, Miner, 1998a). However, we wonder whether technology generates improvisation or not.

Organizations are more likely to improvise and information software development should take this trend into account (Dyba, 2000). Because ICT projects are an important investment, the lack of support from technology to improvisation is problematic. Managers need to evaluate how much a certain infrastructure is likely to support improvisation. This requires a better understanding of the possible tensions between the need to improvise and ICT characteristics, and also of how people use ICTs when they improvise. Understanding why and how people improvise when using technology will also help to reduce the risk of systems failures in the future (Heeks, 2006). This understanding is all the more applicable when the players and the stakes are human, like in crisis. In this dissertation we address the questions related to the dynamics of ICT use and improvisation.

Section 6.   The Dissertation topic: ICTs and organizational improvisation during crisis

We have identified four key issues related to the connection between technology and improvisation in crisis response.

First of all, there is a developing reflection on ICT requirements for collective improvisation during crisis. How should we design our technology to better support improvisation in crisis response? It is true that the use of inadequate tools may have disastrous effects on crisis response. There are few authors addressing this issue. Mendonça (2007) emphasized the lack of technological fit to the need for improvisation in emergency response, which currently leads to some reflection on ICT design. Managers need adequate interfaces to remain resilient in crisis response.

This leads us to the second question with respect to ICTs and crisis improvisation. How do improvisers use technologies and do they use them in a beneficial way for improvisation? This question is less normative than the first but commonly reveals the need for analyzing

how people concretely use ICT during improvisation. We address this point within this dissertation.

The third question focuses on improvisation that is required due to the lack of fit between ICTs and improvisation in crisis response. Orlikowski (1996) developed her first thoughts on this subject in 1996 by acknowledging that users improvise when they use technology. Dawes, Cresswell, and Cahan (2004) explain how crisis responders make do without the appropriate information format. ICT use may imply improvisation and bricolage (Ciborra, 1996b; Pawlowski *et al.*, 2004), which is particularly true in crisis situations. Managers need recommendations to guide users in their improvised use of technology.

Finally, the fourth question addresses the influence of ICT on improvisation. How does using technology influence crisis response? In particular, does it affect the odds for improvisation? Does it affect the probability of success for improvisation? Is improvisation more frequent in organizations that have access to ICT for crisis response? So far, there is no evidence of how ICT organizational improvisation in critical situations. Responding to that question requires a preliminary analysis of the nature of the use of ICT during organizational improvisation for crisis response. We directly address this issue in this dissertation.

Conclusion

Table 2 gathers the key issues that we have identified so far. Each line summarizes key issues, pending managerial needs and theoretical challenges that we detailed in each section. We intend to respond to some of the listed key issues. Others are only partially addressed or not addressed at all.

Table 2. Key issues that we address (or not) in the dissertation

Key Issue	Managerial needs	Theoretical Challenges	Is it addressed by our work?
Crises become more and more frequent (Section 1)	To multiply potential techniques and resources to face crises (Perrow, 2006)	1. The need for a unified definition of crisis. 2. The need to develop our knowledge on some unexplored aspects of crisis response such as improvisation.	Managerial needs: Yes, by providing guidelines and definitions of crisis improvisation
			Theoretical challenge 1: No
			Theoretical challenge 2: Yes.
ICT can burden crisis response or at least reduce organizational resilience (Section 2)	1. To evaluate the relevance of ICT investment to prepare for crisis response 2. To develop practices to properly manage ICT and avoid technological pitfalls during crisis response	The need to report what makes ICT become an obstacle to crisis response	Managerial Need 1: Partially, by identifying ICT characteristics that are likely to influence organizational improvisation during crisis response.
			Managerial need 2: Partially, by identifying patterns of ICT use during crisis response (see part 3).

			Theoretical challenge: Yes, by analyzing ICT use dynamics and effects on crisis improvisation.
Managers remain skeptical about improvisation (Section 3).	Guidelines about how to figure and manage improvisation.	1. There is the challenge address the limitations of the theories on improvisation 2. The need to develop an integrative view of interactions that occur during organizational improvisation	Manager needs: Yes.
			Theoretical challenge 1: Yes, by studying improvisation in critical settings.
			Theoretical challenge 2: Yes, by studying improvisation in critical settings.
There is no evidence of improvisation being beneficial or not to crisis response (Section 4).	A representation of improvisation and its in and outs. Managers are reluctant to mindfully monitor or admit improvisation in crisis response, even if improvisation is not a matter of choice.	1. There is little explanation of the occurrence of improvisation in critical settings 2. No evidence that crisis improvisation is significantly similar to routine improvisation 3. Lack of knowledge on the benefits of improvisation.	Manager needs: No.
			Theoretical challenge 1: Partially. We analyze how ICT use influences organizational improvisation occurrence in crisis response.
			Theoretical challenge 2: No.
			Theoretical challenge 3: No.
But ICT support to improvisation is not established. (Section 5)	1. Guidelines to manage tensions between improvisation requirements and ICT infrastructure. 2. The need to evaluate the ability of a technology to support improvisation before	1. Understanding how people use ICT when they improvise 2. How does ICT use affect improvisation?	Managers need 1: Partially.
			Managers need 2: Partially, by defining technological characteristics

	investing.		that support organizational improvisation in crisis response.
			Theoretical need 1: Yes. It is a core question in our empirical investigation
			Theoretical need 2: Yes.
There is scarce knowledge on IT and improvisation in crisis response. (Section 6).	1. The need for an adequate design for improvisation and resilience in crisis response 2. The need for recommendations to guide users in their improvised use of ICT 3. The need for guidelines to use ICT in a beneficial way when improvisation is required	1. What would be a good design for improvisation in crisis response? 2. The need to better understand the nature of ICT use during organizational improvisation 3. Understanding how ICT use affects improvisation 4. The need to assess ICT fit to crisis improvisation	Managerial need 1: No.
			Managerial need 2: Yes.
			Managerial need 3: Yes.
			Theoretical challenge 1: No
			Theoretical challenge 2: Yes.
			Theoretical challenge 3: Yes.

Annex

In this annex we present an overview of some ICT tools that are commonly used or developed in crisis management. Numerous ICT projects are being developed. For this reason, we describe 3 projects that represent a infinitely small proportion of the ongoing work on ICT and crisis response.

Ushahidi (http://www.ushahidi.com/) is a web interface that enables citizens to view and exchange information about crisis situations in diverse countries through sms, email or webforms. It was initially developed to gather information after the post-election violence in Kenya but it is now used in other countries such as Congo, South Africa, and Mexico. Ushahidi relies on graphical representation of information with colours to distinguish sources of danger.
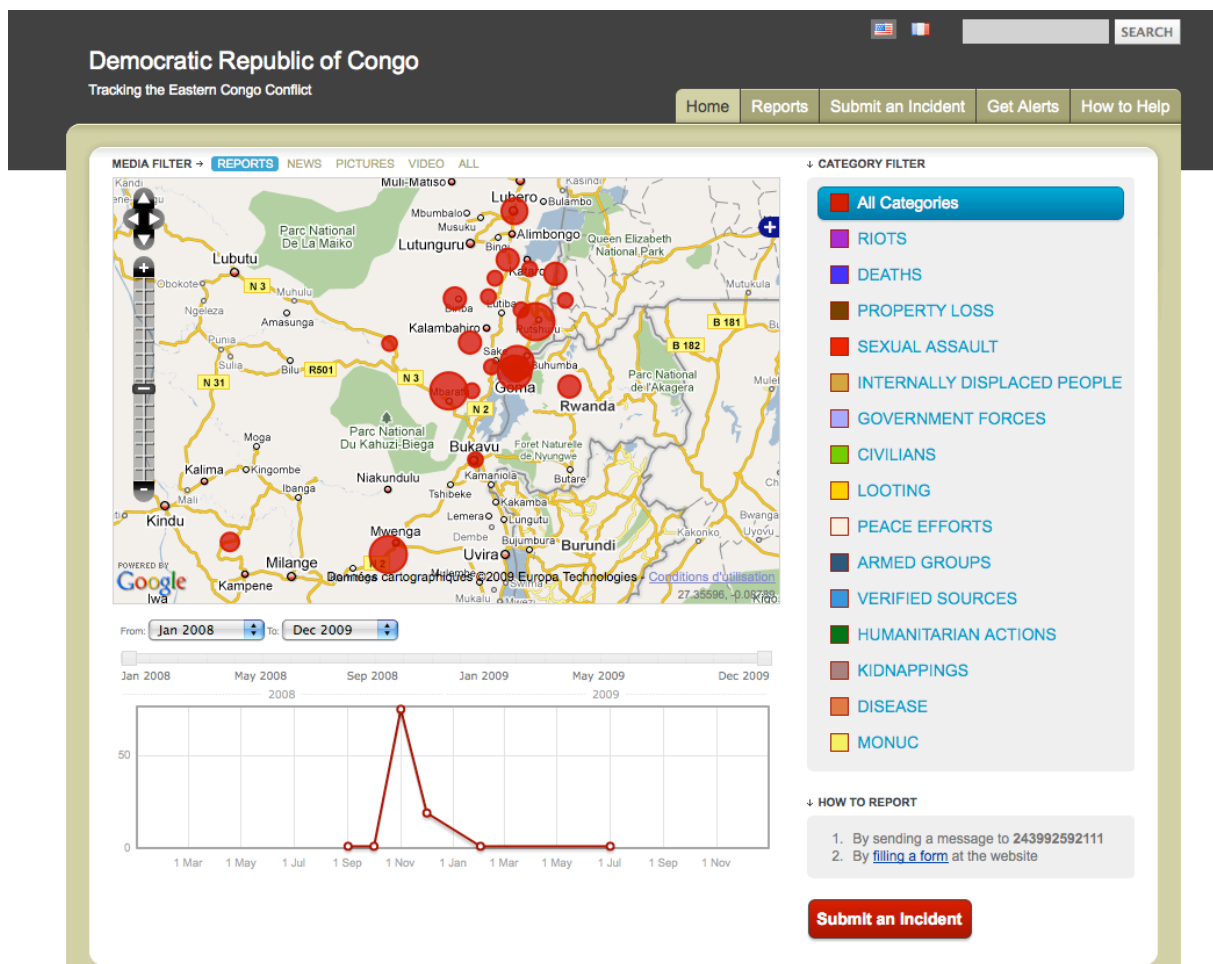
Figure 15. Ushaidi Screenshot

Ushahidi enables users to send alerts and receive alerts, which guarrantees communication between persons in need and those who detain real-time information. The interface to send alerts is presented in Figure 15.

INSTEDD Geo Chat enables mobile phone users to exchange information when the situation is critical. Therefore, crisis responders coordinate with their colleagues by identifying the other users' location and activities. InSTEDD functionalities are represented in Figure 16.

Figure 16. InSTEDD screenshot

OCHA enables crisis managers and watchers to exchange all sorts of documents. It targets humanitarian organizations and aims to support communication and collaboration between national and international actors to "alleviate human suffering in disasters and emergencies" as well "facilitate sustainable solutions"(http://ochaonline.un.org). OCHA is represented in Figure 17.

Figure 17. OCHA Screenshot

Chapter 1.2 Four questions and three papers: Our rationale for the structure of the dissertation

Introduction

As a reminder, we started our dissertation project with the following research question in mind: *"What support does ICT offer to organizational improvisation in crisis response?"*

Because this research question is broad, we clarify the three topics that we address in the dissertation: i) crisis response, ii) organizational improvisation and iii) Information and Communication Technologies (ICTs).

First of all, divergent conceptualizations of organizational crisis and crisis response coexist. Therefore we detail our understanding of these concepts and we specify the type of crisis response we investigate in chapter 2.1.

Secondly, the management literature on improvisation appears diverse at first glance. Authors report various examples improvisation. In addition, they analyze improvisation from distinct perspectives. However, scholars who investigate the concept of improvisation can experience difficulties in making sense of such diversity and in contributing to knowledge building on this concept. As a result, our investigation on ICT support to organizational improvisation in crisis response requires that we preliminary address research question I entitled *"How to cope with diversity in research on improvisation?"* in chapter 2.2.

Finally, Orlikowski and Iacono claim the need to reflect on what ICT consists of when starting a research in the MIS field (2001). First of all, the lack of definition of technology threats the relevance of MIS research (Orlikowski, Iacono, 2001) by making researchers miss crucial details for a thorough analysis (Latour, 2004). Secondly, technology is a single term that covers a plethora of tools and usages, from the use of databases for transversal coordination to the use of Web 2.0 and social media. A quick glance at the latest disasters unveils that both improvisation and ICT use can refer to distinct situations. For instance, Iranian citizens spontaneously used twitter to deliver fresh street level information during mass protest in June 2009[4]. In the case of Twitter use during the 2009 Iranian mass protest, improvisation related to an unexpected and innovative use of an ICT tool. The international response in the aftermath of the 2010 Haiti earthquake[5] provides another example of ICT use for crisis improvisation. As described by journalists, crisis responders needed ICT to communicate their needs to manage improvised ad hoc solutions. This case significantly differs from Twitter use in Iran: Technology was not the object of improvisation but supported coordination between improvisers. As a journalist described:

"One member of the International Federation of Red Cross (IFRC) assessment teams stopped at several to eyeball the situation and talk with the locals. Clipboard in hand, he jotted down

---

[4] http://www.time.com/time/world/article/0,8599,1905125,00.html
[5] http://www.wired.com/magazine/2010/04/ff_haiti/all/1

key indicators like access to water, numbers of children, availability of improvised shelter materials, and whether any other aid outfits had already been there. He snapped the occasional digital photo to augment the reports and logged the location of each camp with a GPS unit — critical in places like Haiti where there never were many street addresses to begin with. Back at base camp, his findings would be added to those of other assessment teams, along with information from media reports and other sources, in an ever-growing database."

Therefore, the objective of this chapter is twofold. First we present the four research questions that were developed from our primary research question e.g. the generic question of technology support to organizational improvisation. Second we explain how each study responds to the research questions. By doing so, we detail how the dissertation project is articulated.

This chapter is structured as follows: In Section 1 defines the dimensions of ICT and ICT support that we retain in this dissertation project. In Section 2 we argue the relevance of using interaction as a unit of analysis to lead a thorough examination of crisis improvisation and its linkages with technology. In Section 3 we present an overview of the dissertation questions and how they relate to each other. Finally Section 4 presents each of the three studies and how they address the four research questions.

Section 1.   Our rationale for the dissertation structure

1.I. Three perspectives on ICT

We identify three perspectives on ICT in the literature. We rely on these perspectives to respond to the primary research question.

At first glance, ICT can be examined as a collection of socially recognized properties. Orlikowski and Iacono define the technology artifact in the following manner (2001): *"those bundles of material and cultural properties packaged in some socially recognizable from such as hardware and/or software"*. In this vein, some studies focus on the common features of ICTs and their impacts on organizations. In this kind of work, authors develop an overall analysis of ICT. Not only do these authors adopt a generic view of ICTs but they also analyze the influence of technology at the organizational or societal level. For instance, Henderson and Venkatraman argue that organizations need to adapt their ICT infrastructures to their strategies to increase performance (1993). Similarly significant amount of studies explore the mechanisms by which technology supports the development of new capabilities (Pavlou *et al.*, 2004). A generic view of ICT impact on organizations exists in crisis management literature as well. For instance, Quarantelli questions the problematic aspects of technology at a general level (1997, 2007). He explains how easy replicating and exchanging information are, therefore provoking information overloads that can burden crisis response.

A generic view of technology is valuable to discuss the relevance of ICT investments and implementation. However, including the users' contingency into analysis enables researchers to expand their scope of inquiry to some practical dimensions of ICT (Orlikowski, 1992). ICT

Simon (1996) defines the artifact as a "meeting point" between an inner environment, "the substance and the organization of the artifact itself" and an outer environment. Therefore an alternate approach consists of examining ICT as a set of interaction between a system of computerized services and the user. This approach aims to assessing whether technology responds to its users' needs. A significant amount of theories follows that approach, such as technological fit theories (Goodhue, Thompson, 1995; Mathieson, Keil, 1998; Rice, 1992) and the technological affordances (Gaver, 1991). These studies explore ICT at a more specific level of analysis than the first approach. They usually take into account a specific service ICT offers, such as risk assessing, decision-making or even communication. In addition, they focus on a specific set of organizational processes, usually the ones that rely on the ICT services. For instance, Massey and Montoya-Weiss focus on knowledge conversion in organizations and how several technological tools participate in knowledge conversion (2006). A considerably high amount of work in MIS research focuses on specific services that can be rendered by technology. For instance, Markus and her colleagues designed the Top Modeler tool to support emergent knowledge processes (Markus *et al.*, 2002). Finally, these studies take into account the users' perception of technology. For instance the TAM theory focuses on the technology easiness of use and its users' perception of the technology usefulness (Davis, 1989).

Finally, the practice-based view provides additional insights on the relationship between ICT and its users. Technology is ever-present in daily life, therefore deeply influencing social systems (Orlikowski, 2007). For example, widespread daily access to Internet played a crucial role in the spontaneous development of information and support websites used during the response to Katrina (Palen et al., 2007). In addition, ICT services are shaped by organizational processes (DeSanctis, Poole, 1994; Masino, Zamarian, 2003). For instance, Katrina crisis responders' customized their use of Google Maps on the basis of their informational needs for evacuation. By doing so, the crisis responders could benefit from the program, using information that was useful to rescue victims such as the damages and the number of victims. In other words, the uses and consequences of ICT emerge unpredictably from complex social interaction (Markus, Robey, 1988; Orlikowski, Robey, 1991). For this reason, studies that follow the practice-based view of technology focus on users and the organizational context of ICT use. To do so, these studies analyze ICT by observing groups of users' practices in relation to a specific ICT tools. For instance, the improvisational model of technology practices emerged from the observation of the daily use of Lotus Notes technology in a customer support department (Orlikowski, 1996). Table 3 presents the three perspectives on ICT presented here in and their corresponding levels of analysis.

Table 3. Focus on technology and users

Perspective on ICT	Level of analysis	Description	Example(s) of theories
ICTs from a general stance	Organizations IS infrastructure ICTs	Researchers focus on ICT generic properties and evaluate their effects on users and organizations	Alignment theory (Henderson, Venkatraman, 1993)
Interactive view of ICTs and users	Set of ICT tools with common characteristics Specific set of tasks or processes	Researchers take into consideration both ICT tools characteristics and user's tasks.	TAM theory (Davis, 1989) IT appropriateness theory (Zigurs, Buckland, 1998) IT affordance (Gaver, 1991) The media richness theory (Daft *et al.*, 1987)
Practice-based view of ICT	Users of a specific ICT tool.	Researchers analyze ICT users' practices	The improvisational model of technology practices (Orlikowski, Hofman, 1997) The Adaptive structuration theory (DeSanctis, Poole, 1994)

1.II. ICT Support in crisis response

Directly applying the three perspectives on technology, we propose three definitions of the notion of ICT *support*. Even though the term "support" remains vague, referring to something that provides assistance or that enables specific processes, existing research refers to specific aspects of support. First as the possibilities offered by technology for crisis response, as the fit between technology's features and crisis responders' needs, and finally as the actors' leveraging of technology for improvising. We detail each of them below and in Table 4.

First of all, some authors focus on the technology's primary function of enabling people to communicate during crisis response. These authors analyze ICT support by exploring the overall possibilities offered by technologies to crisis responder. By doing so, they explore the influence of generic features of ICT on crisis response. For instance, some researchers report how social media enable crucial communication between distant locations, either between victims or between responding organization and experts (For-mukwai, 2010).

Secondly, other authors explore the fit between ICT characteristics and crisis responder's specific needs regarding their interactions. This approach consists of comparing the design of a specific service provided ICT with its effective use in crisis response. In other terms, this approach consists of addressing the following question: *Does ICT fit the users' needs and tasks?*

Finally, a third approach to ICT support focuses on how users practically take advantage of technology to complete their tasks. In relation to ICT support, this approach addresses the following question: *How do users leverage ICT as a resource to complete organizational processes?*

Table 4. Our understanding of ICT support

Perspective on ICT	Focus	Definition of ICT support
Generic perspective on ICT	Organizations ICT at large	Possibilities offered by ICT to organizations
Interactive view of ICT and users	A service provided by ICT The needs of a group of users	There is a good fit between the design of the services provided by ICT and the users' needs
A practice based approach	A group of users One or several ICT tools	Users practically take advantage of ICT to complete their tasks effectively

Section 2.   Interactions as unit of analysis: Our rationale

Interaction is a core component of organizational improvisation but has been overlooked. For this reason, we argue that interaction is a relevant unit of analysis for our study. Our rationale is double.

2.I. What is an interaction?

The notion of interaction has been widely used for research instrumentation but has been scarcely defined. To introduce our rationale, we propose to set the definition of what is an interaction.

Actually, one needs to explore the cybernetics and the psychology literature to know more about what is an interaction. In his work on schismogenesis in the "Iatmul" tribe (in New-Guinea), Bateson (1935) describes how relationships between individuals evolve over time. Depending on how individual A reacts to individual B and how B reacts to A's reaction to B, A and B may enter into conflict. Such a sequence of mutual adjustments to each other's communications and actions constitutes an interaction (Watzlawick *et al.*, 1967). Existing definitions of interaction are consistent with Bateson's work. For Ruesch and Bateson (1951), an interaction can be depicted as an intricate sequence of intertwined individual and collective reactions. Newcomb, Turner and Converse (1965), as well, define interaction as a sequence of behavioral patterns from individuals who react to each other. In that sense, an interaction can be observed through a succession of interdependent actions from two or more individuals (Hare *et al.*, 1965; Newcomb *et al.*, 1970). Such definitions mirror the etymologic origin of the word. Interaction literally means between (inter) actions (Tyndall, 1867 – etymologic dictionary). However, as we suggested here in, an interaction includes a great deal of

communication. Rather, interaction can be viewed as a process that includes actions, reactions, and communication (Bales, 1950).

Communication is a core component of interaction but radically differs in that it consists of an exchange of information X between two sources A and B (Newcomb, 1953; Ruesch, Bateson, 1951) that may be influenced by the interlocutors' actions. As Figure 18 illustrates, the concept of communication corresponds to verbal and non-verbal signs between A and B: A talks to B but also expresses affects through gesture and face expression. In return, B transmits some response to A. As Bales (1950) explains, communication is both an ingredient for and an achievement from interactions.

Finally, interaction is systemic and refers to a complex set of actors and events in time and space (Watzlawick *et al.*, 1967). Not only do A and B react to each other, but they are also embedded in a complex set of mutual adjustments (Goffman, 1967, 1970).

In other words, an interaction is situated, which means its observation should not be restricted to a sum of bilateral exchanges but rather understood in its complexity (Goffman, 1967, 1974; Watzlawick *et al.*, 1967).

The literature has suggested a general definition of an interaction that refers to a complex and dynamic set of exchanges between actors and events. Such a broad definition seems correct enough and highlights how an interaction inherently shapes the course of action. We therefore define an interindividual interaction as the sequence of communications between several individuals that enable or make them change their actions accordingly". Definitions of interactions remain abstract. For this reason, this research hinges on Bales's work to identify interactions (1950). To study, observe and analyze an interaction, we view it necessary to refer to a specific list of possible interactions, as suggested by Bales. Describing an interaction as a process, Bales (1950) places the emphasis on the meaning of each communication that composes interaction. By doing so, he presents 12 categories of interactions that are divided in four main groups and complementary by pairs. Figure 18 represents these interactions.

Social emotional area: Positive Reactions	1. Shows solidarity:raises other's status, gives help, reward	
	2. Shows tension release: jokes, laughs, shows satisfaction	
	3. Agrees: Shows passive acceptance, understands, onours, complies	
Task area: Attempted Answers	4. Gives suggestion: direction, implying autonomy for the others	
	5. Gives opinion: evaluation, analysis, expresses feelings, wish	
	6. Gives orientation: information, repearts, clarifies, confirms	
Task area: Questions	7. Asks for orientation: information, repetition, confirmation	
	8. Asks for opinion: evaluation, analysis, expression of feelings	
	9. Asks for suggestion: direction, possible ways of action	
Social emotional area: Negative Reactions	10.Disagrees: shows passive rejection, formality, witholds help	
	11.Shows tension: asks for help, withdraws out of field	
	12.Shows antagonism: deflates other's status, defends or asserts self	

Figure 18. Interaction categories, Bales (1950)

Task area interactions significantly differ from socio-emotional area interactions. While the former gathers questions and answers related to a specific problem or task that the interaction is related to, the latter refers to negative and positive emotional and social reactions. Bales's categories well match to the context of our research.

Many authors have emphasized the importance of interactions in collective life. As suggested by the notion of symbolic interactionism (Mead, 1934), individuals adapt their actions on the basis of their social interactions Furthermore, meanings are handled and modified through an interactive process (Blumer, 1986). Such a view is consistent with the pragmatist posture (Strauss, Corbin, 2008) that we follow throughout the dissertation.

Arguments supporting the importance of interactions can be found in French sociology. Not only do interactions influence individual development but they are a core component of social life (Piaget, 1977). Finally, research on organization underscores the importance of interaction. For Weick (2001b), interactions support good coordination. In this sense, observing interactions is a way to provide rich insight on how actors dynamically understand and adjust to each other. In the coming section, we will argue the importance of interactions in crisis response and crisis improvisation.

2.II. The importance of interactions in crisis response and crisis improvisation

Generally speaking, coordination is not only the result of task programming (Van de Ven (Faraj, Sproull, 2000; Mintzberg, 1996; Van de Ven *et al.*, 1976) but also of interactions between co-workers. Interactions, notably information feedback loops (March, Simon, 1958), enable mutual adjustments (Mintzberg, 1996) especially in critical situations (Dynes, Quarantelli, 1976). As Espinosa Lerch and Kraut (2002) explain, interactions indirectly influence coordination by four processes: the emergence of common mental frames (Espinosa *et al.*, 2002) team situation awareness (Weick, Sutcliffe, 2001), transactive memory (Brandon, Hollingshead, 2004; Wegner, 1987) and collective mind (Weick, Roberts, 1993).

Depending on how people interact with each other, resources are allocated and distributed. Thus the perspective of having reliable interactions with collaborators during crisis response is necessary to maintain trust, good collaboration within the whole organization (Comfort, 2007; Mishra, 1996; Webb, 1996). Effective interactions also prevent misunderstandings that are frequent when actors involved in crisis response are diverse. From public organizations and officials, to non-profit organizations and citizens, the response to Katrina included more than 265 different entities (Comfort, 2007). Effective interaction between actors is also important because collective mindfulness, resilience and extra-activities are needed during response (Weick, Sutcliffe, 2001). An interaction is likely to influence people coordinating with and adjusting to each other, and finally their participating in crisis response (Comfort, 2007).

While effective communication can support crisis response, ineffective communication can lead to misunderstandings and inaction. For example, in the Mann Gulch Disaster actors experienced problems interacting, which contributed to their isolation and their decisions made in despair (Ciborra, 1996b; Weick, 1993). Additional examples include the Bhopal disaster, during which the incomplete transfer of information between the experts and the police service led to the death of thousands of people (Shrivastava, 1987). Interactions become all the more delicate as the number of stakeholders in crisis response increases. Following the 9/11 attacks, a massive group of citizen volunteers arrived on the location of the incident, slowing down the emergency units' work. In spite of their good intentions, the volunteers required care and preparation and interacted more emotionally than professionally (Dawes *et al.*, 2004). More interactions have the potential to burden crisis response, which explains why more managerial recommendations on how to manage interactions during crisis response are needed.

In the context of crisis improvisation, interactions are more important than ever (Ciborra, 1996b; Montuori, 2003; Weick, 1993). One could argue that improvising is simpler than struggling to follow procedures. However improvising adds complexity to interaction in crisis response, especially in relation to interactions. Through interaction, actors construct a common narrative of past activities (Brown, Duguid, 1991). If deviation from established patterns of action exists, then the interaction is more likely to either be ambiguous or happen either too late or too early for synchronization. For instance, nurses were spontaneously

contacted at unscheduled hours during the 2003 French Heat Wave. They had to make the effort of coordinating accordingly.

2.III.   Interaction: a convenient unit of analysis to observe ICT

Finally, human interactions nowadays mirror ICT use (Orlikowski, 2007) and we view them as a relevant unit of analysis to gain more knowledge on ICT. As some authors point out, studying technology through human actions and interactions is necessary not only because technology is increasingly embedded in social life but also because technology essence is situated – e.g one needs to take into account its context of use to make sense of a technology. Not only do interactions comprise organizational improvisation, but they also constitute a palpable reality of ICT use and of the technology artifact. Broadly speaking, people increasingly rely on communication technologies to interact and for decades interactions have ceased to be offline exclusively. Progressively, widespread access to ICT nowadays (Garcia *et al.*, 2009) such as Internet, telephone, instant messaging and email, deeply modifies the overall context of interaction (Winkin, 2001). As a result, the observation of interactions through technology enables us to uncover evidence of technology use during organizational improvisation.

Section 3.   Research questions specifications and studies overview

In the previous sections we demarcate possible avenues to address the question of ICT support in the dissertation. In this section, we refine those propositions to define the research questions that we address in this work.

For a start, we focus on improvisation polysemy. Indeed there is a loose collection of representations of this term. Each of them corresponds to a specific epistemological stance and avenues of research on improvisation. In our first study, we propose to address the research question I, entitled *How to cope with diversity in research on improvisation?*

We then focus on ICT. In our second study, we propose to examine the influence of ICT properties on the occurrence and development of interactions that are intrinsic to crisis improvisation. By doing so, we address the research question II, entitled *"What possibilities does ICT offer for organizational improvisation in crisis response?"*

Given our focus on technology as a distinct entity, differentiating it from user's practices, we propose a theoretical investigation.

Viewing ICT fit and ICT use as intricately related concepts, we propose to tackle question III and IV altogether. Thus we address the two following research question in our third study:

Research question 3: Does ICT fit users' needs with respect to organizational improvisation during crisis response?

Research question 4: How do users benefit (or not) from ICT when they improvise collectively in crisis response?

Findings from various papers are then confronted and discussed to uncover the theoretical and managerial implications.

3.I. Chapter 2.2. How to cope with polysemous concepts in organization studies? The case of improvisation

For two decades, improvisation has been attracting the attention of researchers in the management field. Researchers have defined and studied improvisation in various manners, strengthening its polysemy. However, scholars lack a classification scheme to evaluate differences and commonalities between studies on improvisation, which lessens opportunities for discussion to improve our understanding of improvisation. To handle this apparent academic diversity that surrounds the concept of improvisation, one needs to assess dissimilarities and common points among studies. In addition, researchers need a comprehensive outlook of the dimensions that account for the diversity within research on improvisation. We responded to this need by using CATPCA and PCA techniques. We also used hierarchical cluster analysis techniques to propose a representation of the divergences between existing approaches of improvisation in management literature. Our findings confirm that research in this field has been eclectic to the point that no predominant view of improvisation exists. Additionally, we propose that diversity stems from the academic divergence of authors in relation to four constituents of the research process: i) evidencing, ii) focalizing, iii) contextualizing, and iv) creating knowledge on improvisation. We finally discuss the theoretical implications of our findings and future avenues for research.

3.II. Chapter 2.3 Information technology, crisis and organizational improvisation: Some theoretical propositions and a literature review

The objectives of this paper are twofold. First of all, we propose a new and general definition of organizational improvisation. We conceptualize organizational improvisation through the dynamic capabilities approach. The first part of this article consists of a proposal for theory on organizational improvisation. We rely on previous work to suggest three components of the interactions that compose organizational improvisation: boundary spanning, expertise leadership and minimal structures of knowledge.

Then, based upon our suggestions, we conduct a literature review on crisis management. In our literature review, we retain articles that deal with ICT use and in which we partially or fully recognize our definition for organizational improvisation. Therefore, our literature review gathers articles from very diverse fields of research.

Finally, we identify five technological characteristics that are likely to support some of the components of organizational improvisation: Many-to-many communication, graphical representation, data centralization, calculation and virtuality.

3.III. Chapter 3.3 ICT, organizational improvisation and emptiness during the 2003 French heat wave crisis response

This paper seeks to understand the role played by Information and Communication Technologies (ICT) in Organizational Improvisation (OI) during crisis response. The crisis

management literature fails at providing a unified assessment of ICT support to improvisation. The theories of fit are commonly used to assess whether technology supports some specific organizational processes. However, they do not fully capture the complexity of improvisation and crisis response. Due to the lack of theoretical background in relation to ICT support to crisis improvisation, we conduct a retrospective qualitative analysis of the 2003 French heat wave crisis response in which both administrative and field actors were involved. Our analysis is based on the grounded theory method and focuses on the interactions that took place between the crisis responders. We make an integrative framework emerge from data. This framework suggests that organizational improvisation enabled crisis responders to face organizational emptiness. However organizational improvisation growth depended on the crisis responders' communicative genres. While a fervent communicative genre supported the development of organizational improvisation among the field actors, a dispassionate communicative genre, developed by the administrative actors around emails and faxes, hindered the administrative actors' participating in organizational improvisation. Finally we discuss our findings and the contribution of this work.

Conclusion

Figure 19 represents our rationale for building the structure of the dissertation that we depict in this chapter. The arrows represent that we reflected on conceptual connections between the propositions and the findings that emerge from our reflection.
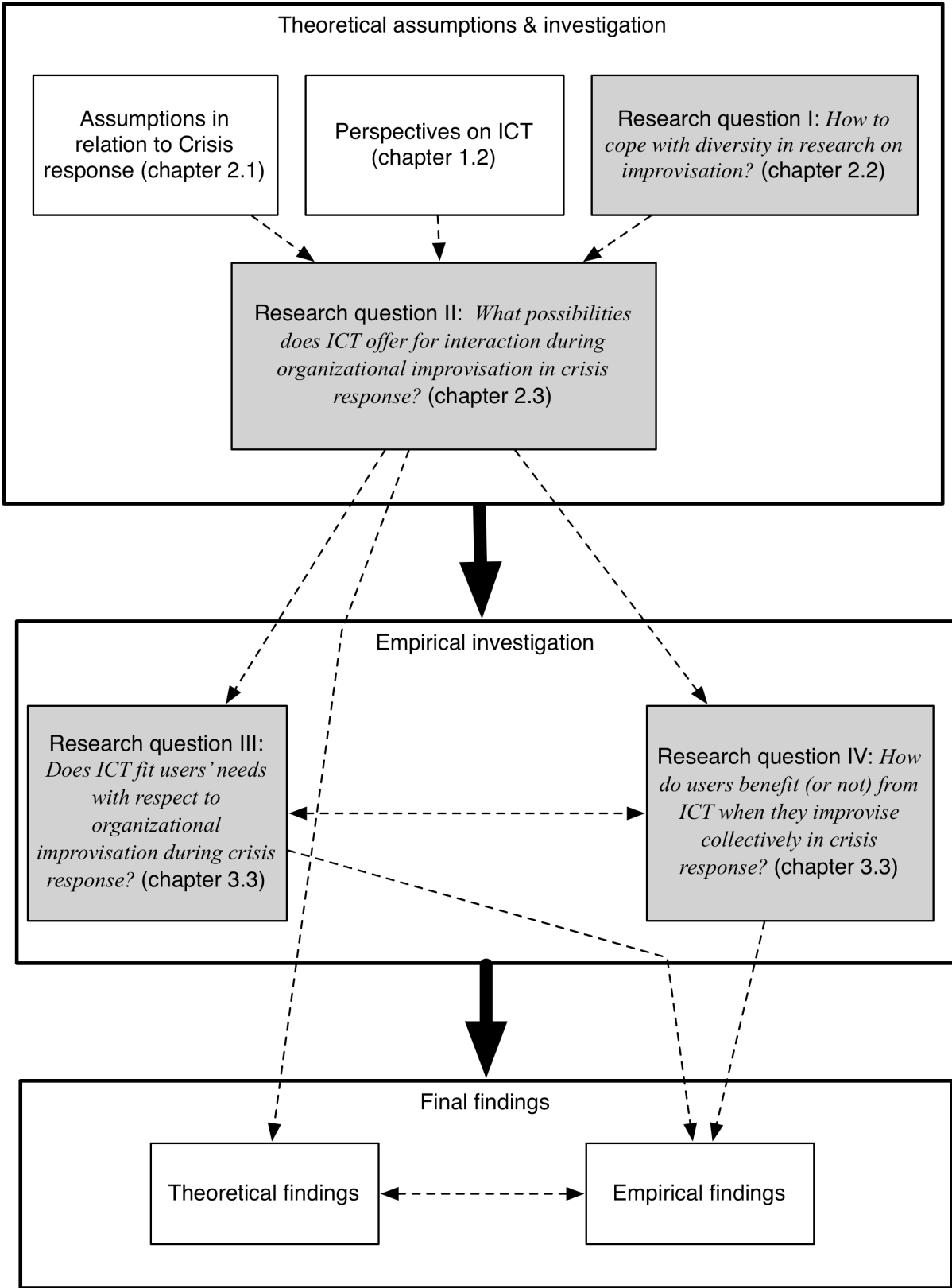
Figure 19. Our rationale for the dissertation structure

Chapter 1.3 Ontological and epistemological Assumptions

Introduction

This chapter presents our ontological and epistemological assumptions. We adopt a pragmatist, realist approach to explore the question of ICT support to organizational improvisation in crisis response. This approach has several implications for our research design that we present in the following sections. Section 1 presents our rationale for being pragmatists. Section 2 details our ontological assumptions and section 3 considers the epistemological implications of our posture.

Section 1.   A pragmatist posture….

Pragmatist thought was first presented near the end of the 19[th] century and has not stopped since then. Pierce (1905, 2000) and James (1975) describe pragmatism as a whole philosophy that includes a particular understanding of truth. Truth is different from reality in that its significance is practical. Reality exists but its structures and relationships are ontologically distinct from our understanding of the world. In other words, there is an external world that we do not fully perceive (Cherryholmes, 1992). On the contrary, the legitimacy of a particular depends on its practical implications and significance (Cherryholmes, 1992). As Cherryholmes explains, pragmatism shifts "*attention to the importance of the consequences of action based upon particular conceptions*" (1992, p. 13). Pragmatism stresses the importance of reflecting on the practical consequences of scientific activities because scientific inquiry is likely to influence political decisions and social dynamics.

In this work, we embrace the pragmatist tenet that truth matters to the extent that it concretely changes our direct environment and practices. Then, pragmatist principles match some personal values about the relevance of scientific inquiry. As a result, our rationale for choosing the topic of the dissertation follows a pragmatist conception of scientific inquiry. We chose to study ICT support to crisis response because we had assessed the need for more practical guidelines in crisis management and we wanted the dissertation to be potentially helpful to managers in critical situations.

Therefore, we acknowledge the need for special attention to the relevance of our work (Lyytinen, 1999a). While Lee (1999) assesses relevance on the degree of the audience's interest in the topic of the research, Lyytinen (1999a) highlights the need to meet managerial needs. Benbasat and Zmud (1999) go further and argue that the relevance of research partly depends on the ease of its implementation. However, relevance has been criticized for being a seducing but unreachable objective (Kock et al., 2002). For this reason, one of our goals in this work our work is to formulate reliable and clear managerial guidelines from our research findings.

Section 2.   ...that calls for a realist ontology

We rely on Blaikie's classification of different philosophical streams that compose realism More specifically, our posture corresponds to *depth realism,* summarized by Blaikie in the following statement (Blaikie, 2007, p. 13):

"*In the depth realist ontology, reality is seen to consist of three levels or domains: the empirical, the actual and the real (...) Seeing reality of these three domains, ranging from what can be observed to an underlying domain of causal structures and mechanisms, suggests the idea of ontological depth, of the stratification of reality that is independent of our knowledge of it (...). The aim of a science based on this ontology is to explain observable phenomena with reference to underlying structures and mechanisms (...) Social reality is viewed either as social arrangements that are the products of the material but unobservable structures of relations*".

We rely on Outwhaite's description of the realist ontology principles (2003, p. 282):

"*1. The distinction between transitive and intransitive objects of science: between our concepts, models etc, the real entities, relations and so forth which make up the natural and the social world.*

2. [There is a stratification] of reality into the domains of the real, the actual and the empirical (...)

3. The conception of causal relationships as tendencies, grounded in the interactions of generative mechanisms.

4. A rejection of both empiricism and conventionalism. The practical expression of realism is the concept of real definition. Real definitions are neither summaries of existing verbal usage nor stipulations that we should use a term in a particular way.

5. The realist concept of explanation involves the postulation of explanatory mechanisms and the attempt to demonstrate their existence".

Our ontological assumptions are consistent with Outwhaite's description of realism. First, we assume that reality does not only take its essence in our perception but also preexists independently to our cognition. However, as Outwhaite explains (2003, p. 283), *"the social situations do not exist independently of the way they are interpreted by those involved in them".* In other words, reality is intransitive in that it has an independent existence from human subjectivity. Reality is also transitive, which means that researchers have no choice but to observe it indirectly through the social world.

Crisis is an intransitive object in that its occurrence does not depend on human subjectivity. In addition crisis can be objectively evaluated in terms of costs and damages. Despite crisis being intransitive, researchers observe critical situations through the organizational dynamics they cause, which makes of crisis a transitive phenomenon.

Similarly, improvisation can be defined in objective terms: a short delay between a decision and an action. Even though objective measurements of organizational improvisation exist, observing the process of improvising requires in depth analysis that involves the researcher's experience most of the time. For instance, researchers have primarily observed improvisation through artistic practices such as music and theatre. In this sense, improvisation is both intransitive and transitive.

According to our ontological assumptions, realists researchers deal with three distinct ontological components: the "real", the "actual" and the "empirical" (see ontological realist principle n°2, p. 37). As we previously explained, reality is distinct from what individuals perceive or understand. The "real" is intransitive while human common sense is the "actual". The empirical refers to individual experience. The empirical and the actual are transitive components of our reality (see ontological realist principle n°1, p. 37). In contrast to the actual and the empirical, the real is intransitive and is not directly observable (see ontological realist principle n°1, p. 37)

Our being *depth realist* has some implications on the type of knowledge we intend to develop in our work. In spite of the real being not directly observable, realism attempts to understand the "real" by identifying how the real is generated (see ontological realist principle n°3, p.37). For this reason, the realist approach excludes pure empiricism (see ontological realist principle n°4, p. 37). Similarly, realism rejects conventionalism because the aim of realist researchers is to approach, even in an approximate fashion, the essence of the functioning of the real rather than producing knowledge that would be unrelated from the real (see ontological realist principle n°4, p. 37). Even tough the real can be understood in multiple ways, realist researchers' choice for an interpretation of the real depends on the practical implications of this interpretation. As Outhwaite (2003) explains, "Any assertion about [the real] is good as any other" (see ontological realist principle n°5; p. 37). In other words, scientific realism is consistent with a pragmatist view of research.

Realism is usually associated with critical realism but it is important to note that our posture is not critical. The critical dimension of theory implies the existence of previous knowledge that can be criticized and confronted within a knowledge building process (Edgley, 2003). Therefore, we agree with Edgley (2003) that the role of science is not necessarily to question ideologies and conceptions in the society. In our view Science should not substitute for philosophy[6].

Section 3.   Some epistemological implications

First of all, realists have to pay particular attention to their biases. This is way we focused our attention on our own biases during the empirical investigation (see chapter 3.1).

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[6] We acknowledge there is a debate about the role of critics in research. We agree with Daniel Robey that critics are necessary to evaluate findings knowledge claims. However, given that knowledge building is our priority, we restrict our criticism to the issues of validity and coherence of academic work.

Secondly, one of the fundamental principles underlying pragmatism is the clarity of thought (Hookway, 2004) that implies the need to provide an integrative and complete explanation of ICT support to improvisation in crisis. To do so, we connect our observation to existing knowledge on the same phenomenon so as to provide the most complete account of ICT support to crisis response. The principle of clarity of thought therefore led to an extended review of literature in the theoretical part of this document. As James explains (James, 1897, 1975), to be clear, one's thought should not tend towards oversimplification but rather "class the diverse cases of a common essence which you discover in items" (James, 1897, p. 67). To that extent, two main steps are easy to identify in our work: First of all, we lay an extensive but not exhaustive conceptual basis. Then, we lead an empirical investigation to confront our theoretical findings and extend our reflection in a theory building approach.

Conclusion

We follow pragmatist and realist principles in this work. We aim to attain reality as an intransitive object through human actions and perceptions. In addition the pragmatist approach compels us to account for the practical implications of our findings. For this reason, we describe the managerial implications of our findings that we submitted to managers in the final step of our analysis.

Summary of the Introduction

In the introduction we argue *why* and *how* we address the primary research question.

Chapter 1.1 presents the theoretical challenges and the managerial needs we intend to tackle in the dissertation. Some dynamics of organizational improvisation, such as the role that interactions play in the development of organizational improvisation, remain unknown. In addition, managers lack guidelines on how to use ICT when improvisation is needed in crisis response.

In Chapter 1.2 we detail our rationale for the structure of the dissertation. We identify four research questions from the primary research question, entitled "What support does technology offer to organizational improvisation in crisis response?" We address these four research questions by completing two theoretical studies and one empiricial study.

In Chapter 1.3, we argue our adopting a pragmatist posture and a depth realist ontological approach.

Part 2. The Theoretical assumptions and proposal for theory

The theoretical part reports some preliminary work on the concepts of crisis response, improvisation and communication technologies (DeSanctis, Poole). The objectives of this part are four-fold.

- Set the definition of the concepts we use in this work, such as crisis, crisis response and organizational improvisation,

- Analyze existing literature on crisis and improvisation and detail the basic theoretical assumptions we extract from it,

- Argue the choices and directions we take in our work (presentations of our unit of analysis and research questions),

- Make some theoretical propositions to respond to research question I.

This part is therefore structured on the following path:

In **chapter 2.1**, we present our basic assumptions on crisis and justify our focus on crisis response in large-scale disasters. By doing so, we narrow the scope of our investigation to a specific type of crisis context.

In **chapter 2.2**, we tackle the notion of improvisation by a literature review and classification. Improvisation is a broad concept that gathers different themes and phenomena. On the basis of a literature review, we identify eight coexisting perspectives on improvisation in management research.

In **chapter 2.3**, we propose some definition of organizational improvisation that brings into the open its characteristics in terms of interindividual interactions. This theoretical proposal is rooted in the dynamic capabilities approach. For the basis of our definition, we review the literature on the ICT contribution to organizational improvisation in crisis response. Our findings from this review reveal five technological characteristics that potentially bolster interactions that comprise organizational improvisation. Our discussion suggests the need for a concrete observation of interactions and ICT use during crisis improvisation, which is presented in the third part of the document.

Chapter 2.1. The context of investigation: Presentation of the scope of enquiry and theoretical assumptions on the concepts of crisis and crisis response

Introduction

This chapter presents our assumptions in relation to crisis. Various conceptualizations of crisis coexist in the management literature (Pauchant, Douville, 1993). For this reason, tackling the concept of crisis has led us to make the following assumptions.

First of all, we approach crisis as a specific organizational episode articulated by four steps: crisis latent development, immediate response, crisis coping and crisis recovery.

Secondly, we focus on the second and the third steps in the organizational crisis cycle that are immediate response and crisis coping. In other words, we address the response that follows the triggering event and aims at mitigating crisis immediate consequences.

Thirdly, we narrow our analysis to crisis response that happens in the context of natural disasters provoked by natural hazards.

This chapter is structured as follows. Section 1 presents a review of the crisis management literature and accounts for major theoretical divergences. Section 2 details some key characteristics of crisis and our theoretical positioning on the definition of crisis as an organizational cyclic episode. We then explain our focus on crisis response in section 3. We argue our intention to study crisis response in the context of natural disasters provoked by natural hazards in section 4.

Section 1.   Crisis research as a developed but heterogeneous field

Crisis is a generic concept. There is a long list of disparate events and situations that one can consider as critical and estimate as valuable for research (Roux-Dufort, 2007). From industrial catastrophes such as Bhopal (Shrivastava, 1987), or the Guadalupe Dunes spills in California (Beamish, 2002), to terrorist attacks (Mendonça, 2007), to organizational and technical accidents (Hutchins, 1991; Perrow, 1999; Weick, Sutcliffe, 2001), to firefighting failure (Weick, 1993) and disease breakouts (Leidner *et al.*, 2009). However, it is necessary to clarify the aspects of crisis that we study.

Crisis is generally defined as a critical and stressful condition that threatens major goals of an organization (Hermann, 1963; Perrow, 1984; Weick, 2001a) and that can be triggered by human or technological errors (Pearson, Claire, 1998).

First, each crisis is unique and it is difficult to find common features to very different situations, ranging from financial breakdowns to natural disasters (Pearson, Claire, 1998; Roux-Dufort, Vidaillet, 2003b). Table 5 illustrates the wide array of events that can trigger crisis. One can deduce from this list of events that one crisis can have multiple causes. For example, during 2005 Katrina, the disruption of services and products simultaneously

happened with the destruction of the organizational information base, escape of hazardous materials, personnel assault and malicious rumor.

An Array of Organizational Crises

- Extortion
- Hostile takeover
- Product tampering
- Vehicular fatality
- Copyright infringement
- Environmental spill
- Computer tampering
- Security breach
- Executive kidnaping
- Product/service boycott
- Work-related homicide
- Malicious rumor
- Natural disaster that disrupts a major product or service
- Natural disaster that destroys organizational information base

- Bribery
- Information sabotage
- Workplace bombing
- Terrorist attack
- Plant explosion
- Sexual harassment
- Escape of hazardous materials
- Personnel assault
- Assault of customers
- Product recall
- Counterfeiting
- Natural disaster that destroys corporate headquarters
- Natural disaster that eliminates key stakeholders

Table 5. Organizational crises and triggering events as defined by Pearson and Claire (1998)

Crisis research involves many divergent perspectives (Boin, 2004). Given the wide diversity of crises, researchers have discussed the very definition of crisis. In spite of this effort, deep divisions remain within the research community (Roux-Dufort, 2007).

First of all, there is a debate on whether crisis is endogenous or exogenous. On one hand, crisis can be seen as an extraordinary event that unexpectedly endangers an organization's survival (Hermann, 1963; Pearson, Claire, 1998; Pearson *et al.*, 1997). On the other hand, crisis reveals the inability of organizations to adapt to an expected situation because of internal structural deficiencies or disequilibrium (Mitroff *et al.*, 1989; Morin, 1976; Probst, Raisch, 2005; Roux-Dufort, 1997; Weick, Sutcliffe, 2001). Even in threatening situations, some organizations succeed in responding. This shows that "being in crisis" is not only related to a specific event but also tied up to the organization ability to cope either with its environment, its fundamental objectives (Fink *et al.*, 1971) or its "harmful activities" (Shrivastava *et al.*, 1988b).

There is another debate on the distinction between regular difficulties that occur in organizational life and crisis. Crisis is specific in that it threatens an organization's fundamental values and survival (Hermann, 1963; Nyström, Starbuck, 1984). It is undeniable that experiencing major difficulties is a part of business life. However, researchers distinguish

crisis from casual difficulties by its stakes, such as organizational survival and social cost. They define crisis as a situation where "many members of a social system fail to receive expected conditions of life from the system" (Barton, 1969, cited by Quarantelli, Dynes, 1977). For example, bankruptcy is part of economic life but becomes a crisis since it burdens social groups.

Similarly, researchers' opinions diverge on crisis existence being objective and subjective. Some authors systematically refer to crisis as an objective reality (Pearson, Claire, 1998; Probst, Raisch, 2005) and define it on the basis of quantifiable criteria such as economic cost and the number of fatalities. Figure 20 represents divergences among authors in the crisis management literature.

However, we think crisis existence is both objective and subjective (Billings *et al.*, 1980; Milburn *et al.*, 1983a; Roux-Dufort, 2007). Despite objective measures, crisis is also a personal experience (Milburn *et al.*, 1983b; Mitroff *et al.*, 1996; Starbuck *et al.*, 1978). More specifically, we define crisis as *an organizational episode in which an organization is unable to respond to an unexpected situation that threatens its functioning and is likely to have negative social outcomes*. We further detail the elements of this definition in the following section.

Figure 20. Divergence among crisis researchers
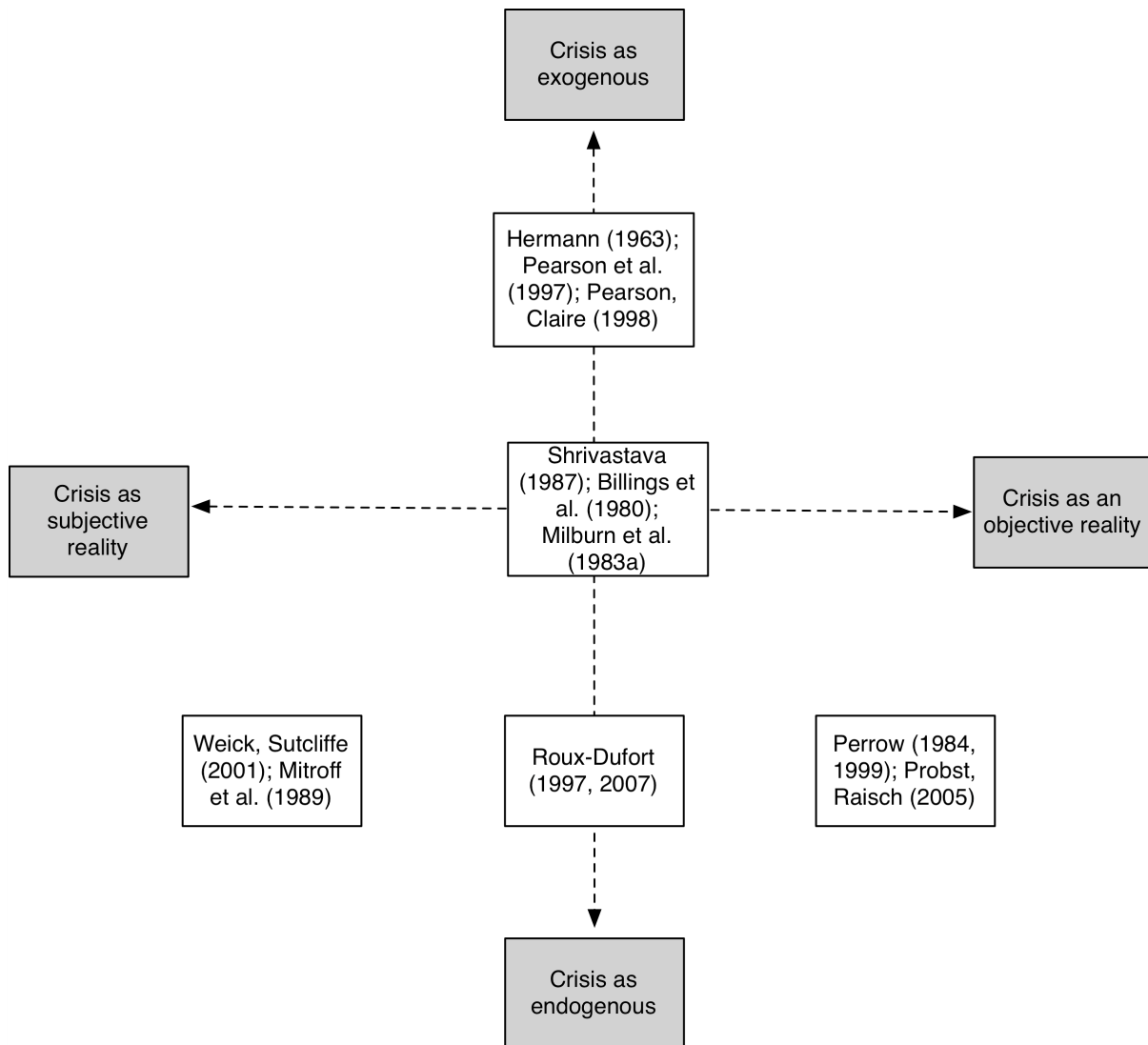
Section 2.   Our basic assumptions on crisis

2.I. Crisis: an organizational phenomenon

We study crises from the inner perspective of organizations. To do so, we examine organizational activities that are specific to a critical situation (Fink *et al.*, 1971; Richardson, 1994; Shrivastava, 1993). In addition, we adopt a systemic approach, inspired from Katz and Kahn's definition of organization in The Social Psychology of Organizations (1966). This definition depicts an organization as an open and complex system of interdependent subsystems. These subsystems interact with each other to meet common objectives. According to this view, crisis corresponds to an inner disequilibrium between resources that the whole organizational system has to cope with (Morin, 1976).

2.II. Social and natural Costs

We assume that crisis directly or indirectly induces social costs (Barton, 1969). For instance, an organizational failure can be considered as a crisis if it directly or indirectly implies higher costs than lower performance, such as material damage, increased unemployment or human loss. For instance, the 2003 French Heat Wave caused 15,000 fatalities (Lalande *et al.*, 2003); the Guadalupe spills spread 20,000,000 gallons of oil in the Pacific Oceans jeopardizing the health of millions of people (Beamish, 2002). In 1984, the Bhopal disaster killed over 3000 people and injured another 200,000 (Shrivastava, 1987). The explosion of the Challenger Shuttle provoked the death of 8 people but also disrupted the activity of the NASA and provoked psychological difficulties among the victims' colleagues (Mitroff *et al.*, 1996).

2.III. Surprise

Crisis differs from routine in terms of objective and subjective specificities. Surprise is one of these subjective specificities and the second key characteristic of crisis (Hermann, 1963). Surprise refers to the fact that a crisis, by definition, is hardly anticipated. Part of the surprise comes from the triggering event, the third key characteristic of a crisis situation, that provokes the crisis situation (Shrivastava, 1994). The triggering event is a seemingly insignificant and low-probability event (Pearson, Claire, 1998) that makes anticipating crises even more difficult. Given organizational flaws, the triggering event's impact is strong (Pearson, Claire, 1998) and opens into a crisis situation that also surprises managers. Bhopal: Anatomy of a crisis (Shrivastava, 1987), narrates the very beginning of the Bhopal Disaster.

"*At the core of any industrial crisis, is a triggering event. In Bhopal, the triggering event was the leakage of a toxic gas, MIC, from storage tanks. Human, organizational, and technological failure in the plant paved the way for the crisis that ensued*" (p.35).

Surprise differentiates crisis from emergency situations. Emergency is characterized by a need for a timely action (Mendonça *et al.*, 2004a). However, surprise in crisis implies new constraints for action and less room to follow routine, which does not necessarily characterize all emergency situations.

2.IV. Emotional and time pressure

Crisis is characterized by high emotional and time pressure that requires an innovative response (Billings *et al.*, 1980; Milburn *et al.*, 1983b; Smart, Vertinsky, 1977; Staw *et al.*, 1981).

Crisis responders' emotional pressure comes from their experience of damages and human suffering, as well as the lack of adequate resources to cope with the situation, such as material, information or time (Starbuck *et al.*, 1978). Emotional pressure is highly subjective and is expressed by stress or even panic (Hall, 1971; Milburn et al., 1983b).

People have various reactions to emotional pressure. Some authors explain that stress can imply denial of the situation (Hart, 1993; Perry, 1991b), threat-rigidity (Smart, Vertinsky, 1977) and inconsistent decision making (Starbuck *et al.*, 1978). Emotional pressure can positively influence crisis response as well by making individuals hyper vigilant (Milburn et

al., 1983b) or incredibly creative (Ciborra, 1996b; Weick, 1993). During the Mann Gulch Disaster, one of the smoke jumpers spontaneously had the idea to burn a circle for self-protection. Claudio Ciborra, in the <u>Labyrinths of Information</u> (1996b), highlighted the ingenuity of this initiative and explained that survival instinct led the smoke jumper to come up with a solution. Emotional pressure is a factor of increased creativity and the ability to improvise during crisis.

Time constraints come from the fact that time is a scarce resource during crisis (Ahituv *et al.*, 1998). The influence of time pressure on information processing was evidenced (Beach, Mitchell, 1978; Galbraith, 1974; Rieskamp, Hoffrage, 2008; Weenig, Maarleveld, 2002). One could safely assume that crisis responders make bad decisions when they lack time. However, by making individuals more vigilant, time constraints can have a positive effect on the quality of information processing (Maule, Edland, 1997).

To conclude, emotional pressure and time constraints are key characteristics of crisis response and have mixed effects on crisis responders. Managed properly, emotional and time pressure may help organizations to be more reactive to triggering events, such as in high-reliability organizations (HRO), (Weick, Sutcliffe, 2001).

2.V. An objective and subjective existence

Crisis is inherently subjective in that it depends on one's ontology, risk aversion and personal life (Billings et al., 1980; Pauchant, Mitroff, 1992). Depending on their perception of the situation as a crisis or not, people may tend to follow routine activities or develop more resilience (Roux-Dufort, Vidaillet, 2003b). Similarly Mullen, Vladi and Mills (2006) argue that the personal dimension of crisis is important. Pauchant and Mitroff (1992) expand on that argument by explaining that the Challenger staff experienced a "*psychological death*", which has a major impact on crisis response. In the psychology literature, Caplan (1964) defines crisis as "*what happens when a person faces a difficulty in which coping repertoire is insufficient*".

Crisis comes not only from self-perception but also from the perception of one's work practices (Roux-Dufort, Vidaillet, 2003b). People may acknowledge the situation as more critical because they have to achieve new tasks, or because routine activities are not relevant to the situation (Crossan *et al.*, 1996), or they have to coordinate with counterparts they did not know before (Perry, Quarantelli, 2005), or even because regular activities have to be completed in hurry. People do not always perceive the triggering event as the beginning of a critical situation and most of the time the process of making sense out of crisis is retrospective (Weick, 1988). In other words, a crisis situation may be more easily recognized by the shift of organizational functioning. This shift can be fragmented in four periods that characterize crisis from the organizational perspective. For instance, individuals more easily perceive crisis once crisis response and recovery takes place (Turner, 1976). Crisis response and coping corresponds to two stages of the development of crisis (Pearson, Claire, 1998; Shrivastava, 1993; Turner, 1976). The next section presents this model.

2.VI. Organizational crisis as a cycle

Table 6 presents the specificities of the different stages of the development of an organizational crisis and specific issues for each stage. Before crisis concretely manifests, latent dysfunctions appear and existing precautions may be violated (stage 1) (Turner, 1976). For example, before the merger between Union Pacific (UP) and South Pacific (SP) in August 1996, expertise was declined and minor accidents occurred (Weick, Sutcliffe, 2001). When negative signals are not detected, crisis is less likely to be avoided (Beamish, 2002; Shrivastava, 1988). Once the triggering event occurs, the organization reacts to the situation without making sense of what is happening (stage 2). Emotional pressure, as described herein, intensifies the personal experience of organizational crisis. The coping stage is characterized by the emergence of organizational processes that aim at limiting damage (stage 3). The organization gets "organized" to cope with the situation (Weick, 2001c). Finally, stage 4 gathers crisis recovery, organizational change and post-crisis learning. This stage is not taken into account in our work.

Table 6. Organizational crisis stages and corresponding issues

Organizational crisis stages	Organizational issues definition
Latent crisis	- Inner dysfunctions are likely to provoke decline (Cameron *et al.*, 1987) and they interact with each other (Perrow, 1984). - Agency issues and information retention occur (Beamish, 2002). - There is a lack of vigilance (Weick, Sutcliffe, 2001) and unexpected accidents occur (Beamish, 2002; Roberts, Bea, 2001; Weick, 1988). - Signal detection management is a crucial determinant of crisis response (Shrivastava, 1988).
Immediate response to triggering event	- Emotional shock, psychological experience of death and breakdown of previously developed representations (Mitroff *et al.*, 1996). - Possible denying of crisis (Fink et al., 1971) and rigidity threats (Staw et al., 1981). - Collective perception of difficulties to cope with high uncertainty and complexity (Billings et al., 1980; Milburn et al., 1983a). - Risk for organizational instability (Pauchant, Mitroff, 1992).
Coping and response period	- Divergences on how to organize crisis response: the Importance of centralization (Hermann, 1963; Staw et al., 1981), loose coupling (Robert, Lajtha, 2002) or structural redundancy (Roberts, 1990a) and introduction of the crisis facilitator. - Creation of emergency management teams or crisis decision units (Smart, Vertinsky, 1977). Additional subsystem to treat uncertainty and crisis events (Katz, Kahn, 1966). - Actions are taken in hopes that one will just happen to reduce the crisis (Starbuck, Greve, Hedberg, 1978, cited by Fiol, Lyles, 1985). - New informational processes (Osborn, 1998) and growing informational needs (Smart, Vertinsky, 1984). - Possible emergence of boundary spanning activities (Leifer, Huber, 1977). - Preplanned crisis procedures may not be relevant to the situation (Pauchant, Mitroff, 1988) or not used (Perry, 1991b) and improvisation can occur. - There is an organizational adaptation (Fink et al., 1971),

	responsibilities are renewed depending on political conflicts between stakeholders (Leifer, Huber, 1977). - Interruptions in the decision making process (Hale *et al.*, 2006)
Post Crisis	- Organizational learning or unlearning from crisis (Fauchart, 2006; Stead, Smallman, 1999). - Positive or negative outcome (Clair, Dufresne, 2005; Seeger *et al.*, 2005).

Section 3.   Crisis response: some theoretical background

3.I. Crisis response: a paradoxical process

The word "crisis" derives from the Greek word krisis that means "decision" (Morin, 1993; Pauchant, Douville, 1993). This implies the importance of managers' understanding of crisis and its outcomes. Research on crisis calls for further developments related to crisis response (Schoenberg, 2005). Part of the research has been more focused on crisis preparation than crisis response so far. During crisis response, planned procedures should be applied (Pearson et al., 1997) but also adjusted as necessary because every crisis is unique and prevention can never be completely adequate for the situation (Quarantelli, 1988; Waugh, Streib, 2006).

At first glance, crisis response may seem tautological because it simultaneously characterizes and aims at solving an ill-structured situation; otherwise it would not be crisis response. However, we define crisis response as *the set of decisions and actions that lead to making sense of the situation and possibly avoiding too much resulting damage*. We disagree with Mishra (1996) as we think crisis response cannot be considered routine. Contrary to routine, crisis confronts organizations with events they are not prepared for and questions their ability to keep things under control. For example, the 2003 French heat wave questioned medical personnel competencies and ability to save lives. Because physicians and nurses lacked knowledge on hyperthermia, they were unable to diagnose and treat patients effectively for the first time in years. Furthermore, organizations can have to operate outside of their routine standards when crisis responders are numerous. For instance, organizations have to quickly relate to unfamiliar entities in disasters. Additionally, some new activities are required but can reduce the pace of response (Quarantelli, 2006). For example, during the French Heat Wave, hospital managers had to invent new procedures when they searched for extra spaces to place corpses.

Finally, people are likely to get confused during crisis response due to the ambiguity of the causes, effects and means of resolution of the crisis (Pearson, Claire, 1998):

"*A paradox is associated with crisis management: We cannot fully understand what we need to do unless we first understand what need to do and have in place before a crisis. At the same time, we cannot understand fully what we need to do beforehand unless we understand what we will be required to do during a crisis*" (Mitroff et al., 1996, p. 59).

Despite the need to act promptly (Pearson, Claire, 1998), crisis responders are uncertain of the outcomes of their decisions (Fink et al., 1971; Nyström, Starbuck, 1984). More generally, crisis challenges individual ability to make sense of events (Weick, 1988).

3.II. Improvisation in crisis response

In the literature, improvisation is somewhat associated with crisis response. However, the conceptual ties between these two concepts are vague. Both conditions of emergence and effects of improvisation in crisis response remain uncertain.

Improvisation logically emerges from time pressure (Crossan *et al.*, 2005), the lack of adequate planning (Rerup, 2001; Suchman, 1993) or a need for the continuous adjustment of action (Crossan *et al.*, 2005; Mendonça, 2007). Improvisation is also likely to happen because the top management's legitimacy is questioned, which endorses the right to alternative paths of action (Benson, 1977). However, the probability of improvisation is not linearly correlated with uncertainty (Cunha et al., 2003).

Good crisis response requires resilience, which requires improvisation (Rerup, 2001). Crisis responders have to quickly adapt to unexpected needs in terms of leadership, decision making and coordination. In addition, every crisis requires a specific response that cannot be always prepared (Waugh, Streib, 2006). Therefore, improvisation brings about innovation that is necessary for crisis response (Fink et al., 1971). For instance, during the 9/11 response, the decision to connect electric cables of telecommunications infrastructures to diesel generators "took milliseconds" (Mendonça, 2007) but deeply enriched the actors' repertoires of action. Finally, improvisation contributes to the renewal of routines (Feldman, Pentland, 2003). However, if not managed properly, improvisation can burden coordination and therefore endanger human lives by bringing more complexity and ambiguity in crisis response (Perry, Quarantelli, 2005). Furthermore, an aborted improvisation boils down to a waste of time for crisis responders. Academics and managers remain uncertain that learning from past improvisation is feasible, due to its extemporaneity. As Ryle (1979) describes: "What comes to pass on one occasion has, with all its concomitants, origins and details, never taken place before and will never take place again".

Section 4.   *Crisis response in the context of natural disasters*

Disasters and crises are distinct phenomena (Shaluf *et al.*, 2003). As disasters are increasingly frequent (Perrow, 2006; Torry, 1979), they represent a considerable proportion of crisis response nowadays. The economic cost associated with natural disasters has increased 14-fold since the 1950's (Guha-Sapir *et al.*, 2004). For this reason, we focus on crisis response in the context of natural disasters that are provoked by natural hazards (Torry, 1979).

The conception of disaster was originally generic (Quarantelli, Dynes, 1977), but disasters differ on the basis of their cause and their outcomes (Gephart, 1984). There are divergent views on the connections between disasters and crisis (Shaluf et al., 2003). For some authors, disasters are the direct consequences of some organizational crisis that was not properly handled (Lin *et al.*, 2006). For others, disaster is a context in which organizational crisis can

happen (Pearson, Claire, 1998). We follow the latter conception on disasters. A disaster is characterized by its physical consequences, such as human loss and material damage, and the social disruption it provokes (Comfort, 1993; Dynes, 1970).

The onset of the natural disaster (also called the physical agent by Quarantelli and Dynes in 1977) can be at the origin of the organizational crisis. Disasters destroy infrastructures, disrupt services, damage organizational information bases and sometimes eliminate key stakeholders (Pearson, Claire, 1998). Ives and Junglas (2006b) provide a good example on how disasters unavoidably provoke organizational crisis. They depict how the Northrop Grumman Corporation, which employed more than 20,000 in New Orleans in August 2005, had to manage the aftermath Katrina left behind. Employees were missing and a communication blackout occurred. The corporation intended to help its workers, which led the IT director to go to New Orleans to search for and evacuate employees and organize the IS recovery. Organizations are likely to be brutally affected by disaster, which puts them into a crisis because they need to cope with unanticipated damage or loss of resource. Furthermore, organizations have to cope with numerous but unfamiliar groups and individuals who are affected by the disaster (Shrivastava, 1988).

Crisis response in the context of natural disaster covers two main steps that correspond to two particular periods in the organizational crisis cycle: the immediate response to triggering events and coping with crisis. Crisis response in natural disaster is therefore likely to be complex. Also, disasters induce "breaks in pattern" and "isolating interruption of norms" (Wallace, 1956, cited by Torry, 1979). In that sense, improvisation, or at least strong deviation from established patterns of action is likely to happen during crisis response in disaster settings.

Conclusion

In this chapter, we present the context of our investigation. We approach crisis through the concept of organizational crisis. We restrict our investigation of organizational crisis to the stages of crisis response and crisis coping. Finally, we focus our interest on disaster situations, in which interactions are crucial but complex and unpredictable.

Table 7 presents the key characteristics of the type of crisis we intend to study: organizational crisis response in the context of natural disasters provoked by natural hazards. Each of these characteristics stands for basic assumption in our work.

Table 7. Key characteristics of disasters, crises and crisis response

Source of characteristics in the literature	Characteristics of the situation under study
Natural disaster provoked by natural hazard	The triggering event (or the physical agent) is natural and partly related to natural hazard.
Disaster	An important diversity of organizations and actors are involved in the response
Disaster	Actors have to quickly develop coordination with unfamiliar organizations
Crisis response	Emotional pressure is high and likely to impact the coping process
Crisis response	Crisis requires innovative response from organizations. By definition, routine and previously defined procedures cannot be blindly followed
Organizational crisis cycle	Crisis life can be divided in four periods: latent dysfunctions, triggering events, coping period and post crisis period.[7]

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[7] We assume in our work that information technology failure is not the main factor in the triggering event of the crisis or the technological error. By doing so, we still consider information technologies' potential support to the organizational response of crisis more easily.

Chapter 2.2 Coping with diversity in research on improvisation[8]

Introduction

The concept of improvisation is the focus of an increasing number of researchers. First, as a daily practice, improvisation deeply influences organizational life (Barley, 1986; Brown, Duguid, 1991; Ciborra, 1996b). Second, improvisation is a relevant concept to organizations that need to be resilient when faced with increasing environmental uncertainty and time constraint, (Weick, 1998). Moreover improvisation challenges researchers (Ciborra, Willcocks, 2006) in that it opens a new window to themes such as "ambidexterity", "tinkering", "*bricolage*" and "organizational paradoxes" (Cunha, 2001; Vera, Crossan, 2007). For these reasons, it is necessary to better understand it.

The widespread use of the concept of improvisation emphasizes its relevance in multiple disciplines, ranging from strategic development (Mintzberg, McHugh, 1985), entrepreneurial projects (Baker, Nelson, 2005; Hmieleski, Corbett, 2008; Jiyao, Jing, 2005), product development (Akgün, Lynn, 2002; Cunha, Gomes, 2003; Moorman, Miner, 1998b), to crisis response (Hutchins, 1991; Lanzara, 1983; Mendonça, Wallace, 2007; Weick, 1993), or even Information system development (ISD) and ICT use (Hanseth *et al.*, 1996; McGann, 2005; Pawlowski *et al.*, 2004). Undoubtedly, a significant amount of work has settled some commonly shared definitions of improvisation. For instance, Cunha, Cunha and Kamoche have provided an integrative definition of improvisation on the basis of an exhaustive literature review (1999c). As a result, authors commonly agree that improvisation consists of an innovative use of resources in a restricted delay between decision and action.

However, research on improvisation seems varied. Researchers have used the concept of improvisation in numerous ways, targeting separate scopes, contexts and motives for enquiry. For instance, some of them use improvisation to label unexpected practices, such as Faia-Correia (2003) whereas others present it as a new paradigm (Hatch, 1999). A more recent stream of research explores the cognitive processes that enable the emergence and the development of improvisation or explore it from a cognitive standpoint (Mendonça, Wallace, 2007).

Even though diversity fosters creativity, researchers can experience difficulties in making sense of the variety of academic work on improvisation. Studies on improvisation are not only diverse from a theoretical perspective, but also include distinct rhetorical and metaphorical techniques. As an example, Bigley and Roberts' work (2001) has little if nothing to do with Pava's use of the concept of improvisation (2002). While the former authors explore the impact of Incident Command System (ICT) on improvisation in emergency situations, the

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latter proposes the original concept of *ethical improvisation* based on an interpretation of the Bible. How then can researchers compare findings without evidence that the studies in question relate to the same aspects of improvisation?

Diversity can transform heterogeneity, therefore preventing discussion between authors to challenge each other's view of improvisation. As a result, researchers have missed discussion on crucial aspects of improvisation, such as the ins and outs of the coordination that takes place between improvisers. As building relevant knowledge on improvisation has become progressively more challenging there is a need for an overall picture of the similarities and dissimilarities between studies on improvisation. This work aims to respond to this need by addressing the following questions:

- *Is research on improvisation effectively diverse?*

- *How to account for diversity in research on improvisation?*

We addressing these two research questions by reviewing and classifying the management literature on improvisation. Literature reviews are relevant beginnings to tackle emergent issues in academic life (Webster, Watson, 2002). One could argue that literature reviews on the concept of improvisation are not new. Moorman and Miner (1998a) led a first literature review on improvisation. They categorized the different fields in which improvisation was analyzed. Cunha, Cunha and Kamoche (1999b) pursued this work by reviewing existing definitions of improvisation. Since then, literature on improvisation has been intensively developing.

Our work differs from previous literature reviews on improvisation in that we use quantitative techniques to provide an updated and revised snapshot of the literature on improvisation. We rely on the classification principles defined by Bowker and Starr (2000) to categorize primary aspects of the literature on improvisation. We then use CATPCA, PCA and cluster analysis techniques on a sample composed of 105 articles. Our analysis suggests two types of findings. First of all, we could not identify any predominant paradigm in research on improvisation. In addition, conceptualizations of improvisation are relatively similar across various periods of time. In our view, these findings mean that research on improvisation is effectively diverse and that no one approach to improvisation has become predominant over time. Secondly, we suggest that diversity originates from divergences between authors in relation to four primary research tasks. First of all, authors rely on different techniques to evidence improvisation conceptually and empirically. While some of them deduce improvisation from existing frameworks, others induce their own understanding of improvisation from data. Secondly, authors do not investigate the same kinds of improvisers nor the same practices related to improvisation. Some authors focus on top management improvisation in designing. Other authors deal with improvisation practices by individuals from various hierarchical layers. Thirdly, authors contextualize improvisation differently. Some of them argue that improvisation endogenously emerge in more or less turbulent environments. However, some authors have depicted improvisation as a spontaneous response to crisis in the last years. Finally, the authors pursue divergent objectives in terms of knowledge creation. Some of

them aim to contribute to a unified representation of improvisation while some others offer alternate views. This work is structured as follows. Section 1 discusses the importance of addressing diversity in management research and presents the aspects of diversity we consider in this study. We then detail the analysis process and the statistical techniques we use in this work in Section 2. Finally, Section 3 details our interpretation of the findings, followed some discussion.

Section 1.   Theoretical background

1.I. Diversity and knowledge building

Diversity has been widely documented in the management literature. In particular, Argyris and Schon (1974) explain how individuals appropriate concepts by developing their own theories, therefore contributing to divergent views of the same topic. Reflection about the benefits and costs of diversity within academic life has been pursued (Pfeffer, 1993), at least since the publication of Koontz's "The management theory jungle" in 1961 (Mathews *et al.*, 1999). In the MIS field specifically, diversity has been questioned. While some authors argue that addressing a wide range of perspectives promotes relevant research and progress, diversity can also hamper the identity of a discipline (Benbasat, Weber, 1996).

Scholars tackled the concept of diversity from either a descriptive or a normative standpoint. From a descriptive standpoint, a significant effort has been led to evaluate diversity. For example, Bakhri and Sheetz evaluate the frequency of use of major theories in the MIS field (2001). Tsai and Wu also contribute to this effort by exploring the effect of co-citation on diversity in the management field (2010). Additionally, some authors focus their exploration of diversity on specific topics. Numerous examples such as Schultze and Orlikowski's work on the concept of virtuality (2001) or Cunha and his colleagues' work on improvisation (1999c), illustrate the ongoing effort to define and evaluate the diversity of studies on specific management topics. Diversity is also controversial as some authors make divergent claims about academic work standards. For example, Benbasat and Zmud called for an explicit discussion about whether academics should focus on a unique set of problems, theories or methods in the MIS disciplines (Benbasat, Weber, 1996). On the contrary Bamberger and Pratt (2010) advocate for diversity and emphasize the need to promote unconventional studies. Some other authors provide more practical recommendations, such as Robey (1996) who argues that methodological rigor is necessary to promote diversity.

The underlying question of this debate is the effect of diversity on knowledge building. Diversity of perspectives in regards to specific concepts nourishes conceptual debate and is inherent in scientific progress. As Khun explains (1962), scientific revolutions stem from the temporary challenging of existing paradigms by alternate perspectives. Similarly, Popper's principle of falsification relies on the tenet that science is not restrictive to one unique approach (1972). Undoubtedly, approaching reality from a single perspective leaves academic life with fewer opportunities for debate and understanding. For this reason, diversity is necessary in research. However, diversity can lead to heterogeneity and cause scholars to miss

opportunities for discussion and the refinement of findings. We propose in the following paragraphs three solid motivations for providing an integrative representation of diversity within an academic discipline.

First of all, a common referential is needed for discussion between authors. When studies have absolutely nothing in common, how does one assess the legitimacy of findings? Discussion is more difficult to lead when authors offer divergent views without sharing common concepts or definitions. For instance, a significant amount of work has discussed the relevance of the theories of ICT fit (Zigurs, Buckland, 1998; Zigurs, Khazanchi, 2008). Even though these theories provide divergent findings as to the relevance of using technology in organizations they share a common assumption of fit, e.g. a minimum level consistency between organizational structures and environment is necessary to attain performance (Drazin, Van de Ven, 1985). In addition, all theories of fit start with the measurement of technology features by a distinct construct from task and user characteristics.

Secondly, if not reported, differences within academic work can dissuade authors from proposing managerial guidelines to improvisers or even contributing to previous managerial recommendations. Of course, it happens that some authors' approach has little in common with some other studies. However, if these authors cannot assess the extent to which their findings complement or contradict other results, then releasing managerial guidelines is riskier. Rather than taking the risk of providing contradictory managerial guidelines regarding improvisation, most researchers do not provide any guidelines at all. For example, Gauthereau and Hollnagel (2005) recommend that researchers be cautious about managerial guidelines on improvisation because the very nature of improvisation is unknown. Similarly, Miner and his colleagues argue that providing managerial recommendations about improvisation is hardly achievable, due to our lack of knowledge on the specificities of each improvisation (Miner *et al.*, 2001). As a result, current conceptualizations of improvisation remain unsatisfactory for managers who lack concrete recommendations such as what resource to leverage for improvisation. In spite of it's relevance to the development of personal resilience (Vera, Crossan, 2004) to face time and organizational constraints (Ciborra, 1999), improvisation is insufficiently used by managers. In our view, diverse approaches and findings on improvisation can product consistent managerial guidelines if they are properly documented.

Thirdly, by not being aware of differences between their research, authors tend to overlook potential sources of insight. An integrative representation of theories can promote synergies between streams of research and help to resolve complex issues. For instance, most authors who have addressed improvisation as an organizational phenomenon fall short of details on how improvisers manage coordination. Interestingly, Weick (1993, 1998) Ciborra (1996a, b) have brought insights on interactions during improvisation. However, their findings have not been fully taken into account to clarify coordination dynamics that take place during improvisation. Similarly, Weick's reflection on improvisation intensity (1998) has been overlooked by many studies of improvisation. This work makes no exception: We do not refer to *improvisation intensity* in the classification because too few articles mention this dimension of improvisation. A common representation of the existing approach is therefore necessary to

grant that theoretical achievements be shared or taken into account in the academic field that deals with improvisation.

1.II. Diversity and research on improvisation

A quick lexicometric search shows improvisation has been deeply examined in a large panel of disciplines. Simple requests on EBCOHost reveal more than 238 articles include the term improvisation in their abstracts. A second request on Web of Science reveals 149 articles in business and behavioral sciences cover improvisation as a topic. This quick investigation also reveals the variety of works on improvisation. Improvisation practices and cognitive aspects have been explored in theatre, literature and music, nursing and psychology. In business research, improvisation is most of the time associated with concepts such as innovation, learning, product development or technology use. This work focuses on the use of the term improvisation in business research.

The commonly accepted definition of improvisation refers to an innovative use of resources and a restricted delay between acting and planning. Some authors characterize improvisation by it's innovative use of resources (Weick, 1993, 1998), or by a reduced delay between decision and action (Ciborra, 1996a; Moorman, Miner, 1998a). This core meaning can be found in the etymological dictionary: the term improvisation (first identified in 1786) comes from the French improvisation that means "compose or say extemporaneously", coming from the Latin improvisus that means unforeseen (in- "not" + provisus "foreseen, provided").

However, the ontology of improvisation differs from one study to another, coming from a set of actions (Heeks, 2002a), a will (Miner *et al.*, 2001), a capability (Rerup, 2001)or a process (Ford, 2008). Furthermore, authors pose different tacit assumptions about improvisation. While some authors understand improvisation as the expression of individual intuition and creativity, others pose improvisation as organizational paradoxes (Clegg *et al.*, 2002) and disruption (Benson, 1977). Finally, studies greatly differ in terms of methods. Some authors draw inspiration from surprising contexts such as circus, medical structures, jazz bands or theatre groups to understand improvisation (Meyer *et al.*, 1998). Others restrict their studies to a strict organizational context (Brown, Duguid, 1991; Faia-Correia, 2003). As a result, it is unclear as to whether researchers refer to the same concept when studying improvisation.

Undeniably, there is a need to clarify the dimensions of diversity with respect to improvisation to promote knowledge building. We propose in this work an integrative classification of research on improvisation. To do so, we preliminary need to answer to the following question: How does one handle diversity in an academic field?

1.III. Strategies to analyze diversity

In this section we detail our strategy to handle diversity in research on improvisation. We approach diversity from a realist stance. We analyze authors' representation of improvisation to make sense of diversity on this topic.

Generally speaking, academic diversity develops with the coexistence of divergent problems, theoretical foundations and methods (Barkhi, Sheetz, 2001; Benbasat, Weber, 1996; Koontz,

1980). However, in this work, we adopt a realist stance that posits that diversity is not restricted to authors' view of improvisation. Due to the primary assumption that reality is not directly observable but only partially ceased through human perception, realist researchers accept that a single term can refer to multiple realities. This means that not only do authors conceptualize improvisation from multiple perspectives, but improvisation can also refer to various empirical cases as well. For instance, experts' improvisation in crisis cells (see Bigley, Roberts, 2001) and improvisation in top management teams who design new strategies (see Perry, 1991a) are likely to result into various conceptualizations. Therefore, handling diversity on improvisation requires examining improvisers and improvisation contexts. Moreover, authors' interest for an empirical case of improvisation is dependent on their ontological and epistemological postures. For example, Clegg, Cunha and Cunha inspire from Benson's dialectical view of organizations to conceptualize improvisation as an organizational paradox (Clegg *et al.*, 2002).

Furthermore, we base our research upon the assumption that the way authors' find, depict and analyze empirical cases of improvisation is likely to play a role in academic diversity. To take into account these aspects of diversity, we analyze the *instrumentation* of concepts by authors, e.g. the manner a concept is arranged with others. To develop our point we draw on Wittgenstein's principles on semantics, cited by Anderson and Ortony (1975). According to these authors, one should analyze how a concept is used to understand author's stance on the concept as well as its contextual specificities. For instance, they examine how the word *eat* conveys various emotions and images, depending on the context of its use. The meaning of eating something is the same whether its object is a fruit or meat. Meanwhile, in the imaginary, our representation of eating a fruit or eating meat significantly differs. As Anderson and Ortony explain:

"*Consider the phrases eat steak, eat soup and eat apple. Eating a steak requires a knife and fork. Soup is sipped with a spoon. Commonly an apple is eaten without an ustensil. In each case, the actions of the lips, teeth, and tongue are different. Further variations in sense are introduced when the agent is considered. Compare (…)*

The executive ate the steak

The baby ate the steak

The dog ate the steak

Each of these sentences gives rise to different suppositions about location, circumstance, manner, instrumentality, and antecedent and consequent conditions. The general point is that a word could have different meaning in a very large number of the sentences in which it might appear, even when there is core meaning"(p.168, 169)

Subtleties about improvisation can be grasped only through the analysis of the details that the authors provide. For this reason we examine how authors describe, analyze and reflect on improvisation. Table 8 summarizes the main aspects of diversity that are taken into account in this work.

Table 8. Aspects of improvisation in our analysis

Stances on diversity	Aspects of improvisation
Traditional aspects of diversity	Theoretical foundations
	Problems
	Methods
Realism stance	Epistemological approach
	Context of improvisation
	Improvisers
Concept instrumentation	Reasoning about improvisation
	Analysis of improvisation
	Description of improvisation

Section 2.   Method

Our analysis followed a three steps process. First, we developed and iteratively defined a classification grid. Second, we completed factorial and cluster analysis of the output of the classification of articles that deal with improvisation. Third, we interpreted the statistical outputs. The diverse steps of our analysis process are represented in Figure 21.
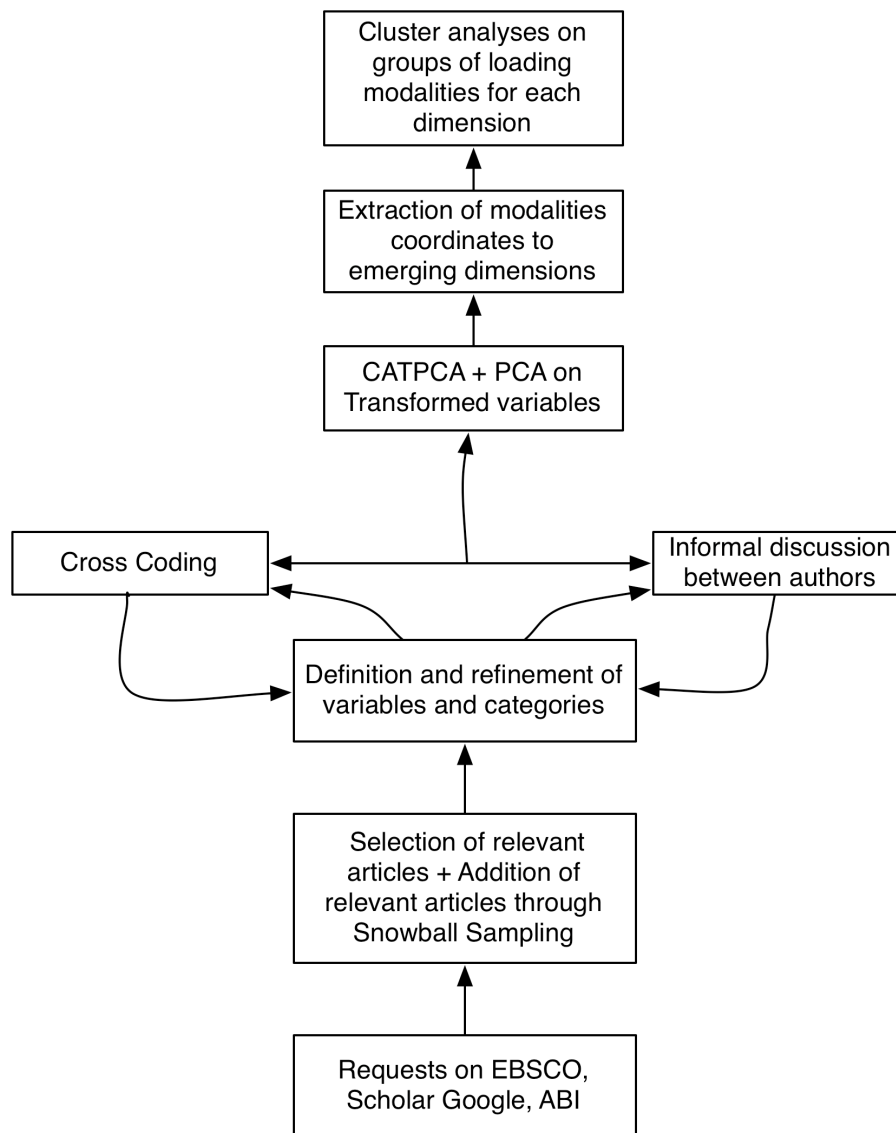
Figure 21. Classification and analysis process

2.I. Classification process

Classification is a widespread practice in academic life. Even unconsciously, individuals tend to gather similar objects and separate distinct ones so as to make sense of their actions (Bowker, Star, 2000). According to these authors, classification is *« a spatial, temporal or spatio-temporal segmentation of the world ».* Therefore, a classification system is *« a set of boxes (metaphorical or literal) into which things can be put into then do some kind of work – bureaucratic or knowledge production »* (p. 10). In our view classification is the most appropriate way to attain our objectives: i) It is a systematic approach that sets uniform criteria of analysis for all the papers, ii) It optimizes chances to detect divergences between studies, iii) It allows peer discussion on predefined categories as well as statistic treatment as a basis for scientific validity.

To conduct this study, we reviewed 105 articles and essays that deal with improvisation in organizations. We selected studies in which improvisation is explicitly mentioned in the abstract. Studies come from diverse fields such as MIS, marketing, innovation management, organization theories and entrepreneurial literature. We used the following process to collect papers: We first performed a first request on Business in ABI/INFORM Complete database with the following specifications: Improvisation in the citation document text (excluding book reviews, dissertations, newspapers) with Scholarly Journal as Publication Type from 1990 to 2010 resulted in 1882 papers[9]. However, this initial sample was too big so we refined our requests. We performed a second request[10] to target papers in which improvisation appeared in the citation and abstract. We completed the results by replicating the same request on EBSCO and Scholar Google. The screenshots of the requests and further detail on this part of the classification process can be found in the Annexes.

We excluded some papers that mentioned improvisation in the abstract without detailing its conceptualization, such as Wagner, Nevell and Piccoli's work (2010) as well as Knox et al. (2007). Finally, we used the snowball sampling technique to enrich the sample with some studies that explicitly mentioned improvisation in the findings and that were frequently cited in papers. We viewed them as fundamental papers that develop a complete view of improvisation but were out of the scope of requests because the term improvisation was missing from citation and abstract. Such a refinement concerned less than 10% of the sample. The process of selection of such papers was iterative and led to discussion between the authors. For instance, Lanzara (1983; 1999), Barley (1986) and Barry and Rerup (2006) represent some of the works that were considered to be included in the sample. However, these papers do not detail their conceptualization of this notion, and we therefore excluded them from the sample. Annex 1 presents the articles that were selected in our classification.

We primarily collected articles that appear in widely known journals. Our rationale is that these articles are influential within the research community and play a significant role in the construction of theories of improvisation. We have excluded conference proceedings from our sample because a significant proportion of conference papers eventually get published in journals.

Two of the authors completed a cross coding to refine the definition of the variables. The cross coding provided the opportunity to discuss divergences related to the subject of classification between authors. Through the cross coding process, we identified three main sources of divergence: i) Some variables were interpreted and used differently. Thus, the authors agreed on a unique definition of these variables. ii) The authors used different categories but agreed on their analysis of the papers, which led us to simplify the scales, iii) the identification of some categories was subjective. We relied on Miles and Huberman's work (1994) to evaluate the agreement rate between authors during the cross coding. We attained an overall agreement rate of 57%.

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[9] The last request was completed on the 10th of July 2010
[10] The latest request was completed on the 25th of July 2010

2.II.Classification grid

The classification process complies with the following rules. First of all, classification should rely on consistent classificatory principles, such as date. Secondly, the categories are mutually exclusive. Thirdly, the classification should provide a fairly complete representation of the world. In reality, the third condition remains most of the time unsatisfied.

Table 9 presents the variables and categories that compose our classification grid in this work. We detail each of the 11 variables and the 33 categories that compose our analysis grid. We iteratively developed the variables and the categories through the classification process.

Table 9. Classification variables and categories

Variables	Description	Categories
Period	At what period was the study published?	Period 1(1992-1998) Period 2 (1999-2003) Period 3 (2004-2010)
Reasoning about improvisation	What is the mode of reasoning about improvisation?	Deductive Inductive Abductive
Epistemological approach of improvisation	What are the ontological assumptions that authors do on improvisation?	Functionalist Interpretive Radical
Primary level of analysis	What organizational actors do the authors observe?	Individual Group Organizational
Contribution to knowledge on improvisation	What kind of knowledge do authors bring about improvisation?	Accumulation centered Accumulation non centered Renewing centered Renewing non centered
Research design	What research design do authors adopt?	Empirical quantitative Empirical qualitative Conceptual
Focus on improvisation practices	What is improvisation useful for?	Design Use
Scope of enquiry	What degree of instrumentality do authors depict?	First level Second level
Conditions for improvisation emergence	Is improvisation triggered or emergent ?	Exogenous Endogenous Mixed emergence
Improvisation context	What is the degree of uncertainty and time constraints when improvisation takes place	Crisis Turbulence Normal
Hierarchical status of improvisers	What is the hierarchical status of the improvisers?	Low Middle Top Mixed

2.II.1. Period

Period refers to the period of publication from 1991 to 2010. We divided the overall period of publication into three sub periods. Cuts between periods correspond to the release of special issues on improvisation in academic journals. We assumed that each period distinguished from the others because of the influence of these special issues. The first period (1992-1998) gathers articles that were published until the release of the 1998 special issue on improvisation in *Organization Science*. The second period goes from 1999 to 2003, when

International Journal of Studies Management released a special issue on improvisation. The final period consequently starts in 2004 and ends in 2010.

2.II.2. Epistemology/paradigmatic posture

We heavily drew from Burrell and Morgan's work (1979) to assess the papers' approach to improvisation. We agree with Deetz (1996) on the added value of Burrell and Morgan's four-paradigm matrix. However, we were reluctant with classifying the authors' epistemological postures because these are sometimes implicit. Applying Burrell and Morgan, we examined whether the two following assertions applied to the description of improvisation in paper: i) the reality of improvisation is embedded in individuals' subjectivity ii) Improvisation is related to discontinuities, shifts and changes. We then deduced whether the authors' epistemological posture was interpretive, functionalist or radical.

We provide some examples of our rationale with respect to this category. Zack (2000) relates how improvisation genres developed from deviations. He depicts improvisation as a subjective experience: *"While improvisation is grounded in forms and memory (...), each improviser must determine to what extent they want to improvise, within those forms, with those forms, or outside those forms?"* (p. 230). The reality of improvisation that he reports is embodied in individuals' experience and subjective. As he explains: *"Ordinary conversation is (...) more interplay than dialog, lodging people together in an intersubjective world in which participants mutually and iteratively create meaning out of interaction"* (p.232). Conversely, the experience of improvisation gets out of the scope of enquiry of Davis et al., (2009). These authors adopt a functionalist view in that they focus on the influence of structure as a distinct reality from individuals' subjectivity. Moreover, they target predictive truth, which suggests the existence of some environmental order. Their proposition 2 is a fair illustration of their approach (p. 8): *"As environmental dynamics increases, the optimal amount of structure decreases"*.

2.II.3. Reasoning about improvisation

We focused on the logical reasoning with respect to improvisation in studies. Authors' discourse and rationale about improvisation may be deductive, inductive and abductive when the authors go back and forth between empirical reality and theory in the same argument. Mendonça and his colleagues, in their work on wild cards (2004b), investigate the properties of improvisational capabilities in a purely deductive manner. In particular they extensively draw on Weick (1993) and Bigley and Robert's work on incident command system (2001) to infer on improvisation and planning as complementary in crisis response. As they conclude: *"Putting these arguments together, it is possible to suggest that organizations need plans but must be aware that these plans should be accommodated to local circumstances"* (p.211). Conversely, some authors rather adopt an inductive perspective on improvisation. They start from empirical reality to convert it into abstraction concepts. This is the case of Weick's work (Weick, 1993, 1998). Other authors develop their thoughts abductively. For instance, Hatch (1999) relies on both literature and personal experience of jazz to come up with properties of organizational structures − ambiguous, emotional and temporal - and recommendations to

manage them. To us, her approach is abductive: she imports properties of organizational improvisation from the jazz metaphor that she confronts with organizational theory. On the point of the ambiguity of structure that is an inherent feature of improvisation, she first draws from jazz the following statement *"This openness (or lack of closure) in structure permits any of the musicians to take the tune in a variety of directions, which, if played well, contribute innovation"*. (p. 85). Then she relies on theory to enrich her reflection on ambiguity of structure: *"In organization theory, ambiguity was first conceptualized in relation to organizational decision making and choice (…). However, whereas March and Olsen theorized ambiguity as part of the explanation for the limits of rationality in organizational choice processes, the jazz metaphor encourages us to reinterpret these empty spaces as opportunities to improvise"*(p. 86).

2.II.4.   Levels of analysis

We drew inspiration from Markus and Robey's work (1988) to define levels of analysis of improvisation. Specifying the level of analysis is a frequent practice among academics when it comes with empirical work (Mason, 2002). It has been presented as a condition of good quality of theoretical work as well (Markus, Robey, 1988). Markus and Robey define the level of analysis as "the entities about which theory poses concepts and relationships" and provide four occurrences for that category: individuals, groups, organization and society (1988). However, our sample did not include studies that analyze improvisation at the societal level, which restricted the level of analysis to three categories. For example, Leybourne and Sadler-Smith (2006) focus on the analysis of individuals' intuition in projects. Sharkansky and Zalmanovitch enhance improvisation as a peacekeeper practice in the Israel Government (2000). As they explain (p.323): *"These improvisations in effect consisted of bending the implementation of formal policies which, in fact, could not be implemented without employing massive force (…) and raising the conflict to an unacceptable pitch. It enabled the city to be governed"*.

2.II.5.   Contribution to knowledge on improvisation

We addressed two dimensions of knowledge creation related to improvisation: i) whether knowledge is accumulated or renewed, ii) whether authors create knowledge on improvisation or peripheral concepts. First, theoretical contribution can consist of an assimilation or an accommodation of knowledge (Piaget, 1977). Accumulation consists of elaborating knowledge on the basis of previously developed definition and frameworks. On the contrary, renewing view of notions contributes to exclude irrelevant theories. The second dimension concerns the proximity between the concept of improvisation and the knowledge created. We distinguished centered contribution in papers that aims to direct infer on improvisation and non-centered contribution that concerns themes that surround improvisation. For instance, Moorman and Miner follow a knowledge-building approach by proposing a definition of improvisation on the basis of prior work (1998a): *"We argue that collective improvisation may be produced by the joint activities of individuals, who are themselves improvising. The joint action of the individuals produces a "system" that we label a collective improvisation"* (p. 704). We have labeled such contribution *Accumulation and centered* because it provides

knowledge on the very notion of improvisation in a cumulative manner. Conversely, Vera and Crossan original insights on improvisation (2005) as their work "*builds on the principles and insights from improvisational theater to unpack the nature of collective improvisation »*. They question the widespread tenet of improvisation as a factor of increasing performance in teams. We labeled this kind of paper *renewing and centered*. Some other papers that we label *renewing non centered* are critical but improvisation is out of the scope of their contribution. For instance Faia-Correia (2003) questions the legitimacy of rule obedience within teams. Finally some authors provide more knowledge building that involves the concept of improvisation such as Konsynski and Tiwana (2004) who elaborate on the notion of improvisational network. We label these studies *accumulation non centered*.

2.II.6.   Research design

We based the classification of research design on Yin's work (2003) that enables a clear distinction between the core designs that have been reported in literature so far. We simplified Yin's categories of research designs and distinguished three categories: i) Empirical quantitative that includes any quantitative treatment in relation to some empirical reality. This category includes surveys and simulation, such as Davis, Eisenhardt and Bringham (2009). ii) Empirical qualitative designs refer to both longitudinal and qualitative case studies such as Ford (2008) and Baker (Baker, 2007). Finally, iii) Conceptual works refer to studies that deal with improvisation that rely on metaphorical and concrete examples, such as Hatch (1999).

2.II.7.   Focus on improvisation practices

We distinguished authors' interest in designing or using systems during improvisation. There has been an extensive debate on the relevance of the conceptual distinction of design from implementation in organizational life (Lin, Conford, 2000) and in improvisation (Baker, 2007). No one can deny that use implies some design, and reciprocally, all the more as improvisation involves simultaneously design and use. We argue that studies focus either on use or design, even though these practices are not independent from each other. The first modality of this category, e.g. design, refers to articles that rather depict improvisers with respect to the design of systems of action, such as strategies, processes, solutions. For example, Davis and colleagues connect the notion of improvisation to strategy formulation and focus on improvisation as a design process (2009). Similarly, Akgun and Lynn explore new product development as improvisation practices (2002). Other studies focus on improvisation within the use of systems. In these kinds of studies, the focus is on improvisation that occurs during implementing activities. In other words improvisers' do have some plans or predefined process but the fit between this material and the situation is ambiguous. King and Ranft, for instance, explore surgeons' improvisation on existing procedures to cope with emergency (2001).

2.II.8.   Scope of enquiry

This category deals with the scope of investigation of improvisation by the authors. The modality that we call "first level" refers to a specific focus on improvisation as a cognitive effort to cope with a specific situation or problem. That modality gathers studies that

primarily depict improviser's efforts to overcome obstacles to action, due to lack of definition or resources. The modality that we call "second level" refers to a larger view of improvisation in studies that include in their analysis of improvisation organizational artifacts, such as technology, objects and knowledge. The second level considers the reinvention process by improvisers of resources, as defined by Rice and Rogers (1990, ref à intégrer). King and Ranft's work (2001) illustrates well a "second level" study. For these authors, improvisation is not only a way to cope with ambiguity but also triggers the development of new knowledge. From their observations of surgeons' practices, they deduce the importance of improvisation for individual or collective learning *"Each surgical procedure is an application of scientific or technical knowledge but also (…) a discovery of new knowledge that can be applied in future procedures"* (p.266).

2.II.9. Conditions of improvisation emergence

We considered two possible occurrences about improvisation emergence that are endogenous and exogenous. We drew this distinction from current research on *endogenous* versus *exogenous* strategy factors (Dechamp et al., 2007). The *exogenous* category refers to papers that focus on improvisation as a response to some unexpected event such as a lack of resource or a natural hazard. The *endogenous* category refers to studies that stress that improvisation stems from the individuals and the groups' tendency to deviate from established practices. For example, Faia-Correia (2003) demonstrates the emergence of improvisation through the evolution of practices. Similarly, Orlikowski (1996) stresses improvisation is incremental rather than resulting from any specific event. Most likely, improvisation is not exclusively endogenous or exogenous but covers the two dimensions. In fact, most of the time, improvisation is a response to an event that demonstrates the inadequacy of existing plans, processes or resources. To this extent, the conditions of emergence of improvisation are both exogenous and endogenous. In this case, we used the *mixed emergence* category.

2.II.10. Improvisation contexts

Improvisation context refers to the uncertainty and time constraints that improvisers face. It has three categories: crisis, turbulence and normality. We rely on the description of environmental uncertainty and time constraints to classify articles. First of all, we labeled "normal" the articles that did not mention extraordinary time constraints and uncertainty such as King and Ranft (2001). Secondly, we used the category "turbulent" to refer to the articles that mentioned environmental velocity such as Eisenhardt and Tabrizzi (1995). Finally, the category "crisis" corresponds to articles that depict improvisation in the context of crisis.

2.II.11. Hierarchical status of improvisers

We used four categories to depict the hierarchical status of improvisers: *low status*, *middle status*, *high status* and *mixed status*. We focus on the hierarchical status of improvisers that are likely to be concerned by the articles' findings. *Mixed status* refers to studies in which authors do not refer to a specific group of improvisers. For instance King and Ranft examined improvisation among surgeons but deduced guidelines in relation to various hierarchical layers (2001).

Section 3.   Statistical treatment

3.I. Descriptive statistics

In this section we compare the frequency of categories within the sample. Figure 25 presents the overall frequencies of categories within the sample. First of all, the number of studies on improvisation significantly increased from 1992-1998 to 2004-2010, which confirms that improvisation has been attracting the attention of a growing number of researchers.

Secondly, more than 70% of the studies focus on individuals' improvisation. In addition, more than 60% of studies provide a *second level* description of improvisation. In these studies improvisation appears as a component of organizational reinvention and change. More than 50% of studies tackle improvisation in turbulent and critical contexts, which suggests that authors relate improvisation to uncertainty and time constraints, as suggested in previous literature reviews (Cunha *et al.*, 1999c).

We identify that some categories become more frequent over time. Interestingly, both crisis and turbulence are increasingly coming to the attention of researchers who study improvisation. However, the academics' interest for turbulence was at its climax between 1999 and 2003. In the latest years, crisis has more attracted academic attention, as represented in Figure 22. A majority of studies have a functionalist perspective on improvisation and the functionalist epistemological posture has become predominant over time, as represented in Figure 23. Similarly, deductive reasoning has become commonplace among studies, as represented in Figure 24. In addition, conceptual studies are dominant in the sample of articles, representing more than a third of studies. However, the frequency of conceptual studies has remained stable from one period to another. In addition, the frequency of quantitative studies has increased from around 15% to 25%. In our view, this statistic confirms previous assertion that conceptual effort on improvisation has been intense (Cunha *et al.*, 1999c).

Figure 22. Improvisation context categories frequency over time
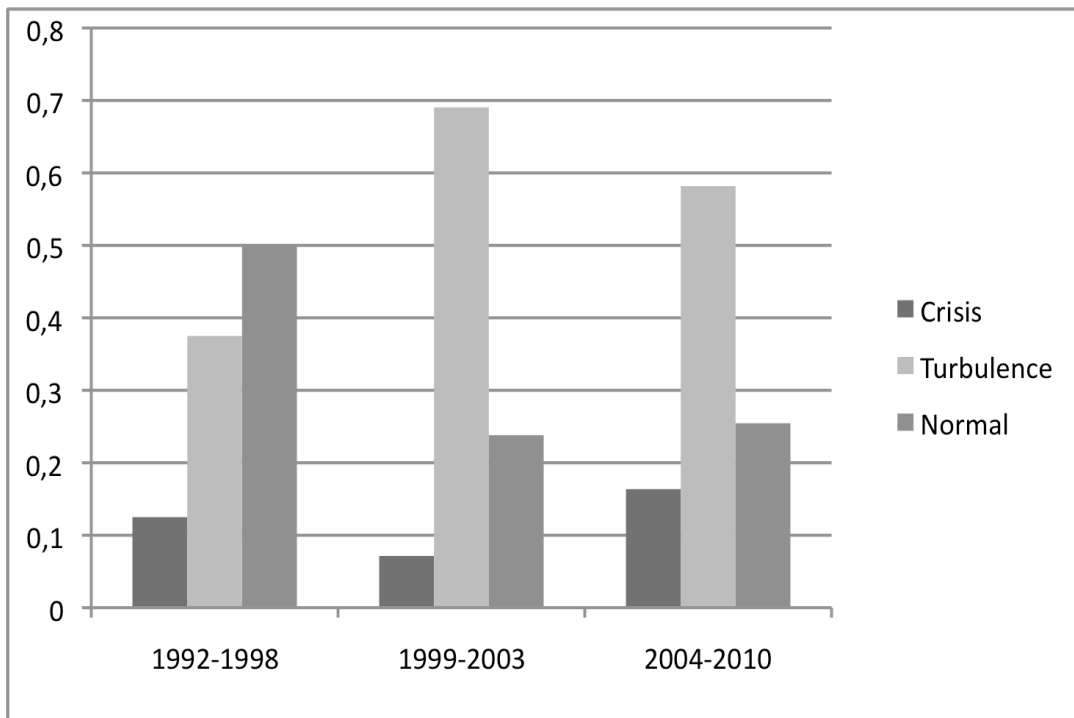
Figure 23. Epistemological categories frequency over time
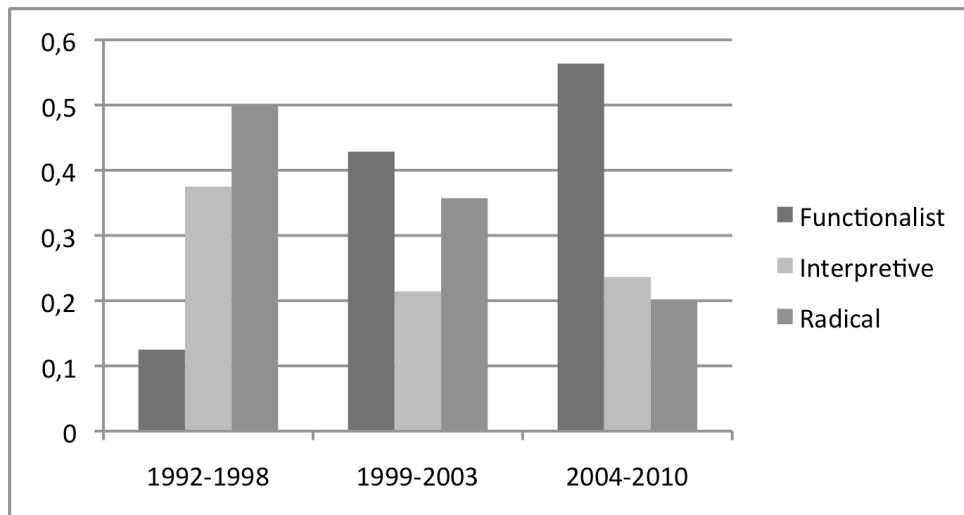
Figure 24. Reasoning categories frequencies over time
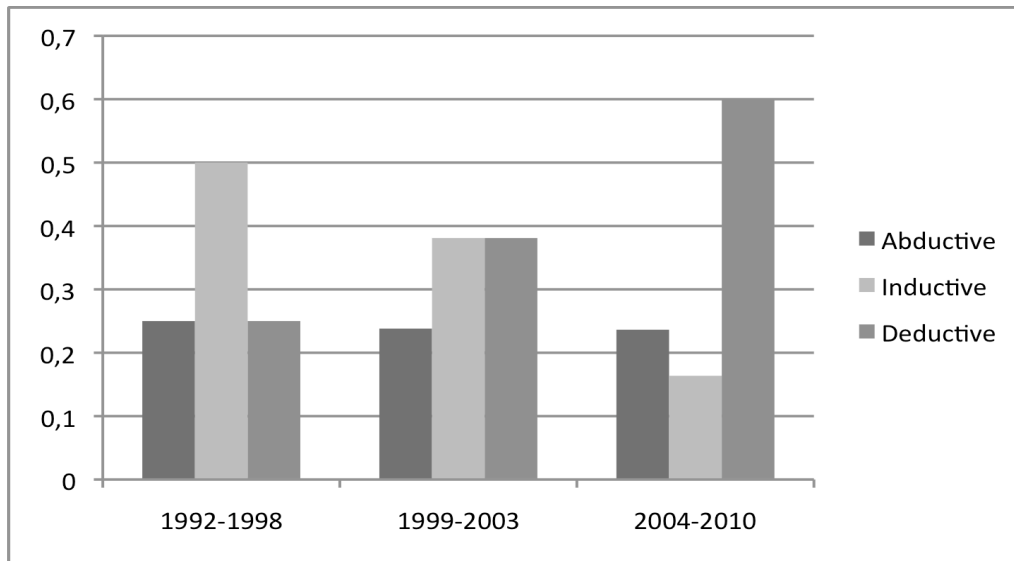
Figure 25. Categories overall frequency
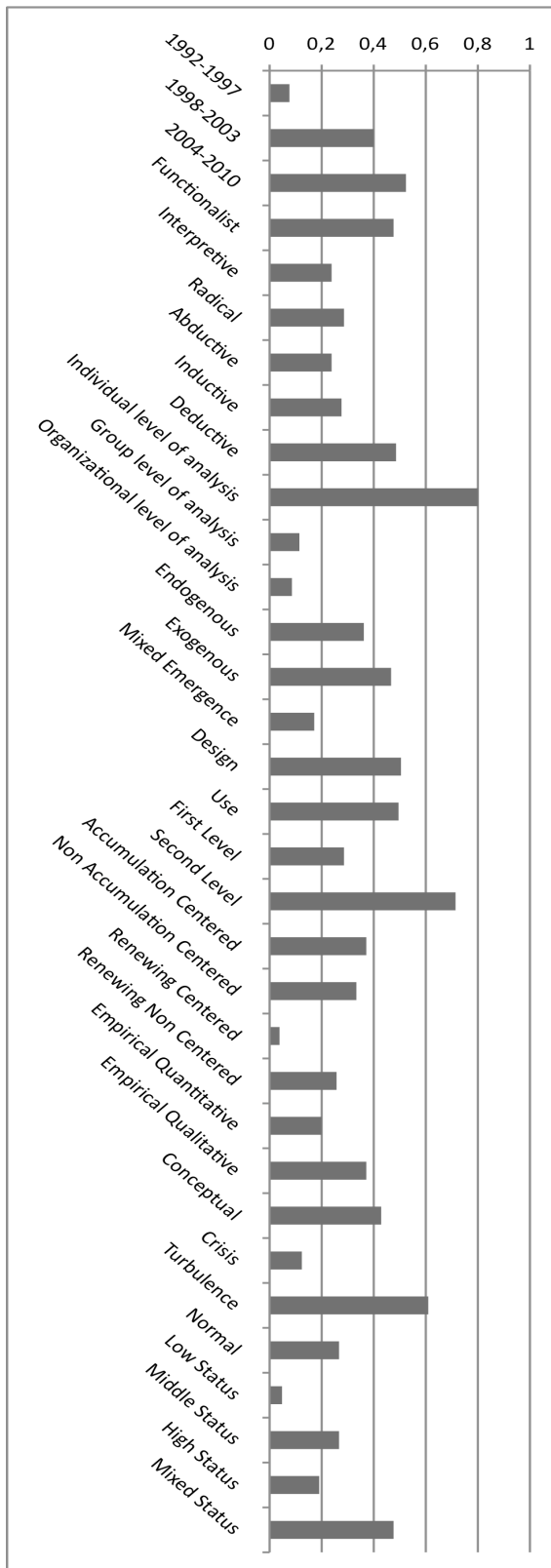
Figure 26. Categories frequency over time radar
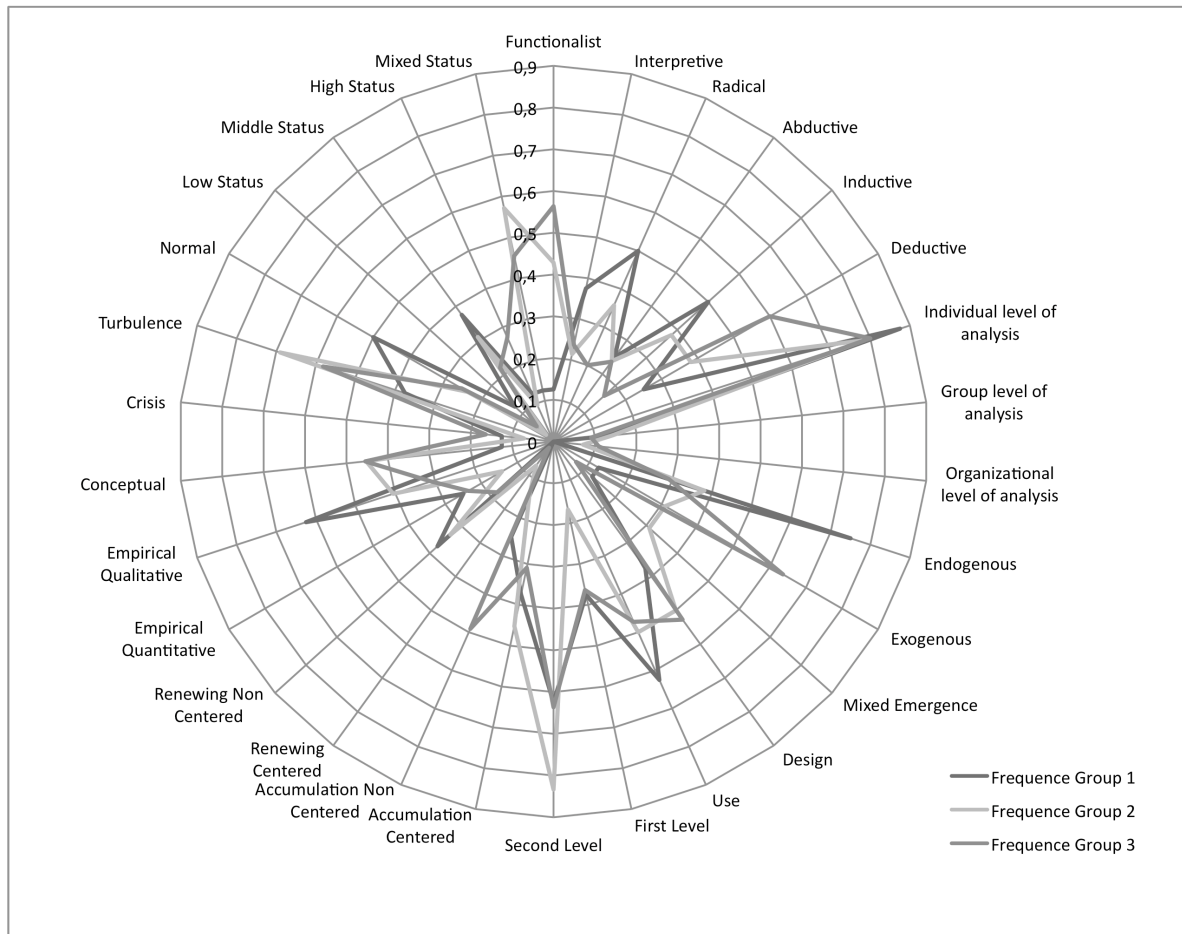
Finally, the radar represents the evolution of categories frequencies from one period to another. In Figure 26, Group 1 refers to articles that were published between 1992 and 1998, Group 2 refers to articles that were published between 1999 and 2003. Finally, group 3 refers to articles published since 2004. The radar output suggests that approaches of improvisation are globally similar from one period to another. We deduce that despite significant evolutions related to reasoning on improvisation and epistemological posture, the frequency of many categories is similar from one period to another.

3.II. Principal Component Analysis

We completed the remainder of our statistical analysis in two steps. First of all, we evidenced some factors that account for diversity within research on improvisation in the management field. Secondly, we completed a cluster analysis to search for groups of categories. We used factor analysis to evidence similarities among variables within the sample.

We used two techniques to make sense of the diversity of articles within the sample. We completed a Categorical Principal Component Analysis (CATPCA) because our categories are nominal data. CATPCA is a similar technique as PCA and is used to deal with categorical variables whose values require quantification. In parallel, we completed a PCA on the transformed variables, which enabled us to use the rotation algorithm VARIMAX on the

sample. Similarly to Principal Component Analysis (PCA), CATPCA can be used to detect groups of variables that evolve similarly within the sample and to reduce the variables. The combination of PCA and CATPCA has been regularly used in statisctics (Manisera *et al.*, 2006).

In the first steps of the statistical treatment, the running of the CATPCA unveiled that both *Authors'Affiliation* and *Improvisation ontology* did not load on any dimension. We deduced from these low values that these variables did not evolve with other variables. Some of the other variables' loadings did not differ from one dimension to another, which led us to simplify the scales. For instance, we simplified the *Research Design* variable into three categories (for more detail see, the presentation of variables section). By doing so, the component loadings converged and diverged more clearly.

The PCA on the transformed data helped to detect the number of relevant components within the sample. We transformed the data by using the principal (VPRINCIPALS) method for quantification. We then compared the results obtained by the PCA on quantified categories. The contribution of the PCA on quantified categories enabled to detect the number of components that were relevant for our analysis. Both the screen test and the examination of the total variance explained suggested that four components (or dimensions) accounted for 60,6 % of the total variance. Similarly, the CATPCA on four dimensions revealed 61% of the variance accounted for.

Table 10 presents the eigenvalues and the variance explained from the PCA on quantified variables. Table 11 presents the eigenvalues and the variance accounted for from the CATPCA on four dimensions. These tables show similar results from both treatments.

Table 10. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2,297	20,883	20,883	2,297	20,883	20,883	1,789	16,267	16,267
2	1,812	16,475	37,358	1,812	16,475	37,358	1,749	15,905	32,172
3	1,496	13,597	50,956	1,496	13,597	50,956	1,606	14,597	46,769
4	1,063	9,666	60,621	1,063	9,666	60,621	1,524	13,852	60,621
5	,938	8,528	69,149						
6	,762	6,932	76,081						
7	,679	6,171	82,252						
8	,613	5,576	87,829						
9	,575	5,229	93,058						
10	,411	3,737	96,796						
11	,352	3,204	100,000						

Extraction Method: Principal Component Analysis.

Table 11. Variance explained by the Model - CATPCA on Four dimensions

| Dimension | Cronbach's Alpha | Variance Accounted For | |
		Total (Eigenvalue)	% of Variance
1	,629	2,335	21,226
2	,469	1,742	15,833
3	,353	1,472	13,383
4	,192	1,212	11,014
Total	,937[a]	6,760	61,457

a. Total Cronbach's Alpha is based on the total Eigenvalue.

As the second step of our statistical treatment, we checked the reliability of our PCA analysis. We checked that our PCA of the sample was reliable from several aspects. First of all the Eigenvalues of the dimensions were all superior to 1. Moreover the reliability tests of component analysis reveal that KMO and Bartlett's test are satisfactory. The KMO index is superior to 0.5, which shows that there is a minimum level of collinearity between variables, which makes our PCA relevant (Jolibert, Jourdan, 2006).

Table 12. Reliability measurement of the PCA on transformed values

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,574
Bartlett's Test of Sphericity	Approx. Chi-Square	179,662
	df	55
	Sig.	,000

Finally, we analyzed component loadings and compared them to the component matrix and the rotated component matrix to identify the loadings of the variables on each of the four components. Table 13 presents the components loadings and Table 14 presents the rotated component matrix.

Table 13. Component loadings – CATPCA

	Dimension			
	1	2	3	4
Period	-,442	-,381	-,156	,358
Epistemo	,545	,477	-,204	-,133
Reasoning	-,647	,004	,435	,311
LevelAna	-,473	,050	-,456	-,156
ImpEmergence	-,094	-,559	-,617	-,110
FocusPractice	,577	-,293	,209	,469
ScopeEnqu	,527	,214	-,221	,466
ContribKnowledge	-,064	,519	-,335	,598
ResearchDesign	,593	-,161	-,313	-,220
Context	-,151	,702	,202	-,283
HierStatImprov	,449	-,367	,534	-,097
Variable Principal Normalization.				

Table 14. Rotated Component Matrix - PCA on the transformed variables

	Component			
	1	2	3	4
Periode Quantification	-,094	-,399	,638	-,089
Epistemo Quantification	-,030	,396	-,338	,548
Reasoning Quantification	-,041	-,843	-,009	-,092
LevelAna Quantification	-,629	,016	,170	-,062
ImpEmergence Quantification	-,283	,260	,744	,008
FocusPractice Quantification	,794	,134	,170	,095
ScopeEnqu Quantification	,392	,252	,038	,538
ContribKnowledge Quantification	-,008	-,073	-,112	,800
ResearchDesign Quantification	,136	,718	,084	-,013
Context Quantification	-,402	-,162	-,627	,175
HierStatImprov Quantification	,581	,165	-,242	-,482
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 7 iterations.				

3.III. Cluster analysis

To detect similarities between studies, we examined the proximity between the categories. To do so, we used hierarchical cluster analysis techniques, as detailed by Hair and his colleagues (Hair *et al.*, 1984). More specifically, we have extracted the factorial scores of each modality, e.g. the coordinates of the modalities in the referential composed by the four dimensions.

Our cluster analysis on the set of 33 categories did not enable us to detect any significant group. We used the replication technique to validate our findings. The replication technique is recommended by Aldenderfer and Blashfield (1984, p. 65) and consists of replicating the same cluster analysis with various algorithms to verify that the dendogram patterns are stable across the various techniques used to form clusters (Durrieu, Valette-Florence, 2005). Annex 4 provides some example of the similarities between our replicated dendogram. In Figure 27, we represent the dendogram that we obtained with the Ward's method. In this dendogram, the category "crisis" is an outlier, e.g. a category with low proximity with other categories. In addition, the dendogram reveals that 5-10 iterations aggregated only a small number of categories. We conclude from these findings that our sample does not include any homogenous group of category

Figure 27. Categories overall dendogram

Dendrogram using Ward Linkage
Rescaled Distance Cluster Combine
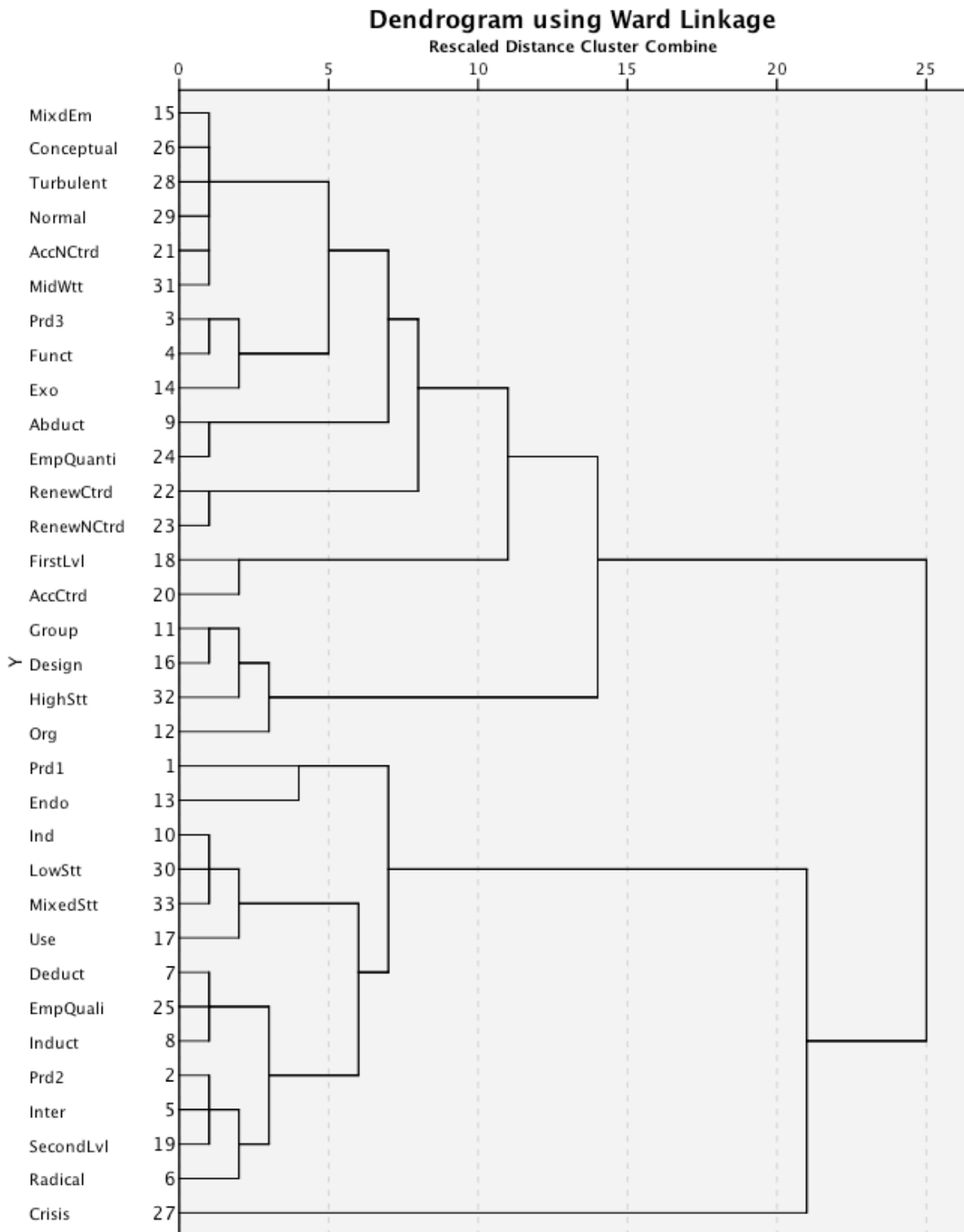
We then used cluster analysis techniques on the fragments of categories that loaded on each dimension. We present these clusters in the following sections.

Section 4.   Interpretation of findings

The PCA and CATPCA techniques unveiled four statistical components. We interpret these components as four dimensions of diversity in the management literature on improvisation. We label the four dimensions as follows: i) Evidencing, ii) Focalizing iii) Contextualizing and iv) Creating knowledge. We also view the dimensions as meta-variables in our classification as we deduced these dimensions from the variables loadings in the CATPCA and PCA outputs. Going further in our interpretation, we propose that each dimension corresponds to a specific task in the research process.

We then considered each component. We performed a cluster analysis on the portions of categories that loaded on each component. For each component, we identified two groups from the cluster analysis. We interpret this finding in the following way. With respect to each task, e.g. evidencing, focalizing, contextualizing and creating knowledge, two primary academic perspectives coexist. Making the sum of two perspectives per each task, we identify eight perspectives on improvisation that are not exclusive. Figure 28 presents the four dimensions and the eight perspectives on improvisation.

Figure 28. Eight perspectives on improvisation
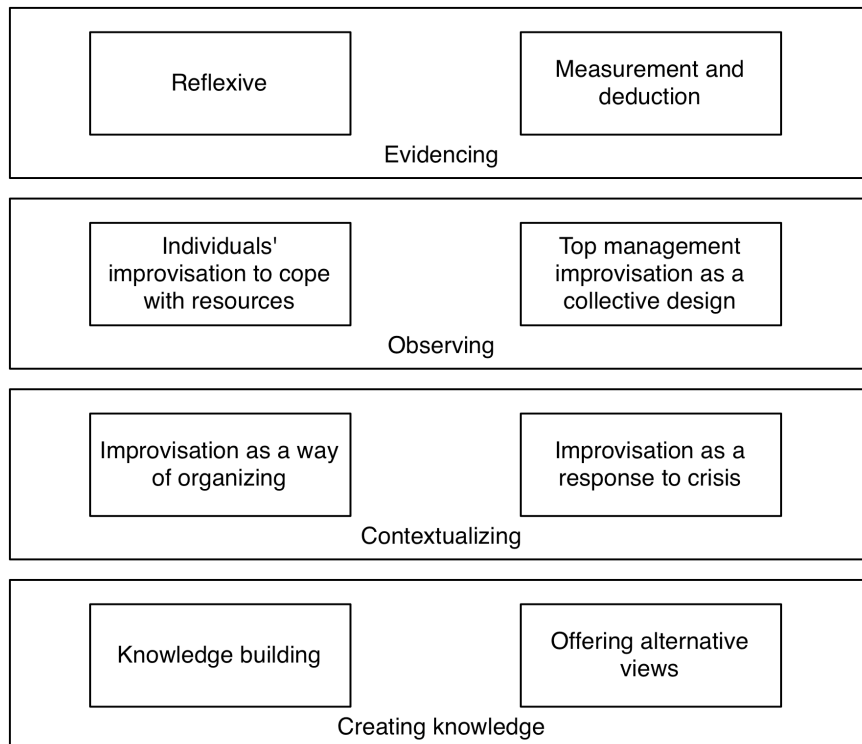
First of all, authors observe different kinds of improvisers and improvisation practices. They focus on different groups of improvisers and distinct improvisation practices. While some authors focus on improvisation among top managers in designing activities, other studies

explore how individuals from lower or mixed hierarchical layers improvise when they implement or use resources.

Secondly, authors conceptually and empirically evidence improvisation in distinct manners. Some authors deduce characteristics of improvisation from preexisting frameworks while others develop their own conceptualization of improvisation.

Thirdly, the context of improvisation differs across studies. A specific stream of research focuses on crisis improvisation to respond to unanticipated events. Other papers of the sample study improvisation as a practice that progressively emerges and structures organizational practices.

Finally, research on improvisation differs on the basis of the knowledge created. While some papers target a clarification of improvisation in a functionalist perspective, another stream of research evidence relates improvisation and organizational functioning in a more critical or interpretive fashion. Table 15 presents the various dimensions of diversity and the related variables.

Dimensions of diversity within the management literature on improvisation	Variables
Dimension 1: Evidencing	Reasoning about improvisation
	Research design
Dimension 2: Focalizing	Level of analysis
	Focus on improvisation practice
	Hierarchical status of improvisers
Dimension 3: Contextualizing	Context for improvisation
	Improvisation emergence
	Period
Dimension 4: Creating knowledge	Epistemological posture
	Scope of enquiry
	Contribution to knowledge

Table 15. Dimensions of diversity and corresponding variables

4.I. Evidencing improvisation

Evidencing corresponds to the methodological techniques that authors employ to recognize an organizational phenomenon as an improvisation.

This dimension refers to three possible paths of reasoning that authors use to define improvisation as well as make theoretical assumptions and propositions. Some authors rely on a theoretical source to provide a definition of improvisation and it's characteristics. For example, Lau and his colleagues rely on Orlikowski and Hoffman's improvisational model to identify and understand improvisation practices into clinical settings (Lau *et al.*, 1999). These authors use an existing model as a conceptual foundation to recognize and discuss improvisation. Some other studies primarily rely on empirical observation to conceptualize

improvisation. By doing so, they either induce their own view of improvisation or discuss potential existing theories in an abductive manner. For example, Hatch draw on both her experience of jazz music to question traditional understandings of organizations and propose alternative ways to understand ambiguity and emotionality in organization (Hatch, 1999). By doing so, she proposes an alternative view of improvisation and organizations.

Evidencing also refers to the techniques used to identify and analyze improvisation, e.g. the research design. Most quantitative studies develop or rely on preexisting measurement tools to analyze improvisation. For instance, Moorman and Miner provide a three items scale to measure organizational improvisation level of actions (Moorman, Miner, 1998b, p. 10). Conceptual studies provide a rich description of past improvisation and detail the authors' rationale for differentiating and diverse types of improvisation. For example, Weick explains that improvisation can be more or less intense and describes different levels of intensity of improvisation (1998). To illustrate this point, we present Lanzara's work (1999) that specifies improvisation as a component of bricolage:

« *We observe a variety of mundane building activities, recombinations of preexisting components, small scale practical experiments, local readjustments and repairs, extemporaneous improvisations, which taken together resemble what, by using a French word, can be labeled bricolage* (Lévi-Strauss, 1962) » (p. 334).

As suggested by the dendogram, two main perspectives can be identified as divergent techniques to provide evidence of improvisation. First of all, quantitative studies, such as surveys, introduce improvisation in a deductive fashion. For instance, Eisenhardt and Tabrizzi (1995) relies on previous work to evidence the role of improvisation in organizations that handle uncertainty. These authors then deduce the role played by improvisation in the experiential model of firms' fast adaptation to turbulent environments. Secondly, qualitative research induces improvisation characteristics from in-depth analysis or metaphors. Even though they inspire from and remain consistent with organizational theories, the authors from this stream of thought develop original conceptualizations of improvisation. For instance, Clegg, Cunha and Cunha draw inspiration from a dialectical approach to organizations to recognize and define improvisation as a paradox between acting and planning (2002). Similarly, Ciborra proposes an original conceptualization of improvisation as an inherent practice in organizing (1999):

"*While improvising, the agent is able to frame and recombine features of her situation, so that they become resources for intervention. In a burst of action the contours of the problematic situation, plans for problem solving and the deployment of resources coalesce. Improvisation is intentional but extemporaneous, that is, happening almost unexpectedly ('ex tempore'—outside the flow of time), and with little known cause or relationship*"(p. 78).
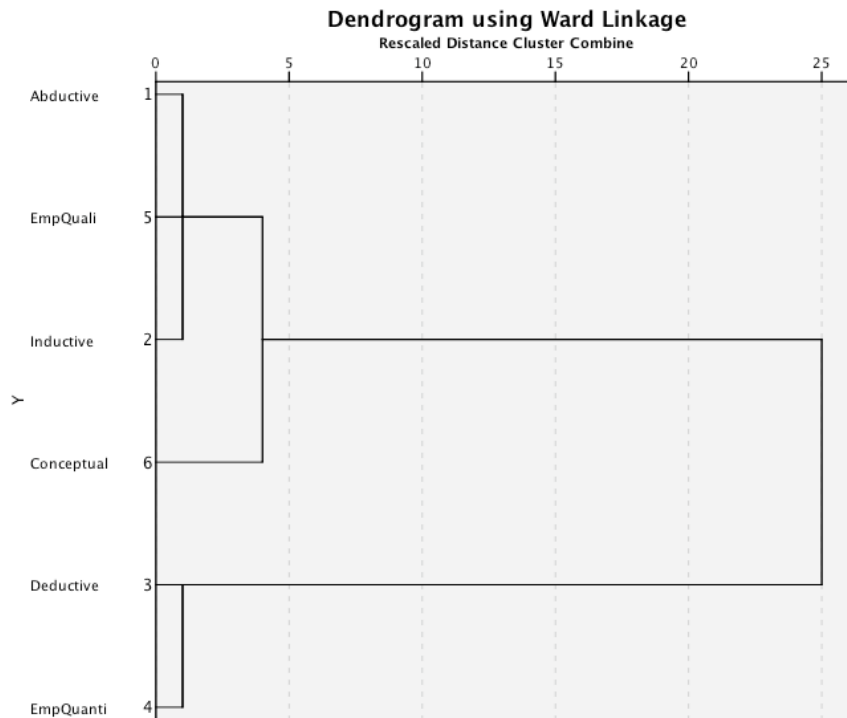
Figure 29. Evidencing dendogram

4.II.Focalizing

The second dimension that we label *focalizing* corresponds to the authors' focus when they observe improvisation in organizations. *Focalizing* refers to three variables. First of all, the hierarchical status of improvisers responds to the following question: *who is improvising among organizational members?* Secondly, the variable entitled practices of improvisation correspond to the question of *what is the object of improvisation*? Finally, the level of analysis describes *who* is observed within the organization.

We identify two main manners of observing improvisation in organizations, as suggested by the dendogram. First of all, some authors specifically deal with improvisation within top management. For instance, David, Eisenhardt and Bingham deal with strategic improvising that consists of the improvised design of strategy (2009). They focus on top managers and decision makers as actors of improvisation at the organizational level.

These articles depict improvisation as collective output. Conversely, some other studies explore improvisation as a practice among all sorts of actors within the organizations. While some authors provide information about the status of improvisers within the organizations, some others are less specific. Instead of targeting on a specific hierarchical status, they focus the individuals' experience of improvisation when they use organizational means and resources.
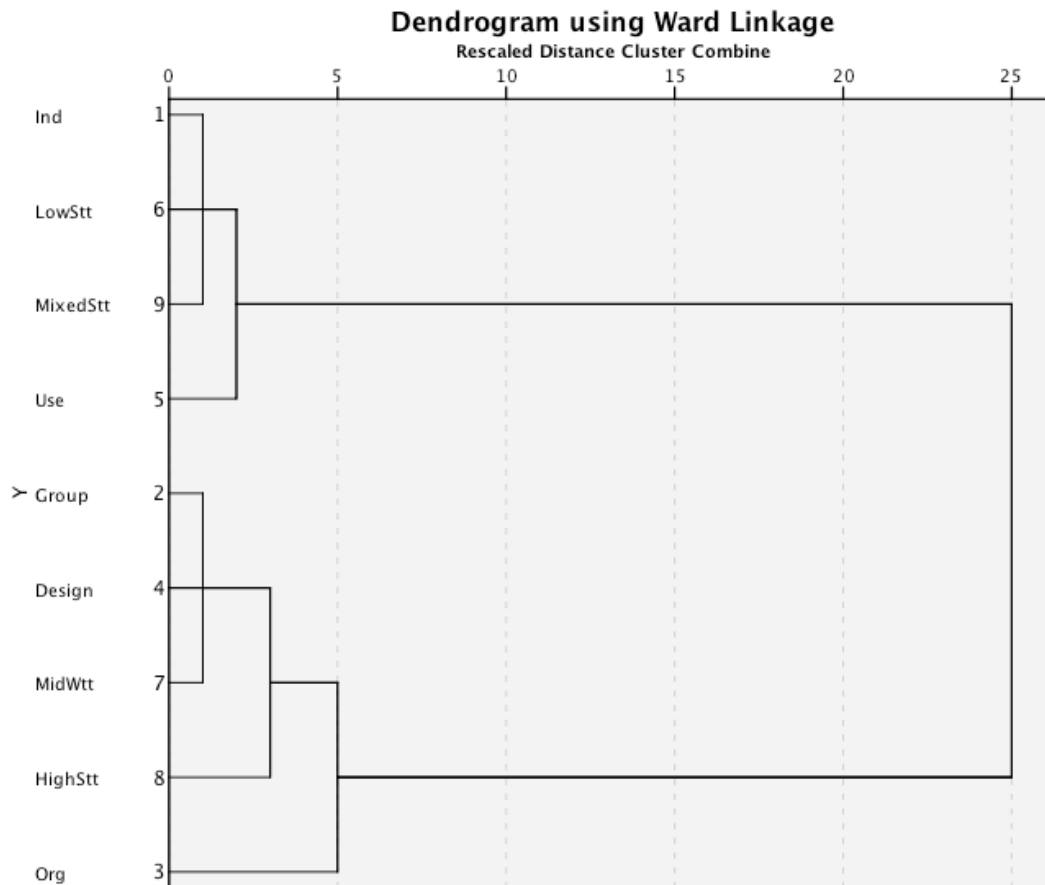
Figure 30. Observing dendogram

4.III. Contextualizing

The third dimension that we label *contextualizing* refers to the empirical context of improvisation. *Contextualizing* refers to three variables. First of all, it refers to the level of uncertainty and time pressure that improvisers face. Some studies examine improvisation when uncertainty and time constraints are not inherent to the organization's environment. For instance, Orlikowski examines how technology users progressively develop local improvisations to handle the misfit of technology to their needs (1996). She hardly refers to uncertainty as a condition of emergence of improvisation but primarily focuses on the sociotechnical environment of users as one of components of improvisation. Similarly, Macredie and Sandom find a correlation between local improvisation and customers' dissatisfaction in normal and turbulent environments (1999). Some other studies pay more attention to organizational contingency and take into account turbulence as an ingredient to improvisation. For instance, Brown and Eisenhardt highlight improvisation as a response to environmental uncertainty (1997). Finally, some authors focus on crisis improvisation.

We rely on the contextualizing dendogram to distinguish two main manners of contextualizing improvisation. A first approach consists of viewing improvisation as way of organizing that enables organization to deal with more or less turbulence. A second stream of

research investigates improvisation as an exogenous phenomenon. The dendogram reveals that studies that examine how organizational members react to crisis through improvisation have been more frequent since 2003. For instance, Webb examines role improvising as a technique to cope with uncertainty regarding resources and tasks (2004). Roux-Dufort and Vidaillet find that the occurrence of improvisation depends on individual's perception of crisis (2003a). Contextualizing refers to the period of completion of the study as well. As our findings suggest, the academic interest for organizational context can depend on the period of time when the study is completed. Because some topics are more fashionable at certain times among academic audience, crisis, as a context of improvisation, has been increasingly investigated.
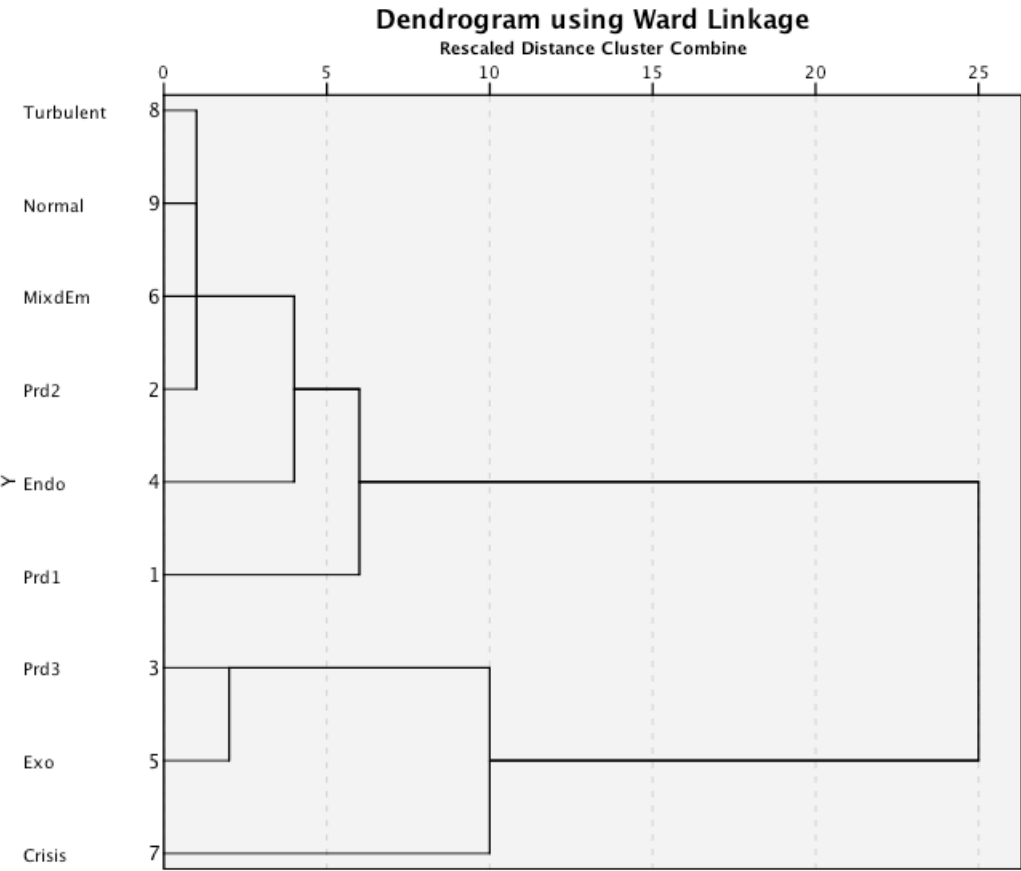
Figure 31. Contextualizing dendogram

4.IV. Creating knowledge

The fourth and final dimension that we label *creating knowledge* relates to the type of knowledge that authors create on organizations. Including the authors' epistemological posture, this dimension unveils whether authors propose that knowledge on improvisation has some predictive power (functionalist perspective). Conversely, some authors assume that knowledge on improvisation is not univocal given that improvisation has changing attributes

depending on individual's subjectivity (interpretive perspective) or environmental and ideological shifts (radical perspective). The *creating knowledge* dimension also refers to the scope of investigation of improvisation. The first level studies narrow investigation to the emergence and occurrence of improvisation. However, second level studies provide a wider view of the organizational implications of improvisation by relating improvisation to other concepts such as innovation and organizational change. Finally, *creating knowledge* refers to the type of knowledge created in the sample studies.

We distinguish two main perspectives on knowledge creation on improvisation. First of all, some authors build on previous work to accumulate or unify knowledge on improvisation as an objective and predictable phenomenon. For instance, Cunha, Cunha and Kamoche (1999c) provide an integrative definition of improvisation from existing definitions. By doing so, they combine some distinct aspects of improvisation such as bricolage and extemporaneity into their conceptual propositions. Contrasting with this perspective, other studies aim to offer original perspectives on improvisation as an organizational phenomenon. For instance, Faia-Correia (2003) investigates how improvisation can reverse the established hierarchical order within an organization. By doing so, she offers new and controversial perspectives on the influence of improvisation on organizational functioning.

Dendrogram using Ward Linkage
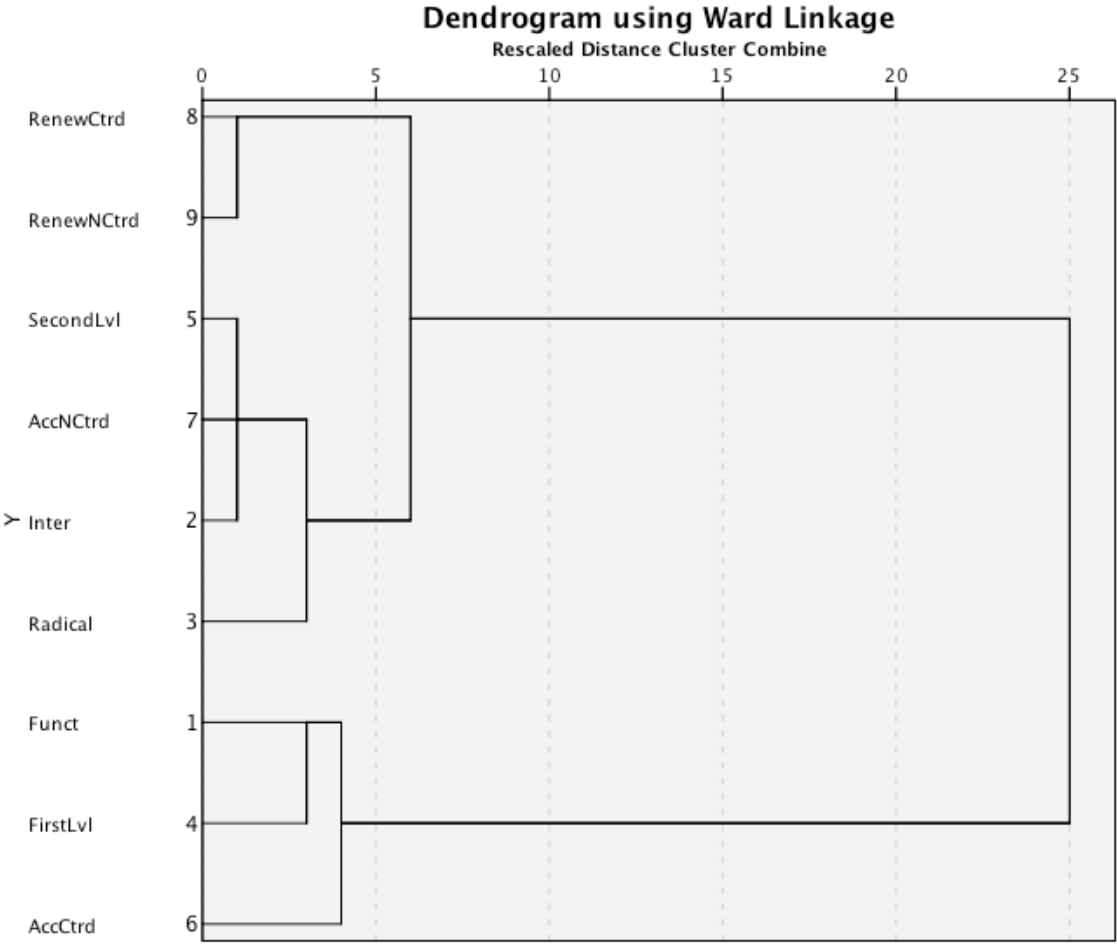
Figure 32. Knowledge creation dendogram

Section 5.   Discussion of findings

In this paper, we detail our interest in handling diversity in research on improvisation. We argue the need not to restrict our analysis to theoretical criteria such as theoretical foundation or research questions. On the contrary, we suggest that diversity in research on improvisation stems from at least two interrelated sources: the empirical reality and how authors depict, analyze and reflect on this reality.

Following this approach, we have classified the literature on improvisation by considering various aspects of improvisation. Our findings from the PCA, CATPCA and cluster analysis reveal that diversity does exist because we could not identify any predominant approach of improvisation. Furthermore, our findings update Cunha, Cunha and Kamoche's work on research on improvisation (Cunha *et al.*, 1999c). Conceptual papers remain predominant, but empirical methodologies are increasingly used. Our work reveals temporal evolutions of research on improvisation regarding epistemological postures, reasoning and improvisation contexts. In addition, we suggest that diversity of research on improvisation stems from divergences between authors in relation to four primary research tasks: i) evidencing, ii) focalizing, iii) contextualizing and iv) creating knowledge on improvisation foster diversity of research on improvisation.

The contribution of this work to academic life is twofold. First, we confirm that research on improvisation is effectively diverse. To explain this diversity we submit three hypotheses. A first hypothesis would be that this diversity is due to the specificities of the concept of improvisation. Considering other topics, one can realize that research on topics such as ICT fit (Zigurs, Khazanchi, 2008), technology diffusion (Fichman, 1992), knowledge (Alavi, Leidner, 2001) or even culture (Gallivan, Srite, 2005), converge around a limited set of perspectives. However, further investigation of improvisation is necessary to confirm or infirm this hypothesis. An alternate explanation would be that research on improvisation is too "young" to structure into a unified field of research. Improvisation has started attracting researchers' attention for two decades on the contrary to other concepts that have been studied for a longer time. The final explanation is related to our holistic approach to diversity. By taking into account a large panel of variables, we enhanced heterogeneity within our sample.

We also identify the major differences between existing approaches of improvisation in the management literature. Thus, this study offers some criteria to distinguish studies that approach improvisation in a similar manner from others. This techniques has already been used to provide clarity in research domains (Prescott, Conger, 1995). Authors can compare studies' common points and differences with respect to recognizing, observing, contextualizing and creating knowledge. As a result, two studies that seemingly have nothing in common can be compared to promote knowledge building. For example, our study reveals that Akgün and Lynn's (2002) approach of improvisation is similar to Chelariu, Johnston and Young's work (2002). At first glance, these two studies deal with unrelated topics: while the

former study investigates improvisation in New Product Development (NPD) teams, the latter focuses on organizational learning from improvisation. However, by using our research outputs as an analysis grid, one can find that these two studies offer complementary findings and views of improvisation. Both these studies adopt the same approach to improvisation as a collective phenomenon in top hierarchical layers. Furthermore, both studies depict improvisation as an inherent practice in organizations and provide consistent guidelines on how to develop improvisational capabilities. Akgün and Lynn recommend that managers promote their team's stability over time (2002). Chelariu and colleagues go further by highlighting the importance of stable interactions and wisely shared information flows within the team (2002). Similarly, we recommend that authors specify their approach of improvisation at each of the four steps that we describe in this study to promote knowledge building and discussion among researchers.

In spite of all our efforts, some limits and criticism can be raised regarding our work. First of all, one can easily question the relevance of classification in research. Given its exclusive theoretical basis, classification implies lack of experience and can lead to simplistic conclusions (Sandelands, Srivatsan, 1993). Deetz (1996) argues that the temptation to reduce rich paradigms or conceptions to simplistic categories is commonplace in research. Moreover, there is the risk of bias because of our overusing the "other" category. By doing so, some insightful and original papers on improvisation can be marginalized and eventually overlooked (Deetz, 1996). In addition, As Bowker and Starr suggest (2000), classification is rarely complete, in spite of completeness being an essential feature of classification in theory. Finally, classifying implies the risk to extrapolate or misinterpret the authors' view on improvisation. Consequently, we had important discussion on categories in order to determine whether they could be retained for statistical treatment.

Secondly, our scope of inquiry is not exhaustive. This work aims to address diversity in research on improvisation. However we have eluded in this work conceptual polysemy. One major aspects of polysemy of improvisation is that some other surroundings concepts are used instead of improvisation, such as bricolage or tinkering. It would be interesting to create a conceptual mapping to represent the logical connections between improvisation and other concepts. Similarly, we only depict mainstream or at least well-known papers because we assume that these will have a significant impact on current and future research. It is worth knowing more about conference proceedings and their influence in knowledge building.

Given our findings and the limitations of our work, we propose three avenues for future research. Our findings partly suggest that research on improvisation is diverse and includes more than 8 different perspectives. Why does a unifying perspective on improvisation not exist? One option to respond to this question would be to further trace the development of the research field on improvisation. Thus the next step to this work is to account for the evolution of research on improvisation year after year. Using k-means cluster analysis, one could develop a historical view of the development of research on improvisation, therefore identifying some influential stream of research more specifically.

Another direction for research could be to enrich existing work on diversity by addressing concepts' polysemy in management. Polysemy refers to the plurality of meanings possibly taken by a concept (Deane, 1988; Pisanelli *et al.*, 2004) and promotes a diverse understanding of concepts within the same field. Undeniably, polysemy also results from diversity in that it stems from the use of various terms to depict similar phenomena. Concepts such as strategy and values are relevant illustration of rampant polysemy in management (Hambrick, 1980). For instance, the term *value* has been widely used in radically different settings. For some authors in strategic management, value may simply mean performance or at least the creation of additional benefit thanks to an optimal organizational function. Porter's thought (1991) is one of the most thorough developments on the notion of value, notably through the concept of *value chain*. In a single glance, one can intuitively acknowledge that the notion of value refers to a wide panel of managerial realities, coming from profitability to satisfaction.

Our final direction for future research consists of exploring the connections between improvisation and peripheral concepts such as bricolage, resilience, ambidextry, tinkering etc. Linkages between improvisation and other concepts are diverse but comprise mostly causal-effect, inclusion or mean-end relationships. For example, improvisation has been depicted as a means for organization to be more resilient by Rerup (2001). In fact resilience was defined as an organization's ability to deal with its vulnerabilities (McManus, 2008) and results not only from anticipatory but also improvisational skills (Rerup, 2001). Our literature review also suggests empirical investigation is required on such relationships in that authors have developed contradictory views on improvisation role in organizational life. For instance, Bansler and Havn (2004) suggest improvisation enables sensemaking. Lanzara (1999), on the contrary, posits improvisation prevents sensemaking.

Conclusion

To conclude this study, we propose to use our findings to position our doctoral work. Our *evidencing* of improvisation follows the reflexive approach. In chapter 2.3 we discuss existing conceptualizations and their limitations to identify the need to identify the role played by interactions in organizational improvisation during crisis response. We then make theoretical propositions that we deductively draw from existing literature. We then complete an in-depth qualitative analysis of improvisation. With respect to *focalizing*, we diverge from the two main perspectives on improvisation that we document in this study by focusing on improvisation as a collective phenomenon between mixed hierarchical layers. We *contextualize* improvisation as a response to critical events. With respect to *knowledge creation*, we primarily attempt to offer additional insights on interactions that compose organizational improvisation and ICT use. Our objective is to propose an alternative view of organizational improvisation. Figure 33 represents our position in relation to the four dimensions and the eight perspectives that we document in this study.
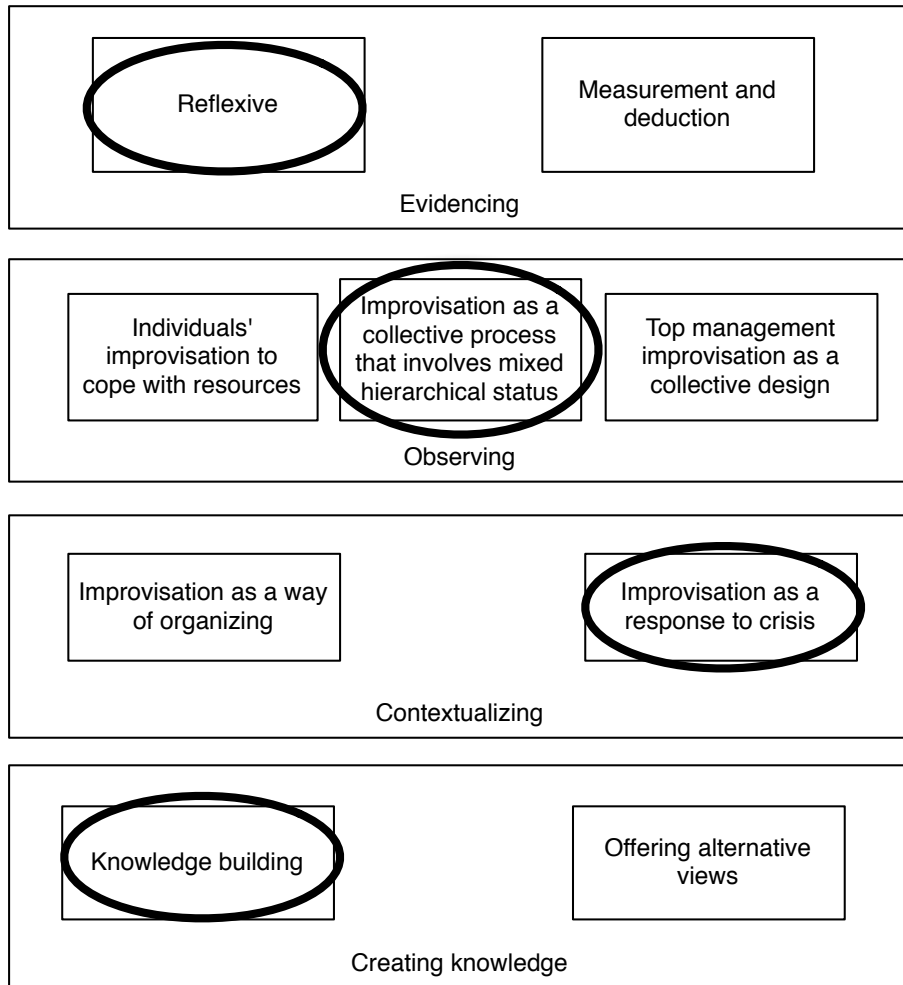
Figure 33. Our position in relation to improvisation in the dissertation

Annex 1. Description of the sample

Table 16. Description of the articles sample

Year & SamplingTechnique	Authors and reference	Journal Name
1992 Snowball Sampling	Bastien, Hostager, Cooperation as communicative accomplishment: A symbolic interaction analysis of an improvised jazz concert	Communication Studies
1993 Snowball Sampling	Weick, the collapse of, Man Gulch Disaster	ASQ
1994 REQUEST	Spark, Machiavellianism and personal success in marketing: The moderating role of latitude for improvisation	Journal of the Academy of Marketing Science
1995 Snowball Sampling	Eisenhardt, Tabrizi, accelerating adaptive process: product innovation in the Global Computer Industry	ASQ
1996 REQUEST	Orlikowski, Improvising organizational transformation over time: a situated change perspective	ISR
1996 REQUEST	Crossan, Lane, White, The improvising organization: Where planning meets opportunity	Organizational Dynamics
1997, REQUEST	Brown, Eisenhardt, The art of continuous change	ASQ
1997 REQUEST	Aram, Walochik, Improvisation and the Spanish manager	International Studies of management and organization
1998 REQUEST	Berniker, Working the jazz metaphor: Musings driving down I-5 past midnight	Organization Science
1998 REQUEST	Barett, Creativity and improvisation in jazz and organizations: Implications for organizational learning	Organization Science
1998 REQUEST	Crossan, improvisation in action	Organization Science
1998 REQUEST	Moorman, Miner, The convergence of planning and execution: Improvisation in new product development	Journal of Marketing
1998 REQUEST	Moorman, Miner, organizational improvisation and organizational memory	AMR
1998 REQUEST	Weick, Improvisation as a Mindset for analysis.	Organization Science
1999 Snowball Sampling	Ciborra, Notes on improvisation and time in organizations	Accounting, management, and information technologies
1999 REQUEST	Cunha, Cunha, Kamoche, Organizational	International Journal of

	improvisation: What, when, how and why	Management Reviews
1999 Snowball Sampling	Lanzara, Between transient constructs and persistent structures: designing systems in action	Journal of Strategic Information Systems
1999 REQUEST	Lau et al., Patterns of improvisation for evidence based practice in clinical settings	Information technology and people
1999 REQUEST	Hatch, Exploring the Empty Spaces of Organizing: How improvisational Jazz halps redescribe organizational structure	Organization Studies
1999 REQUEST	Macredie, Sandom, It-enabled change: Evaluating an improvisational perspective	EJIS
2000 REQUEST	Sharkansky, Zalmanovitch, Improvisation in Public administration and policy making in Israel.	Public Admnistration Review
2000 REQUEST	Dyba, Improvisation in small software organizations	IEEE Software
2000 REQUEST	Zach, Jazz improvisation and organizing - Once more from the top	Organization Science
2001 REQUEST	Bigley, Roberts, The Incident Command System: High-reliability organizing for complex and volatile environments	AMJ
2001 REQUEST	Cunha, Cunha, The brave paradoxical world	Strategic Change
2001 REQUEST	Kamoche, Cunha, Minimal structures: From jazz improvisation to product innovation	Organization Studies
2001 REQUEST	King, Ranft, Capturing knowledge and knowing through improvisation: what managers can learn from the thoracic surgery board certification process	Journal of Management
2001 REQUEST	Miner, Bassoff, Moorman, Organizational improvisation and learning: A field study	ASQ
2001 Snowball Sampling	Rerup, "Houston, we have a problem": Anticipation and Improvisation as sources of organizational resilience	Comportamento organizacional e gestao
2001	Sashittal, Jassawalla, Marketing implementation in smaller organizations: Definition, framework, and propositional inventory	Journal of the Academy of Marketing Science
2002 REQUEST	Akgyn et al., Multi-dimensionality of learning in new product development teams	European Journal of Innovation Management
2002 REQUEST	Akgun, Lynn, New Product Development Team Improvisation and speed to market	European Journal of Innovation Management
2002 REQUEST	Chelariu, Learning to Improvise, Improvising to Learn	Journal of Business Research
2002 Snowball Sampling	Clegg, Cunha, Cunha, Dialectic View	Human Relations
2002 REQUEST	Heeks, Information Systems and	The Information

	Developing Countries: failure, success, and Local Improvisation	Society
2002 Snowball Sampling	Lewis et al., Product development tensions: Exploring contrasting styles of project management.	ASQ
2002 REQUEST	McGinn, Keros, Improvisation and the logic of exchange in socially embedded transactions	ASQ
2002 REQUEST	McKnight, Bontis, E-improvisation: collaborative groupware technology expands the reach and effectiveness of organizational improvisation	Knowledge and Process Management
2002 REQUEST	Pava, The path of moral growth.	Journal of Business Ethics
2002 Snowball Sampling	Tsoukas, Chia, On Organizational Becoming: Rethinking Organizational Change	Organization Science
2003 REQUEST	Baker, Miner, Eesley: Improvising Firms, Bricolage,	Research Policy
2003 REQUEST	Cunha, Kamoche, Cunha, Organizational Improvisation and Leadership. A field Study in Two Computer Mediated Settings	Internation Studies of managemet and organization
2003 REQUEST	Cunha, Cunha, Organizational Improvisation and Change: two Syntheses and a filled gap	Journal of Organizational Change Management
2003 REQUEST	Cunha, Gomes, Order and Disorder in Product Innovation	Creativity and innovation management
2003 REQUEST	Faia-Corriea, Mind the gap between processes and practices	International Studies of management and organization
2003 REQUEST	Kamoche, Improvisation in organizations	Internation Studies of management and organization
2003 REQUEST	Kamoche, Cunha, Cunha, Towards a Theory of OI Locking beyond the metaphor of jazz	The Journal of Management Studies
2003 REQUEST	Montuori, The complexity of improvisation and the improvisation of complexity	Human Relations
2003 REQUEST	Pinnington, Morris, Pinnington, The Relational Structure of Improvisation-A Case Illustration from Corporate Video Production	International Studies of management and organization
2003 REQUEST	Roux-Dufort, VIdaillet, The Difficulties of Improvising in a Crisis Situation-A Case Study	International Studies of management and organization
2004 REQUEST	Cunha, Organizational time: a dialectical view	Organization

2004 REQUEST	Ibott, O'Keefe, transforming the Ericsson-Vodafone Relationship	Long Range Planning
2004 REQUEST	Konsynski, Tiwana, The improvisation-efficiency paradox in interfirm electronic networks governance and architecture considerations	Journal of Information Technology
2004 REQUEST	Mendonça, Cunha, Kaivo-oja, Ruff,Wild Wards, Weak Signals and Organizational Improvisation.	Futures
2004 REQUEST	Mendonça, Wallace, Studying organizationally-situated improvisation in response to extreme events.	International Journal of Mass Emergencies and Disasters
2004, Snowball Sampling	Webb, role improvising during crisis situations	International Journal of Emergency Management
2004 REQUEST	Stolegraaf, Dickson, The paradox of a marketing planning capability	Joural of the Academy of Marketing Science
2004 REQUEST	Vera, Crossan, Theatrical improvisation: Lessons for organizations	Organization Studies
2005 REQUEST	Chédotel, L'improvisation organisationnelle, Revue Française de Gestion	RFG
2005 REQUEST	Crossan, Cunha, Vera, Cunha, Time and Organizational Improvisation	Academy of Management Review
2005 REQUEST	Gauthereau, Hollnagel, Planning, Control, and Adaptation	European Management Journal
2005 REQUEST	Pinnington, Learning in a competitive field: MBA students' improvised case studies of IHRM	Internation Journal of Human Resource Management
2005 REQUEST	Purser, Petranker, Unfreezing the future: Exploring the dynamic of time in organizational change	The Journal of Applied Behavorial Science
2005 REQUEST	Vera, Crossan, Improvisation and innovative performance in teams	Organization Science
2006 REQUEST	Akgun, Lynn, Yilmaz, Learning process in new product development teams and effects on product success	Industrial Marketing Management
2006 REQUEST	Brigham, Introna, hospitality, improvisation and gestell: a phenomenology of mobile information.	Journal of Information Technology
2006 REQUEST	Cunha, Cunha, Towards a complexity theory of strategy	Management Decision
2006 REQUEST	Duguid, What Telking about Machines tells us	Organization Studies
2006 REQUEST	Elbanna, The validity of the improvisation argument in the implementation of a rigid technology	Journal of Information Technology
2006 REQUEST	Heeks, Health Information Systems: Failure, success and improvisation	International Journal of Medical Informatics

2006 REQUEST	Hmlieleski, Corbett, Proclivity for improvisation as a predictor of entrepreneurial intentions	Journal of Small Business Management
2006 REQUEST	Johanson, Johanson, Turbulence, Discovery and Foreign Market Entry: A Longitudinal Study of an Entry into the Russian Market	Management International Review
2006 REQUEST	John, Grove, Frisk, Improvisation in service performances: lessons from jazz	Managing Service Quality
2006 REQUEST	Leybourne, Managing change by abandoning planning and embracing improvisation	Journal of General Management
2006 REQUEST	Leybourne, Improvisation within the project management of Change, Some observations from UK Financial Services	Journal of Change Management
2006 REQUEST	Leybourne, Sadler-Smith, The role of intuition and improvisation in project management	International Journal of Project Management
2006 REQUEST	Mendonça, Friedrich, Training for improvisation in emergency management: opportunities and limits for information technology	International Journal of Emergency Management
2007 REQUEST	Akgun, Byrne, Lynn, Keskin, New Product Development in Turbulent Environments	Journal of Engineering and Technology Management
2007 REQUEST	Baker, Resources in play: Bricolage in the Toy Store (y)	Journal of Business Venturing
2007 REQUEST	Dennis, Macaulay, using jazz to investigate improvisation and market orientation	EJM
2007 REQUEST	Faia Correia, Cunha, Getting Started Initializing Organization around new technology	Management Research
2007 REQUEST	Jambekar, Improvisation model for team performance enhancement in a manufacturing environment.	Team Performance Management
2007	Mantere, Sillince, Music as a metaphor for organizational change.	Journal of Organizational Change Management
2007 REQUEST	McDaniel, Management strategies for complex adaptive systems: Sensemaking, learning and improvisation	Performance Improvement Quarterly
2007 REQUEST	Mendonça, Decision support for improvisation in response to extreme events: Learning from the response to the 2001 World Trade Center attack	Decision Support System
2007 REQUEST	Mendonça, Wallace, A cognitive model of improvisation in emergency management	Ieee Transactions on Systems Man and Cybernetics
2007 REQUEST	Mendonça et al., Collaborative	Communications of the

	adhocracies and mix-and-match technologies in emergency management	ACM
2007 REQUEST	Vera, Rodriguez, leading improvisation: lessons from the american revolution	Organizational Dynamics
2008 SnowballSampling	Carlsson, ElSawy, Managing the five tensions of IT-enabled decision support in turbulent & high velocity environment	Information systems and e-business management
2008 REQUEST	Bergh, Lim, Learning how to restructure: Absorptive capacity and improvisational views of restructuring actions and performance	SMJ
2008 REQUEST	Erden, Krogh, Nonaka, The quality of group tacit knowledge	Journal of Strategic Information Systems
2008 REQUEST	Ford, Complex adaptive systems and improvisation theory: Toward framing a model to enable continuous change	Journal of Change Management
2008 REQUEST	Hmlieski, Corbett, the contrasting interaction effects of improvisational behavior	Journal of Business Venturing
2008 REQUEST	Samra et al., Effects of improvisation on product cycle time and product success: A study of new product development (npd) teams in the united states	International Journal of Managemet
2009 REQUEST	Bingham C, Oscillating improvisation: How entrepreneurial firms create success in foreign market entries over time	Strategic Entrepreneurship Journal
2009 REQUEST	Daly, Grove, The impact of improvisation training on service employees in a European airline: a case study	EJM
2009 REQUEST	Davis, Eisenhardt, Bingham, Optimal Structure, Market Dynamism, and the Strategy of Simple Rules	ASQ
2009 REQUEST	Kautz, Improvisation in Information Systems Development Practice	Journal of Information Technology Case and Application
2009 REQUEST	Leybourne, culture and organizational improvisation in UK financial services	Journal of service science management
2009 REQUEST	Leybourne, improvisation and APM: a comparative	Int. Journal of Managing Projects in Business
2009. REQUEST	Oakes, Freedom and constraint in the empowerment as jazz metaphor.	Marketing Theory
2009 REQUEST	Vendelø, Improvisation and Learning in Organizations: An opportunity for future empirical research	Organizational Learning
2009 REQUEST	Yanow, Tsoukas, What is reflection-in-action? A phenomenological account	Journal of Management Studies
2010, REQUEST	Di Domenico, Social Bricolage: Theorizing Social Value Creation in Social Enterprises	Entrepreneurship: Theory & Practice

2010 REQUEST	Mendonça, Webb, Burst, L'improvisation dans les interventions d'urgence: les relations entre cognition, comportement et interactions sociales	Tracés

Annex 2. Description of the requests

Figure 34. Request screenshot

An example of the second type of request on GoogleScholar – Improvisation in Title, resulted in 195 papers (similar request was led on ABI/Inform – with the citation AND abstract option- resulted in 116 papers and EBSCO – Improvisation in Abstract OR Title- resulted in 126 papers).

Annex 3. Statistical outputs

Table 17. Number of iterations during the CATPCA

	Variance Accounted For		Loss		
Iteration Number	Total	Increase	Total	Centroid Coordinates	Restriction of Centroid to Vector Coordinates
0[a]	6,232624	,000005	37,767376	37,153416	,613961
1	6,343096	,110472	37,656904	37,153416	,503488
2	6,470576	,127480	37,529424	37,062312	,467111
3	6,549961	,079385	37,450039	37,014874	,435164
4	6,604051	,054090	37,395949	36,984251	,411698
5	6,642576	,038525	37,357424	36,961684	,395740
6	6,670698	,028122	37,329302	36,943885	,385417
7	6,691536	,020837	37,308464	36,929473	,378991
8	6,707147	,015612	37,292853	36,917723	,375130
9	6,718960	,011813	37,281040	36,908135	,372905
10	6,727984	,009024	37,272016	36,900314	,371702
11	6,734939	,006955	37,265061	36,893934	,371127
12	6,740343	,005403	37,259657	36,888729	,370928
13	6,744567	,004224	37,255433	36,884485	,370948
14	6,747884	,003318	37,252116	36,881028	,371087
15	6,750499	,002614	37,249501	36,878218	,371284
16	6,752562	,002063	37,247438	36,875938	,371500
17	6,754192	,001630	37,245808	36,874096	,371712
18	6,755480	,001288	37,244520	36,872611	,371910
19	6,756497	,001017	37,243503	36,871419	,372085
20	6,757299	,000803	37,242701	36,870465	,372236
21	6,757932	,000633	37,242068	36,869705	,372363
22	6,758431	,000499	37,241569	36,869101	,372468
23	6,758824	,000393	37,241176	36,868624	,372552
24	6,759133	,000309	37,240867	36,868248	,372619
25	6,759376	,000243	37,240624	36,867954	,372670
26	6,759568	,000191	37,240432	36,867724	,372708
27	6,759718	,000150	37,240282	36,867547	,372735
28	6,759836	,000118	37,240164	36,867410	,372754
29	6,759929	,000093	37,240071	36,867306	,372764
30	6,760002	,000073	37,239998	36,867228	,372769
31	6,760060	,000057	37,239940	36,867171	,372769
32	6,760105	,000045	37,239895	36,867129	,372766
33	6,760140	,000036	37,239860	36,867100	,372759
34	6,760168	,000028	37,239832	36,867081	,372750
35	6,760190	,000022	37,239810	36,867070	,372740

36	6,760208	,000017	37,239792	36,867064	,372729
37	6,760221	,000014	37,239779	36,867062	,372717
38	6,760232	,000011	37,239768	36,867064	,372704
39[b]	6,760240	,000008	37,239760	36,867068	,372691

a. Iteration 0 displays the statistics of the solution with all variables, except variables with optimal scaling level Multiple Nominal, treated as numerical.

b. The iteration process stopped because the convergence test value was reached.

Table 18. Variance accounted for each variable

Variance Accounted For

| | Centroid Coordinates | | | | | Total (Vector Coordinates) | | | | |
| | Dimension | | | | | Dimension | | | | |
	1	2	3	4	Mean	1	2	3	4	Total
Periode	,196	,146	,025	,128	,124	,195	,145	,024	,128	,493
Epistemo	,327	,271	,042	,022	,165	,297	,228	,042	,018	,584
Reasoning	,426	,004	,192	,106	,182	,419	,000	,189	,097	,705
LevelAna	,230	,004	,219	,028	,120	,224	,003	,208	,024	,459
ImpEmergence	,012	,316	,385	,032	,186	,009	,313	,380	,012	,714
FocusPractice	,333	,086	,044	,220	,171	,333	,086	,044	,220	,682
ScopeEnqu	,278	,046	,049	,218	,147	,278	,046	,049	,218	,590
ContribKnowledge	,038	,286	,117	,367	,202	,004	,269	,112	,357	,743
ResearchDesign	,352	,036	,105	,062	,139	,351	,026	,098	,048	,523
Context	,056	,494	,054	,086	,173	,023	,493	,041	,080	,637
HierStatImprov	,211	,166	,308	,010	,174	,201	,134	,286	,009	,631
Active Total	2,459	1,854	1,541	1,279	1,783	2,335	1,742	1,472	1,212	6,760
% of Variance	22,356	16,852	14,010	11,627	16,211	21,226	15,833	13,383	11,014	61,457

Table 19. Communalities

	Initial	Extraction
Periode Quantification	1,000	,583
Epistemo Quantification	1,000	,572
Reasoning Quantification	1,000	,720
LevelAna Quantification	1,000	,428
ImpEmergence Quantification	1,000	,702
FocusPractice Quantification	1,000	,687
ScopeEnqu Quantification	1,000	,508
ContribKnowledge Quantification	1,000	,659
ResearchDesign Quantification	1,000	,541
Context Quantification	1,000	,612
HierStatImprov Quantification	1,000	,657

Extraction Method: Principal Component Analysis.

Table 20. Component transformed matrix

Component	1	2	3	4
1	,609	,681	-,242	,327
2	-,464	-,103	-,639	,605
3	-,499	,495	,617	,353
4	,406	-,529	,391	,634

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.

Annex 4. An example of replication

We provide in this annex an example of the outputs that we obtained by replicating cluster analyses with diverse algorithms. This example corresponds to our replication of our cluster analysis of the *focalizing* dimension categories. From one dendogram to another the groups are the same, despite small variations in relation to distance.
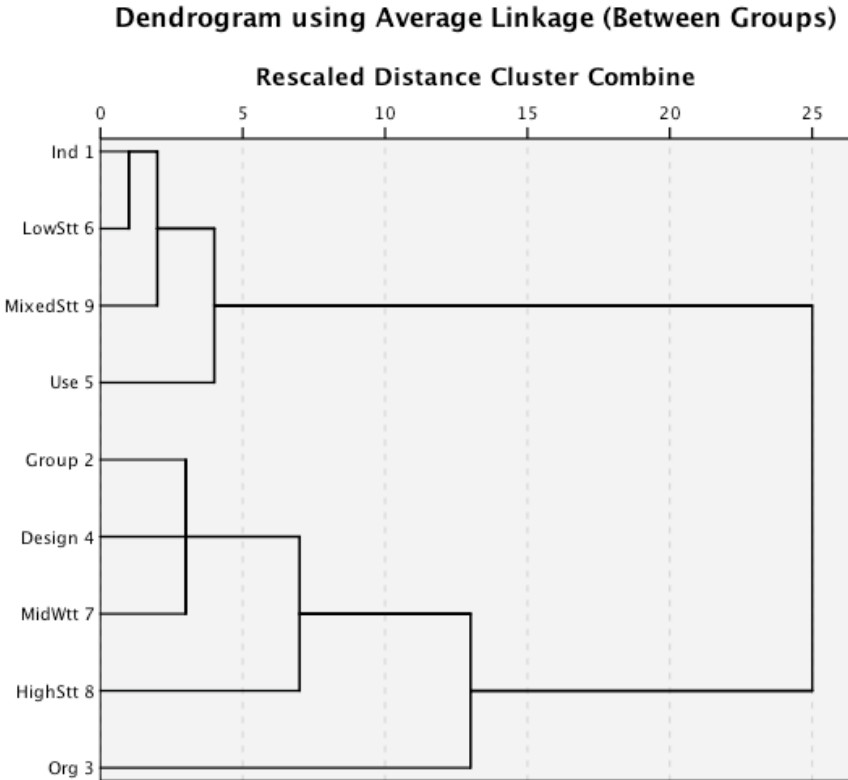
Figure 35. Between-groups linkage dendogram
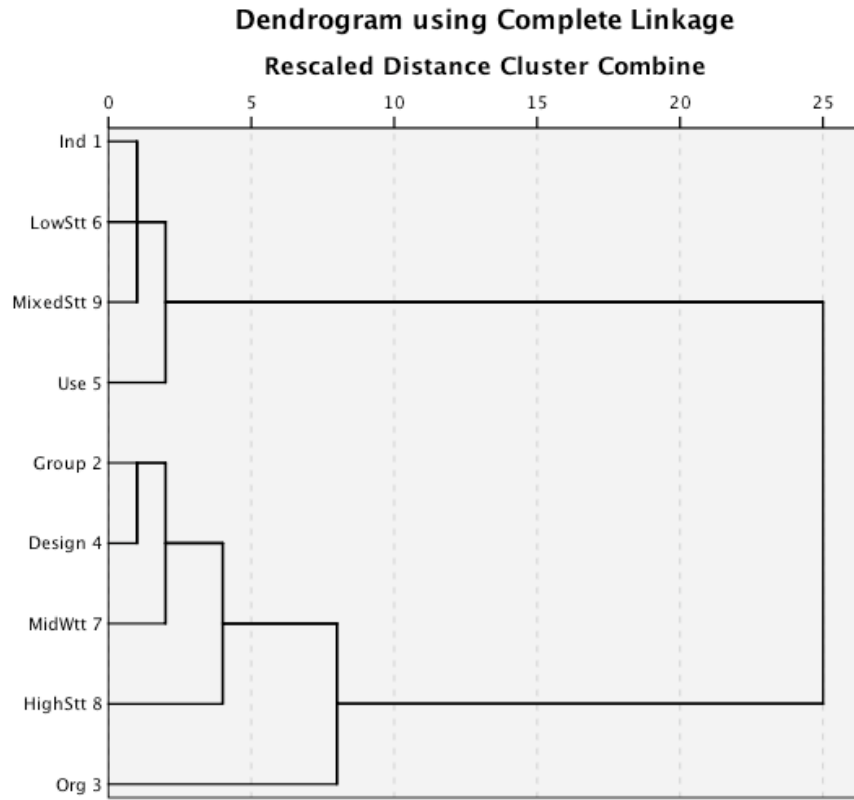
Figure 36. Highest neighborhood dendogram
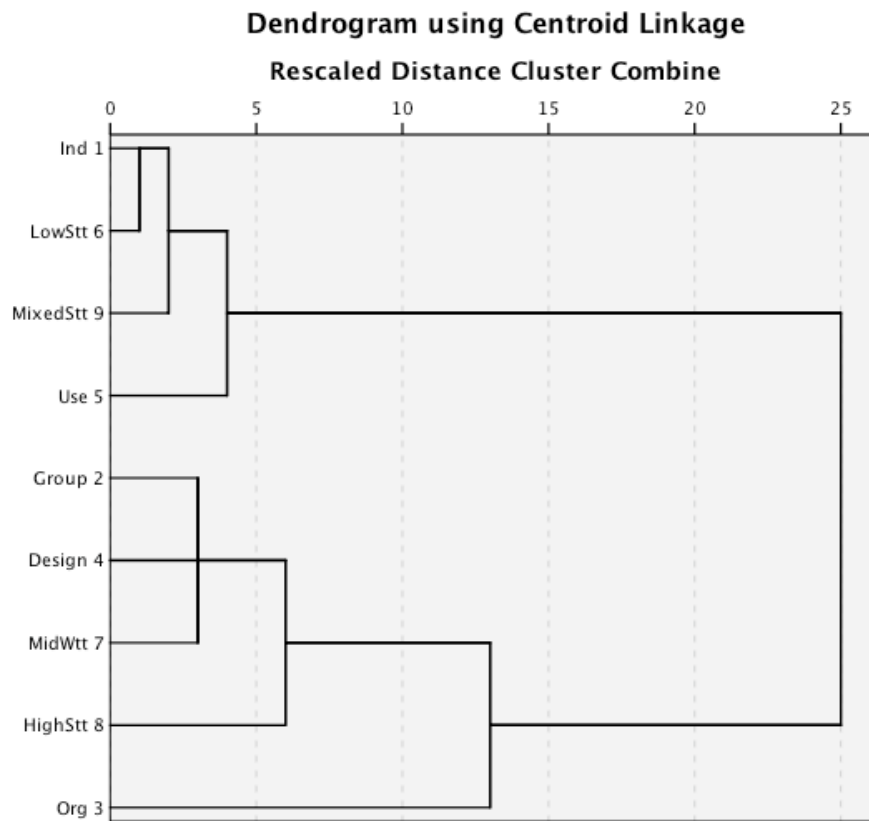
Figure 37. Centroid method dendogram

Chapter 2.3 Information and Communication Technology ((ICT)), crisis, and organizational improvisation: theoretical propositions and literature review

Introduction

As previous chapters explain, crisis has increasingly become a subject of extensive research, and a primary concern for managers. Industrial accidents are more likely to happen due to increasing organizational and technical complexity (Perrow, 1984), and organizations remain vulnerable to acts of terrorism and natural disasters. A significant body of work in crisis management focuses on the prevention of crises.

Because of organizations' inability to prevent or avoid accidents and disasters, crisis response has become an equally important aspect of crisis management, especially managing the immediate aftermath to limit additional consequences. During crisis response, planning and anticipation are necessary (Rerup, 2001; Shrivastava, 1993). However resilience is crucial because one must expect reality to be different from what was anticipated (Rerup, 2001; Waugh, Streib, 2006).

Crisis response requires organizations to engage in unfamiliar actions without the time to formulate detailed plans. Depending on the nature of a crisis, organizations may need to revise previous plans, when there are no guidelines that can be clearly followed or when the situation is unexpectedly new and complex. Every crisis is unique and planning for crisis response is limited by the uncertainty inherent in the notion of crisis (Billings *et al.*, 1980). For these reasons, improvisation is considered as a core element of crisis response (Mendonça, 2007). The organizational ability to improvise is crucial to avoiding rigidity-threat effects during crisis response (Staw *et al.*, 1981).

For this reason, researchers have led great efforts to analyze improvisation from both cognitive and behavioral perspectives. For example, Cunha and his colleagues elaborate a generic definition of improvisation, followed by an exhaustive classification of improvisation's treatment in academic literature (Cunha *et al.*, 1999c). A significant amount of work has been achieved to move the focus of analysis of improvisation to the organizational level. For example, Moorman and Miner's work (1998a, b) is representative of the prominent studies that aim to delineate improvisation as a measurable construct. These authors have contributed to a better knowledge of the antecedents of organizational improvisation such as turbulence, real time information and organizational memory (Moorman, Miner, 1998b). However three specific aspects of improvisation as an organizational response to crisis remain unclear.

First of all, the mechanisms by which routine practices support improvisation remain undefined. The degree to which improvisation departs from routine is variable, which leaves unanswered the general question of the connection between improvisation and routine. Additionally, in the context of crisis, routines can transform into a threat for organizations

(Barnett, Pratt, 2000; Staw *et al.*, 1981), which makes it necessary to clarify the role of routine in crisis improvisation.

Secondly, the question of how improvisers manage to coordinate with each other requires further understanding. Widely accepted definitions of improvisation emphasize the short delay between decision and action but fall short of details on interactions that permit extemporaneous coordination. For instance, Moorman and Miner predict that heavier information flows contribute to the emergence of improvisation (Moorman, Miner, 1998a). However, their results lack details on how improvisers avoid risks of information overload and select relevant information while using ICT tools.

Thirdly, ICTs' reliability for supporting improvisation remains uncertain. The role of information and communication technology (ICT) in crisis management has also been investigated (Comfort, 1993; Quarantelli, 1997). ICTs provide crucial support for communication and coordination during disasters. In particular, mobile devices enable fast communication and the prevention of additional damage. When examining crisis improvisation, one can infer that real time communication fits well to the need for a limited delay between decision and action that features improvisation (Moorman, Miner, 1998b). However, ICTs have been criticized for wasted time caused by information overload (Hiltz, Turoff, 1985; Quarantelli, 1997, 2007), the lack of user-friendly tools (Mendonça, 2007) as well as integration issues (Dawes *et al.*, 2004).

 This study seeks to fulfill two related needs: 1) proposing an explanation of how collective improvisation works and 2) investigating the role that ICTs play in improvisation during crisis response. The first need exists because some of the literature on organizational improvisation provides rich but disconnected findings, thus making it necessary to provide an overview of the mechanisms that structure organizational improvisation. We begin by analyzing previous definitions of organizational improvisation in section 1. In section 2, we make some theoretical propositions regarding the constituents of organizational improvisation. We then address the second need by reviewing the literature on ICTs support to crisis improvisation. Section 3 presents our method and section 4 presents our findings. We finally discuss the limitations of our work in section 5.

Section 1.   Theoretical background on improvisation

This section details our analysis of the literature on organizational improvisation. We first describe some aspects of improvisation unveiled by existing definitions. By discussing the limitations of these definitions, we emphasize the need for further understanding of some specific aspects of organizational improvisation in crisis response.

1.I. Improvisation definitions

Table 21 summarizes eight different ways in which organizational improvisation has been conceptualized. Although all the definitions refer to innovative responses, there is little in common across definitions. However, the first four definitions capture the relationship between improvisation and planned activity. By describing improvisation as a situation in

which the time between the conception of an action and its execution is reduced, Moorman and Miner (1998a) characterize improvisation as "decision as action unfolds". This means that organizational members make decisions as they are already in the process of enacting them. The need to improvise is also associated with unstable and high-velocity environments in which innovation is necessary (Crossan *et al.*, 2005 Cunha, 2005; Eisenhardt, 1989). Organizations may be compelled to improvise when there is "*time pressure or emergency to respond to an unexpected problem*" (Weick, 1993). Still, organizations do not always improvise in these circumstances, such as during crises (Roux-Dufort, Vidaillet, 2003a).

Table 21. Definitions of improvisation

Source	Definition
(Ciborra, 1996a)	"Thinking and action emerge simultaneously and on the spur of the moment"
(Vendelø, 2009)	"Convergence between acting and planning, and reworking of pre-composed material in relation to unanticipated ideas"
(Moorman, Miner, 1998a)	"Organizational improvisation refers to the convergence of conception and execution"
(Berliner, 1994, cited by (Bansler, Havn, 2004)	"Composing and performing extemporaneously, conception as action unfolds"
(Lanzara, 1999)	"Unexpected practices, deviation from routines, puzzling or random behaviors calling for interpretation"
(Meyer, 1998)	"Devising resourceful solutions to intractable problems".
(Preston, 1987)	"A process of introducing changes to an initial model while maintaining continuity in the performance"
(Crossan, 1998)	"Action is taken in spontaneous and intuitive fashion"
(Cunha *et al.*, 1999c)	"The conception of action as it unfolds by an organization and/or its members drawing on available material, cognitive, affective and social resources"

The second five definitions in Table 1 all refer to resources. The idea that improvisation involves the creative recombination of resources at hand, also known as *bricolage* (Cunha *et al.*, 1999a), is fundamental to these definitions. Particularly in crisis situations, organizations do not have the time or capacity to acquire new resources. Improvisation is unlike organizational invention in that it departs from what the organization accomplished and learned from the past. For Rerup (2001), improvisation is a form of resilience, which is achieved by recombining past experience and resources into new patterns of action. Cunha, Cunha and Kamoche (1999c) refer to the wide range of material, cognitive, affective and social resources that may be recombined to generate improvised responses to crisis.

1.II.Some conceptual limitations

Some theories oversimplify the connection between structures and improvisation as an antinomy. Undoubtedly less structure provides more room for agility and improvisation (Davis *et al.*, 2009). Furthermore, improvisation serves as an alternative way of functioning

when planning impossible or irrelevant. For example, in a high velocity environment, improvisational strategic decision making enables organization to react to threats and opportunities (Perry, 1991a). Similarly, Weick argues that improvisation is merely a negation of foresight and planning (1998). However, many examples of crisis indicate that operational routines are the only means to complete response when planned strategy cannot be followed. By opposing improvisation to routine, scholars imply that effective management involves the abandonment of plans and structures because they inhibit creative responses. In our view, the conceptual ties between improvisation and routine require further investigation.

In fact, the simultaneous occurrence of planning and acting in improvisation forms an organizational paradox (Clegg *et al.*, 2002; Joffre *et al.*, 2006). It leads us to notice that the paradoxical nature of acting and planning mirrors the simultaneity of ends and means which is logically and temporally contradictory. How can individuals coordinate their actions as they develop coordination mechanisms? How can plans and actions occur simultaneously? These paradoxes illustrate the tensions inherent in improvisation while they also beg for more analytical thought about how such paradoxes can be resolved (Lewis, 2000).

How to shed light on these uncertainties regarding improvisation? One could draw from the jazz metaphor to understand the ins and outs of improvisation interactions. Most definitions of organizational improvisation draw upon the analogy between management action and artistic performance, usually in jazz or theatre (Cunha *et al.*, 1999c; Vera, Crossan, 2005). From the jazz metaphor, extemporaneous improvisation is understood as intentional variations on melody, harmony or rhythm to produce music that is fresh and new. These metaphors reflect the inherent complexity of improvisation, which can be compared to the complexity of managerial responses to crisis situations. They suggest that managers can act similarly to creative artists by improvising instead of following prescribed plans. Although the insights drawn from jazz and theatre metaphors are useful (Hatch, 1999; Kamoche, Cunha, 2001; Vendelø, 2009), they are limited by the differences between art and business contexts (Hatch, 1998). Even though management is a purposeful activity, its objective is not creative expression. Moreover, the crises managers are faced with in the business world differ from the artistic risks taken by the jazz or theatre performer. Additionally, Organizations are more complex than even the largest jazz orchestra or Wagnerian opera, so improvisation in organizational contexts cannot simply mirror the principles derived from the study of performing arts. ICT is also not typically used to assist improvisers on stage.

Even though opportunities to observe organizational improvisation live are scarce, we argue the necessity to pursue investigation on how improvisation functions. We believe that improvisation has been all too often presented as a magical solution to the inability to plan during a crisis. An exclusively positive view of improvisation ignores potentially harmful consequences in which safety and security may be threatened by abandoning standard procedures. Improvisation can pose some challenges for organizations such as decreased effectiveness (Davis *et al.*, 2009; Moorman, Miner, 1998b), loss of organizational cohesion (Miner *et al.*, 2001) and interpersonal conflicts (Aram, Walochik, 1996). Many treatments of improvisation overstate the importance of spontaneity at the expense of misunderstanding the

relationship between spontaneous and planned action (Vera, Crossan, 2005). Identifying what is improvisational in organizations is a starting point to propose mechanisms by which managers can successfully manage the occurring improvisation.

From our review of the literature on improvisation, we identify two needs. First of all, since organizational improvisation is a collective response, the coordination between improvisers needs greater emphasis. Furthermore, a more satisfactory analysis of the interactions that compose organizational improvisation should reconcile the paradox of planning and action as simultaneous activities. In other words, organizational improvisation theory should articulate the relationship between plans and actions more precisely. Secondly, the manner in which available resources are combined should be specifically addressed. ICTs should be included as a resource so that their potential contribution to crisis response is not ignored. These clarifications would provide a more practical understanding of organizational improvisation, one from which actionable responses may be derived. In the following section, we articulate a more comprehensive description of organizational improvisation, drawing from a variety of sources of knowledge on improvisation.

Section 2.   Organizational improvisation constituents

In our work, we view organizational improvisation as a collective process that involves spontaneous deviation from established uses of resources and that requires coordination among actors who command resources. We propose to analyze improvisation not as an isolated event but rather as a component of a wider process of organizational adaptation. This analysis implies that improvisation is a crucial factor for long-term stability and builds on organizational capabilities and resources.

In this section, we propose a description of the functioning of organizational improvisation. From our analysis of the literature on crisis management and improvisation, we have deduced five main constituents of organizational improvisation. We define each of these constituents and then explain their role in organizational improvisation. This description relies on deductions from theories. Although it is not exhaustive it offers a structured exploration of organizational improvisation in crisis response.

Table 22 summarizes the constituents of organizational improvisation in crisis response and their functions.

Table 22. Crisis organizational improvisation constituents and their functions

Organizational improvisation constituents	Function
Spontaneity	Understanding whether predefined procedures are executable. Development of new ideas. Adjustment to coworkers' actions
Deviation from established use or resources	Adaptation of the ongoing course of action to the specificities of the situation Development of new capabilities Enrichment of existing capabilities
Boundary spanning	Information translation Development of a common referential: narration, information, practices, vocabulary Common narration of past actions Common orientations for future actions Heedful interactions Integration of outside intelligence
Expertise leadership	Selection of ideas Dialogical reasoning Development of new ideas Integration of outsider intelligence
Minimal structures	Rules for interactions and actions Anticipation of what can be done or not Change detection

2.I. Collective process

Organizational improvisation is collective due to the fact that it involves a coordinated response rather than an individual response. Although individual actors contribute improvised responses during crises such efforts, no matter how heroic or creative, can easily dissipate without the efforts of others. Considering improvisation to be collective does not imply that an organization acts as a unified entity; rather, organizational action involves the coordinated efforts of many individuals representing different interests within the organization. A unified response by an organization is rare under normal conditions and highly unlikely during crisis.

We also conceive of improvisation as a process, which occurs over a short period of time. Thus, the study of organizational improvisation should document the sequences of events during the aftermath of a crisis. Methodologically, this can be achieved more practically by reconstructing events from interviews and documented sources. In the longer term, successful improvisations may be retained as part of an organization's repertoire, from which it may draw from in future crises. Hatch (1998) and Weick (1998), for example, regard improvised actions as part of the organizational memory after the crisis has ended. However, improvised actions in the short term may not necessarily be retained for future situations requiring improvisation. Indeed, the new repertoire may not be useful unless there is a very similar kind

of crisis in the future. Given the nature of crisis, we are skeptical of the claim that improvised responses to one crisis would always be useful for a subsequent crisis.

2.II. Spontaneity

Among the features of organizational improvisation, there is the spontaneous reaction to unexpected events.

Many definitions emphasize the role personality traits play in spontaneous action (Webster, 1992). However, a group's ability to formulate "an immediate development on a topic" (George, 1997; Webster, 1992) plays a significant role in crisis improvisation. For example, the ability to find new ideas depends on how reflection on work practices is managed (Zollo, Winter, 2002). George and Jones (1997) identify forms of spontaneity in organizations among which helping coworkers, protecting the organization, and making constructive suggestions are crucial activities in organizations that improvise during crises (Larson *et al.*, 2006).

In spite of being inherent to resilience, spontaneity is not the unique characteristic of improvisation (Crossan, 1998). However, spontaneity develops in at least three manners in improvising groups. First of all, improvising individuals have to spontaneously recognize whether predefined procedures are executable. Secondly, improvisers have to develop a mixing and matching of planned procedures (Mendonça *et al.*, 2007). In this study we propose that improvisers have to quickly adjust to coworkers' actions to participate in the ongoing improvisation. We therefore propose that spontaneity during improvisation does not only concern idea generation but coordination as well.

2.III. Deviation from established uses of resources

The second feature of organizational improvisation is the creative treatment of resources by actors. Improvisers deviate their use of resources from established patterns during crisis response to meet the necessity to urgently complete some tasks whose devoted resources are not at hand (Crossan *et al.*, 2005; Cunha *et al.*, 1999c). Drawing on available resources rather than seeking the proper ones corresponds to the notion of *bricolage*, defined by Levi-Strauss (1962). While some authors argue that improvisation does not necessarily lead to the use of *bricolage* (Baker, 2007), most studies assert that deviation from established use of resources is an important part of improvisation (Moorman, Miner, 1998a).

Then one can wonder what role existing patterns of action play in improvisation. The largely unresolved paradox discussed earlier addresses the requirement that improvisation include simultaneous performance of plans and actions. Rather than regarding plans as irrelevant to improvisation, we regard established use of organizational resources, ranging from procedures to technology resources (Jefferson, 2006b), to be part of organizational improvisation. We support this claim with recent research on routines and earlier work on scripts, both of which involve resources.

Pentland and Rueters (1994) define routine as a "set of possible patterns enabled and constrained by a variety of organizational, social, physical and cognitive structures from which organizational members enact particular performance". For some authors, routines

serve to constrain organizational members to believe that activities that made the organization successful in the past remain the legitimate course for the future. However, this narrow view of routines obstructs fresh thinking and inhibits creative deviations from past practices (Crossan, Sorrenti, 2002; Milburn *et al.*, 1983b; Moorman, Miner, 1998a). Routine is inherently improvisational for Feldman and Pentland (2003), who view routines not as restricted cognitive frames but rather as generative systems that enable adaptation and organizational change. In other words, familiar routines are renewed whenever they are performed (Feldman, 2000). This view challenges the position that distinguishes between improvisation and routine (Moorman, Miner, 1998a).

Routines are formed around the use of organizational resources. The rationale for describing routines as a part of improvisation is that they are not a single repetitive pattern of actions (Cohen, 1994; Pentland, Rueter, 1994), but rather a set of interdependent sequences of actions. Routines are not restricted to groups or subunits, but confront different units of work, cultures and communities of practice. Routines support intra-organizational cohesion, even in crisis, providing a reference point from which adjustments or radical changes can be made. By comparing improvisations with established routines, actors can gauge the degree to which their deviations depart from established uses of resources. In this sense, improvisation literally fills the gap between repetition of a routine and a completely original performance (Suchman, 2007). Without knowledge of routines, actors would be unprepared to execute spontaneous actions that differed from established ways to use resources.

Routines bear similarity to the concept of scripts. Scripts may be either individual or collective in nature. Gioia and Poole (1984) consider scripts to be "stored knowledge that is called into play whenever the situational cues evoke an expectation for certain events to occur." Although scripts are defined differently from routines, they represent a structured set of cognitive elements that help the understanding of new situations. Scripts provide not only an unconscious reference but also means for adaptation and improvisation. Crises are typically the kind of situation in which scripts can assist improvisation. According to Gioia and Poole (1984), "Other situations (than stereotypical) entail some variation on the protoscript and require some means of distinguishing knowledge of these variations in memory."

By tying the definition of improvisation to the deviation from established use of resources, we invite further comparison with the discourse on dynamic capabilities. Dynamic capabilities correspond to an organization's ability to satisfy environmental requirements by recombining resources to develop capabilities that previously existed only potentially. As a response the limitations of the resource-based-view of the firm (Barney, 1991; Grant, 1996), dynamic capabilities theory focuses on the outcome of organizational and cognitive processes that integrate novel applications of existing capabilities (Teece *et al.*, 1997). Although no clear consensus exists on the definition of dynamic capabilities, the emphasis of most definitions is upon the ability of organizations to reconfigure and redeploy resources is different ways (Eisenhardt, 2000; Zollo, Winter, 2002). This capability to use existing resources in novel ways corresponds to the notion of *bricolage* from the improvisation literature. Zollo and

Winter's (2002) definition of dynamic capability as "a learned and stable pattern of collective activities through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness" closely reflects the spirit of the improvisational nature of resource usage.

2.IV.   Interaction between actors

The third dimension of organizational improvisation in crisis response is the need for coordination and interactions. As in most coordinated efforts, the transmission of information is crucial to integrate a new idea or an initiative in collective functioning. Without information transmission, subunits may have a different perception of the situation, and improvisation may not be coordinated (Roux-Dufort, Vidaillet, 2003a). Subunits need to remain informed about what is new and how it affects their own work, which compels them to pay extra attention to events and listen in their coworkers (Kristensen *et al.*, 2006; Pettersson *et al.*, 2004) By analogy, performers in a jazz band must listen to band mates to detect unexpected changes introduced by another member. Normally, coordination in jazz is accomplished with familiar signals, such as a glance, nod or a quick breath. Organizational communication also needs to be frequent and accurate during improvisation.

Three main types of mechanisms appear to regulate interactions during organizational improvisation: boundary spanning, expertise leadership, and minimal structures.

The first type, *boundary spanning,* helps information translation from one community of users to another, as defined by Wenger (1999). Boundary spanning enables a translation of information from one group to another to assure consistent action, thanks to the boundary spanners that can be either individuals, such as victims (Kristensen *et al.*, 2006), or objects such as a technological tool (Gasson, 2005). For instance, social media and Internet web sites enable crisis responders to publicly share information with other crisis responders and victims (Lang, Benbunan-Fich, 2010). Different communities or subsystems may have divergent rules or codes for action which, in addition to political tensions, can have a negative impact on the organizational ability to react during crisis (Beamish, 2002). As crisis responses frequently involve groups with specific rules and codes, boundary spanning is crucial to maintaining a common referential composed of information, practices and vocabulary, or a common idea between the individuals involved in the ongoing improvisation of how tasks were performed – also called narration (Brown, Duguid, 1991) and should be pursued (Kapucu, 2006). Furthermore, boundary spanning compels actors to understand that the groups they have to collaborate with have developed different practices and values. Gasson explains that boundary spanners often have to convince groups that their practices are not the best or need to be adjusted, reducing the risk of misunderstandings that can endanger improvisation (2005).

Secondly, *expertise* helps to identify which interpretation of reality is legitimate. For example, in high reliability organizations that have to organize instantaneously, new issues for collective action are first addressed to experts (Weick, Sutcliffe, 2001). For this reason, expertise leadership can regulate interactions to coordinate organizational improvisation. Especially in crisis situations, dialogical reasoning, which consists in dialogue and feedback

between experts, helps to guide the ongoing searching for ad hoc solutions (Faraj, Xiao, 2006). The emergence of expertise leadership requires that experts can contact and interact with other participants. Expertise leadership can develop thanks to boundary objects. For instance, social media allows discussion between interlocutors to integrate outside intelligence and expertise into the ongoing improvisation (Turoff *et al.*, 2004).

Thirdly, interactions that compose improvisation are based on *minimal structures*, such as rules or coordination patterns, facilitate information sharing (Pinnington *et al.*, 2003 2003). Minimal structures include rules and codes that assure coordination and information feedback. They are particularly important during jazz performance (Kamoche, Cunha, 2001). Extended interpretation of the jazz metaphor reveals insights into collective improvisation and the role that minimal structures play in the coordination among performers. For instance, minimal rules may guide the order of solos in a performance, and signals between performers can cue changes in the direction of the performance. However, minimal structures are also apparent in organizational contexts.

Our reading of dynamic capabilities theory suggests that all these mechanisms participate in the organizational adjustments that are crucial during improvisation (Zollo, Winter, 2002).

The primary purpose of systematically defining the constituents of improvisation is to guide our review of the literature on ICTs' role in crisis response. In the following section we briefly describe the method for reviewing and classifying this literature.

Section 3. *Method*

We searched for articles that dealt with crisis response through web databases, including EBSCOhost, Web of Science, and ABI Inform. We searched for papers that included the keywords *technology*, *crisis* and *response* in the citation or abstract.[11] We did not mention improvisation in the keywords because some parts of improvisation can be described in the authors' work without being explicitly mentioned. We included the term response to collect papers that provided enough practical details about actions and interactions that were undertaken during crisis responses that were under study. The scope of selection using these keywords went well beyond the IS literature, yielding around 110 articles including conceptual papers, essays, and case studies. The initial screening of these papers resulted in many not being retained either because they did not provide any evidence of improvisation, because they did not deal with ICTs' contribution to crisis response or because they did not provide enough details about crisis response. To complete our search, we examined publications from specialized journals on crisis response that were not included in the databases, such as IJISCRAM. 12 of the remaining papers are used in this study as the basis

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[11] We repeated the following request SEARCH FOR full text and scholarly peer reviewed journals WITH technology AND crisis AND response IN citation & abstract. Our last request on the 20th of August resulted in 42 papers on ABI/Inform, 31 results on EBSCO Host, 50 results on Scholar Google, with extended search in Business, Administration, Finance, and Economics, Engineering, Computer Science, and Mathematics, Social Sciences, Arts, and Humanities.

for investigating the relationship between ICT features and constituents of improvisation. These articles are presented in Table 25 in the Annex.

Each article's content was extracted and entered into a summary table. We considered each characteristic of improvisation presented in this paper and analyzed how they were supported by ICT. For example, Table 23 shows the entry for the article "Learning from Crisis" (Dawes *et al.*, 2004), which reports on organizational uses of technology to cope with the loss of information resources following the 9/11 attacks on the World Trade Center. These tables are useful in supporting a narrative review of each article.

Table 23. Article extraction entry example

Table 23. Article extraction entry example

Improvisation Characteristic	Spontaneous action	Deviation from established use of resources	Boundary Spanning	Minimal Structures	Expertise
Description	Immediate creation of a data analysis centre (Whittaker, Sidner). Spontaneous disposal of military devices.	Adaptive use of applications initially designed for weather forecasting to spread information about availability of housing and other resources. Reuse of DNA software by police to identify victims. Use of existing investments with other sources to build an ad hoc GIS.	Using GIS, different groups could follow the evolution of information needs and transfer missing information to the units in need.	Data coordination and integration failed. There was no unique principle to govern data collection and quality control. Resulted in GIS data problems.	Emergency management applications managed by experienced volunteers from other states, vendor experts, and IT experts from police. The management of the deployment was shared according to skills.
Analysis: ICT support	The DAC was consistent because all resources were immediately available or recovered. Internet network was the only reliable infrastructure during the disaster.	Use of standardized and modular applications facilitated their integration and innovative use. Existing investment could be used thanks to immediate share of existing resources.	GIS centralized data for different groups and enabled information sharing. Graphical representation provided one unique geographical reference and facilitated information sharing.	ICT helped to gather data and transmit it to everyone but did not provide any regulation of the information format.	Many-to-many communications supported coordination from different sources of expertise.

We have completed manual analysis because the number of articles we have classified has been reduced to 12. From the entire set of articles, we identified six ICT properties that contribute to crisis response:

(1) *Graphical representation* refers to an organized projection of colours and shapes on the computer interface. Graphical representation usually inspires from cartography techniques but can involve videos and photos as well. Conceptual and geographical mapping relies on the

representing techniques. Geographic Information Systems (GIS) relies on the graphical representation property. Other projects of common operating picture use graphical components to provide a share representation of some crisis settings (Landgren, 2007).

(2) *Modularity* refers to the ability of quickly combining and reusing applications even in a short notice. Therefore modularity supports the development of new patterns of interactions. For example, the relatives of the victims of the hurricane Katrina combined the Google Maps application with other programs in an ad hoc fashion to share information about the damaged houses and victims. Even though modularity is not restricted to applications but concerns system configuration (Turoff *et al.*, 2004), we focus on applicative modularity in this work.

(3) *Calculation* supports data selection, scenario simulation and complex algorithmic treatment of data. Artificial Intelligence (AI) extensively relies on this property (Yuan, Detlor, 2005). A certain stream of research on crisis response reports common use of the calculation property to run simulations (Mendonça *et al.*, 2006), or even support decision making and risk assessing.

(4) *Many-to-many communication* refers to the ability of more than two users to share information. In this way, ICTs significantly differ from phones that primarily enable bilateral rather than multilateral exchanges. For example, many-to-many communication simply requires clicking on "Respond to" or "Forward to" when individuals use emails to interact.

(5) *Centralization of data* affects the ability to access different data through one interface; Centralization is not feasible without a preliminary organization of data and processes. For instance, databases can represent enormous amounts of data with unique attributes so that users can retrieve information with limited manipulation of the database during the search.

(6) *Virtuality* refers to the non-material characteristics of data, which facilitates recovery, replication, modification and exchange of information. As a polysemic term, virtuality has been the object of extensive discussion (Schultze, Orlikowski, 2001). Most researchers focus on virtual organizations or virtual teams that correspond to group of collaborators geographically distant from each other (Griffith *et al.*, 2003; Kirkman, Mathieu, 2005; Panteli, Fineman, 2005). Another stream of research has studied the features of virtual interaction as opposed to face-to-face interaction (Massey *et al.*, 2003; Warkentin *et al.*, 1997). While most studies approach virtuality as a way of interacting, we propose to define it as a property of ICT. Virtuality enables crisis users to freely modify or update information without any notice to collaborators. While in some cases crisis responders have the right to modify information depending on their prerogatives or their status, in other cases every user can potentially modify the content on online websites. This implies the risk of misinformation. However, it enables actors to immediately update information on their own rather than relying on someone else to transmit information.

These properties were then cross-tabulated against the five components of our definition of improvisation. We recognized other ICT properties during analysis, such as data integration, automation, or dynamic content. However, these were either redundant or appeared much less frequently. So we excluded them from the cross-tabulation.

Section 4.   Results

The result of cross tabulation is shown in Table 24. We draw five main propositions from our analysis.

First of all, the graphical representation of data during crisis response creates a unique reference that places shared information into a uniform format (Comfort, 1993). A uniformed format for information plays two roles. First of all, converting information into the format required by graphical codes makes it necessary for users to translate or reformulate their ideas. In that sense technology becomes a *boundary object*. Secondly, graphs have the ability to represent complex data in a way that can be comprehended with a single glance. This feature enables fast interpretation and foster, in our view, *spontaneous generation of ideas* or *spontaneous adjustment*.

Secondly, the combination of the centralization of data and the calculation is a starting point for *expertise leadership*. For instance, intelligent systems rely on databases to select and contact experts who are the most competent for different kinds of skills (Yuan, Detlor, 2005). By doing so, experts have the opportunity to participate in the ongoing improvisation by suggesting new ideas or at least providing guidelines. The design of Control and Command systems (C2) provides another example of how ICTs can support expertise leadership. C2 systems warn experts of the need for their intervening, thanks to the centralization of data about ongoing processes and the calculation of the gap between the course of action and the planned response (Ntuen *et al.*, 2006). Similarly, Decision Support Systems potentially support dialogical reasoning between experts by detecting when the course of action deviates from established use of resources (Mendonça, 2007).

Thirdly, combined virtuality and many-to-many communication supports both *expertise leadership* and *deviations from established uses of resources*. First of all calculation facilitates virtual discussions between experts enable appropriate responses (Dantas, Seville, 2006). With no immediate cost or delay, expert can share their ideas or provide feedbacks. By supporting discussion and dialogical reasoning, the combination of virtuality and many-to-many communication increases the odds for a combination of different resources (Dawes *et al.*, 2004).

Fourthly, the structured centralization of data enables actors to find information concerning others' past actions, therefore promoting *boundary spanning* interactions and the development of a common referential. In fact actors can build a common narrative that operates as a translator between groups and frames rules for action (Majchrzak *et al.*, 2007). This finding is consistent with previous research that recommends the use of logs to trace ongoing crisis response (Turoff *et al.*, 2004). By just a simple click, a log can reveal a collection of information related to past and ongoing actions.

Fifthly, coordination relies on virtuality. *Boundary spanning* practices between distant groups cannot exist without immediate and free replication and exchange of information (Comfort, 1993). Virtuality also helps to keep shared information consistent in time, thanks to

information feedback. Therefore, *minimal structures* can be initiated and managed by experts (Yuan, Detlor, 2005). This helps to avoid potentially disastrous misunderstandings (Larson *et al.*, 2006).

Mechanisms supported by ICT	Expertise leadership	Minimal structures	Boundary Spanning	Deviation from established use of resources	Spontaneous action
Graphical Representation			Comfort, 1993. Dawes et al., 2004. Mendonça et al., 2007.	Palen et al., 2007. Mendonça et al., 2007.	
Modularity	Turoff, Chumer, Van de Walle, Yao, 2004			Dawes et al., 2004. Dantas, Seville, 2006. Mendonça et al., 2007. McKinney, 2008.	Comfort, 1993. Dawes et al., 2004. McKinney, 2008
Calculation	Yuan, Detlor, 2005.		Carver, Turoff, 2007. Majchrzak et al., 2007	Yuan, Detlor, 2005. Mendonça et al., 2007. Comfort, 1993. Comfort et al., 2001.	Comfort, 1993.
Many to many Communication	Calloway, Keen, 1996. Dawes et al., 2004.			Comfort, 1993. Yuan, Detlor, 2005. Comfort et al., 2001.	
Data Centralization	Dantas, Seville, 2006. Ntuen, Balogun, 2006.	Palen et al., 2007. McKinney, 2008	Comfort, 1993. Palen et al., 2007. Ntuen, Balogun, 2006. Turoff, Chumer, Van de Walle, Yao, 2004	Mendonça et al., 2007. Comfort et al., 2001.	
Virtuality	Yuan, Detlor, 2005. Mendonça et al., 2007	Yuan, Detlor, 2005.	Dantas, Seville, 2006. Mendonça et al., 2007. Carver, Turoff, 2007. Majchrzak et al., 2007 Ntuen, Balogun, 2006.	Comfort, 1993. Calloway, Keen, 1996. Dawes et al., 2004. Yuan, Detlor, 2005. Dantas, Seville, 2006. Mendonça et al., 2007. Carver, Turoff, 2007. Majchrzak, Jarvenpaa, Hollingshead, 2007.	Yuan, Detlor, 2005. Palen, Liu, Hiltz, 2007. Carver, Turoff, 2007. McKinney, 2008

Table 24. Cross tabulation results

Section 5.   Discussion

Our objective in this paper is to provide a generic and well-argued description of organizational improvisation and ICT support to organizational improvisation in crisis response. Our work is exclusively exploratory and theoretical. It extends previous work by Quarantelli (2007) and Turoff and his colleagues (2004). However this study presents some unavoidable limitations that we detail.

First of all, our work is limited by our selective and incomplete use of prior literature. 15 articles represent a small sample. For this reason, our results require further consolidation or at least some confrontation with empirical testing.

Secondly, we are aware of the incompleteness of the suggested description of organizational improvisation. For example, it does not cover collaboration, which is a crucial need during crisis (Mishra, 1996). In our view, collaboration is of primary importance during improvisation in that it signifies that coworkers trust each other enough to improvise together. Undoubtedly, the coordination mechanisms that we suggest in this study are of limited interest if actors are not mentally involved in the ongoing improvisation. However, there is no clear evidence that collaboration is a constituent of improvisation. One can argue that the willingness to collaborate may grow between improvisers because of the ongoing improvisation. Because of this ambiguity, we restricted our reflection to coordination. In addition, our objective in this work was to propose a resolution of the inner paradoxes of organizational improvisation that mainly include the question of coordination.

Similarly, our study overlooks organizational needs or constraints that are also important during crisis response and can burden organizational improvisation. Definitely, the two aspects of collaboration and organizational constraints should be examined in future research on organizational improvisation.

This study focuses on technology features and does not take into account the contingencies of the users. Crisis response implies the use of diverse tools. Considering technology at large enables us to determine whether technological investments are useful or not. In our study, technology is seen as an objective tool. Other perspectives suggest that technology and users are dependent on each other. Brighan and Introna (2006) provide an interesting example of how technology is defined by its users practices. It illustrates the limitation of our findings that only suggest potential sources of support from technology in crisis improvisation.

"When a consultant takes a mobile phone, the consultant acquires a certain capability (to contact and be contacted) but that is not all that happens. We need to look at this seemingly obvious statement of 'consultant, 'mobile phone' and 'taking up' more closely. The mobile phone only becomes a mobile phone when taken up by the consultant. When it lies on the table it is a potential to be 'a mobile phone', but it only becomes an actual 'possibility for contacting' when it is picked up and one dials the number, and, of course, there is sufficient credit on the account, and it is possible to get a signal, and so forth. In taking up the mobile phone, both the mobile phone and the consultant get transformed. The mobile phone is no

longer 'merely' an object and the consultant becomes a human that embodies the possibility to contact and to be contacted at a distance". (p. 141)

Empirical investigation may reveal further properties of technology that support improvisation. Moreover, a more exhaustive review may strengthen our results, or it may contradict them. Our hope is that our analysis will help guide more thorough and conceptually sound investigations of ICTs' role in improvised organizational responses to crises.

Our interest in how technologies can provide support to organizational improvisation remains partial. In fact, technological support to improvisation may be achieved in other manners. For instance, simulation systems can provide training before the emergency (Mendonça, Fiedrich, 2004). Similarly this study does not take into account mobility as an ICT property that definitely plays a role in improvisation by enabling continuous tracking of victims (Yuan-Hsiang *et al.*, 2004).

Finally the scope of the inquiry of this paper is limited. Our theoretical propositions primarily stem from our analysis of crisis management literature. As a result, these propositions focus on crisis improvisation and elude other cases of improvisation. In addition, our findings specifically deal with technology use in a limited range of crisis situations: crisis response to natural disasters. For this reason, generalizability of our findings is likely to be limited. Further research should assess the adequacy of our findings within other contexts for improvisation and technology use.

Conclusion

In this work we tackle three aspects of organizational improvisation in crisis response that have been insufficiently explained so far by the literature. First, we address the paradox of acting and planning by examining theoretical work on interactions between crisis improvisers. Second, we clarify ICT support to crisis improvisation by reviewing crisis management literature. Finally, we inspire from the dynamic capabilities approach to explore the conceptual ties between improvisation and routine.

Our work identifies five constituents of organizational improvisation in crisis response among which three main mechanisms that regulate organizational improvisation. We aim at a more realistic view of crisis response, enriched by the dynamic capability approach. Our results show that ICT is a potential support for organizational improvisation during crisis. Thus, the contribution of this work is threefold.

First of all, we rely on the dynamic capability approach to propose that routines are likely to provide support to improvisation rather than prevent it from developing. We view routines as providing a referential from which actors can deviate. Furthermore routines are not static and do not necessarily enclose actors into well-known patterns of actions. As suggested by the dynamic capabilities approach, organizational members integrate novelty into existing capabilities thanks to codification, discussion and repetition (Zollo, Winter, 2002).

Secondly we propose some description of the core constituents of organizational improvisation in crisis response. We make further conceptual propositions about the role played by these constituents. By doing so, we attempt to respond to the conceptual paradox of planning and acting that we mention earlier in this article: How can improvisers coordinate with each other.

Finally, we propose an explanation of the ICT support to organizational improvisation by highlighting six ICT properties and their support to the constituents of organizational improvisation. We explicitly state some ICT properties that are generally implicitly taken into consideration by most studies.

Annex

Table 25. Description of the sample articles

Authors & title	Date	Journal Name
COMFORT LK, Integrating information technology into international crisis management and policy.	1993	Journal of contingencies and crisis management
CALLOWAY LJ, and KEEN PGW, Organizing for crisis response.	1996	Journal of Information Technology
COMFORT LK, SUNGU Y, JOHNSON D, and DUNN M, Complex systems in crisis: Anticipation and resilience in dynamic environments.	2001	Journal of contingencies and crisis management
TUROFF M, CHUMER M, VAN DE WALLE B, and YAO X, The design of a dynamic emergency response management information system.	2004	Journal of Information Technology Theory and Application
DAWES SS, CRESSWELL AM, and CAHAN BB, Learning from crisis - lessons in human and information infrastructure from the world trade center response.	2004	Social Science Computer Review
YUAN Y, and DETLOR B, Intelligent mobile crisis response systems.	2005	Communications of the ACM
DANTAS A, and SEVILLE E, Organisational issues in implementing and information sharing framework: Lessons from the matata flooding events in new zealand.	2006	Journal of Contingencies & Crisis Management
NTUEN C, BALOGUN O, BOYLE E, and TURNER A, Supporting command and control training functions in the emergency management domain using cognitive systems engineering.	2006	Ergonomics
CARVER L, and TUROFF M, Human-computer interaction: The human and computer as a team in emergency management information systems.	2007	Communications of the ACM
MENDONÇA D, JEFFERSON T, and HARRALD J, Collaborative adhocracies and mix-and-match technologies in emergency management - using the emergent interoperability approach to address unanticipated contingencies during emergency response.	2007	Communications of the ACM
PALEN L, HILTZ SR, and LIU SB, Online forums supporting grassroots participation in emergency preparedness and response.	2007	Communications of the ACM
MCKINNEY EH, Supporting pre-existing teams in crisis with it: A preliminary organizational-team collaboration framework.	2008	Journal of Information Technology Theory and Application

Summary of the Theoretical part

In the theoretical part we present our basic assumptions and we make propositions

Chapter 2.1 presents our assumptions in relation to crisis: We approach crisis as an organizational episode, caused by both a triggering event and organizational dysfunctions. We focus on organizational response to crises during disasters provoked by natural hazards.

Chapter 2.2 presents our first study that addresses the issue of diversity in research on improvisation. Our study confirms that the field of research on improvisation is diverse. In addition, we explain that authors diverge with respect to four essential tasks to the research process. Finally, we propose an analysis grid of the literature on improvisation based on eight perspectives.

In chapter 2.3 we present our second study. We address some of the limitations of our current understanding of improvisation by making theoretical propositions in relation to the constituents of improvisation. We draw inspiration from the Dynamic Capabilities approach. We then review studies that deal with ICT, crisis response and improvisation. We identify six ICT properties that support organizational improvisation in crisis response

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Part 3. The empirical part

The empirical work aims to respond to the limitations of our theoretical findings to research question II. To do so, we develop an integrative analysis of the 2003 French heat wave crisis response. This part is structured as follows.

Chapter 3.1 presents the case of the 2003 French heat wave crisis response. We first detail the specificities of the response network that gathers 23 types of organizations involved in the crisis response. We then present the specificities of the 2003 French heat wave crisis response.

Chapter 3.2 details our research design. We present the research objectives and topics of the empirical work. We then present our methodology, our sources of data and the diverse steps of our data collection and analysis.

Finally, **chapter 3.3** presents our empirical investigation and findings. We respond to research questions III and IV by providing an integrative framework that emerged from our coding.

Chapter 3.1. Presentation of the 2003 French heat wave case

Introduction

The heat wave, which occurred during the summer of 2003 in France, had dramatic effects on the environment and the population. During the months of July and August, there was a dramatic drought. Lakes and rivers were dried-up enough to block energy supplying (Salagnac, 2007). The simultaneous effects of the heat and the drought raised the risk of fires and energy blackouts in electrical and nuclear power plants. Additionally, the 2003 French heat wave provoked a sudden increase in mortality in the Ile-de-France region, especially among the elderly. Although the effects of the climate on the French territory and the French population had already been documented, the health care system failed to anticipate the increase of mortality caused by the heat wave (Got, 2008). As a result, the death rate was more than 150% higher than previous years during the two first weeks on the month of August (Fouillet *et al.*, 2006; Hémon *et al.*, 2003). Figure 38 represents both temperatures and death numbers in Paris between the 15th of June 2003 and the 15th of September 2003, which illustrates the simultaneity between increases in deaths and temperatures around the 12th of August. The response to the heat wave involved a set of 23 types of organizations that we label the *response network*.
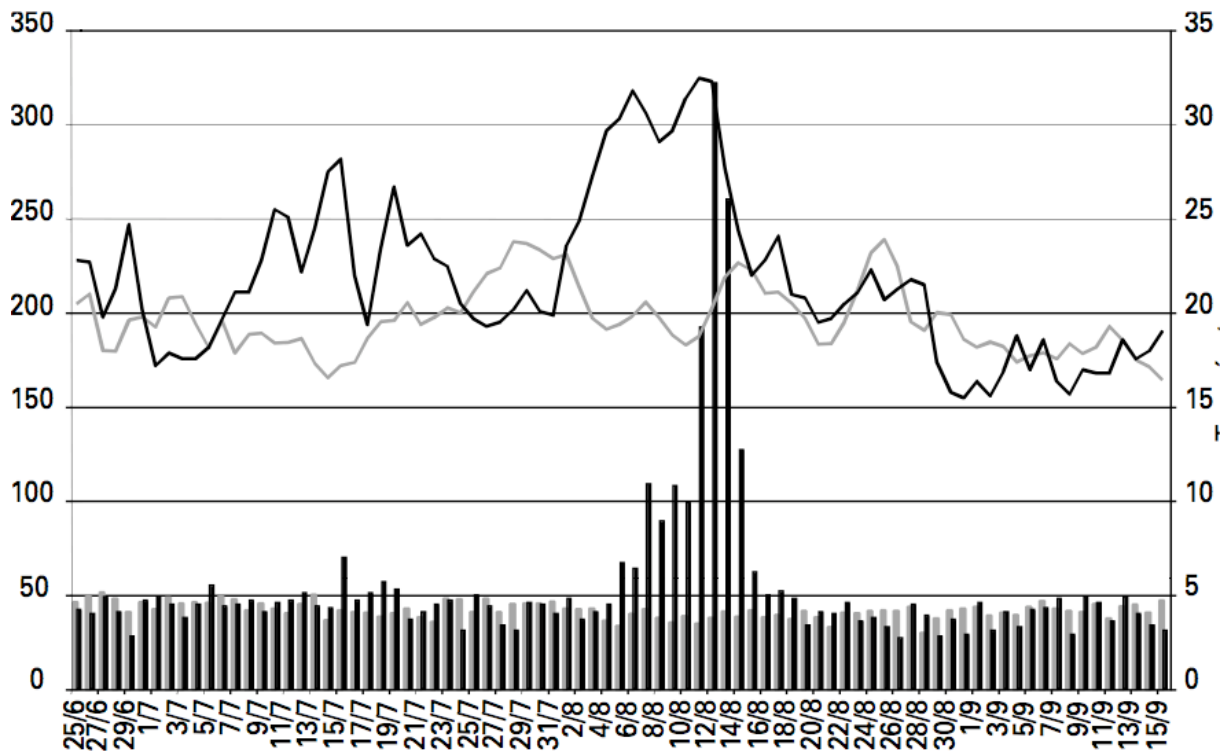
Figure 38. Death numbers (left ordinate) and Celsius temperatures (right ordinate) in Paris between 6/25 and 9/15

This chapter describes the heat wave crisis response and is structured as follows. Section 1 presents the 23 types of organizations that compose the response network. Section 2 then details the response network functioning. Section 3 describes the organizational crises that were triggered by the heat wave within the response network. Section 4 provides a chronology of the response to the heat wave crisis.

Section 1.   The response network actors

We identified three main groups of organizations within the response network.

First of all, the group of civil protection and police organizations is in charge of assuring public security and order. In critical situations, these organizations have the additional responsibility of providing civil protection and emergency services, such as caring for injured people and organizing rescue operations. This group mainly includes the Paris Firefighter Brigade (BSPP) [12] and Paris Police services. Both of these services are under the authority of the Paris Prefecture of Police (PPP). Similarly, the PPP is under the authority of the Minister of the Interior of France.

Secondly, the group of health care organizations is in charge of taking care of injured and sick people. This group includes three types of organizations with distinct levels of responsibilities. Local actors such as emergency medical services and hospitals handle patients' flow, diagnosis and care. Regional organizations manage and regulate medical activities in Paris and its surroundings. Some national organizations from the group of health care organizations manage the funding and organization of health care activities within France. Other organizations from this group are in charge of alerting all the health care organizations when some disaster is likely to happen such as the National Health Watch Institute (INVS).

Finally, we identified a third group of organizations that were involved in crisis response. We label this group *"outsider organizations"* because these organizations were not entitled to respond to the heat wave. However, outsider organizations had a significant influence on the development of crisis response and improvisation. Finally, we include patients and citizens in the response network because some of them were affected by the ongoing improvisation[13].

Figure 39 details the connections between the organizations that were involved in the response to the 2003 French heat wave crisis. Organizations with national responsibilities are represented on the top. Progressively moving towards the bottom one can find organizations with regional and then local responsibilities. As the legend explains, unidirectional arrows signify hierarchical top-down connections. Bidirectional arrows represent strong cooperational ties. Finally links with no arrow correspond to ad hoc connections that emerged between organizations during the heat wave. We provide further details about the specificities of each organizations and each group of organizations in the following paragraphs.

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[12] All acronyms of organizations that were involved in the crisis response are in French.
[13] We did not collect data from victims.
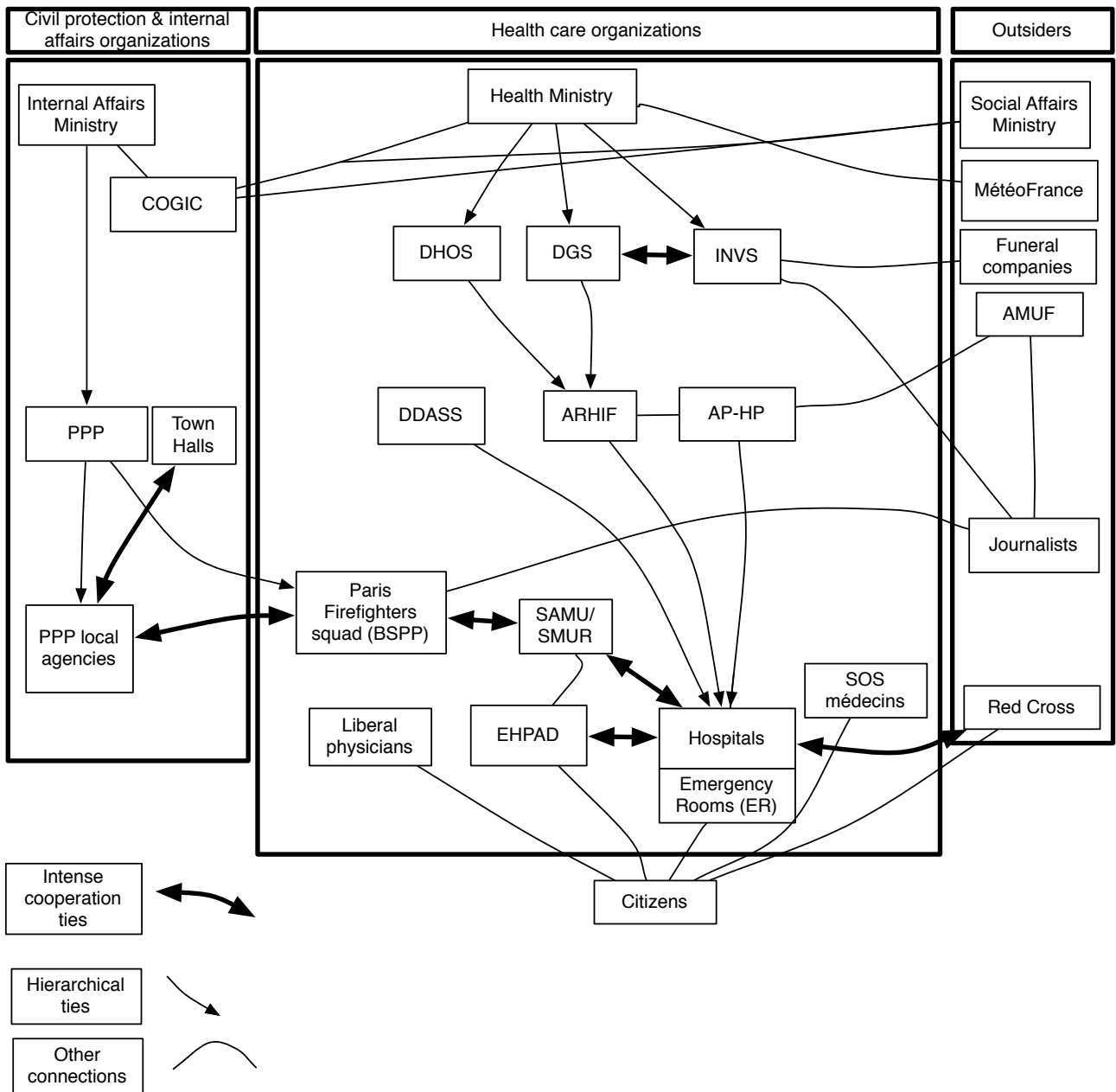
Figure 39. The Ile-de-France Health Network

1.I. Health care organizations

Health services were prominent in 2003, especially in the Parisian Region. According to the INSEE (the national institute that produces statistics), French health activities represented more than half of the national budget of France and involved more than 170,000 persons in Ile de France (e.g. 1/5 of the French employed by the health care industry).[14]

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[14] For more detail see www.insee.fr and more specifically
http://www.insee.fr/fr/themes/tableau.asp?reg_id=20&ref_id=sanopte73

In 2003, international reports depicted the French health system as one of the most efficient health care systems in the world (Le Faou, 2003). However, the French health care system has been aiming to restrict its budget and rationalizing its processes since the mid nineties (Le Faou, 2003). Budget restrictions have resulted in actions intended to reduce costs, such as temporarily closing unoccupied beds and services. For example, the DHOS and ARH recommend every summer that hospitals close between 10 and 30% of their services. Because an increasing number of people suffer from long term diseases for which patients obtain fully-financed treatments, hospitals and emergency units' budgets are more restricted (Poutout, 2005).

Within the health care system, two main logics coexist: a professional and an administrative logic (Boudes, Laroche, 2009; Robelet *et al.*, 2005). On the one hand, the health care system's mission is to treat patients. This mission governs field actors' activities and reasoning, in particular in local organizations such as hospitals, SOS médecins and BSPP. On the other hand, an administrative logic stems from the necessity to coordinate and regulate health care activities at regional and national levels (Robelet *et al.*, 2005). The administrative organization of the response network features this logic. National organizations such as the DGS and the DHOS make decisions on resource allocation (Le Faou, 2003). National organizations and regional organizations such as the DDASS and the ARH agencies are in charge of monitoring health care activities. Some regional organizations such as the AP-HP directly interact with field actors and are familiar to field actors' needs. However, their primary mission is to coordinate health care activities and apply decisions that were made by national organizations.

Both the professional and the administrative logics influence organizational practices in the response network. The administrative actors competently make decisions by using statistical tools, data sets and analysis grids. For this reason, they primarily focused their attention on risk mitigation objectives when they interacted during the heat wave. Conversely, local organizational actors had a vivid perception of the new and dramatic aspects of the situation when the heat wave struck (Milet, 2005). Field actors that include Emergency Room Technicians (ERTs), firefighters and emergency medical practitioners considered taking care of patients as the top priority in their work. Some field actors experienced administrative matters as being constrictive. In the following paragraph, we detail each health care organization.

1.I.1. National organizations

1.I.1.1. The Health Ministry also called Le ministère de la Santé

The Health Ministry activities are related to health services, health insurance and social welfare in France. However, this ministry delegates many of its responsibilities to national organizations such as the DGS (more detail in the following paragraphs). The Health Minister collaborates with his or her cabinet advisers who play a significant role in decision making in the ministry.

1.I.1.2. The National Health Watch Institute or Institut National de Veille Sanitaire (INVS)

The INVS's role is to warn and alert when some phenomenon is likely to affect French people's health. The INVS' mission is to watch potential sources of epidemic and injuries at national and international levels. When the INVS identifies a potential health threat, it then provides its recommendations to the DGS that implements them. The INVS was created in 1998 but in 2003 most field actors, such as physicians, did not know of its existence and name.

1.I.1.3. National Health Agency or Direction Générale de la Santé (DGS)

The National Agency for Health is in charge of developing and implementing programs for health at the national scale. Coordinating with the INVS to implement the monitoring/alerting system is part of its responsibilities as well.

1.I.1.4. Hospitalization and Health Care Organizations Agency or *Direction de l'hospitalisation et de l'organisation des soins* (DHOS)

This agency's task is to organize health care activities in France, relying on coordination with the DDASS and DGS. In particular, this organization is devoted to the allocation of financial resources. Recently, its mission has expanded to the management of the coordination between the diverse actors involved in health issues.

1.I.2. Regional organizations

1.I.2.1. Local Agency for Social and Health or *Départementale de l'aide sociale et sanitaire* (DDASS)

The DDASS is in charge of social and health matters in French regions and counties. The DDASS delegates to sub agencies that are located in Paris (DASS 75) and the Ile-de-France counties (for instance DDASS93, DDASS94).

1.I.2.2. Ile de France Hospitalization Agency or *Agence Régionale Hospitalière d'Ile de France* (ARHIF)

The ARHIF manages and coordinates hospitals, in particular when national programs and projects are implemented. For instance, there has been a specific program to promote hand washing by professionals. This project provided washing solutions, communication displays, etc.

1.I.2.3. Parisian Agency for Hospitals Management or Assistance Publique des Hopitaux de Paris (APHP)

The APHP is in charge of managing 39 hospitals in the Parisian region, which includes all hospitals in Paris intra muros and some hospitals in the neighborhoods of Paris. The APHP regulates funding, resource allocation, patient flows and alerting. The APHP hospitals have a strong identity, calling the head of the APHP the "core". As a result, conflicts between the

APHP and the DDASS commonly occur because of these two organizations have equal responsibilities in some hospitals.

1.I.3. Local organizations

1.I.3.1. Hospital personnel

Each hospital is in charge of the quality and the coordination of its health care activities. Hospital personnel include managers, administrative personnel and medical personnel. While the managers are responsible for the back office management such as human resources, information systems, quality and performance measurement, another set of administrative personnel handle coordination between services and surrounding hospitals and assisted living facilities. From a medical standpoint, each hospital gathers diverse specialists from psychiatric to emergency practitioners. Professional values are strong among medical staff such as physicians, Emergency Room Technicians (ERTs) and nurses. Public and private hospitals hardly coordinated with each other during the heat wave (Evin, 2004). However, public hospitals personnel were retrospectively appraised by national organizations for their courage. Most of the hospitals personnel faced an overwhelming workload and relentlessly worked at treating patients despite their suffering from the heat and exhaustion (Evin, 2004; Lalande *et al.*, 2003)

1.I.3.2. Emergency Room (ER) personnel

This is a special group within medical staff. While people who suffer from long-term diseases get planned treatments, patients who spontaneously suffer from injuries are treated in emergency services. Emergency rooms were overwhelmed during the heat wave. Officials did not recognize Emergency Rooms Technicians (ERT) as medical specialists in 2003. For this reason they were extensively represented by trade unions such as the AMUF.

1.I.3.3. Private physicians

Private medical activity is now very segmented and highly specialized (Poutout, 2005). Some private physicians practice in double locations: they see patients in a private medical practice as well as in hospitals and clinics. Coordination between physicians and other health care organizations is controversial. Some private physicians were criticized for not being available during crisis response (Lalande *et al.*, 2003). As a result, hospitals were missing staff but could not contact physicians. During public hearings, the specialization of physicians was claimed to be a social issue. For older people who have multiple sources of suffering, it is complicated to find a physician who is experienced and knowledgable about their specific needs.

1.I.3.4. Assisted living facilities also called Établissement d'hébergement pour Personnes Âgées Dépendantes (EHPAD)

These types of establishments offer apartments and health support for the elderly. During the heat wave, administrative actors struggled to grant sufficient access to hydrating resources to both EHPADs and hospitals. However, EHPAD are eligible for access to resources in surrounding hospitals in case of important shortages: When the EHPAD staff is overloaded

with patients, their counterparts in hospitals are called upon to take care of them, therefore alleviating the workload of the EHPAD staff. During the heat wave, mortuary chambers in many EHPADs were overloaded. In most cases, even the surrounding hospitals could not manage all the corpses, which provoked more confusion within EHPAD.

1.I.3.5. Physician network for emergency service, called *SOS Médecins*

This non-profit organization involves physicians who offer mobile medical intervention for emergencies at home. As other emergency services, they experienced an overwhelming increase in requests between the 4[th] of August and the 14[th] of August. Public hearings revealed that they had interacted with journalists since the beginning of the crisis.

1.I.3.6. Emergency ambulance service, called *Service d'Assistance Médicale d'Urgence* (SAMU) and Emergency and Ressuscitation Mobile Service, called *Service mobile d'Urgence et de Réanimation* (SMUR)

SAMU and SMUR's memberships are composed of emergency medical practitioners who provide mobile and immediate help to people who are injured. It provides phone assistance as well, with the objective of providing medical advice for emergency situations. Emergency ambulance services coordinate with hospitals when they cannot treat their patients with mobile devices. They also coordinate with firefighter squads but provide a different service in that the SAMU first tries to advice by phone before intervening. Moreover physicians are less numerous among firefighters than within SAMU. The emergency ambulance services extensively coordinate with firefighter squads (BSPP). During the crisis, firefighter squads and the SAMU developed ad hoc information systems together.

1.II. Civil protection & internal affairs organizations

The objectives of the civil protection organizations are twofold. First of all, they have to maintain public order and protect the civilian population from terrorism and large-scale accidents. Secondly, they have to provide support to civil protection in critical situations. The civil protection organizations' mission is oriented towards security. For this reason, these organizations abide by strict rules of operation. For instance, the BSPP refused to transmit data about deaths to the INVS without an official authorization from the Paris Police Prefecture on the 11[th] of August.

1.II.1. National organizations

1.II.1.1. Internal Affairs Ministry, called Ministère de l'Intérieur

This ministry is at the head of the civil protection organizations. Its involvement in the crisis response efforts was initiated on the 12[th] of August. On the 13[th], this ministry intervened by providing military beds for the purpose of stocking corpses.

1.II.1.2. The Inter-Ministry Coordination Agency, also called Le centre opérationnel de gestion interministériel des crises (COGIC)

The COGIC organized inter-ministry meetings between the Internal Affairs Ministry, the Health Ministry and the Social Affairs Ministry on the 12th of August to collectively find solutions to specific issues such as corpses storage and electrical blackouts.

1.II.2. Local organizations

1.II.2.1. Paris police authorities also known as *Préfecture de Police de Paris* (PPP)

This organization is responsible for the protection of citizens. PPP is additionally in charge of police services and the administrative processes related to identification documents.

1.II.2.2. Paris Police Prefecture local agencies:

PPP local agencies exist in every administrative region, or arrondissement in Paris. PPP local agencies directly intervene when called. This organization is an equivalent to 911 services in the United States. During the heat wave, he PPP local agencies collaborated with BSPP and SAMU/SMUR to assist people who fainted, in particular homeless people.

1.II.2.3. Paris Firefighters Squads also called *Brigade des Sapeurs Pompiers de Paris* (BSPP)

One of their missions is to alleviate citizens' immediate suffering and to provide assistance in emergency situations. Their area of expertise is not restricted solely to damage from fires due to the fact that firefighter squads include medical personnel. The BSPP is officially a military organization, a characteristic that distinguishes it from squads of firefighters from other regions. Its hierarchy and values are similar to those of the army. On the field, the BSPP extensively coordinates with the SAMU/SMUR teams in managing patient transfers into hospitals.

1.II.2.4. Paris Town Hall

The Paris Town Hall provided material support to health care organizations. In addition, they transmitted alerting information to the public in relation to hyperthermia. Finally, they collected data about victims when these data could not be obtained from private physicians.

1.III. "Outsider" organizations

These organizations do not extensively coordinate with the other organizations routine situations. However, they developed ad hoc connections within the response network during the heat wave.

1.III.1. National organizations

1.III.1.1. Weather forecast agency called in French *Météo France*

Météo France is in charge of providing national weather forecasts. Prior to the crisis there was already coordination between Météo France and the InVS. *Météo France* was in charge of providing updated information on the weather on a regular basis.

1.III.1.2. The Social Affairs Ministry also called Ministère des Affaires Sociales et de l'Emploi

This ministry is in charge of social issues such as social exclusion and unemployment. In 2002 as well as on the 26th of May 2003, the Ministry anticipated that the elderly could suffer from the heat during the summer and sent a fax to local governmental agencies to recommend extra attention on this specific point. During the heat wave, this ministry was involved in the response by participating in inter-ministry meetings beginning the 12th of August. However, the Social Affairs Ministry members remained isolated and stated that they received scarce information from health care organizations.

1.III.1.3. Funeral homes also called *Pompes Funèbres*

Funeral home companies usually do not coordinate with hospitals but with town halls and prefectures. However during the heat wave, the lack of coffins to stock corpses was problematic. For this reason, hospitals developed extensive coordination with funeral companies. Furthermore, funeral homes participated in some inter-organizational meetings. The leading company on the market was the only organization that was able to provide statistics related to mortality at a quick rate. Given data about coffin orders and the fact that they corner approximately 25% of the market, it was easy for them to determine an estimated number of fatalities. Thus they transmitted their data about death rates to ministries since the 12th of August.

1.III.1.4. Journalists

Television journalists from local and national channels as well as local and national newspapers journalists, such as *Le Parisien* had frequent interactions with crisis responders. From the beginning of the crisis, firefighter squads were followed by journalists. News programs broadcasted interviews with medics and provided advice to avoid hyperthermia to the public. In addition, some medics participated in television and radio programs to alert the public to the situation. Journalists heavily criticized the lack of reactivity from national health care organizations such as the DGS, INVS and the Health Ministry. As the number of fatalities came as a surprise, journalists investigated how data was managed, which resulted in a political and social controversy. During the last phase of the crisis response, press conferences were frequent and some administrative actors permitted inter- organizational meetings to be recorded as evidence of their willingness to remain transparent. Internet users, including journalists, covered the evolution of the heat wave and interacted with the population through articles and comments about web pages.

1.III.1.5. French Emergency Room Technician Trade Union, or *Association des Médecins Urgentistes de France* (AMUF)

This trade union was particularly active in July 2003 and alerted the public about bed shortages. The union leader, Patrick Pelloux, intervened on television by sending out an alert about the massive amount of deaths on August 10th, asserting that such deaths could have been avoided and were not natural. On that point he experienced an open conflict with the DGS director who claimed at that time that he was a liar. Patrick Pelloux and his colleagues intervened in ad hoc transversal meetings that took place on the 11th and the 13th of August.

1.III.2.1.   Paris Red Cross, called *Croix Rouge*

The Red Cross is an international non-profit organization. Its activities are diverse, ranging from commodity collection for poor people to first aid intervention. In France alone, it is comprised of more than 50000 volunteers. The Paris Red Cross intervened in alleviating the workload of other crisis responders during the 2003 summer. Its values are oriented towards charity and volunteering.

Section 2.   *The response network values*

We define the response network as the set of the 23 types of organizations involved in the response to the organizational crisis caused by the heat wave (more detail on the organizational crisis in section 3). Our definition of the response network is consistent with Romelaer's definition of an organization (2002) in that it gathers individuals and groups that have regular and stable connections between each other. This enables us to study organizational improvisation – rather than inter-organizational improvisation – within a network. In the coming paragraphs, we detail the role of collaboration and hierarchy within the response network. We then present the actors of the response network.

2.I. Collaboration

We use the term network due to the multiplicity of interactions that took place between the organizations during the response to the heat wave crisis.

Some organizations had developed close ties of cooperation well before the crisis (Robelet *et al.*, 2005). For example, health care services to the elderly were officially restructured in 1998 into a network constituted by assisted living facilities, town halls, home hospitalization services and hospitals. Some other connections between these organizations were similar to a meshing configuration. For example, the firefighter squads (BSPP) were not only under the authority of the Prefecture de Police, but also had institutionalized links of cooperation with emergency medical services such as Emergency rooms, SAMU and SMUR. Generally speaking, the functioning of the health care system is based on interindividual interaction (Destais, 2003) and interorganizational connections. Typically, the regulation of the flow of patients is predefined by procedures but also depends on the informal interactions between emergency units and friendships between professionals. Finally new links of cooperation developed between actors from diverse professional groups during the crisis response. For example, some professionals contacted the health department minister or participated in institutional meetings.

Collaboration is a widespread value within the network. Each hospital is supposed to collaborate with local private physicians. The APHP and hospitals also cooperate with the mobile emergency services by sharing tasks. Similarly, the BSPP handle a significant part of the emergency medical interventions.

Collaboration implies information sharing. During the heat wave, hospitals provided information to potential victims in assisted living facilities (EHPAD). Similarly, town halls were contacted by medical services to collect data about people who were likely to be hurt from the temperatures, such as old persons. Funeral parlors spontaneously contacted the Health Ministry and the prefectures as well.

2.II. Hierarchy

The *response network* does not only include collaboration; Hierarchical values are also important within this network. For instance top-down and bottom-up coordination coexist between the Health Ministry and other entities of the network. Hospitals have to validate the most critical decisions by the Health Ministry and the prefectures, e.g State representative in local counties. However, the Health Ministry delegates many activities to the DGS and the DHOS that are responsible for health related issues in France. The Health Ministry also relies on these organizations for the monitoring of the national health care system. At a more local level, the DGS and the DHOS delegate some of their prerogatives to the DDASS and the APHP. Similarly, hierarchy is particularly important between firefighters (BSPP), police services (the PPP local agencies and the PPP) and the Internal Affairs Ministry.

2.III. Organizational and informational barriers

The concept of complexity is prevalent within the response network. There have been more than 24 reforms within the French health care system since 1945 (Poutout, 2005), which explains why some organizations remain unknown within the response network. This was the case of the agency for health alerts (called *Institut de Veille Sanitaire,* also known as INVS) before the 2003 French heat wave.

As Denis, Lamothe and Langley argue, organizations related to health issue classically involves organizations with divergent objectives and values (2001). It is interesting to note the example of the Parisian firefighter squads (BSPP), under the authority of police services and governed by military values (firemen in Ile de France have a military status, on the contrary to other places in France), that were prone to withhold information based on the rationale of avoiding public panic. On the contrary, some active medical personnel such as ERT searched to transmit and publish death rates as much as possible to provoke a reaction among the public and promote civil mobilization towards the situation of the elderly.

Organizational barriers are important as the network gathers organizations with distinct missions and values. For example, field actors of the network claimed their opinion was looked down upon by the administrative organizations because they missed a global view of the health care system. As an emergency room technician explains:

"*The Health ministry advisers were more or less competent. Most of the time they were honest but their interest narrowed to political and financial objectives. No minister ever had an ear to listen to professionals, unless they had the same rank*" (L'urgentiste, p.26).

Organizational barriers also arise from the gap between professional values and logics within the network. Health care organizations are oriented towards saving lives where as civil

protection organizations look after keeping calm among citizens. As some health care institutional actor explained during the public hearings:

"*My observation is that hospitals and sanitary institutions are completely disconnected from the prefect services, may it be right or wrong. I am only making an observation*".

Finally, separate information systems strengthen organizational barriers. Only one federating information system existed in 2003 to coordinate hospitals and the Health Ministry: the PMSI. The PMSI is a routine tool used to compile and store data to get an idea of the time spent by each patient in services. As the PMSI use is restricted to accounting we exclude it from our analysis. Data sharing was restricted, because IS architectures were segmented from one hospital to another in spite of the need to develop a new culture of data sharing (Fieschi, 2003). As a firefighter explains during public hearings, the lack of information sharing prevents organizations from getting a comprehensive view of their own processes.

"*The firefighters' squads have a partial view on of the state of health of the whole population that is under their protection. We do not receive information about all the deaths, in particular these that concern people who were at home but who could not call us. We do not know what happens to victims after their being transferred to hospitals*".

Finally, the frequency of ICT use differs from one organization to another, strengthening organizational barriers. Field actors, especially physicians, show modest use of emails (Brooks, Menachemi, 2006) on the contrary to administrative actors. Phones and faxes were primary means for communication in health care organizations in 2003 (Chen et al., 2010).

This study focuses on four types of technology that were used before and during the organizational response to the crisis provoked by the 2003 French heat wave: the Internet, email, faxes and phones. During the 2003 French heat wave, these technologies were helpful. As parliamentary reports on the heat wave crisis response explain, the Internet, used by physicians and other actors, helped to obtain information about hyperthermia and death rates. Actors needed an overview of the situation as well. A director acknowledges in a report:

"*At that time, we could not know the exact number of sick people in all the emergency rooms. We strove to evaluate numbers but, given our means, we hardly managed it*".

Section 3.   The 2003 French heat wave as an organizational crisis

In August 2003, the heat questioned the ability of several organizations to perform their missions, therefore putting these organizations into crises. During the heat wave, civil protection and health care organizations partially failed at protecting the lives of vulnerable citizens. Emergency rooms were overwhelmed with patients and the civil protection services did not manage to prevent outdoor and indoor fatal faints. As an increasing number of people suffered from the heat, hospital mortuary chambers were overcrowded and funeral homes were unable to manage the increasing number of corpses. The following week, the Health Minister, the National Health Watch Institute and the National Health Agency failed to provide the public with a fair approximation of the number of deaths. It took an entire week

for the Health Minister to enact the emergency plan, also known as the "White Plan", that includes directions to cope with a sudden increase of casualties caused by a disaster.

The 2003 French heat wave not only triggered internal organizational crises within the response network but also paralyzed transversal coordination within the response network. As a result, the organizations that compose the response network failed at performing their collective mission: taking care of people and saving lives. More specifically, the extremely high temperatures led to two fundamental tensions between the health network's fundamental objectives and its actual functioning during the heat wave. First of all, hospitals were lacking information, knowledge, administrative support, energy and material resources that they usually draw from regional and national administrative organizations. Secondly, the public health system could not share information and coordinate properly to optimize resource allocation. While more than 15 employees were mobilized to write one note alerting the public to the situation, help was desperately needed to simply hydrate patients in hospitals. Each organization had internally settled crisis management teams and meetings. However, information was not shared between the groups of civil protection organizations and medical organizations. For all these reasons, the 2003 French heat wave not only put some organizations into crises but also triggered an organizational crisis within the *response network*.

We argue that the 2003 French heat wave crisis matches our theoretical assumptions about crises (for more detail about these assumptions, see chapter 2.1). The heat was not the only source of difficulties that influenced hospitals' functioning during the 2003 summer. Crisis was caused by the combination of unexpected triggering events, such as the heat, and inherent dysfunctions (Milet, 2005). For instance, the overall restriction of the number of available beds made health care organizations react slower to the sudden increase of casualties. The Hospitalization and Health Care Organizations Agency (DHOS) ordered hospitals to reduce their activity in May of 2003. Every summer, the national agencies that are in charge of managing the health care system and its budget temporarily close around 25% of services in hospitals. The rationale for this annual closing is that people usually go on vacation and the occurrence of casualties is likely lower during the summer. In addition, a significant proportion of medical personnel goes on vacation during the month of August. Thus summer brings the opportunity to make savings by closing services. Beds are "closed" and stocked, which limits the hospitals' capacity to care for large quantities of patients. However, in August 2003, casualties suddenly increased and the number of patients waiting for treatment in emergency rooms far exceeded the number of beds available. Opinions of actors involved in the response network on the bed closings diverge. While some Emergency Room Technicians (ERT) claimed that the lack of beds jammed the access to emergency rooms and increased the ERTs' work overload and stress (Pelloux, 2004), some other reports argue that there is no correlation between beds closings and the mortality rates (Bastianelli *et al.*, 2003).

Regardless of the divergent opinions on the bed closings, the response network was inherently dysfunctional because of the multiple misconnections between the organizations included in the response network. As the Lalande report explains, the administration did not know how to

collect information while the majority of crisis responders who were on the field did not think about the necessity to communicate with the administration (Lalande *et al.*, 2003). Despite evidence that some ERTs tried to contact administrations by sending emails or making phone calls, no one can deny that the response network lacked cohesion:

"*Organizational disconnections between health care administrations, between ministries and between administrations and actors who were on the field restricted possibilities for information sharing. Every organization that managed the response network nationally [e.g. INVS, DHOS, Health Ministry, etc] had centralized and developed its own ad hoc information system to deal with the crisis. However, there was no effective networking between these organizations. Generally speaking the "center" does not know how to collect information and the "periphery" does not think of the necessity of communicating information*". (Summary, p. 2)

The response to the 2003 French heat wave crisis was burdened by the lack of information sharing between crisis responders. In spite of well-established patterns of coordination, most actors are not used to sharing information. For instance emergency rooms handled extra activities rather than relying private physicians to complete these tasks. The extra workload burdened the management of the overwhelming number of patients in hospitals. As some national reports explains:

"*When they were on the field, private physicians and SOS médecins were overwhelmed by calls and faced some dramatically tough situations. However, numerous crisis responders such as SAMU personnel, squads of firefighters and emergency staff claimed there was a lack of coordination between hospitals and other care units. They also mentioned that a massive number of private physicians who were familiar with the elderly patients, had departed for their summer vacation. The absence of these physicians created many problems: Medical personnel was lacking information about the patients' medical background (...) and were overwhelmed with requests for death certificates*". (Summary, p. 4).

Our understanding of the 2003 French heat wave is consistent with theories on crisis in two other aspects: the heat wave provoked both substantial emotional and time pressure. In this study, we focus our analysis on the crisis coping/response step of the whole episode. Figure 40 represents the combined effects of organizational dysfunctions and heat on the emergence of organizational crises during the heat wave. Organizational dysfunctions burdened coordination within the response network while the heat played the role of the triggering event.
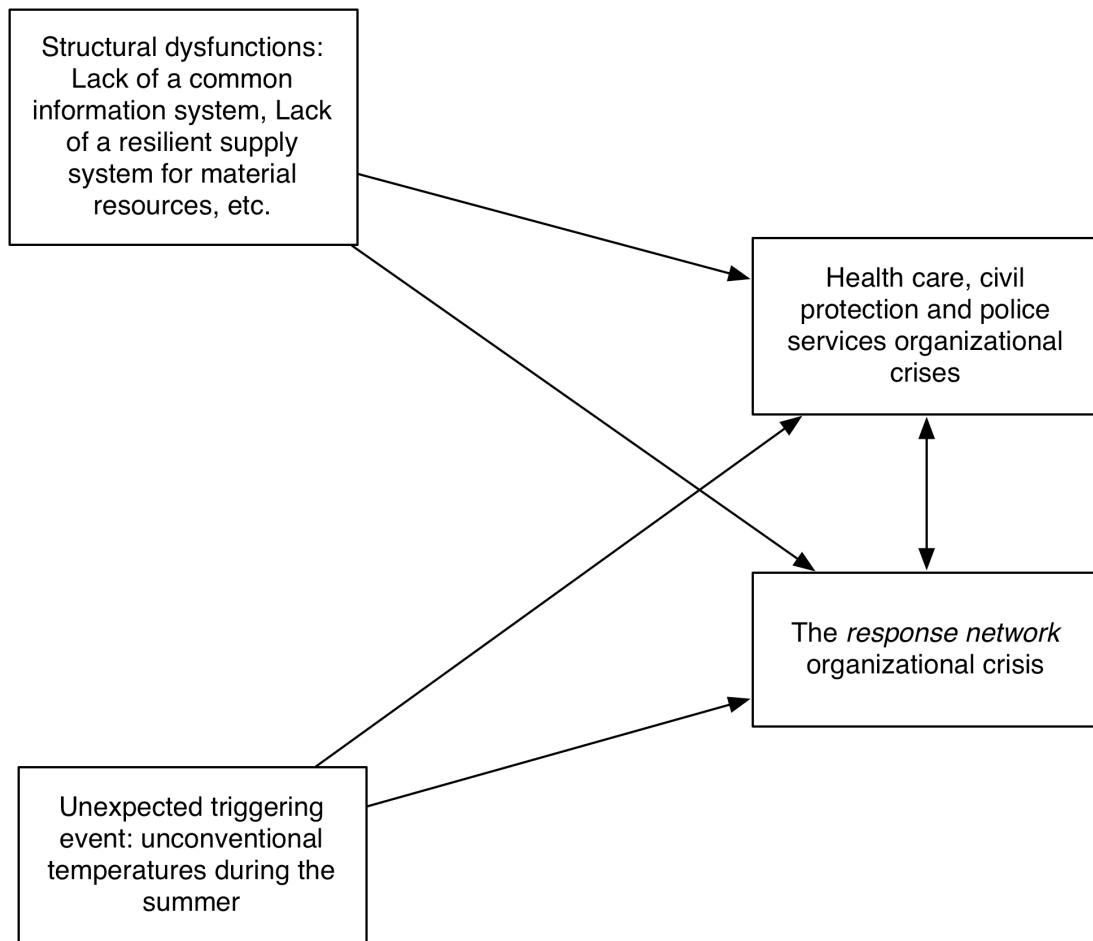
Figure 40. The 2003 heat wave crisis as an endogenous and an exogenous episode

Section 4.   Crisis response chronology

We provide a chronology of the events of the crisis that we developed from the systematic examination of the interactions between actors. We triangulated this chronology with two chronologies previously developed in the literature (Boudes, Laroche, 2009; Lagadec, 2004).

4.I. Disparate signals (from the 4th to the 7th)

Loose signal detection started on the 4th. There were disparate signals from emergency professionals, such as SAMU and BSPP. For example, the DDASS from Britain signaled the suspicious deaths of three persons under the age of 60. These signals were reported to the heads of the INVS and the DGS, who expressed their concern regarding the health effects caused by the heat. One of the Health ministry's advisers then asked his delegates to write an alert message to health professionals on the 6th. The writing of the alert message followed a full validation process that took more than 36 hours. Similarly some of the AP-HP directors informally met emergency squad members on the 5th to voice their concerns about the heat.

4.II. The beginning of the coping (between the 8th and the 10th)

The situation rapidly worsened. Health care operational actors became overwhelmed and began to improvise. The AP-HP sent an alert that basically asked the hospital staff to mobilize itself, help each other with patients and prepare to face difficulties because the weather was to be hot during the weekend. The AP-HP asked hospitals to act as if the White plan was on the scene. On Friday morning the situation remained under control. Still, during the afternoon, all the emergency squads were overwhelmed with patients and requests. During the weekend, the situation worsened even more for all emergency services: emergency units in hospitals, SAMU and SMUR, firefighters, SOS médecins. During the weekend many field actors developed improvisation practices, ranging from the ad hoc information system between firefighters and SAMU to innovative uses of ice in hospitals. At the end of the weekend, Patrick Pelloux, the AMUF leader, alerted the public on television and asserted that deaths were numerous and that the situation was more than critical. Some administrative actors then participated in the ongoing collective improvisation, such as AP-HP and DHOS, to provide extra resources.

4.III. What do we do now? (between the 11th and the 13th)

From the 11th, the administrative sphere recognized that the situation was out of control and attempted to resolve several issues. The catastrophe was taking place and panic emerged because no organization had a precise idea of the number of deaths. The hospital's staff was exhausted, as Patrick Pelloux claimed on television. Transversal meetings between DHOS, DGS, AP-HP, InVS and Health Ministry advisers took place on the 11th and the 12th.

4.IV. The beginning of the controversy (between the 13th and the 20th)

Since the afternoon of the 13th, the situation got better; the temperatures and the attendance of emergency services simultaneously decreased. However, the administrative sphere had settled into heavy data collection processes on the hospitals' activities, which required hour-per-hour reports from services in critical situations about patients, deaths and temperatures in rooms. In the afternoon the Internal Affairs Ministry officially triggered the national emergency plan, also called "White Plan". From this time on, the effort to compile statistics of death rates started and the political controversy surrounding the government's ability to handle the situation developed. This was the end of the organizational crisis but the beginning of the political crisis.

Conclusion

This chapter presents a chronology of the crisis response to the 2003 heat wave and the response of network actors. The response network is composed of three groups of organizations: civil protection and internal affairs organizations, health care organizations and "outsider" organizations. Undoubtedly, the heat was not the only factor that hindered the health care and civil protection organizations' ability to perform its mission: taking care of people and saving lives. Organizational and informational barriers partially account for the heat wave crisis, even though collaboration and hierarchy played important roles in the functioning of the response network.

Chapter 3.2. The research design of the empirical investigation

Introduction

The empirical part of the dissertation consists of a retrospective qualitative study of the response to the organizational crisis provoked by the heat wave in France in 2003. The 2003 French heat wave took place from the 4th to the 20th of August and allegedly provoked 14,802 deaths in France. In the 2003 summer, temperatures exceeded 105°F (40°C). During the month of August 2003, the situation worsened with temperatures higher than 115°F during days and nights. On the 5th of August, surprising deaths were reported. During the whole month, medical organizations hardly overcame the overwhelming number of incoming patients. The Health Network struggled to respond to the overwhelming number of patients. Crisis responders had to improvise collectively to handle the local resources shortages and uncertainty regarding what could be done to alleviate the patients' suffering. Crisis responders developed innovative practices to handle the situation collectively. Some of the crisis responders extensively used ICT but hardly participate in the ongoing improvisation. Conversely, evidence of electronic communication between improvisers is scarce.

This empirical investigation addresses the two following research questions:

- *Does ICT fit users' needs with respect to interaction during crisis improvisation? (III)*

- *How do users benefit (or not) from ICT when they improvise collectively in crisis response?* (IV)

The objective of this chapter is to present the research design of this empirical work.

The objective of our empirical work is to provide an integrative response to research questions III and IV. To do so we restricted our investigated to three topics (Blaikie, 2007). In addition, our method follows the principle of the grounded theory.

Our data collection covers three main sources: public hearings, internal archives and external archives that we selected on the basis of their reliability and their proximity with the research topics. The public hearings consisted of more than 100 hours of public collective interviewing completed in the aftermath of the heat wave by members of two investigation commissions. Internal archives correspond to the documents that the heat wave crisis responders exchanged, ranging from emails to press releases drafts. The external archives gather essays, academic works, reports and newspapers' documentation on the crisis response to the 2003 French heat wave. In this study we coded emails, faxes and public hearings and completed additional analysis of external archives. Given the important amount of data we had to analyze, we had to complete a data reduction by following a theme dictionary (Thiétart, 2007).

Beside it is important to note at this point that we have changed the study research design since the thesis proposal. We eventually focused our data coding on the content of public hearings that took place in the aftermath of the heat wave. We attained theoretical and

semantic saturation by the end of the coding of the public hearings.[15] Rather than completing observation and focus groups we relied on external and internal archives to triangulate data.

This chapter is structured as follows. Section 1 defines the study objectives and topics. Section 2 presents an overview of our methodology choices: a retrospective qualitative case study. In addition argue our rationale for following the grounded theory (Corbin, Strauss, 1990; Strauss, Corbin, 2008). Section 3 presents our three data sources. Section 4 details the iterative process that we followed to collect and analyze data.

Section 1.   Our research objectives

Our primary objective is to provide an integrative and contextualized response to research questions III and IV. As a result, we address research questions III and IV simultaneously by observing interactions that took place during the 2003 French heat wave crisis response.

Our rationale for following this approach is twofold. First, we assume that technology fit, users practices and organizational context depend on each other. Technology fit depends on the users tasks and the context of use. Reciprocally, users' practices around technology have a moderating effect on user's needs and technological fit. Second, because reality is made of complex dynamics (Bourdieu, 1980) and that technology is a core component of our technology (Latour, 2004; Orlikowski, Iacono, 2001)., there is higher value in an integrative description than a partial formalization.

Our ambition to complete an integrative investigation has major implications. The scope of our investigation includes a significant panel of variables, such as crisis responders' interactions, ICT characteristics and use, improvisational practices. For this reason, we segmented our investigation into three topics that we detail in this paragraph. We identified this research technique in Blaikie's work (2007, p. 6). Our objective is therefore to simultaneously investigate topics I, II and III:

Topic I. The features of technology use to interact during crisis response.

Topic II. The variables that account for technology use for interacting between crisis improvisers.

Topic III. The influence of technology use on the interactions that compose organizational improvisation.

According to Blaikie (2007), empirical investigation covers three topics: "What?", "How?", "Why?". The "What?" question *requires a descriptive answer*" to account for characteristics of the phenomenon that is under study. In our study, the "What?" question consists of exploring the nature and dynamics of interactions and technology use during organizational improvisation in the context of crisis response, which corresponds to topic I. We agree with Latour (2004) that a rigorous description of concrete life is necessary to avoid the risk of

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[15] Theoretical saturation refers to the fact that data does not provide any further content. Semantic saturation occurs when the coding does not make further coding emerge.

creating knowledge that is disconnected from reality or to treat technology as a "black box". However, our approach is not only descriptive but also explanatory. Descriptive and explanatory approaches are interrelated (De Vaus, 2001).

The "Why?" question asks for either the causes or the reasons for the existence of characteristics and regularities of the phenomenon that is under study (Blaikie, 2007). It corresponds to the topic II and deals with factors that account for ICT use for interacting during organizational improvisation in crisis response. Finally, the "How?" question investigates the effect of the phenomenon under study on organizational life. Accordingly, it corresponds to the analysis of the influence of ICT use on interactions that compose organizational improvisation. Figure 41 presents each topic as well as connections between topics.

Figure 41. Connections between topics
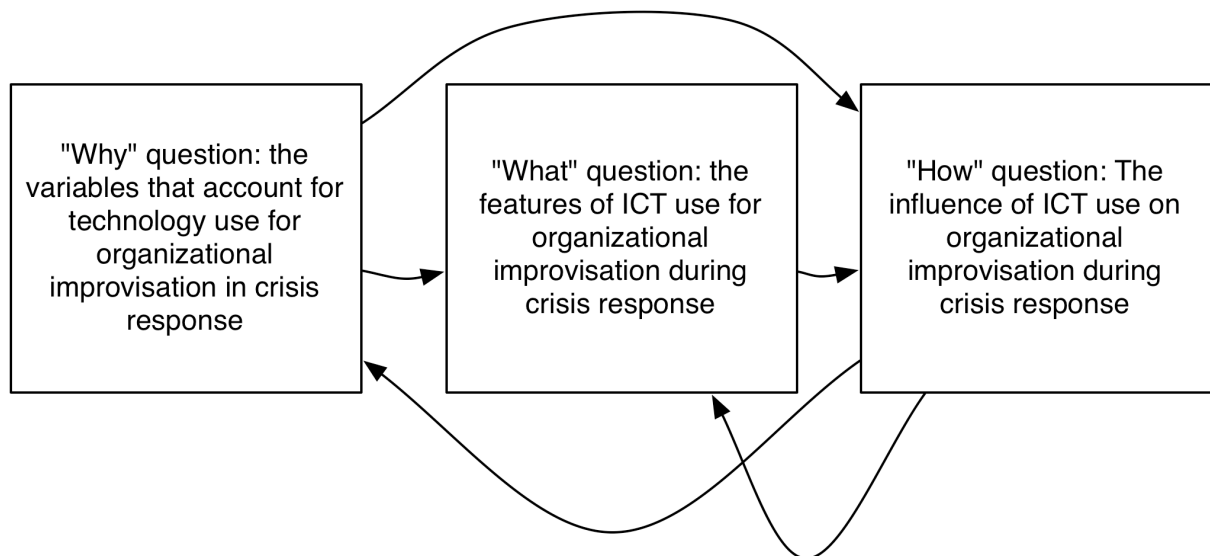
As Figure 41 illustrates, topics are interrelated: The users rationale for using or not using ICT for crisis improvisation may depend on how ICTs are used by crisis responders. Similarly, The influence of ICT use on improvisation stems from the features of ICT use. Investigating all the topics in the same study enables us to provide a global explanation of ICT support to organizational improvisation during crisis response.

Section 2.   Method: An overview

In this section we present the major characteristics of our study. First, our investigation is retrospective and qualitative. Second, our approach is inspired from the grounded theory perspective. We also introduce some major implications of the grounded theory approach on our research design.

2.I. Our motivation for a qualitative case study

Qualitative methods help to explain phenomena that have not been explored in an extended manner in the MIS field yet, such as organizational improvisation. Since our definition of organizational improvisation basically starts from theory, it is necessary to evaluate its consistency with empirical data, which is another motivation for a qualitative approach.

Our motivation for a qualitative methodology is threefold. First of all, qualitative methodology is consistent with an exploratory approach. There has been little description of the constituents of organizational improvisation in crisis response in the literature so far. More specifically, we know little about how crisis improvisers interact with each other. Qualitative methodology allows responding to this lack by capturing data "from the inside" through a process of deep attentiveness (Miles, Huberman, 1994). Secondly, explicating the nature and dynamics of interactions that compose organizational improvisation is a preliminary step to study possible relations between organizational improvisation and other variables. To that sense, a qualitative investigation seemed prior to any quantitative approach. Thirdly, qualitative methodology is consistent with holistic investigation (Miles, Huberman, 1994).

In this work, we opted for a case study methodology. A case study enables to develop deep observation of organizational processes and behaviors that compose a specific phenomenon (Gombault, 2005). It grasps the complexity of organizational improvisation in crisis response.

2.II. A grounded theory approach

In this section, we present the grounded theory approach as defined by Corbin and Strauss (1990) and its practical implications on the design of our research. We first justify our interest in the grounded theory approach. Then, we argue that the Straussian perspective on grounded theory is the most consistent with our pragmatist approach of the research question (for more detail on our following of pragmatist principles, see chapter 1.3).

2.II.1.   Our rationale for a grounded theory approach

Our motivation to use the grounded theory method is threefold. In fact, Locke acknowledges at least three conditions for following a grounded theory approach (2001). Among them we retained three main motivations that were further explicated by Sousa and Hendricks (2006):

First, there is deficient theoretical guidance: existing theoretical frameworks are undeveloped or do not provide satisfying answers to the research questions, which signifies the need for theory enrichment (i).

Second, Core concepts are loosely coupled to each other or the connections between concepts are obscure. An inductive approach is adequate to clarify the connections between the concepts under study (ii).

Third, observation of participants is necessary to respond to the research questions (iii).

Our dissertation project meets these three conditions, which supports our strategy of following the grounded theory approach.

First of all, the conceptualization of organizational improvisation remains incomplete. In chapter 2.2 we explain that we lack details on how improvisers interact during crisis response

Secondly, the concepts of crisis and improvisation remain loosely coupled, in spite of significant academic efforts to clarify the antecedents and consequences of improvisation. Improvisation occurs in both routine and crisis situations but evidence that improvisation develops likewise in both cases does not exist. Most researchers argue that improvisation is adequate to respond to turbulence and uncertainty (Crossan *et al.*, 2005). However, improvisation does not systematically happen in crisis (Cunha *et al.*, 2003; Roux-Dufort, Vidaillet, 2003b). As a result, the connections between improvisation and crisis remain uncertain and vague.

The conceptual links between ICT and improvisation need some clarification as well. As a result conceptual guidance about technology fit to improvisers is missing, which is a motivation for our study. We develop this point in previous chapters.

Finally, investigation on improvisation requires the observation of improvisers' practices to provide insights about the research question. The theoretical propositions that we make about the interactions that may compose and regulate organizational improvisation are only exploratory. Furthermore, as we argue in chapter 1.3, the ontology of improvisation is inherently practical (Cunha, 2004). Deriving substantive concepts therefore implies observation of participants' interactions and actions.

2.II.2.   A Straussian perspective

This study adopts the Straussian perspective on grounded theory (1990; 2008). Corbin and Strauss's view is one among three major streams in the grounded theory literature. Corbin and Strauss's approach differs from Glaser and Strauss (1973) and Charmaz 's perspective (2006)[16] in being essentially interactionist and pragmatist.

In Corbin and Strauss view, the world is highly complex and unstable in time and pace:

"*We are confronting a universe marked by tremendous fluidity: it won't and can't stand still. It is a universe where fragmentation, splintering and disappearance are the mirror images of appearance, emergence and coalescence. This is a universe where nothing is strictly determined*" (Strauss, 1993, cited by Strauss, Corbin, 2008, p. 6).

This contingency is the result of complex interactions between multiple factors (see Assumption 9; p7 in Strauss and Corbin, 2008). Neither actions nor interactions are rational, which means that means-end analytic schemes are not appropriate according to the grounded theory perspective. Thus abstraction and concepts get their all significance because they provide additional insights to professionals.

"*Concepts provide ways of talking about and arriving at shared understanding among professionals. If you don't have a language, you can't talk – and if you can't talk, you can't*

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[16] Charmaz's perspective on grounded theory is constructivist. Theory emerges for a collaborative theory construction process between the interviewer and interviewees.

do, and the basis of many professions is still doing" (Blumer, 1969, cited by Strauss, Corbin, 2008, p. 6).

However, our rationale for following a grounded theory perspective goes beyond ontological and epistemological consideration. In fact, the Straussian perspective accepts that researchers develop preconceptions before the beginning of the empirical investigation. On the contrary, Glaser and Strauss argue that conceptual analysis naturally emerges from empirical data. In our work, literature exploration was useful to develop research questions, and enhance sensitivity for field, which corresponds to Corbin and Strauss's approach (p.37). Finally our approach is not compatible with Charmaz' constructivist posture (2006). Even if interpretation is an important part of the theory building process, we do not intend to co-construct interpretation with actors. Our rationale is that organizational improvisation and crisis do exist independently of actor's perception. For more detail on our assumptions on the ontology of crises and improvisation, please refer to chapter 1.3.

2.II.3. <u>Methodological implications of our following the grounded theory approach</u>

We mention here some fundamental principles that stem from the grounded theory approach and that had major implications on our research design. These principles are presented by Corbin and Strauss (Corbin, Strauss, 1990):

Even if we present data collection and data analysis separately, the two processes are completed simultaneously. According to the grounded theory approach, data collection and data analysis are interrelated processes (Corbin, Strauss, 1990). Data analysis starts as soon as first bunches of data are collected. Moreover data analysis also influences data collection, as it is suggested by the principle of theoretical sampling. We therefore collected data purposefully from places and informants that supported the development of our findings. For this reason, we adjusted our instrumentation strategy on the outcome of the microanalysis and the coding processes.

Second, we follow an iterative process for theory building that goes back and forth between data and theoretical propositions and that is described by Figure 42. The analysis process appears to be generally inductive. Still, the coding process is guided by abduction of hypotheses (Haig, 1995, 2005; Koenig, 1993) and a deduction from confrontation with rival hypotheses that are based on theory (Orton, 1997).

Third, our analysis is concept centric. It articulates connections and comparisons between concepts rather than data. Even if concepts are grounded in data, we aim at analyzing relationships between concepts rather than data (Glaser, Strauss, 1973; Strauss, Corbin, 2008).

Figure 42. The iterative process for theory building (From Bandeira-de-Mello, Garreau, 2008)
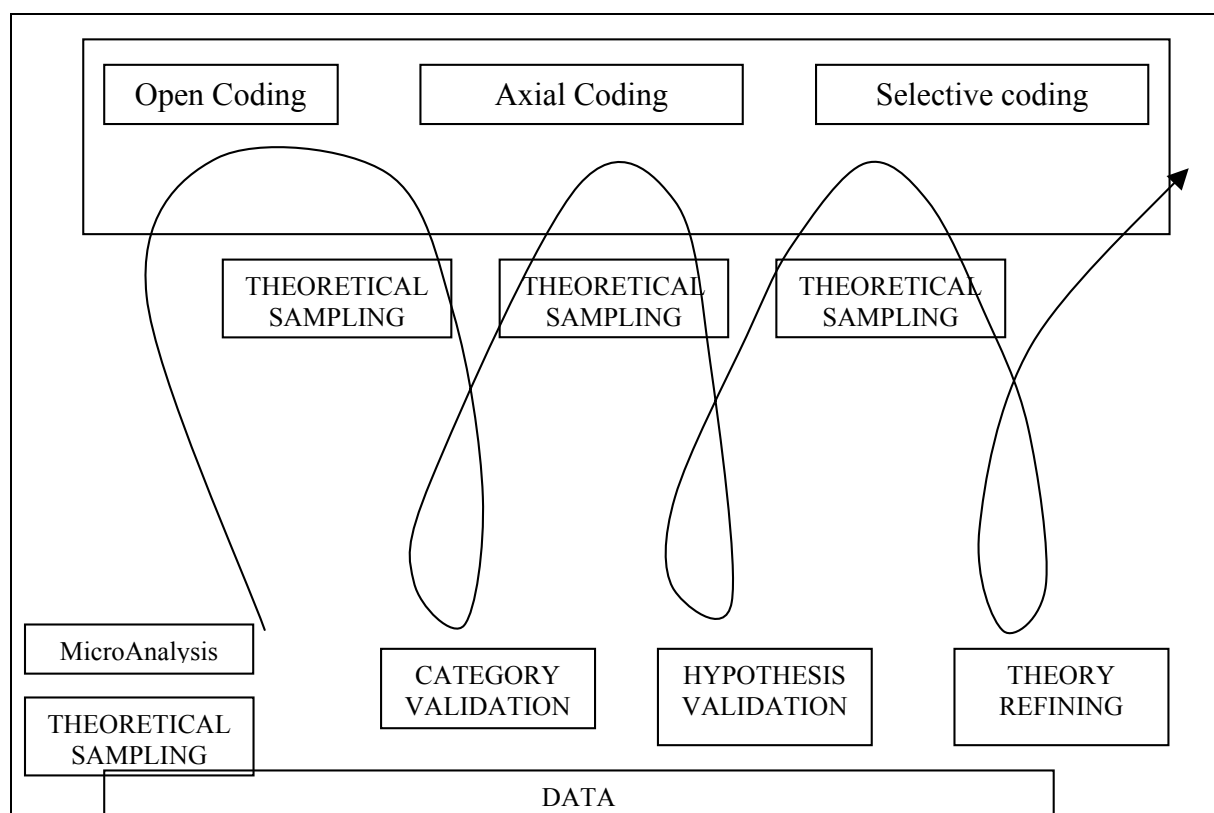
Section 3. Instrumentation

Instrumentation refers to the techniques that researchers use to collect data (Miles, Huberman, 1994). Data collection on improvisation is challenging. Moorman and Miner characterize improvisation by an almost restricted delay between action and decision and provide a scale of organizational improvisation (1998a). Even though this scale is useful in questionnaires, improvisation is difficult to detect for an external observer who mainly perceives the extemporaneous dimension of improvisation (Ciborra, 1996b). For Weick (Weick, 1988), observing crisis improvisation is all the more complex as sensemaking is retrospective in critical contexts. Finally, the beginning and the end of improvisation are difficult to grasp in that there is sometimes no firm sign from actors that they are going to improvise.

We rely on four techniques to collect data about improvisation. First of all, improvisation is easier to observe retrospectively even though the retrospective biases can threat the validity of our findings (for more detail on validity please refer to chapter 3.3). Secondly, we focus observation on tangible elements of organizational improvisation, e.g. interactions between improvisers and facts to optimize data validity. Thirdly we rely on theoretical sampling principles to optimize our chances to observe crisis improvisation. Finally, we rely on the reality check techniques to compare empirical evidence of improvisation with the definitions of improvisation that we found in the literature.

3.I. Retrospective observation

In this study we retrospectively observed interactions between the crisis responders of the 2003 French heat wave. For this reason, we had to manage specific biases related to our retrospective research design.

The first challenge of this retrospective study is to make account of past practices as faithfully as possible (Weick, 1993). Before collecting data, we had anticipated some potential difficulties related to data collection and analysis. Even though the public hearings were completed in the weeks that followed the heat wave, some potential biases can threat data validity. Table 26 details some of these biases.

First of all, the public hearings offer retrospective statements from the crisis responders. For this reason, we suspected that the participants of the public hearings had a tendency to transform past event because of a retrospective bias, a hindsight bias and some emotional bias. Due to their similarity to interviews, one could think that public hearings restricted to consensual subjects. In the case of the 2003 heat wave, national political and social controversies took place. For instance, French families were accused of not taking care of the elderly (Le Grand-Sébille, Véga, 2005; Richard, 2008). In addition, the public criticized the government for its handling epidemic deaths during the heat wave. Due to these controversies, the participants of the public hearings were questioned about their responsibilities and their ability to complete their job at the time of the heat wave. To conclude, taboo issues and lack of trust were scarce during public hearings.

We had to manage our personal biases as well: preconceptions, temporal biases and conceptual misleadings. There has been an extended discussion in the literature on the risk of biases that are specific to retrospective studies. To some researchers, "the use of retrospective accounts in management research needs to be seriously questioned" (Golden, 1992). For this reason, we had thought about the possible means to avoid its impairing effects on the quality of our work.

To face these difficulties, we extensively relied on triangulation the diverse sources of data. We first lead triangulation between the contents of public hearing sessions. We then compared internal archives and public hearings. Finally, the external archives were used to triangulate data from public hearings as well. For instance, we had to check that we did not overestimate the frequency of email use in 2003. We also rely on Klein and Myers's guidelines to manage our potential biases (1999). In particular, the principles of dialogical reasoning and suspicion call for sensitivity to possible inconsistencies and distortions within findings. Finally, the grounded theory approach advocates sensitivity to potential rival hypotheses in the theory building process (Glaser, Strauss, 1973).

We provide here two illustrations of how the triangulation process enabled us to understand interactions. The first example illustrates a taboo and responsibility issue. The Paris Police Prefecture's director account was nuanced by two of the BSPP officers. The former claimed that the Prefecture discovered for the first time the gravity of the situation and the number of deaths on the 12[th] of August:

"It is thanks to the Paris mortuary autopsy service that we understood that the situation was serious. (…) But we were already on the 12th".

The BSPP officers later mentioned during the public hearings that their superior called the Prefecture to know whether they were authorized to provide information about the death rates to journalists on the 8th of August. Some journalists supported the BSPP officers' claim about this interaction. By triangulating these two claims, we understood that some interactions between the BSPP and the PPP had been eluded by the PPP director because they revealed some dysfunctions within the PPP.

Similarly, our analysis of the external archives supported triangulation of data between public hearings session. For instance, the Evin report contradicts the AP-HP director claiming that no patient had been abandoned, on the basis of some ERT and firefighters' claims (Evin, 2004, p. 93).

We provide a second illustration of the triangulation process between public hearings and archives. While the Health Ministry advisers claimed that they had no idea of the gravity of the situation before the 11th of August. The emails that were exchanged and received on the 7th and the 8th of August reveal that one of these advisors had recommended that the DGS issue an emergency message about the effect of hyperthermia. This interaction was evidenced in external archives as well. First, the Evin Report mentions that the AP-HP called one of the Health Ministry advisers on the 7th of August (2004, p. 97). Furthermore, Patrick Pelloux depicted in his essay his preliminary warnings to the Health Minister at the beginning of the month of August (2004).

Table 26. Major biases in our analysis

The type of methodological issue	Definition
Retrospective bias	Tendency to embellish or transform past events or actions to maintain self-esteem (Nisbett, Wilson, 1977).
Hindsight bias	Some significant inconsistencies in the respondent's discourse (Fischhoff, Beyth, 1975).
Emotional bias	Tendency to transform the reality because of emotion (Mitchell, Thompson, 1994).
Taboo & responsibility issues	Tendency to avoid topics or transform one's statements because of the negative image of the organization they may convey. Respondents may lie or over-rationalize past events and actions (Grawitz, 2001)
Lack of trust issues	Tendency to retain information that may jeopardize the informant status if revealed.
Preconceptions from the researcher	Preconceptions about the context of the crisis response (Grawitz, 2001)
Temporal bias from the researcher	Tendency to translate one's context to the past (Marrou, 1954).
Conceptual misleading	The concepts under study do not refer to any reality for the respondents and are pure intellectual construction (Harris, 2001).

3.II. Observing ICT and improvisation through interactions

Analyzing ICT support to organizational improvisation requires opening the "black box" of technology and the analysis of the ICT artefact as embedded in social practices. Orlikowski (1996), Vaast and Washalm (2005)'s represent some of the prominent authors that have investigated IS from the practice-based view.

Many authors advocate a practical approach of the ICT artifact in empirical studies. After all, the raison d'être of ICTs is to respond to user's daily needs. As a result, the ICT artifact embbeds in everyday practices (Orlikowski, 2007). Moreover, due to the lack of definitions for ICT, studies misrepresent technology as unproblematic in itself (Orlikowski, Iacono, 2001). On the contrary to that, the ICT artifact, defined by "those bundles of material and cultural properties packages in some socially recognizable from such as hardware and/or software" by Orlikowski and Iacono (2001), intervenes into organizational processes (Masino, Zamarian, 2003). For example, emails are not only recognized through their functionalities. They also represent a communication mode and relate to new practices for organizing work and coordinating from distant locations (Panteli, Fineman, 2005).

But how can we concretely observe *practices*? And how can we plan for a strategy to collect data from a *practical* approach? There is a developing debate on the relevance of the notion of practice for scientific observation. To a certain extent, every action is a practice and it is difficult to discern what is a practice from what is not (Pesqueux, 2009). Suchman, Blomberg, Orr and Trigg (1999) respond to this issue by suggesting the practical view of IT is possible

through observations of daily work practices and interactions. Partly for this reason, we approach ICT use through interindividual interactions, our unit of analysis in this study. For more detail on our focus on interactions, please refer to chapter 1.2

3.III. Theoretical Sampling

Theoretical sampling concerns multiple stages of our empirical investigation. Generally speaking, theoretical sampling is a method that aims at collecting data from places, people and events that will maximize opportunities to develop concepts (Corbin, Strauss, 1990; Strauss, Corbin, 2008).

We use theoretical sampling in two steps: in the predefinition of the research design that precedes data collection and during data collection.

First, we deduced from our conceptual work the case we wanted to study, following Mason's recommendations (Mason, 2002). This effort goes beyond choosing a field case, but also consists of setting the boundaries of the case that are the level of analysis and the unit of analysis (Miles, Huberman, 1994). This led us to the following strategy. We first focused our investigation on the case of the 2003 French Heat Wave. We then studied organizational improvisation within the response network that was composed by organizations involved in the crisis response.

First of all, we focused on the 2003 French Heat Wave because it has been formally called a "crisis". By reviewing literature, we also noticed improvisation was a major dimension of emergency practices. Improvisation is perceived as a necessity by some authors from the health care management field. Physicians sometimes have to improvise by diagnosing (Kirmayer, 1994). Given time pressure, uncertainty and the need for personal, decision making in health care organizations is complex (Hunink, Glasziou, 2001) and requires improvisation to respond to unanticipated scenarios (Anderson, McDaniel, 2000).

We focused our investigation on crisis response in the Ile-de-France because the situation was particularly dramatic in this part of France: buildings were not adapted to the weather, many families and employees were gone for vacation which made the crisis all the more difficult to cope with. Moreover, the high density of population implied a more intense attendance to hospitals during the heat wave.

Preliminary reading of external archives confirmed that our choice to study the 2003 French heat matches to our research questions: There is evidence that actors had to be surprisingly innovative and adjust each other to emergent coordination mechanisms. For example, nurses' creativity was a major condition for continuity of care: they reused painting hooks to hang hydrating tincture. Responsibilities for ad hoc data gathering and transmission emerged among hospitals managers.

We then used theoretical sampling to iteratively select segments of data, as recommended by the grounded theory authors (Strauss, Corbin, 2008). We refer to this practice as data reduction in this chapter. We used a theme dictionary to iteratively select data for coding and analysis.

3.IV. Reality check

We got inspired from Harris's work on the word *courage* (2001) so as to check what we define improvisation definitely ring a bell in respondents' minds. To do that, we compare her or the description of improvisation in empirical data is consistent with theoretical definitions of improvisation. We deduced the reality check grid from our reviewing and comparing of the definitions of improvisation in the management literature.

By doing so, we have identified five dimensions of improvisation. In other words, improvisation consists of a i) new and ii) creative iii) resource rearranging, in a iv) short delay between decision and action, that permits v) adaptation. We then considered every action that endorsed these five dimensions as improvisation. In Annexes, Table 34 accounts for the dimensions of improvisation in existing definitions.

Section 4.   Data sources

We detail each of the three main sources of data.

First of all, we relied on the content of public hearings as primary data in our analysis. The Public hearings took place in the aftermath of the heat wave and aimed to understand the response network failures. The first round of public hearings was completed in and involved 59 crisis responders. Crisis responders were selected to participate depending on their roles and their interactions during the crisis response. Each public hearing involved the commission committee and one or several crisis responders. We focused on hearings by people who experienced directly the heat wave. The commission used a snowball sampling technique to contact people. They also relied on previously published reports to contact the participants of the public hearings.

Secondly, we coded some of the internal archives that were joined by the participants of the public hearings: Emails, internal reports, letters, faxes, press releases. We used some internal archives as secondary data as well.

Thirdly, our investigation included the analysis of a large panel of external archives as secondary data. In the aftermaths of the heat wave, a significant amount of investigators searched for some explanation for the delayed enacting of emergency plans. External archives are composed of national and international reports, academic work and books on the heat wave. External archives enable us to understand the economic and social context of the 2003 French heat. In addition, it provides insights on the French health care system and the professional values of the groups of actors that compose the response network. Archives do not only help to understand the basic functioning of the health care system but also to identify major events, that is to say the beginning and end of the crisis response.

Table 27 presents the three main sources of data that we collect in this study. In this table we specify the themes that appear in each source of data.

Table 27. Data sources

Data sources	Type of data	Use of data source	Related themes (see the theme dictionary)
Public hearings	Primary data	Identification of interactions and actors Coding	Interactions configuration, settings and development. Organizational context: crisis settings, structure, organizational improvisation, organizational functioning. Individual characteristics. Technological characteristics.
Internal archives: faxes, emails, press releases	Primary data	Identification of interactions Coding	Interactions development Events and chronology
External archives: Essays, academic articles, reports, newspaper articles	Secondary data	Triangulation of events Chronology of events and interactions Understanding the organizational and environmental context	Events. Economic and social context. Organizational structures ICT infrastructure

4.I. Public hearings

Public hearings articulated into two rounds. The first round of public hearings took place in September 2003 during the completion of the Jacquat report. The verbal content of these public hearings was totally transcribed in 134 pages. The whole content of these public hearings is available online[17]. The second round of public hearings took place in February 2004 during the completion of the Evin report. Similarly to the first round, the verbal content of these public hearings were fully transcribed into 575 pages and is online.[18] Each session of the public hearings involved several actors. First of all, the members of parliament who were completing the reports asked questions to one or several crisis responders. For this reason, public hearings are somewhat similar to conversations between several interlocutors.

Our analysis focused on public hearings that involved crisis responders. We excluded from analysis the content that did not relate to the dictionary themes, such as experts' statements about the future developments of the national health watching system. Table 28 presents the numbers of the actors from the response network that participated in the public hearings as well as the number of hearings that we analyzed. Our analysis focused on the public hearings of 52 crisis responders in 36 hearing sessions. Each hearing session lasted at least 60 minutes.

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[17] http://www.assemblee-nationale.fr/12/rap-info/i1091-t1-3.asp#TopOfPage
[18] http://www.assemblee-nationale.fr/12/rap-enq/r1455-t2.asp

Table 28.Organizational affiliation of the public hearings participants

Organization	Number of participants	Number of hearings
Paris Police Prefecture	1	1
Paris Firefighter squads (BSPP)	2	1
Health Ministry	4	5
Social Affairs Ministry	2	2
DHOS	2	2
AP-HP	2	2
INVS	1	2
Météo France	2	1
DGS	2	3
AMUHF	2	2
SAMU	1	1
Internal Affairs Ministry	4	2
EHPAD	4	2
Paris Town Hall	1	1
Journalists	1	1
SOS Médecins	4	1
Hospitals	8	3
ARH	2	1
Red Cross	2	1
Liberal physicians	4	1
Inter Ministry Cooperation	1	1
Total	**52**	**36**

Public hearings helped to identify the major actors of the crisis response. In addition, they provided data on the organizational context, interactions, individual and technology characteristics.

Our rationale for analyzing public hearings rather than leading retrospective interviews is threefold. First of all, retrospective biases were likely to be stronger in relation to retrospective interviewing than public hearings. The heat wave occurred 6 years before our empirical investigation. For instance, crisis responders were likely to embellish past experiences or even get confused about the order of events. Secondly, public hearings took place in the aftermath of crisis response and captured details about ICT use. On the contrary retrospective interviews implied a great effort for respondents to remember about their interactions during the heat wave. Thirdly, the content of public hearings fits the research design in that they focused on interactions and information transmission.

4.II.Internal archives

Two types of documents compose the internal archives. The first type of documents – emails, faxes and letters – describes the information exchanges between the crisis responders during the 2003 heat wave. These documents were made public by their senders, which means that we had no grant to have access to all the emails that were exchanged during the 2003 heat

wave crisis response. The second type of document corresponds to charts, press releases and copies of internal reports that were completed during the heat wave. We focused our analysis on all the emails and faxes that were joined to the public hearings. We used some documents of the second type as secondary data, such as the description of the functioning of the emergency medical services that was joined to public hearings.

We coded 199 email and 58 faxes in a similar manner as public hearings. We coded the content, as well as the document header, e.g. organizational logo, title or object of the letter, signature, etc. We then relied on the categories that emerged from the analysis of email and faxes to refine and test our model. For instance, we assessed whether these could be found in all sources of data.

We also relied on email and faxes to triangulate the chronology of events and interactions. However, existing academic work and reports present exhaustive chronologies of events that occurred during the 2003 heat wave (Boudes, Laroche, 2009; Lagadec, 2005; Lalande *et al.*, 2003), so we simply checked that the internal documents illustrated the established chronologies of the heat wave crisis response. Table 29 reports the number of emails that we analyzed.

Table 29. Number of analyzed emails and faxes

Date	Number of analyzed emails	Number of analyzed faxes
6th of August	1	5
7th of August	2	5
8th of August	16	3
9th of August	0	0
10th of August	0	0
11th of August	22	3
12th of August	17	15
13th of August	52	16
14th of August	79	6
15th & 16th of August	20	5
Total	**199**	**58**

4.III. External archives

External archives include essays, national and international reports and academic papers. These documents present structured analyses of the implications of the 2003 heat wave. Because of dramatic fallouts, the 2003 heat wave has attracted many researchers and experts so far. As a result, the crisis response to the 2003 French heat wave has been significantly documented. We included 20 newspapers articles in the external archives in spite of a low reliability (Milet, 2005).

We view external archives as a major source of secondary data in our research (Thiétart, 2007). First of all, we use them to establish the chronology of events during the heat wave. In addition, we used these documents to triangulate data. Finally, we used external archives to refine our coding and our model. External archives refer to four types of documents: i) Essays represented in Table 24, ii) academic work represented in Table 25, iii) reports represented in Table 26, and finally iv) newspaper articles, represented in Table 27.

The search for external archives mainly went through Internet access and informal requests to respondents. Analyzing archives and documents we face three main issues: i) How to grant the archives' content is true? ii) When analyzing, how to avoid biases from the researcher? iii) How should we treat data that has already been treated by someone else? To cope with these issues, we got inspired from historical methods of analysis of documents and archives.

The first issue corresponds to a well-known issue in history. Indeed there is little or no evidence that archives objectively describe the past. Analyzing archives, one rather investigates how the archive's author transcribed and interpreted events than objective reality (Marrou, 1954). The second issue refers to the difficulty for the researcher not to extrapolate from his or her experience of the present to understand the past.

The third issue refers to the integration of secondary data into empirical research. Secondary data refers to "sources of data that has been collected by others, not specifically for the research question at hand" (Frankfort-Nachmias, Nachmias, 1996). Secondary data can be found in archives, e.g reports, newspapers articles, academic papers and internal documents, but have already been selected and treated accordingly to a specific research design. As a result, they do not perfectly match with the requirements of our work. Meanwhile, the archives usually represent an important source of secondary data and includes a wide diversity of format and content, which facilitates triangulation (Cowton, 1998).

Given the input archives bring to this work, we assessed their reliability. Data reliability is an important criterion to assess the quality of an academic work (Corbin, Strauss, 1990). In particular, *sampling validity* "is concerned with any sampling that occurred in the selection of the texts to be examined (…)" (Harris, 2001). To assess *sampling validity* of the external we collected, we classified them. This assessment enabled us to exclude the less relevant archives for analysis. Documents differ according to two criteria.

The first criterion was *proximity* between the content of the document and the core of investigation. Obviously, improvisation, interactions and CT are the core concepts of our investigation. Still, qualitative investigation is holistic (Miles, Huberman, 1994) and requires analytic ties between core concepts and broader variables (Strauss, Corbin, 2008). In terms of proximity, we therefore distinguish *core, connected* and *remote* contents. In our search for archives document, we retained core archives on the crisis response, the context of the 2003 French Heat wave and on the health care system functioning. Archives also differed in terms of scientific reliability: some are scientific studies and their content may therefore be considered as secondary data (Thiétart, 2007). Others are not supported by any methodology and rather provide testimony and opinions. The scientific reliability of archives is somewhat

related to their format. For example, research articles rely on approved methodology. Official reports are likely to offer less rigorous methodology but they gather a rich content: emails, internal notes, public interviews from actors.

Table 30. Classification of essays

Title, authors & source	Proximity	Reliability
Les systèmes de santé en questions: Allemagne, France, Royaume-Uni, États-Unis et Canada, A-L. Le Faou., 2003, Paris, Éditions Ellipses.	Medium	Medium
Canicules, La santé publique en question, L. Abenhaim, 2003 Editions Fayard	High	Medium
Urgentiste, P. Pelloux, 2004, Editions Fayard	Medium	Low
Les chiffres de la canicule. Lettre d'information de Pénombre, 2003, December	High	Low
Heat Wave: A social autopsy of disaster in Chicago, E. Klinenberg lu. The university of Chicago Press	Medium	High

Table 31. Classification of academic work

Authors, Title & Source	Proximity	Reliability
Impact sanitaire de la vague de chaleur d'Août 2003 : Premier résultats et travaux à mener. Bulletin épidémiologique Hebdomadaire – Novembre 2003	High	Medium
The heat wave in France in August 2003, D. Hémon, E. Jougla. Revue épidémiologique de santé publique, Février 2004	Medium	High
Média et Santé publique : l'exemple de la canicule pendant l'été 2003 en France, Boyer, L., Robitail, S., Debensasion, D., Pasquier, P. Revue d'épidémiologie et de santé publique, 2005	Medium	Medium
Understanding the French 2003 Heat Wave Experience: Beyond the heat, a multi-layered challenge, P. Lagadec. Journal of contingencies and crisis management, 2004	High	High
August 2003: Reflections in a French summer Disaster, Thirion, Debeusasorn. Journal of crisis and contingencies management, 2004	High	High
Boudes T, and Laroche H (2009) Taking off the heat: Narrative sensemaking in post-crisis inquiry reports. Organization Studies 377-396.	High	High

Table 32. Classification of reports

Authors, Title & Source	Proximity	Reliability
Rapport de la mission d'expertise et d'évaluation du système de santé pendant la canicule 2003, Lalande, Legrain, Valleron, Meyniel, Fourcade. Ministère de la santé, de la famille et des personnes handicapées, 2003, 61 p.	High	Medium
Surmortalité liée à la canicule d'Août 2003. Rapport d'étape – Hermon, Jougla. INSERM, septembre 2003. 59 p.	High	Medium
Apport Information Canicule : La crise sanitaire et sociale déclenchée par la canicule, D. Jacquat, 580 p.	High	Medium
Impact sanitaire de la vague de chaleur d'Août 2003 en France, M. Ledrans, H. Isnard. Institut de veille sanitaire (INVS), Octobre 2003, 120 p.	Medium	Medium
Continuité et permanence des soins libéraux Durant l'été 2003, J-C Cuenat, C. Daniel, R. Olivier, T. Roquel. Inspection générale des affaires sociales, 63 p.	High	Medium
Rapport sur les rapports d'enquête sur la canicule, Lagadec, Schepens, Laroche. Revue pluridisciplinaire en sciences humaines, 275 p, 2004	High	High
La France et les Français face à la canicule : les leçons d'une crise, Létard, Flandre, Lepeltier, 2004, 405 p.	High	Medium
Rapport n° 1455 au nom de la commission d'enquête sur les conséquences sanitaires et sociales de la canicule, F. Aubert, 573 p.	High	Medium
WHO Regional Committee for Europe (2003) Heatwaves: impacts and responses, WHO, 11p.	Medium	Medium

Table 33. Clasification of newspapers article

Source, Title & Date	Proximity	Reliability
Le Monde, La sécheresse persistante fait craindre un été catastrophique, 20th of July 2003.	High	Low
Le Monde, Canicule et sécheresse, un double choc exceptionnel, 6th of August 2003.	High	Low
Le Monde, La canicule s'installe pour une semaine, 6th of August	High	Low
Le Monde, La canicule a provoqué lundi la mort d'un homme de 32 ans dans le Sud-Ouest, 8th of August	High	Low
Le Monde, Jean-Pierre Raffarin et Roselyne Bachelot n'ont pas créé de cellule spéciale pour gérer la crise, 10th of August	High	Low
Le Monde, La vague de chaleur devrait durer encore huit jours, 7th of August 2003	High	Low
Le Monde, La canicule serait responsable de la mort d'une cinquantaine de personnes en Ile-de-France, 12th of August 2003	High	Low
Le Monde, les urgentistes s'alarment du nombre de décès, 12th of August.	High	Low
Le Monde, La prévention, remède essentiel contre l'hyperthermie, 13th of August	High	Low
Le Monde, Nonchalance, 13th of August	High	Low
Le Monde, hospitaliers s'estiment à présent confrontés à une « épidémie de coups de chaleur », 13th of August	High	Low
Le Monde, Canicule : premières réactions du gouvernement, 13th of August	High	Low
Le Monde, Douze jours pour prendre conscience d'un « drame humain », 15th of August	High	Low
Le Monde, Le Plan blanc est activé, 15th of August	High	Low
Le Monde, Les autorités sanitaires envisagent 3 000 morts liées à la chaleur, 15th of August	High	Low
Le Monde, LUCIEN ABENHAÏM, directeur général de la santé « Cela correspond à ce que l'on observe dans les épidémies de grippe », 15th of August	High	Low
Le Monde, Mourir, en France, sous la canicule, 15th of August	High	Low
France caught cold by Heatwave, Bulletin of the World Health Organization 2003, 81 (10)	High	Low
Libération, comment les chiffres ont flambé, 18th of December	High	Low

We preliminary read these documents to refine our theme dictionary. We then systematically classified the content of these archives. We used Document Summary Form to analyze external archives, as recommended by Miles and Huberman (1994). We analyzed 20 newspaper articles and 26 other documents that we present in the coming tables. Figure 43 and Figure 44 presented in the Annex are examples of our 46 document summary forms. We structured the document summary form on the basis of the themes that compose the theme

dictionary (for more detail on the theme dictionary, please refer to final section of this chapter): crisis, technology, improvisation and interactions. We added some extra memos to analyze the longest documents.

Section 5.   Data handling

In this section we detail how we handled the important amount of data in this investigation in our analysis. To complete data reduction, we relied on a similar technique as the one used to elaborate the interviewer guide: we elaborated a theme dictionary (Thiétart, 2007).

5.I. An iterative process

We iteratively collected, read and coded data to optimize our chances to focus on the most relevant data. After settling our research objectives and methods, we started collecting data. We then started to build the theme dictionary for data reduction, e.g. the exclusion from analysis of the data that did not relate to our research questions. However, our first coding experience led us to add or delete data in the theme dictionary. Figure 43 describes data collection and analysis as an iterative process.

In the first step, we collected the first external archives such as national and international reports. We extensively relied on literature and chapter 2.3 to build the preliminary version of the theme dictionary, presented in Table 35. We then modified the theme dictionary in an abductive manner.

We made a preliminary reading of the public hearings and some external archives. On the basis of our readings we refined the theme dictionary. For instance, we made multiple additions and deletions of subthemes in relation to ICT. The first version of the theme dictionary contained the ICT properties that we had deduced in chapter 2.3. However, we did not recognize these properties in public hearings and external archives during the first weeks of analysis. We then responded to this gap between our theme dictionary and data in two manners. We included additional ICT features from literature reviewing in the dictionary themes. In parallel, we focused on interactions to investigate ICT use. To do so, we included subthemes on interactions in the dictionary themes. Eventually, we reidentified some ICT properties in the final steps of our analysis.

Similarly, the preliminary reading of external archives led us to include *trust* in the dictionary theme because the national reports questioned the INVS and DGS members' reliability in transmitting information. However, the reading of public hearings led us to nuance our understanding of this criticism because the INVS and DGS members claimed their integrity. Emails supported their claim. Consequently, we reformulated the theme of trust as reactivity and induced its definition from data.

In the third step, we analyzed external archives and then included cultural and professional values in the theme dictionary. Since that time, we did not have to include additional theme in the theme dictionary.

In the fourth step, we coded data in public hearings and internal archives, leading to a preliminary version of the model. The coding of public hearings enabled us to attain theoretical saturation, which led us to exclude interviews from our data collection techniques. In addition, we understood at that time the necessity to expand data collection to emails and faxes to get more specific data on interactions. Once we attained theoretical saturation within the whole set of data, we extensively discussed the empirical model with colleagues and senior researchers, which helped to refine our findings.

Finally we reanalyzed external archives on the basis of our model and tested rival hypotheses. For more detail on this process, please refer to chapter 3.3.
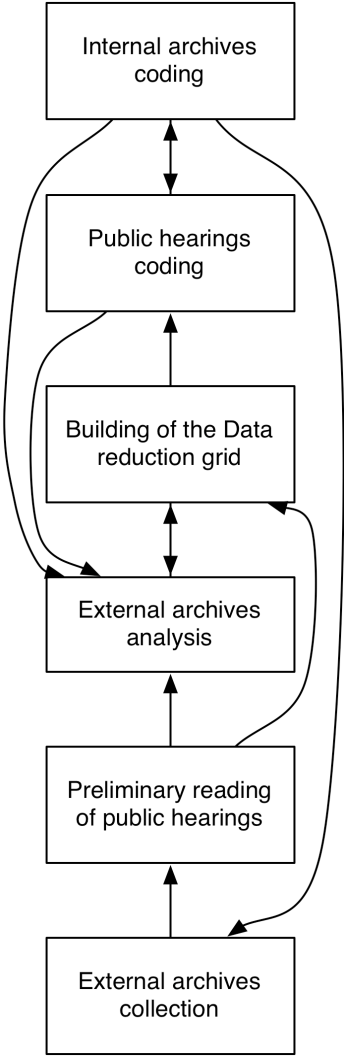
Figure 43. Data collection and analysis as an iterative process

5.II. Data reduction

We completed data reduction to focus the coding of primary data and the analysis of secondary data. Data reduction helped us to avoid getting lost into the diversity of data. The

data sources do not restrict to data about organizational improvisation and ICT use by the crisis responders during the 2003 French heat wave. For instance, a significant part of the public hearings data contains information about the possible improvements of the health watching system. However, a certain amount of information contained in data sources does not directly relate to our research questions. Finally, we used a theme dictionary to specify the meanings of the themes that we analyzed, which contributed to clarity of thought.

Due to large amounts of data, we consider that data reduction is consistent with the grounded theory approach. In addition we use here the conditional/consequential matrix defined by Strauss and Corbin (2008, p. 94) to represent the importance of the contextual variables in our analysis.

Figure 44 represents these variables. First of all, macroeconomic variables partially account for the medical personnel improvising during the heat wave. For example, crisis responders had to tackle shortages in beds due to budget restrictions in the French health care system. The functioning of the health network as well as organizational structures account for misunderstandings that occurred between medical personnel and other organizations during the crisis response. At this point, it is important to note that excluded the political aspects of the crisis response. Undoubtedly, political rivalry played a role in the crisis responders' behaviors during the 2003 French heat wave. The heat wave resulted in a political fiasco that led the Health Minister and the DGS director to quit (Boyer *et al.*, 2005). Furthermore, conflicts between crisis responders emerged partly because of political divergences (Pelloux, 2004). However, we exclude the political aspects of the 2003 French heat wave in our analysis. Political conflicts aroused in the latter part of the crisis response and are loosely related to improvisation (for more detail see the crisis response chronology in chapter 3.1).

We selected data for analysis on the basis of four themes. The theme dictionary tables can be found in the Annexes.

First, we tried to collect data on the *interaction*s that took place during the crisis response. This type of data includes subthemes such as interactions configuration, interactions settings and interactions development and is presented in Table 36.

Second, we investigated various aspects of *organizational crisis*. We identified most of these themes in our reading of external archives. We then reviewed their definition in the literature on crisis response. They are presented in Table 37.

Third, we included *organizational improvisation* components in the theme dictionary. They can be found in Table 38.

Fourth, we investigated *organizational structures and organizational functioning* as contextual variables. They are presented in Table 39.

Finally, we collect data on *individual characteristics* and *ICT properties* that are likely to influence the interaction dynamics and therefore organizational improvisation. These themes are presented in Table 40 and Table 41.

For each type of data, we provide its definition and some of its possible values. The theme dictionary was originally driven from our literature review on the concepts of improvisation, crisis, ICT characteristics and ICT use. However, we have refined the theme dictionaries through preliminary data collection and analysis.

Figure 44. The conditional matrix
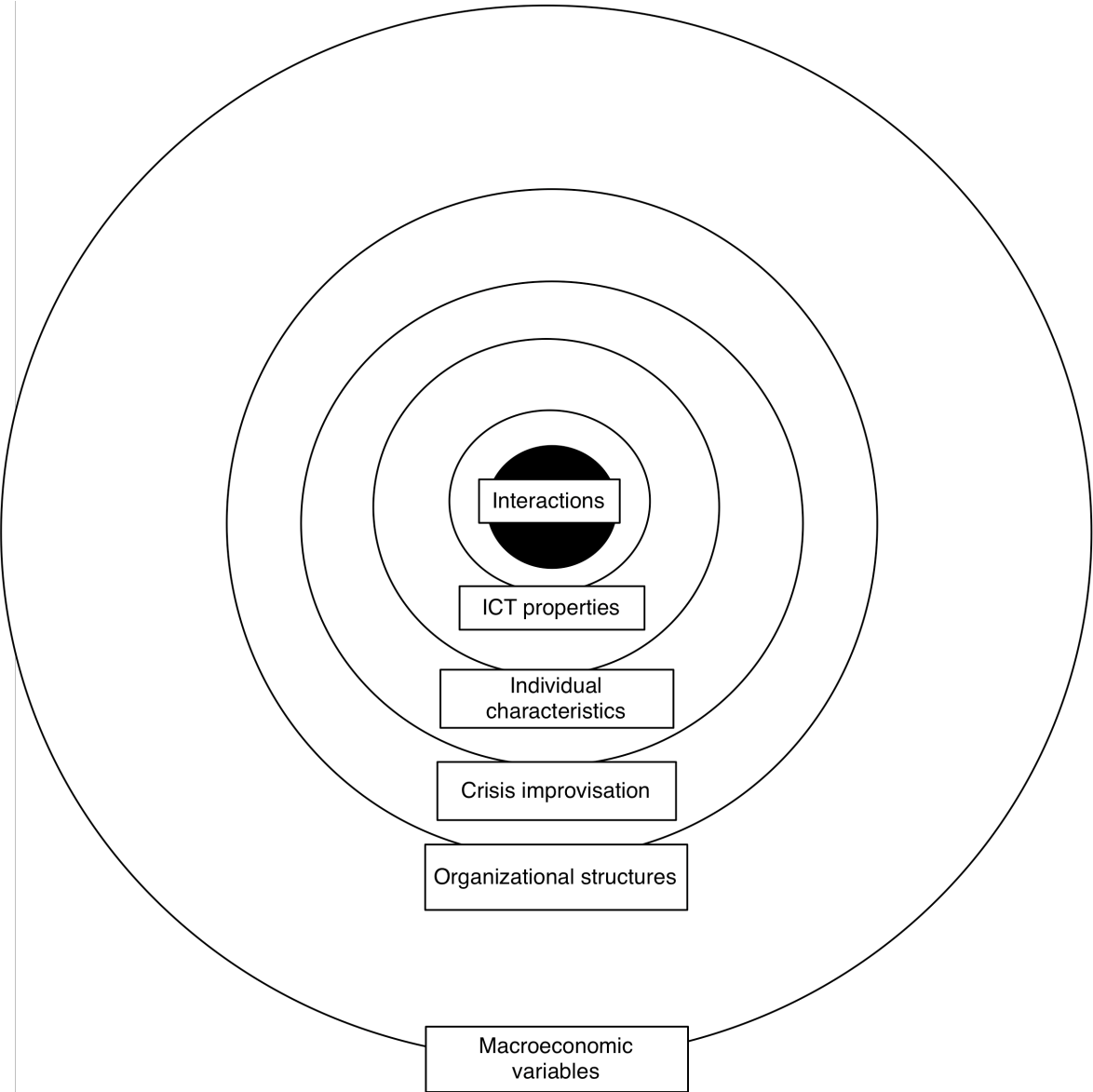
Conclusion

This chapter describes our research design for investigating organizational improvisation and ICT use during the 2003 French heat wave. Our research objective is to provide an integrative answer to research questions III and IV. We theoretically sampled our case study. Following a grounded theory approach, we theoretically sampled our data. We have iteratively completed data collection and data analysis. By doing so, we have focused our data collection on three sources of data and have structured our analysis around four themes.

Annex 1. Reality check tool

Table 34. The five dimensions of improvisation

Definitions of improvisation	Dimensions of improvisation				
	Temporal contradiction	**Unexpected novelty**	**Creativity**	**Resource rearranging**	**Adaptation**
"A process of introducing changes to an initial model while maintaining continuity in the performance" (Preston, 1987)					X
"Thinking and action emerge simultaneously and on the spur of the moment" (Ciborra, 1996a)	X				
"Convergence between acting and planning, and reworking of pre-composed material in relation to unanticipated ideas" (Vendelø, 2009)	X	X			
"Organizational improvisation refers to the convergence of conception and execution" (Moorman, Miner, 1998b)	X				
"Composing and performing extemporaneously, conception as action unfolds" (Berliner, 1994, cited by Bansler, Havn, 2003)	X	X			
"Unexpected practices, deviation from routines, puzzling or random behaviors calling for interpretation" (Lanzara, 1999)		X		X	

"Action is taken in spontaneous and intuitive fashion" (Crossan, 1998)	X				
"Action that fills the gap between routine organizational procedures and events in the course of daily work" (Suchman, 2007)	X			X	X
"To cope or ingeniously adapt to a set of circumstances" (Preston, 1991, cited by Vera, Crossan, 2005)			X		X
"Decision as action unfolds" (Moorman, Miner, 1998a)	X				
"Devising resourceful solutions to intractable problems". (Meyer, 1998).				X	X
"The conception of action as it unfolds by an organization and/or its members drawing on available material, cognitive, affective and social resources" (Cunha *et al.*, 1999c)	X		X	X	
"Improvisation is the ability to recombine chunks of past experience into new patterns of action" (Rerup, 2001)			X	X	X

Annex 2. Document summary forms for secondary data

Figure 45. First example of document summary forms

Document summary form N° 1
Type of document: Essay / Book
Number of pages: 224p.
Summary:

Title: Les systèmes de Santé en questions... Le Faou
Source: 2003/ Ellipses

Specificities of the Health Care System:
Origin- Functioning- Future developments

Crisis response:

N/A

Improvisation:

N/A

Organizational improvisation:

N/A

Technology: the PMSI - Comes from US. Used for Accounting & monitoring Costs. Very long to use (p.195) No connection with processes.

What was the problem?

N/A — The author talks about budget restrictions since 96 (Juppé)
PMSI used to plan resources allocat° since mid 90' (p.131)
More power to ARH since 90'- décentralisation

Interactions:

N/A Plan Mattei: 2002. (p132)

Related category: Hospital Functioning - Context. Technology

Other Comment: The book explores the law legacy that governs Health Care activities (p. 64)- Préambule Constitution Fr. Montant dépenses sociale 400m̄ €
↓ densités hosp. (Fr one of the highest 9,2/1000h/93)

Figure 46. Second example of document summary forms

Lalande

Document summary form N° 15
Type of document: Report   Source: Assemblée nationale
Number of pages: 120p.
Summary:

Objectives: Understanding of dysfunctions.
How the actors handled the situation.
Evaluate monitoring / watching systems.

Crisis response:

Hospitals were overwhelmed but coped with
the situation.
Physicians were missing & difficult to contact,
Administrations hardly collaborated : DHOS
isolated

Improvisation:

Yes, in hospitals.
Corpse management /
electrical blackouts

PGS
vacated
but the
emergency
message
too late

Organizational improvisation: Yes.
No detail

AP-HP
worked
alone

Technology: the PNSI not usable / helpless.
Emails but not in a good timing
People DID use emails _ Death Certificate
system limit - others

What was the problem?

Disconnections between organizations
lack of reliable IS.

Interactions:

Yes _ but no information transmission
because of org. culture & conflicts
between organizations

Related category:

Impro
lack of Communication
Hospitals functioning

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Annex 3. Dictionary themes

Table 35. Preliminary version of the theme dictionary

Themes	Subthemes and their definitions
Structure and context	Coordination mechanism (Mintzberg, 1979) Economic situation: Any macroeconomic variable that significantly impacted crisis response
Individual characteristics	Age, Gender, Hierarchical status.
ICT properties (see chapter 2.3)	Graphical representation: visual representation of data thanks to colours, shapes and photos. Modularity: the ability to add or delete some applications Data centralization: the ability to stock the whole data on a single server Data calculation: the computerized treatment of data Many-to-many communication: the ability to communicate with multiple persons simultaneously Virtuality: the degree to which data can be copied and transmitted with no material support
ICT use	ICT use frequency: the degree of use of technology in crisis response Technology perception: the degree to which users perceive technology as a support or a constraint (Orlikowski, 1992)
Crisis conditions of emergence and crisis experience	Rigidity threat: the degree to which actors do or do not adapt their behaviors to cope with the situation (Staw et al., 1981) Crisis experience: the degree to which the actors perceived the situation as critical (Billings et al., 1980) Communication problems: the impact of information centralization and retention on crisis response (Smart, Vertinsky, 1977)
Preparation to crisis response	Crisis planning in organizations: the degree of anticipation and preparation to critical situations (Lanzara, 1983; Smith, 1990)
Organizational improvisation (see chapter 2.3)	Deviation from established use of resources Expertise leadership Boundary spanning Minimal structures

Table 36. Interaction theme dictionary

Subtheme	Definition
The number of interacting persons	Determines the number of persons interacting within one interaction. Depending on the number of participants, the interaction development and outcome may differ
Participants organizational origin	The professional groups or community of practice(Wenger, 1999) to which each participant belongs.
Interaction role	The role that is endorsed by each participant during the interaction (Turner, 1988)
Social and friend ties and their strength	"The combination of the amount of time, the emotional intensity, and the reciprocal services which characterize the tie" (Granovetter, 1973; Lincoln, Jon, 1979)
Interaction start and end	Determines the beginning and the end of an interaction
Interaction objective	Participants' objectives or motivation to start an interaction. It may also reveal some strategy (see individual factors). Even if participants did not have the initiative to interact, they may have followed particular procedures that are rationalized. (Turner, 1988)
Interaction novelty	The extent to which participants already had the same type of interaction and what differs from interactions participants have been used to. Also describes the extent to which participants were not expecting the interaction to occur (see spontaneity)
Interaction theme	The subject on which people interact. It is the subject of the informational content for the interaction
Interaction regulation coding	The rules, patterns that regulate interactions (Goffman, 1970)
Relational Development	Time that is available to develop trust and complicity during a particular interaction (McGrath, 1991)
Narration development	The extent which previous later interactions recount the relatedness of earlier interactions (Rafaeli, Sudweeks, 1997),
Interaction channel	The communication means that are used to interact
ICT use frequency for interactions	The frequency of use of ICT by a participant.
Degree of alignment on the interlocutor	The extent to which the participant aligns one's own use of words, communication practices and ICT use depending on interlocutors
ICT use experience	Determines the experience of use of participants and the status of ICT as a tool for work and communication

Table 37. Organizational crisis theme dictionary

Subtheme	Definition
Complexity	The extent to which the outcome of the interaction or the interaction itself depends on other interactions or events.
Uncertainty	The extent to which the present situation was unanticipated (defines the concept of surprise that characterizes crisis) and the extent to which the future is difficult to anticipate., (in particular when it comes to the outcome of the interaction)
Triggering event	The first signal that starts the crisis response.
Emotional Pressure	The extent to which the situation is stressing participants.
Time pressure	The extent to which cannot take their time to interact
Contradiction	The situation is perceived as contradictory for the participants
Rigidity threats	Describes the organization's tendency to urge and strengthen preplanned procedures in reaction to crisis (staw et al., 1981). It may questions the organizational ability to improvise or, on the contrary, stimulated improvisation
Centralization	Describes the organization's tendency not to delegate and centralize power (Smart, Vertinsky, 1977)
Entropy	Defines a disequilibrium in terms of energy that individuals spent to achieve their tasks (Katz, Kahn, 1966; Morin, 1977)

Table 38. Organizational improvisation theme dictionary

Subtheme	Definition
Deviation from established patterns of action	The extent to which organizational members deviate from routine and plans
Spontaneity	The ability to individually or collectively to elaborate something new in response to a particular situation (George, Jones, 1997).
Extemporaneity	The extent to which an individual or a collective action is done without preparation

Table 39. Organizational structures and functioning theme dictionary

Subtheme	Definition
Hierarchy	Describes the formal distribution of power and responsibilities within organization
Organization mission	Defines the primary organizational raison d'être.
Organizational culture	Describes the major values that exist in regards to work, workers and organizational functioning (Martin, 1992)
Technological infrastructure	Describes the hardware resources, software resources and competencies (Byrd, Turner, 2000)
Location	The geographical locations of an organization.
Interorganizational Connections	Determines entities the organization connects to (both in routine and crisis situations)
Sub systems	Describes the sub parts of the organization.
Communities of practice	Defines the professional group that gathers individuals having common interests and practices (Wenger, 1989)

Table 40. Individual characteristics theme dictionary

Sub-Theme	Definition
Reactivity	Describes the personal ability to react to events or to provide help to co-workers.
Professional Values and expectations	Personal expectations in regard to professional activities and professional values in general. Depends on the individual's status in the organization.
Reference group	The set of people the participant perceives as belonging to his or her work environment that defines the social world of work in which he or she engages (Lawrence, 2006)
Crisis experience	The personal or professional experience of crisis and emergency situations.
Crisis response participation	The willingness or the ability to participate into crisis response.
Collaboration	Describes the personal experience of collaboration and values in respect to cooperation
Cooperation	Describes the personal experience with previous collaboration and personal values that are related to cooperation.
Personal experience of the heat wave	The extent to which the participant suffered from Heat Wave outside his or her professional activities. Accounts for a deep emotional experience of heat wave

Table 41. ICT properties theme dictionary

Sub-Theme	Definition
Flexibility in functionality	Defines the technology ability to operate well in many different environment; e.g input quality and quantity (Knoll, Jarvenpaa, 1994)
Flexibility in use	Defines the technology ability to provide different informational output and use (Knoll, Jarvenpaa, 1994)
Flexibility in modification	Defines the technology ability for rapid adjustments with minimal efforts (Knoll, Jarvenpaa, 1994)
Calculation	Whether the actors rely on data selection and complex treatment for crisis response
Data Centralization	Affects the ability to access different data from different sources through a single interface
Virtuality	Refers to the non material characteristic of data that implies a facilitated recovery, replication and exchange. Conversely, materiality refers to the use of additional objects for communication
Reliability	Describes the extent to which participants can rely on telecommunication devices for work
Technological affordance	Defines strengths and weaknesses of technologies with respect to possibilities they offer the people that might use them (Gaver, 1991)
Information load	Corresponds to the amount of information that is received and treated by the participant in a specified delay
Many-to-many communication	Defines reciprocal information sharing among more than two users
Relation Intimacy	Refers to the strength of virtual communication (Calloway, Keen, 1996)
Relation multiplexity	The number of individuals with whom a person interacts (Calloway, Keen, 1996)

Chapter 3.3 ICT, communicative genres, organizational improvisation and emptiness during the 2003 French heat wave crisis response

Introduction

This paper applies the grounded theory method to understand how ICT supported the organizational improvisation that took place during the response to the 2003 French heat wave crisis.

In August 2003, the weather in France suddenly became scorching, attaining record temperatures (46 C, e.g.130 F) for the first time since 1976. August is usually a time for vacation and the population enjoyed the heat during the first few days. But the reality of the heat wave quickly became less glamorous. The number of health complications from the heat rapidly increased; the elderly, especially in urban areas, were not able to combat hyperthermia and 14,802 people died in France between the 4th and the 20th of August. The heat wave was depicted as a natural disaster that provoked an organizational crisis in hospitals (Lalande *et al.*, 2003). Not only were health care units overwhelmed with people suffering from heat related illnesses but they also faced unexpected shortages of medical supplies, water, ice, air conditioners and even nurses. Hospital morgues were overcrowded with corpses and many electrical devices overheated and broke down. Moreover, physicians struggled to diagnose and cure hyperthermia because medical knowledge on heat waves was almost nonexistent in France. The Health Ministry[19] did not finish collecting information related to the number of death. Because of this lack of information, the Health Minister and his advisers did not understand the gravity of the situation and therefore delayed the enacting of emergency guidelines such as the White Plan.

The crisis response revealed several different examples of improvisation. Nurses spontaneously substituted missing perfusion equipment by wall hooks to hang up hydrating solutions. Hospitals were lacking air-conditioned rooms. To cool down several places at one time with small effort, nurses motorized the available air conditioners by placing them on wheels. Firemen and some emergency organizations invented a system of code to differentiate between deaths caused by the heat from those other resulting from other causes. Finally, some administrative actors rented refrigerated vans used to transport food to manage the large quantity of corpses that were overcrowding morgues.

During the 2003 heat wave crisis response, improvisation progressively became organizational but could not grow to the largest scale possible, e.g. all the groups of actors who were involved in the crisis response. For instance, most administrative actors, in spite of having access to crucial resources, failed to participate in the ongoing improvisation. Interestingly enough, many improvisers had face-to-face meetings and relied on phones to interact. On the contrary, groups of actors who improvised little or not at all extensively used emails and faxes. Finally, the actors who used technology to coordinate during organizational

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[19] The definitions of acronyms are provided in chapter 3.1

improvisation represent a very small proportion of the overall quantity of the crisis responders.

This study aims to bring some clarity to this mysterious contrast between ICT use and organizational improvisation. This requires understanding why technology supported, but from some reason, prevented improvisation from fully developing into an organizational form. More specifically, our work addresses the two following questions:

- *Does ICT fit users' needs with respect to organizational improvisation during crisis response?*

- *How do users benefit (or not) from ICT when they interact to improvise collectively in crisis response?*

These two questions respectively correspond to research questions III and IV in the dissertation. Theories on the fit between technology, tasks and contingence seem to be the most appropriate to analyze this phenomenon. However, we argue in this paper that a theory building approach is required to fully understand the role that ICTs played in the 2003 French heat wave crisis response. Taking this view into account, we apply the grounded theory method to build a theoretical framework. Our findings suggest that actors needed to tackle what we call organizational emptiness during crisis response. To respond to this emptiness, crisis responders had no choice but to improvise. However, our analysis reveals that the crisis responders' participation in the ongoing improvisation depended on their communicative genres, e.g. the communication practices and strategies that are widely recognized and applied within a group of actors (Orlikowski, Yates, 1994; Yates, Orlikowski, 1992). When they improvised, the field actors communicated in a "fervent" genre, characterized by personal involvement and emotional interactions. Conversely, a "dispassionate" communicative genre was commonplace between administrative actors. The dispassionate genre consisted of protecting oneself from potential criticism stressing one's transparency in electronic communication. By preventing the administrative actors to mention and take part in improvisation, the dispassionate genre burdened the development of organizational improvisation.

The presentation of our research is structured as follows. After a succinct presentation of the concepts of crisis and improvisation, we assess the relevance of the theories of fit to evaluate the extent of technological support during crisis improvisation. Then, we justify our interest in the grounded theory method Finally we present a comprehensive view of our findings and discuss their theoretical and managerial implications. Annexes provide more detail about the process of coding.

Section 1. *Theoretical background on improvisation and crisis response*

1.I. Organizational crisis during disasters

Disasters refer to massive material and human damage (Perry, Quarantelli, 2005) that disturbs organizational functioning enough to trigger organizational crises (Pearson, Claire, 1998).

This is what happened during the 2003 French heat wave (Lalande *et al.*, 2003). The temperature elevation was a natural disaster: it favored drought, fires and electricity breakout all over Europe. It also triggered organizational crisis within the French health network by threatening its functioning and primary mission: taking care of citizens (Lalande *et al.*, 2003).

Organizational crisis is a critical experience that threatens organizations' primary goals and values (Hermann, 1963). Because of important constraints, organizational crisis requires quick and innovative response by improvising (Crossan, 1998). Stakes and costs of a mishandled crisis are not only material but also social (Dynes, Quarantelli, 1976), which causes important stress and emotional pressure (Milburn *et al.*, 1983a 1983; Smart, Vertinsky, 1977).

This means that organizations have to manage both disaster response and potential organizational crises during disasters. They participate in alleviating material and human damage but also cope with unexpected incidents that put them into crisis. For instance, during the 9/11 or Katrina disasters, hospitals, emergency units, and police services struggled to save lives. They also spent time and energy reestablishing the electrical infrastructure that was necessary for the functioning of equipment (Mendonça, Wallace, 2007). During the heat wave, the response network responded to the heat but also needed to manage their own shortages of resources, lack of information and overwhelmed nurses (for more detail on the response network, please refer to chapter 3.1).

Organizations face important complexity and uncertainty while responding to organizational crisis in disasters. Uncertainty refers to the organizations' difficulties to forecast events related to the crisis. Uncertainty requires the organization to be resilient by developing not only anticipatory but also improvisational skills (Rerup, 2001). Complexity stems from the intricate set of interdependent outcomes from the crisis (Milburn *et al.*, 1983a). Improvisation requires organizations to make do with available resources and to be responsive enough to quickly develop new solutions by improvisation.

1.II. Organizational improvisation for crisis response

Improvisation has been frequently associated with critical situations (Ciborra, 1996a; Hutchins, 1991; Rerup, 2001) but is not restricted to situations during which time and emotional pressure are important (Ciborra, 1996a). Improvisation refers to a creatively acting on the spur of the moment. It implies a limited delay between acting and planning (Moorman, Miner, 1998b), which results in a seemingly extemporaneous action (Weick, 1998). Improvisation includes novelty of action, also called bricolage (Cunha *et al.*, 1999c) that consists of deviating from established uses of resources.

Improvisation frequently occurs during crisis response due to strong time pressure, complexity and uncertainty (Crossan *et al.*, 2005; Cunha, 2004). Improvising can be more relevant than planning during crisis response because it enables adaptation to the specificities of the situation (Rerup, 2001; Waugh, Streib, 2006). However, improvisation can become difficult to manage since it involves various individuals and groups (Hutchins, 1991). It requires efficient interactions (Weick, 1998) and the ability to quickly understand one

another's actions. Examples of failed improvisation provide evidence of how misguided interactions can lead to misunderstandings of intentions and threaten coordination. The Mann Gulch disaster, analyzed by Weick (1993) and Ciborra (1996b), is a vivid illustration of the influence interactions have on coordination when improvisation occurs. As Weick explains (1993), more people could have survived the fire if the demonstration of improvisation had been perceived as a way to escape fire rather than suicide.

"*Dodge [one of the survivors] yelled at the crew to drop their tools, and then, to everyone's astonishment, lit a fire in front of them and ordered them to lie down in the area it had burned. No one did, and they all ran for the ridge*" (p. 629).

Listening and adjusting to individual initiatives is of primary importance when leading collective improvisation. Taking this into account, how can actors be more vigilant to each other when they have less time to adjust to the ongoing action and experience important emotional pressure? Some resources are crucial to meet this requirement. For instance, Moorman and Miner highlight the importance of organizational memory to rely on common structures (Moorman, Miner, 1998b).

This study explores ICTs as other resources for interaction during improvisation. By doing so, we propose an alternate view of technology and improvisation. While most studies present improvisation as a natural way to handle technology in use (Ciborra, 1996a; Ciborra *et al.*, 1999), development (McGann, Lyytinen, 2008) and implementation (Heeks, 2006), this study focuses on ICTs as resources for improvisation during crisis response (Mendonça, Wallace, 2007), that we label "*crisis improvisation*".

1.III. Technological fit to crisis improvisation

In this section, we address the first research question, entitled "Does ICT fit users' needs with respect to organizational improvisation during crisis response?"

To respond to this question, we first discuss the relevance of the theories of fit as a potential theoretical background to investigate ICT support to crisis improvisation.

So far, academics have not provided clear evidence of whether technology significantly supports crisis improvisation or not. First of all, it appears that the increasing use of ICTs has made some tasks for crisis response more feasible. Without the large panel of tools we have access to nowadays, there is no doubt that crisis management would be trickier. For example, Web 2.0 not only enables information gathering and representation, but also contributes to social ties and collective intelligence (For-mukwai, 2010; Vieweg et al., 2008). Geographical Information Systems (GIS) enable locating and tracking crisis responders. More basic tools such as email, forums and Computer Supported Collaborative Work (CSCW) tools enable collaboration, particularly with the use of maps. For instance Google Maps was extensively used during the swine flu pandemic to mark and share knowledge about victims all over the world[20]. Google maps supported improvisation by allowing users to update the

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[20]http://maps.google.com/maps/ms?ie=UTF8&hl=en&t=p&msa=0&msid=106484775090296685271.0
004681a37b713f6b5950&ll=32.639375,-110.390625&spn=15.738151,25.488281&z=5

representation of the pandemic evolution. Finally, ICTs enable crisis responders to communicate almost instantaneously thanks to quick and easy information transmission. By doing so, ICTs respond to the crisis responders' need for quick information feedback (Dynes, Quarantelli, 1976; Quarantelli, 2007).

However, researchers have provided enough evidence to question whether the ICTs meet crisis responders' needs when improvisation is needed. Technology is not always user-friendly in that its design restricts the users' actions to predefined processes and parameters. Beyond reliability issues (Jaeger et al., 2007), functionalities may even obstruct crisis response given users practices (Dawes et al., 2004). For example, replying to message and managing ICT devices compels users to take time that could otherwise be used for action (Jaeger et al., 2007). Similarly, if actors are too dependent on technology, loss of data during a crisis situation can bewilder users enough to jeopardize crisis improvisation (Hutchins, 1991). In other words, technology may threaten improvisers' creativity if not managed properly (Mendonça et al., 2002).

The crisis management literature equally presents pros and cons about ICT use for crisis response. Due to the lack of comparison between the pros and the cons, the crisis management literature fails at specifically defining the degree to which ICTs fit to crisis responder's needs when they have to improvise. One can consider responding to this lack by relying on the theories of fit.

The theories of fit have been widely used in the IS literature to examine ICT support to organizational processes. In spirit, these theories assume that a minimal level of coherence between resources, processes and structures is necessary to attain performance (Drazin, Van de Ven, 1985). In the IS literature, the technology fit theories take into account technology characteristics, tasks characteristics, individual and contextual characteristics. Table 42 represents some widely accepted theories of technology fit in the IS literature and their constructs (inspired from Zigurs and Khazanchi's work (2008)). For instance, the media richness theories compare the specificities of the ICT users' tasks with the media characteristics. Knoll and Jarvenpaa assess whether ICT can meet the users' changing needs in turbulent environments (Knoll, Jarvenpaa, 1994). Finally, Task Technology Fit and IT appropriateness theories include the perception of an ICT by its users into the evaluation of technology fit.

Table 42. Theories of fit in the IS literature

Name of the theory	Analyzed constructs
Media Richness Theory (Daft *et al.*, 1987; Dennis, Kinney, 1998; Rice, 1992)	Media richness, task equivocality, task uncertainty
Technology fit in highly turbulent environment (Knoll, Jarvenpaa, 1994)	Environmental turbulence, flexibility in use, flexibility in modification, flexibility in function
Task Technology Fit (Goodhue, Thompson, 1995; Zigurs, Buckland, 1998; Zigurs, Khazanchi, 2008)	Task complexity, task interdependence, task uncertainty, individual use of technology
IT appropriateness (Khazanchi, 2005)	Respondent position, organizational size, perceived appropriateness of an ICT.

In this study, we argue that the theories of technology fit cannot be applied to the context of crisis improvisation without some conceptual enrichment.

These theories miss details regarding the specificities of improvisation. While improvisation can be characterized as a complex and uncertain task (Zigurs, Buckland, 1998), it is also extemporaneous and situated (Ciborra, Willcocks, 2006). However, the theories of fit do not take into account these fundamental features of improvisation. In other words, one cannot anticipate an improviser's identity, e.g. *who will improvise* and the improvisers' practices, e.g. *what improvisation will consist of.* Even though these aspects are likely to play a role in ICT use during improvisation (Brigham, Introna, 2006), they cannot be defined prior to an improvisation, which prevents researchers to provide an overall assessment of ICT fit to improvisation.

Based upon our research, there is a relative similarity between individuals' experience of technology when examined through the theories of fit. However, crisis response involves numerous groups of individuals as well as various ICT tools and tasks. For instance, the crisis response to Katrina involved companies, emergency units, administration and so on. Each organization had access to various ICTs such as the Internet, phones, PDAs (Chua, 2007; Davis, 2008, December; Ives, Junglas, 2006a; Quarantelli, 2006). Tasks were diverse as well, ranging from treating patients to managing extra transportation systems. Thus the ICT services that enable interactions between crisis responders are likely to not fit every individual involved in crisis response.

Finally, the concept of fit implies a conceptual distinction between context, tasks and technology (Zigurs, Khazanchi, 2008). However, crisis improvisers can improvise on technology. In this case, crisis responders adapt to the technological tools they have at hand, even though these tools are not adequate to the users' tasks (Konsynski, Tiwana, 2004). However, the theories of fit do not take into account the users' adaptation to technology.

Against this background, we believe that observing and analyzing field data would provide additional insights to our research questions. As we present in chapter 3.1, the need for a

theory building approach to the question of ICTs and crisis improvisation exists[21], regardless of the limitations of the theories of fit. To respond to this need, we rely on a research design based on the grounded theory.

Section 2.   Methodology and coding

Chapter 3.1 of the dissertation provides more details on the 2003 French heat wave crisis response. More specifically, this chapter describes the field actors and the administrative actors of the response network. Chapter 3.2 details our research design, in particular our data collecting and analyzing. The methodology and coding section details the coding process that contributed to the emergence of the concepts or organizational emptiness, dispassionate communicative genre and fervent communicative genre.

The research method in this study is qualitative and retrospective. We followed the grounded theory approach, as defined by Corbin and Strauss (Corbin, Strauss, 1990; Orlikowski, 1996; Orlikowski, Hofman, 1997). The grounded theory approach aims to build alternate explanations of social phenomena by rigorous coding processes. Following a grounded theory methodology, we identified categories from data. We then transformed them into concepts, which correspond to the abstraction process as defined by Strauss and Corbin (2008).

Our analysis was iterative. By going back and forth between data and findings, we formulated hypotheses from the data and we confronted these hypotheses with more data. We coded data through the four steps that Corbin and Strauss recommend to follow (1990): microanalysis, open coding, axial coding. We describe each of these steps.

In the very beginning of our analysis, we completed a microscopic analysis of each word of the segments of the public hearings transcripts that we had selected for analysis. Several categories emerged from this analysis, as represented by Step 1 in Figure 47. We present some examples of the categories that emerged from our microscopic analysis in Table 43.

"Difficulty to see and understand" referred to the lack of understanding of the situation for decision makers. For instance, the administrative actors lacked information about the number of victims of the heat wave. Due to this lack, they experienced difficulties in settling clear directions to field actors. On their side, field actors had vivid experiences of heat and death. Additionally, they received little help from administrative actors and lacked resources. For this reason, they felt isolated, which refers to the category "Difficulty to be listened to". The category "Lack of communication" referred to the misconnections between groups of actors within the response network. Finally, the code "death" refers to the real time experience of physical suffering, isolation, emotional exhaustion and confusion.

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[21] For more detail on our motivation for following the grounded theory approach please refer to chapter 3.2

Table 43. Some examples of categories

Name of the category	Verbatim	Explanation of the category
Difficulty to see and understand	"We had no clue of what was going on"	The decision makers hardly make sense of the situation or they misinterpret the situation.
Difficulty to be listened to	"She told that we would manage the situation anyway"	The actor has the feeling that his or her superior do not care about his or her difficulties in coping with the crisis
Death	"People were dying. Nurses were exhausted"	Physical experience of death and exhaustion by field actors.
Lack of resources	"Patients were sitting on chairs, desperately waiting for treatment"	Lack of beds, medicines, air conditioner, etc
Lack of communication	"I do not know who I am supposed to contact anyway"	The crisis responders who are supposed to act collectively do not contact each other.

We extensively relied on memos to further analyze these categories and transform them into codes. For instance, we reflected on the category "difficulty to see and understand" and we noticed that the administrative actors of the response network experienced an overall confusion during the heat wave. Some of them had a medical background and for this reason they felt concerned about the temperatures and its effects on patients' health. Despite this concern, most of the administrative actors did not receive any alarming message in the beginning of the crisis.

Since the 11[th] of August, the administrative actors realized that patients were dying. Since that moment, some of the administrative actors experienced an existential crisis when they faced their own inability to react properly to the situation. Finally they indirectly experienced death when the media started to mention that more than 5,000 people had died between the 4[th] of the 10[th] of August. From this analysis, we extended the category "death" to the indirect experience of death and suffering.

We then relied on the memos we had written during our open coding to complete the axial coding. The axial coding consists of refining and clarifying the codes by comparing and discussing the conceptual ties between the subcategories (Corbin, Strauss, 1990). The axial coding started in January 2010 and finish in August 2010. We first identified "difficulty to see and understand", "difficulty to be listened to" and "death" as the subcategories of the code entitled death. Then we related the notion of death and the categories "lack of resources" and "lack of means". This process corresponds to Step 2 in Figure 47.

Thanks to discussion with colleagues, we challenged the assumption that the administrative actors were experiencing death metaphorically. Instead we suggest they experienced some loss of control over their work coupled with the lack of resources, which provoked an overall

confusion about the response network's ability to fulfill its mission. Thus, we refined the code "death" as the code "organizational hole" that referred to the crisis responders' experience of lacking something. We understood then that experiencing an "organizational hole" led the some crisis responders – mostly the field actors - to improvise. Conversely, the administrative actors experienced organizational holes but did not improvise. This process is represented in Figure 47 as steps 3 and 4.

By detailing the concept of organizational hole, we realized that the heat wave crisis responders experienced diverse lacks concomitantly. Therefore, we had to find a more appropriate term to convey the idea that crisis responders did not experience one specific lack at a time but rather experienced something more complex. To clarify this point, we made some semantic research on the distinction between organizational *holes*, *vacuum* or *void*. The term *hole* conveys the image of an identifiable lack. However, our analysis rather suggested that lacks were interdependent. To us the notions of *vacuum* and *void* were inadequate because they do not convey the idea that people had a positive reaction to the lacks by improvising. These terms defined a *"space filled with nothing"*, therefore conveying the idea of non-existence. On the contrary, our analysis suggested that the lack of resource or means made crisis responders identify opportunities for ad hoc solutions. In our view the notion of emptiness was relevant because it defined a space that is *"vacant or unoccupied"* and therefore free for reinvention. In old English emptiness referred to the lack of occupation. For instance young people would refer to their emptiness to signal they were single (Thesaurus dictionary). Therefore the notion of organizational emptiness refers to the fact that some resources or means were interdependently missing which prevented actors to complete processes on the usual track. This final step of the axial coding is represented as Step 5 in Figure 47.

Finally, we completed the selective coding by clarifying the logical connections between the codes. More specifically, we defined the influence of organizational improvisation on organizational emptiness and the other concepts that compose our framework. This final step brought the opportunity to test the relevance of each code and to refine our framework. We presented the framework in multiple seminars, which helped us to challenge the overall coherence of the framework. For instance, we had initially made a distinction between crisis responders' interactions and the dispassionate communicative genres. This conceptualization was challenged when some colleagues asked us the difference between an interaction and a communicative genre. Further reflecting on this comment led us to delete the code "interaction" from our findings. We then realized that two communicative genres were coexisting into the response network.

Figure 47. The coding process steps
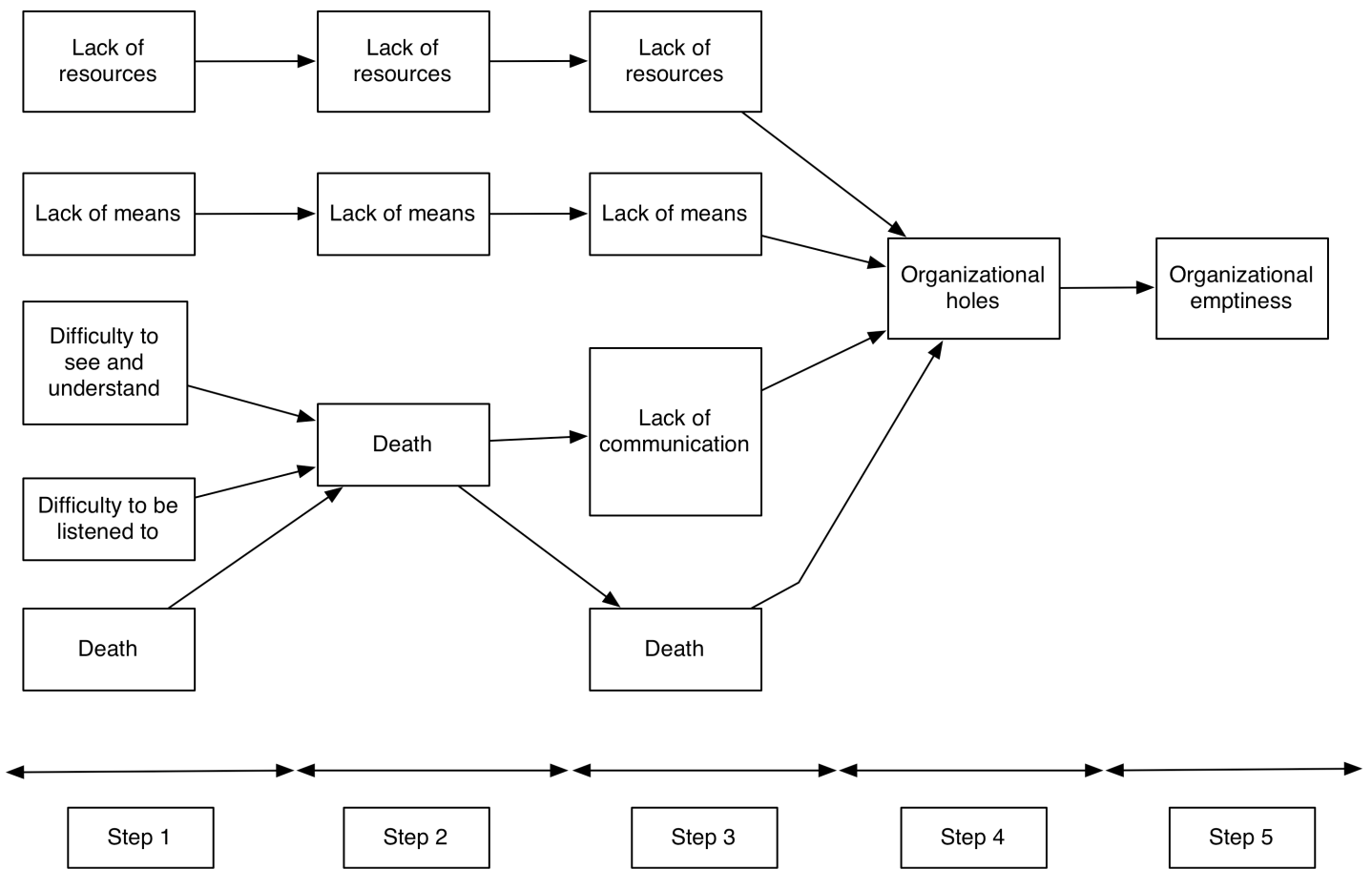
Section 3.   Findings

We present here the framework and the concepts that emanated from our data analysis.

Our framework shows that organizational emptiness challenged crisis responders and compelled them to improvise together. However, crisis responders' participation in organizational improvisation depended on their communicative genres. A communicative genre is a set of practices and strategies that develop and are widely recognized within a group of interlocutors (Orlikowski, Yates, 1994; Yates, Orlikowski, 2002; Yates, Orlikowski, 1992; Yates *et al.*, 1999). Two communicative genres with the response network emerged from our coding (for more detail on the definition of the response network, please refer to chapter 3.1). While a *fervent* communicative genre was commonplace among field actors, administrative actors primarily interacted in a *dispassionate* communicative genre. The "fervent" communicative genre included a great deal of discussion as well as some personal and emotional involvement. The dispassionate communicative genre developed around emails and faxes and implied that interlocutors focus on objective data with low personal and emotional involvement.

Improvisation rapidly grew organizational but its expansion was limited and did not encompass the whole response network. Improvisation became organizational in hospitals and some institutions. However, crisis responders that mainly communicated through emails in the dispassionate communicative genre had a restricted participation into organizational improvisation. Figure 48 presents the overall view of the proposed framework. We then detail each part of the framework.
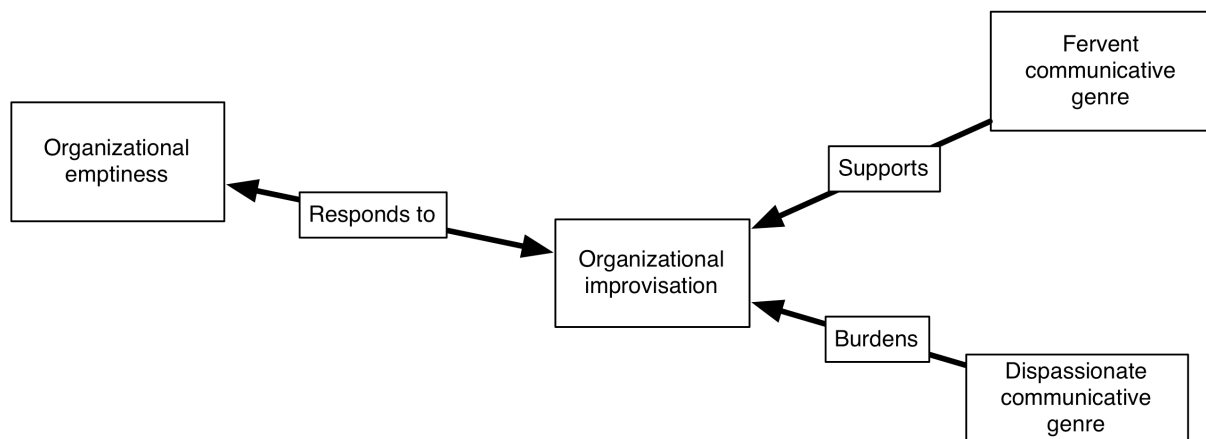
Figure 48. The overall framework

3.I. Organizational emptiness and organizational improvisation

In this study the notion of organizational emptiness refers to *the absence of operation of resources or means in spite of their being necessary to perform a specific process*. The notion of organizational input involved in this definition is two-fold, referring to organizational resources and means. Barney provides a fair definition and a typology of various resources that an organization can miss (1991). Following his approach we view two main types of organizational resources: 1) material such as objects and people or 2) immaterial such as competencies, cognitive frames and information. We rely on Mintzberg's definition of a organizational means (1979). They are of six types: processes, outputs, instructions, informal connection between individuals and groups, norms and skills. We provide in the coming lines more details and examples of organizational emptiness.

Following a realist approach, we propose that the concept of organizational emptiness be both intransitive and transitive (for more detail on the transitivity please refer to chapter 1.3). First of all, organizational emptiness is an intransitive reality. A mismatch between resource allocation and the individuals' needs is an objective fact. For example, the number of deaths objectively exceeded the capacity of mortuary chambers. Similarly, no information system devoted to inter organizational coordination existed in summer 2003. However, individuals also make their own experience of emptiness. Facing emptiness, individuals and groups experienced a feeling of urgent lack, which relates to the experience of cognitive dissonance, as defined by Festinger (1957).

Being both intransitive and transitive, organizational emptiness has an independent existence that we can hardly understand. Even though individuals perceived emptiness through the experience of crucial lacks during the heat wave; emptiness has an independent existence from human subjectivity. Individuals' perception of a lack of resources or means does not mean that these resources and means do not actually exist. In the aftermath of the heat wave, crisis responders eventually understood that some resources and means that they missed at the time of the crisis response actually existed. For example, hospitals experienced shortages of medicines despite considerable stocks. In this case, emptiness stemmed from the rigidity threat in relation to resource supply processes.

Improvisation helped to partially fill the organizational emptiness by providing ad hoc solutions. For instance, firefighters squads and the SAMU personnel developed an ad hoc coding system to distinguish the deaths that they suspected to be due to the heat from others. Improvisation as a response to emptiness has already been reported in literature by several authors. The ambiguity and lack of definition of some processes can provide an opportunity for actors to develop unexpected behaviors. Burt, who founded the theory of structural holes, explained how ambiguities in human agency could raise unexpected behaviors such as opportunistic strategies (Burt, 1992, 2004). This connection is consistent with French sociology that accounts for emptiness as an opportunity for actors to develop their reflexivity (Alter, 2000) and power (Crozier, Friedberg, 1977). In particular, the garbage can theory depicts how frequent ambiguity in processes is and how it causes unexpected interactions among decision makers. As explained by Cohen, March and Olsen (Cohen *et al.*, 1972):

"*Situations of decision making under goal ambiguity are common in complex organizations. (...) Often, problems are resolved without recourse to explicit bargaining or to an explicit price system market*". (p. 1).

Finally the connection between emptiness and improvisation was conceptually addressed by Hatch (1999). According to this author, actors cope with structures ambiguity mainly by improvising ad hoc solutions and meanings. The following paragraphs present pieces of evidence of organizational emptiness. For each, we demonstrate how actors improvised to respond to emptiness.

3.I.1. Material resource

All sorts of material resources were missing during the crisis response. More specifically medical personnel were in need of beds, ice, air conditioners, etc. Other kinds of material were needed to cool down rooms because the building structures were not adapted to such high temperatures. As hospitals could not command air conditioners, nurses put them on wheels to cool down more than one room at a time. Otherwise, nurses put bed sheets into water and hung them up at windows in the hottest rooms.

Some of the available resources were not usable in some cases. In many hospitals the water was too hot to be drunk or too refresh patients. As an ERT describes, medical students improvised by asking for ice to restaurants and bars that were located nearby the hospital:

"I asked for bottles of water. My superior did not understand why I was urging her so much to get it. Yes, we had some water. But it was too hot to be drunk. So students who had come back from their vacation asked in bars for some ice. Some barmaid told me: "It is the only thing I can do"".

3.I.2. Immaterial resources

Information was one of the most needed intangible resources. At any moment, the administrative sphere could trace events in hospitals. Although scarce, social ties did exist between administrative and field actors (more detail in the *Communicational connections between individuals and groups* section). An information system existed – the PMSI – but would not provide information in real time. No system enabled the tracking of patients to detect the work overload in hospitals at that time. Consequently, the response network subsequently had to establish an ad hoc information system to report their daily activity. As a DGS manager described the settling of an ad hoc information system:

"*As requested by the [Health] Minister's advisers, we required from the ARH that all the hospitals adapt to the situation. We were informed that the situation was exceptional. At that moment we asked every hospital director to transmit information. We stressed our need to get information on a daily basis. This is why we provided a form that we transmitted to the ARHs. Frequent phone interactions were helpful to forecast tendencies on a short notice.*"

Organizations were missing cognitive resources to cope with the situation as well. During public hearings, an officer from the BSPP explained that there was no code to refer to the specific situation they were facing, which prevented firefighters from following established guidelines. As this officer explains, firefighters had no idea of how they could handle the situation. For this reason, they improvised a new code.

"*We had to invent a new code, this code was called "syndromes due to heat". We had not thought about this code previously*".

3.I.3. Processes

During the French heat wave, squads that were intervening did not know what type of intervention they were completing. Therefore, they had no idea of what information they should collect and what parameters were important for decision making. As an officer explains:

"*Teams leaders were asked to analyze each case they handled on their own, without referring to code protocols. Therefore each case was approached empirically once we understood there was a significant number of interventions due to fainting*".

To respond to this lack, the BSPP squads developed ad hoc criteria for decision making. More than developing a new intervention code, firefighters created an ad hoc process to handle data in relation to hyperthermia:

"*Since the 7th of August, officers were asked to complete their reports with complementary information such as environmental and body temperature and aerologic conditions. By doing*

so, they had a better idea of the role heat played in fainting patients and made better decisions".

As a firefighter officer explained, the BSPP squads cooperated with the SAMU to settle the ad hoc process to take care of the victims of hyperthermia:

"*Since the 8ᵗʰ, we cooperated with the SAMU to develop therapy procedures to take care of the victims ourselves and alleviate the workload in hospitals. We created what we called a refreezing protocol, a reanimation protocol and a medical algorithm to decide whether to transfer the victims to hospitals or not (...)*".

3.I.4. Instructions and orders

Institutions had to provide new directions so that resource shortages could be resolved almost everywhere. Resources were missing because directions to get resources had not been defined.

"*There were sudden shortages of resources in many facilities. In collaboration with the DGS we gave directions so that hospitals would help assisted living facilities manage shortages. The situation was unusual. We enabled drugstores to get more medicines to organizations that were in critical situations*".

Similarly, a specific instruction in relation to alerting was lacking. As an operational actor explained during a public hearing:

"*I would have been able to transmit data and alerts. But to who? I have no supervisor to contact in case of problems*".

During crisis response, ad hoc instructions emerged and were transmitted by fax from institutional actors such as the AP-HP. These instructions recommended the postponement of scheduled activities to focus efforts on hydrating patients who were suffering from hyperthermia.

3.I.5. Outputs

Within the response network, some organizations could not reach their objectives and could not fulfill their missions. For this reason, these organizations had to redefine their outputs. For instance the INVS could not complete its health-watching mission due to the lack of information. As the INVS explained during public hearings:

"*The InVS mission is to inform the DGS about all the potential threats, such as meningitis, legionaire's disease, SARS*".

Similarly, the medical personnel and civil protection organizations were unable to fulfill their mission of saving lives when the number of victims suddenly increased. In these cases, the crisis responders redefined their tasks into bringing ice, hydrating patients, counting victims and sending faxes.

3.I.6. Norms

Crisis responders faced unexpected situations in relation to which no rule or norm preexisted. Because of that, they developed divergent views, depending on their professional values or their common sense. The implications of the lack of norms can be illustrated by the dilemma experienced by firefighters when it comes to transmit information to journalists.

During the crisis there was no predefined norm or instruction about information transmission about death rates. When contacted by journalists with respect to death rates, a BSPP officer asked for advice to the head physician. The latter was agreeable to transmit information. As the BSPP officer who was in charge of communication with journalists explained:

"When journalists contact me to get information about the death rates I go to the head physician of our squad and I ask him if I can tell the journalists that 7 persons died. He responded yes, because 7 is the minimum approximation of deaths and that we have nothing to hide. He is ok to transmit the figures to the journalists but he tells me that we need to validate this decision by the PPP. When I told him that the journalists wanted to interview me on that topic he immediately contacted the Police authorities (...)".

The PPP officer contacted by the BSPP officer disagreed on transmitting information. At that moment a dilemma tore the firefighter's mind. On one hand, BSPP officers should abide by the PPP officers' decision. On the other, the public expected to be informed about abnormal death rates. This dilemma led him to deviate from established obedience due to superiors in the military culture: He personally expressed his view and attempted to negotiate with the PPP officer. The improvised attempt for negotiation aborted. However, the lack of norms led crisis responders to deviate from established patterns of behavior, which is a core feature of improvisation (Clegg *et al.*, 2002). As the BSPP officer explained:

"My boss calls them while I am standing into the office. He says that the situation is critical. He requests permission to transmit information about the deaths that are due to the heat wave. He then switches the phone loudspeaker on, which allows me to hear the following instructions: We have to avoid any public psychoses and therefore we should not transmit any data. (...) I heard my boss having the following conversation with the PPP officer:

- *You should know that the whole country gets concerned when one homeless person freezes to death in the winter. Currently, more than seven persons have died from the heat. This may be an even more important situation today...*

- *Yes but we are not really sure that these people died from the heat, are we?*

Then my boss nodded. (...) To me, physicians are the most competent to decide whether they could transmit 7, 8 or 40 as figures".

3.I.7. Skills

At the beginning of the crisis response, physicians were convinced the symptoms of hyperthermia were due to some infectious disease. For this reason they gave antibiotics to their first patients. Physicians were powerless because whatever they attempted to do, patients

would die in their hands. Specific know-hows to manage the effects of hyperthermia were lacking. As an illustration of this lack, one of these physicians spent an entire Friday night on the Internet searching for information about hyperthermia and its effects:

"[A physician] collected research on hyperthermia on the Internet. He already knew that heat can kill but did not understand how. On Friday, he used free access to research documents and read over everything. Then he discovered the same thing had happened in Chicago in 1995" (Jacquat report, pp.283-289).

Hospitals' staff similarly responded to the lack of skills and competencies in relation to hyperthermia. Improvisation, as a trial and error process (Ciborra, 1996b), enabled diverse actors to develop know-how with respect to hydration.

3.I.8. Communicational connections between individual and groups

Not only were information systems disconnected but individuals and groups would miss communication tools such as common vocabulary and codes as well. They were also reluctant to share information or respond to each other's alerts. This dimension of organizational emptiness is not new in the crisis management literature (Garnett, Kouzmin, 2007) and the management literature. In their study on collaboration in virtual teams, Panteli and Fineman explain how silence is interpreted by actors as a message and plays a full part in communication in organizations (2005).

It is important to note that such communicational gaps were inherent to the structure of the Parisian Heat wave Crisis Response Network (HCN). Furthermore, due to the diversity of organizations and functions within the network, actors experienced the heat wave in radically diverse ways. Operational actors were struck by the heat, the feeling of being powerless against death and the lack of water. In the administrative sphere, the feeling of crisis was less brutal. This same feeling was delayed as actors got information about the situation, urgent calls, or watched Patrick Pelloux's intervention on television on the Sunday evening news.

The lack of communicational bridges is illustrated in the role that information retention played in crisis response. As some INVS director explained, field and administrative actors exchanged little information:

"Between the 6th and the 8th of August, transmitted information is parceled: only one DDASS – and I am not accusing anyone, this are only facts – from Morbihan (Nota: A French region on the west coast) informs us that there has been tree deaths of pretty young people. That is all".

Another example of missed communication bridges came from the head of the Health Ministry advisers. As field actors were experiencing the catastrophe in real time administrative actors experienced the crisis indirectly and did not always make sense of the situation as a crisis. In particular, they hardly figured that the situation was critical, partly because the words "crisis" or "heat wave" were not clearly mentioned. As one of the health ministry advisers explained:

"Before I arrived on the 11th of August I had received no phone call during my break. I had 300 emails to read and no one clearly mentioned the heat wave".

Organizational improvisation helped to fill, at least partially, the lack of communication. As an administrative director explained:

"Today, men and women who participated in the response to the heat wave can be proud of having given everything that they could give at that time. This collective struggle developed a belonging feeling and solidarity among teams. The most frequently used attribute to depict the experience of the heat wave is « federating »".

Figure 49 summarizes the mutual influence between organizational emptiness and organizational improvisation. Arrows represent crisis responders' improvised practices as a response to organizational emptiness.
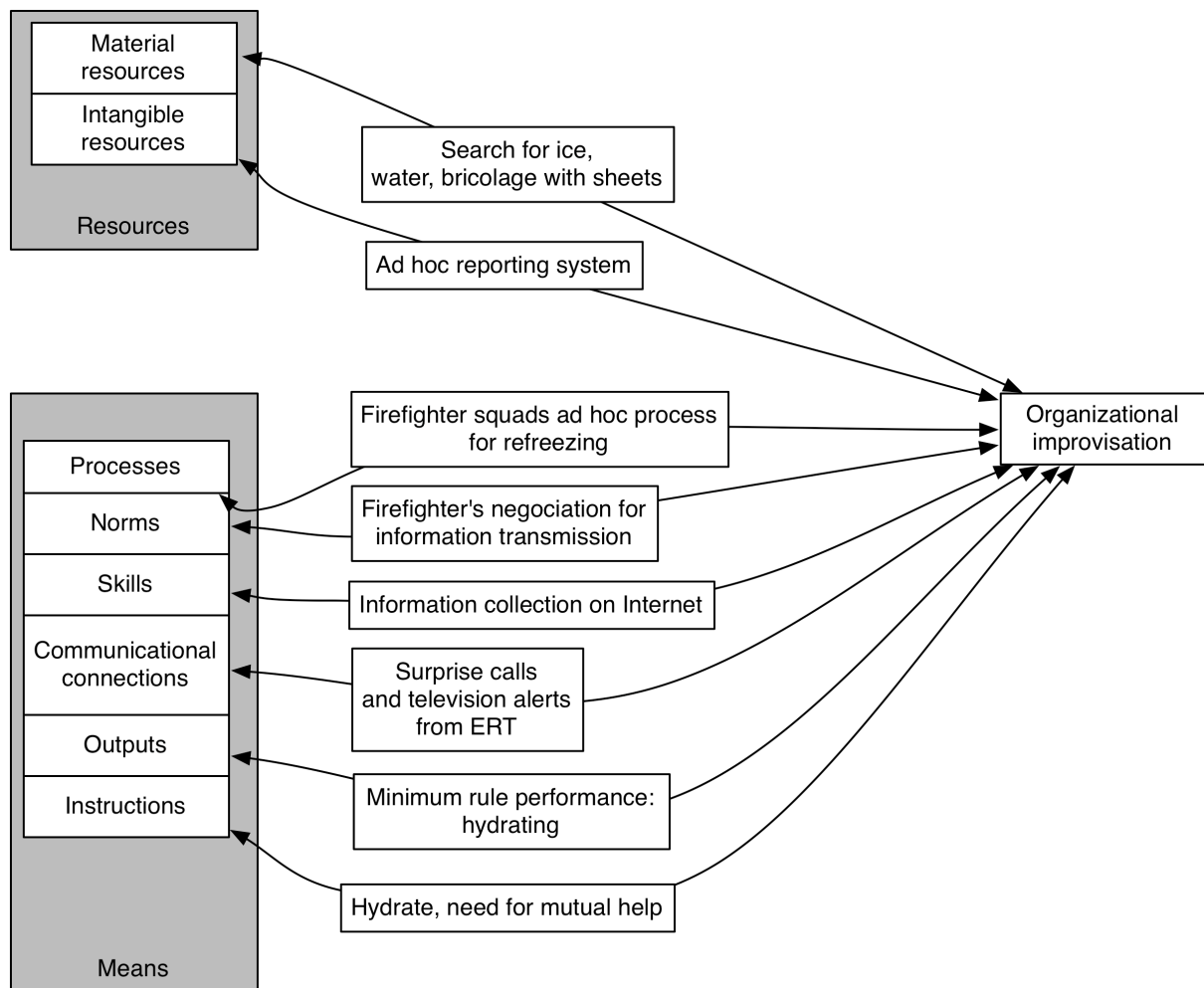
Figure 49. Organizational emptiness and improvisation

3.II. Communicative genres during the 2003 French heat wave

We detail here the notion of *communicative genre* and expand on their impact on organizational improvisation. Some preliminary codes about technology use emerged during analysis. We eventually refined these codes by relying on existing studies on the concept of communicative genres. By doing so, we identified two communicative genres that coexisted. We first define the notion of communicative genre. Then we detail the *fervent* and *dispassionate* communicative genres. The two communicative genres are depicted in Figure 50.

Figure 50. Dispassionate and fervent communicative genres
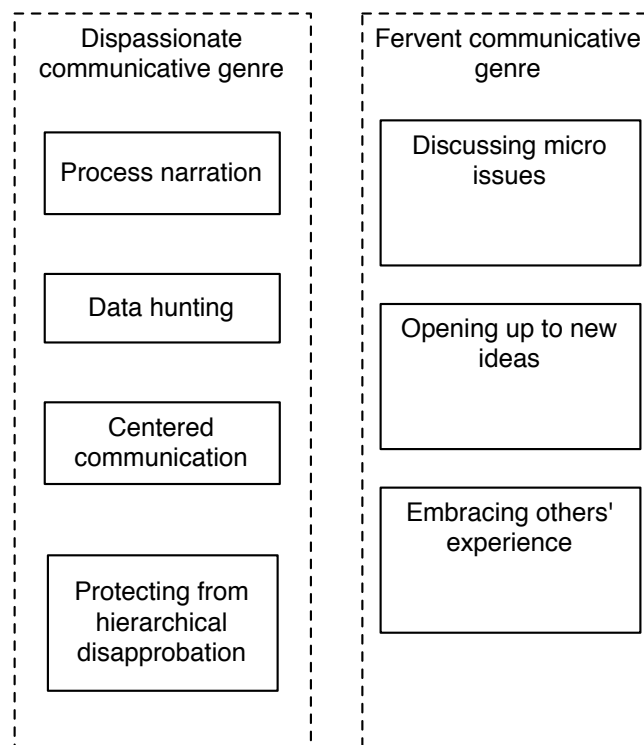
Orlikowski and Yates' work provide a clear explanation of what a communicative genre is (1994). As those authors explain:

"*A genre of organizational communication such as the business letter, shareholders' meetings, or report, is a distinctive type of communication, characterized by a socially recognized and common aspect of form (...). The communicative purpose of a genre is not rooted (...) in a purpose that is collectively constructed, recognized and reinforced within a community*" (p.543).

In other words, a communicative genre consists of a repertoire of communicative practices and strategies that are associated with specific social codes and communication media. For instance business letters correspond to specific communication strategies towards shareholders. Similarly to routines, genres develop on the long term.

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3.II.1. The *fervent* communicative genre

The fervent communicative genre describes vivid exchanges between responders, including emotions and controversies. When they use the fervent genre, the crisis responders generally interact in face to face or by phones. In addition, they aim to persuade and emotionally move their interlocutors. We detail the fervent communicative genre features and how the fervent communicative genre supported the development of organizational improvisation at a collective level.

3.II.1.1. Discussing micro issues

When communicating in a fervent genre, crisis responders discussed specific events or issues. Focusing on micro issues, interlocutors were more prone to express their personal opinions and discuss them. For example, a manager from the DHOS explained how she expressed her concern to the government about a specific AP-HP alarming message sent of the 8th. By doing so she explained the Health Ministry's advisers that the meeting that was to take place on the 11th was an opportunity to respond this message:

"The central administration does not usually participate in the hospitals' internal meetings. But this time I warned the ministry's advisers that the message I had received from the AP-HP was too alarming. Then one of the advisers told me that I should attend the meeting that we were invited to. She told me that I should ask the AP to invite the DGS".

This kind of interaction permitted dialogic reasoning between actors. Dialogic reasoning is a process during which actors develop their ideas collectively and dialectically (Faraj, Xiao, 2006). Dialogical reasoning is reported to happen often in organizations that need to cope with critical situations. During the 2003 French heat wave, dialogical reasoning frequently occurred to find ad hoc solutions.

Actors' involvement in crisis response depended on their ability to discuss to develop a common understanding about the situation. For example, cases of old patients who assail physicians with requests are typical in routine situation. For this reason, physicians underestimated the suffering of some old patients in their services at the beginning of the heat wave. Hospitals' medical personnel overcame misrepresentations about the elderly mainly by discussion:

"On the 11th, I understood one thing: to mobilize all services and not only emergency services in hospitals we had to explain that the situation was distinct from the ordinary issue of abandoned elderly. The old person with the SAMU phone number anchored next to the phone is a cliché. At that time field actors who went into emergency rooms saw what was happening. This is why I argue that we need to see and talk".

Moreover discussion was definitely needed to be reactive. As some administrative actor points out:

"We would have needed to confront several sources of information. We needed data from the field; all the data that comes from hospitals and restrooms because these were the places

were the number of deaths was its climax. We should have brought information from these services as well as others to a single point".

Through discussion, responders developed dialogical reasoning with experts, supporting the emergence of expertise leadership. Both dialogical reasoning and expertise leadership can be viewed as a core component of improvisation. As a BSPP officer explained, discussion with physicians within the squads provided the opportunity for officers to understand from the physicians that the heat wave was likely to have an impact on people's health. Furthermore, the discussion led the physician to lead improvisation with respect to the measurement of temperatures among firefighters:

"*By discussing with my superiors and physicians, I noticed that they were trying to make a connection between the growing number of victims and the heat. The physician took the first measures of temperature and then asked everyone to do the same with every victim*".

3.II.1.2. <u>Opening up to new ideas</u>

The fervent communicative genre is characterized by the interlocutor's feeling free to tackle unexpected topics. Interlocutors started some subjects. As conversations were occurring, various topics, problems or solutions were brought up. This kind of interaction is commonplace in organizations and was described by the Garbage Can theory (Cohen *et al.*, 1972). Interactions gather issues, solutions and ideas in a pell-mell fashion. Creativity is more important during such interactions because interlocutors make unexpected connections between problems and solutions.

Sometimes new problems were mentioned during the conversation, leading actors to brainstorm together and develop a new idea. During public hearings, the AP-HP director explained how she had the idea of calling students back:

"*On the 11th of August, I was discussing with a service care director. We were wondering what we could do to cope with the situation. Then we thought we could call students to volunteer (...). As a result 400 students came back (...). There was so much to be done*".

In other cases, the interaction was provoked to solve a specific and concrete problem. Patrick Pelloux's essay provides a fair description of brainstorming meetings that would open to new ideas as sources of improvisation and bricolage. For instance, he depicts how administrative actors had the idea of using food vans to stock bodies so as to alleviate mortuary chambers that were overloaded.

Finally, some of these interactions did not necessarily provide new ideas but enabled actors to be more vigilant about some potential issues and transmit their concerns among colleagues. In this kind of situation, actors were more prone to improvise because they had in mind the absence of a predefined solution. As an ERT explained:

"*This crisis meeting gathered specialists from various disciplines among which the AP-HP ones. Deviating from the original subject, summer potential issues such as bed were mentioned aside*".

Opening up to new ideas created room for spontaneous suggestions and innovating ideas, therefore supporting improvisation.

3.II.1.3. **Embracing other's personal experience**

Actors built a common vocabulary and shared their experience in an empathic manner. This is consistent with previous findings on the importance of boundary spanning in crisis response (Kapucu, 2006). Actors took into consideration personal emotions and concerns from colleagues and counterparts. As some administrative actors described her reaction after her discussion with a counterpart:

" *At 8 o'clock in the morning, I receive this call from AP-HP. I am driving at that time. But I stop my car at 9 o'clock because at Porte d'Italie to call back because I had found this call disturbing. I called to say that I needed to attend the meeting because the alert from [my counterpart] – that I knew very well – seemed very alarming*".

Embracing other's experience participated into discussion and dialogical reasoning. As a BSPP officer explained, sharing about one's feelings contributed to build an ad-hoc alert threshold:

"*I think the alert threshold was surpassed because my services twice alerted upper services. This alert threshold is not something mathematical. It is rather a general feeling that stems from so many interventions that a particular event*".

Embracing other's experience implied the importance of inter individual connection and knowledge sharing. It required that interlocutors provided details about their own experience: their sensation, emotions or even the people or objects they were surrounded by. For instance there was the need in some hospitals to get some fresh air. Some ERT described the interactions that took place between all the people who tried to cool down rooms for patients:

"*Plumbers, firefighters, building workers and so on. They all deployed the creativity and spent hours to think about possible bricolage to cool down the place. They tried to improve air channels, they sprayed water on the building walls, they covered the walls with bed sheets*". (l'Urgentiste, p.55)

Furthermore the fervent communicative genre implies that individuals felt confident enough to express their emotions:

"*The person who received alert calls on the 7ᵗʰ of August knew very well how hospitals work. His knowledge enabled him to understand his interlocutors' situation and made him think that something very serious was coming out. This is why he immediately called [his colleagues]* ".

This is why empathy and trust were core aspects of the fervent communicative genre. Such interactions implied a frank expression, with no euphemism. An ERT reported his discussion with a colleague. At the end of this conversation, the two colleagues deviated from established patterns of actions by directly calling national organizations directors (DHOS and INVS) to alert them:

"This night, information from colleagues converges: people are dying in hospitals halls. (…) I then receive this call from this professor:

- *I was about to call you, I told him. Have you heard about all that stuff? Things are bad…*

- *I think we are in deep shit, he answers.*

At that time, we mutually agree to act. We decide to alert. He decides to take care of the DGS. I will handle the DHOS". (L'urgentiste, p.38).

Embracing other's experience promoted spontaneity and boundary spanning processes that are core features of improvisation.

3.II.2. The *dispassionate* communicative genre

In this section we describe the dispassionate communicative genre and its effects on organizational improvisation. As a reminder, the "dispassionate" communicative genre was developed in relation to email and fax use. Two examples of email archives can be found in the Annex, in Figure 54 and Figure 55.

3.II.2.1. Process narration

Actors primarily reported ongoing processes and data in emails. Processes were mentioned to introduce what tasks were needed. For instance, on the 6th of August, one of the Health ministry advisers explained to his counterparts at the DGS his concern about the effect of the heat on citizens' health. He then suggested the need for a recommendation memo about the heat wave that should be sent to health care organizations:

"It would be useful to send a memo to recall basic precautions to care for the youngest and eldest patients. There are plenty of studies about the health related impacts of heat waves (…). I think the CDC [Center for Disease Control in Atlanta] reviewed them). It could result into an emergency message".

Actors spent three days responding to this initiative. As Patrick Pelloux explains in his essay, they exchanged 60 emails to end up with a final version of the memo. Interaction via email reported major or minor revisions from interlocutors on the document.

Otherwise emails were used to transmit information about what had been completed previously. By doing so actors developed a narrative structure that supported coordination. For instance, an INVS [22]employee reported the general ideas that emerged from an informal phone interaction with colleagues. He sent his colleagues the following email:

"I called [colleagues] to discuss about what could be done [to investigate the health related impacts of the heat wave].

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[22] INVS is the national health-watching institute in France. For more detail on the response network organizations please refer to chapter 3.1

First of all, we should take into account the feasibility criterion. We therefore should collaborate with organizations that already have an information system and data from previous years

 Here is our idea: trying to bring information up to the INVS rather than settling for a specific data collection system".

By mentioning a previously received email, the sender transcribed what was discussed previously to his email, which supported process narration. The email was then forwarded multiple times without any comment or additional idea. Its content was of the strategic level, dealing with feasibility as a generic criterion to make decision on whether the strategy should be implemented. However, the interlocutors did not mention any detail on how to implement the strategy. It is interesting to note that the INVS never implemented its plans for investigation.

Despite the development of a narration, discussion to implement ideas scarcely occurred when crisis responders communicated in a dispassionate genre. Process reporting lessened opportunities for dialogic reasoning between email and fax users. These users hardly approached micro issues as well, even though phone exchanges afforded the opportunity to talk about ongoing actions.

3.II.2.2. <u>Data hunting</u>

When objective, data provides a legitimate basis to make decisions. For this reason, email users extensively sent figures and data during crisis response. As a result, administrative actors spent the whole crisis response period to find out the number of deaths.

Indeed emails including data were systematically transmitted between actors, but with scarce discussion. Moreover they hardly mentioned concrete facts, objects and persons. For instance the following message was initially sent to the INVS and then transferred to seven actors:

"*There was a call at 4 pm from the DDASS in Morbihan. Three persons had died at work. As reported vby the emergency services, these persons were pretty young. The person called the DGS and was advised to call the INVS. Here is his phone number (…)".*

First the message was introduced in a forwarded email as follows: "*I let you evaluate the situation"*, or "FYI".

Then some interlocutor announced common points and differences between dead persons (such as age, weight, gender) to evaluate whether these deaths were due to infection or not. The objective of these emails was to negate or confirm the interpretation of the situation by the interlocutors with more data. Actors strove to stay as neutral as possible when it came to interpretation and to refer to objective figures. They rarely expressed personal views of the situation or refer to their sensations. In many cases, interlocutors expected each other to make sense of the data, which delayed action and obstacles extemporaneous action (Tylern, Tang, 2003).

As a core feature of the dispassionate communicative genre, data hunting prevented actors from fueling reflection with opinions and emotions. As data is central in interaction, there was little room for discussion.

3.II.2.3.   Centered communication

Remaining focused on the reporting of administrative processes, administrative actors hardly integrated field actors' requests for help or action into their process. For instance an ERT contacted one of the DGS employees on the 11th of August. His email vividly depicts his feeling powerless to tackle deaths and suffering:

"*Many elderly die in emergency rooms indirectly or directly from hyperthermia. Three persons died in Saint Joseph [hospital] so far. The emergency roomers (ERs), at least ours, are totally flooded with patients. Some of them stay 4 or 5 on the same stretchers in ER. We have to search for more beds and have completely deleted all our scheduled medical interventions. I have never experienced such a situation in 25 years. The situation is really serious*".

His administrative interlocutor reformulated his request as a transmission of information and did not respond to the ERT's opinion on the criticality of the situation. His response did not include any personal reaction to the description of the suffering and his tone remained neutral. He accounted for forms as management tools to be used in hospitals in generic terms:

"*Thank you for the information you transmitted earlier about heat strokes in Saint Joseph and Bichat hospitals. I relayed it internally. The InVS has just settled an emergency data collection process. Please find attached the forms that compose it. All these documents have been sent to hospitals. The person to contact is….*".

The ERT response unveiled statistics issues related to data collection:

"*Thanks for your message. We have sent messages everywhere. The problem with data is that they will not reflect indirect effects of hyperthermia (...). The situation is desperate here. The government or the DRASS should trigger the White Plan or an Emergency plan very quickly. As I made my promise to your colleague, could you please transfer information?*"

With no surprise the administrative interlocutor effectively transmitted the email but no discussion was developed on data collection. It is interesting to note the email response to the ERT who had alerted administrative actors to get resources:

"*Thank you for information. Beyond the current investigation we intend to lead a long term investigation on the total mortality – or even morbidity – that will take into account some specific pathologies, such as cardiac, vascular, and respiratory diseases. Our project has to be validated but we hope that an international comparison will be feasible*".

Hunting data led email users to hold on to a functional interpretation of the situation. It led them to elude some practical and logical issues. Furthermore centered communication prevented actors from discussing micro issues and from developing pell-mell interactions.

3.II.2.4. Protecting from hierarchical disapprobation

In relation to the dispassionate communicative genre, email media was an instrument to show transparency off. Basing their rationale on risk taking and the traceability of emails, actors used emails as a traceable proof of their responsiveness. However, the intention to enhance one's reactivity resulted in extensive forwarding but scarce discussion. To protect from disapprobation, email users forwarded their emails to their colleagues, counterparts and those who were likely to evaluate them. This finding is consistent with recent studies on the importance of status in electronic communication (Dabbish *et al.*, 2005) and the side effects of electronic communication (Courbon, Tajan, 1997).

In our view, email use illustrated the actors' intent to prevent criticism. Therefore they avoided to mention controversial content, which limited discursive exchanges about the widespread bricolage and improvisation practices. Similarly operational actors have been reluctant to use email since they improvised. However tracking interactions is technically permitted by email storage on server information traceability (Ramesh, 1998; Ramesh *et al.*, 2002). As highlighted by Car and Sheikh (2004):

"*The written record of email consultations enables close monitoring and evaluation of appropriateness and safety. Whereas face to face and telephone consultations are rarely recorded verbatim (typically being documented with only a few key words), email provides direct evidence of patient-doctor conversation*" (p.441).

Traceability is also enacted by email users (Boukef, 2005; Ducheneaut, Bellotti, 2001; Kalika *et al.*, 2007). As a conclusion, we posit that search for protection from potential hierarchical disapprobation led email users to avoid mentioning controversial aspects of the situations or specific issues. In addition they remained on a general stance and directed their messages towards status rather than persons. Figure 51 presents the effects of the fervent and the dispassionate communicative genre on organizational improvisation. In this figure, the arrows represent causal consequence relationships.
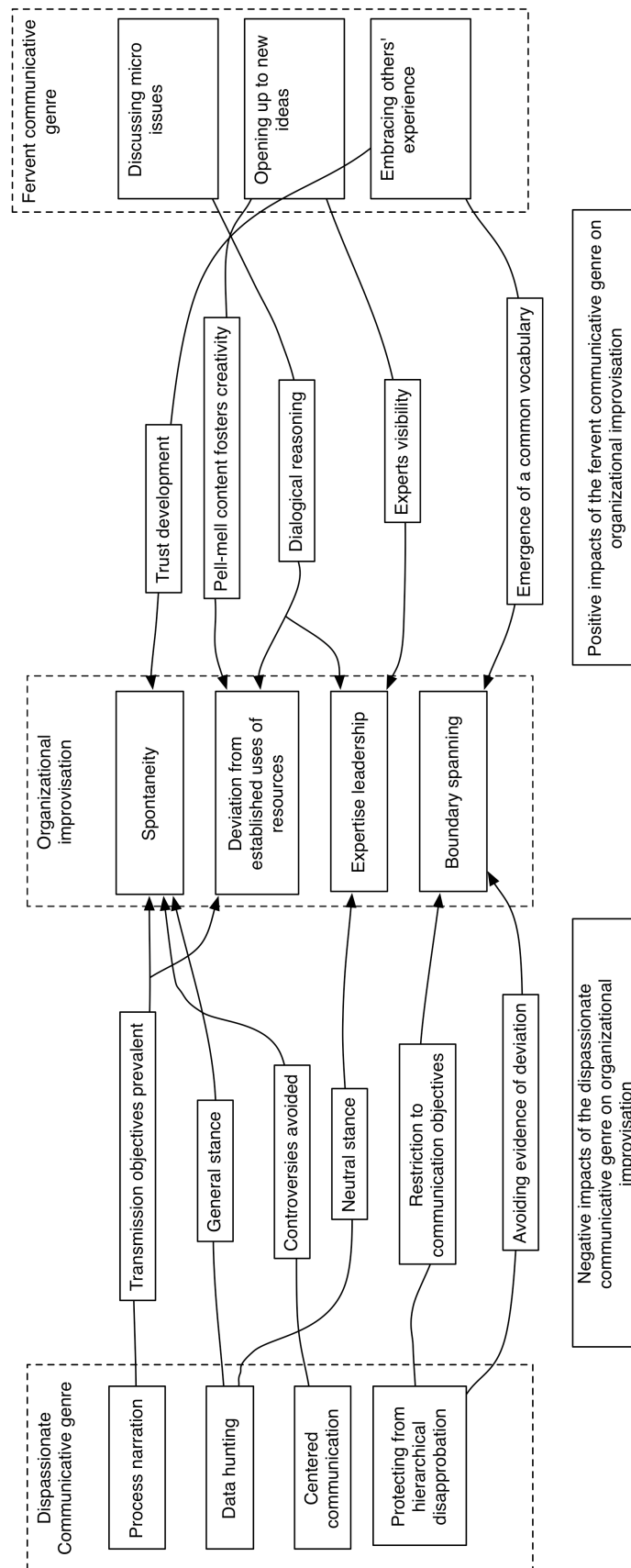
Figure 51. The fervent and dispassionate communicative genres and organizational improvisation

3.III. Moving from the *dispassionate* communicative genre

Some administrative actors participated in organizational improvisation during crisis response in diverse manners. Simultaneously these actors developed new communication practices and strategies in relation to fax use. More specifically, they personnally involved in messages by expressing their emotions and opinions. In addition, they expressed their empathy towards improvisers.

For instance, one of the AP-HP directors spontaneously sent a fax on the 8[th] of August to transmit guidelines to hospitals. These directions mentioned the need to alleviate the workload of emergency units, by sending back homes the patients whose health state was satisfactorily and canceling previously planned surgery operations. Given the similarities between these guidelines and the ones defined in the emergency plan called the "White Plan", the AP-HP directors unofficially enacted the White Plan in hospitals on the 8th. By enacting an emergency plan without asking permission to the prefectures or to the Health Ministry, the AP-HP directors deviated from the rules that health care and civil protection organizations usually abide by. The AP-HP co-director, who was the author of this fax, wrote a personal comment next to the guidelines. In this comment, he expressed his concern and his being aware that hospitals are facing problems:

"*The situation is very alarming. I insistently ask everyone to take all the necessary initiatives as soon as you get this message. I am aware that the situation is complicated*".

This fax message differed from the ones previously sent in that it does not correspond to the dispassionate communicative genre. Thi message is presented in Figure 52 in the Annex.

Similarly, the DHOS director sent a fax on the 12[th] of August to recommend that hospitals feel free to *"consider every opportunity to increase beds capacities, even by collaborating with funeral homes"*. In other words, the DHOS director gave permission to hospital directors to improvise ad hoc solutions to manage corpses.

The DHOS director spontaneously joined the following request to the hospitals' director in his message, radically diverging from the dispassionate communicative genre:

"*The medical teams as well as all the hospitals personnel have been assailed with requests. We are currently experiencing an extraordinary situation. In such conditions, the hospitals' personnel have been demonstrating the best of our values: professionalism, availability, solidarity. They are the pride of our hospitals and of our health care system. I ask you to transmit my congratulations and my thanks"*. This message is presented in Figure 53 in the Annex.

Our analysis of these two messages suggests that some administrative actors managed to participate into organizational improvisation. Thus, they used faxes to communicate and moved from the usual dispassionate communicative genre to interact with improvisers.

Section 4.   Discussion of findings

This paper addresses the need to understand what makes technology a potential obstacle to organizational improvisation. There is no doubt that ICT significantly helps resilience and reactivity in crisis response. However, crisis management authors provide enough evidence to question ICT support to crisis improvisation. In addition, the theories of fit require further investigating before applying to cases of crisis improvisation. Following the grounded theory method, we propose an integrative explanation of the influence of technology on crisis improvisation. As improvisation constitutes a response to organizational emptiness, there is the need to promote a "fervent" communicative genre. These are vivid exchanges that involve personal experience, emotions and objects. They are characterized by discussion on micro issues and dialogical reasoning. Our analysis unveils that the "dispassionate" communicative genres developed by the administrative actors of the crisis response network hindered such interactions. The way users appropriated emails and faxes prevented them from creating a space for the expression of emotions, disorders and creativity. However, some administrative actors managed to participate into improvisation. When they did, they gave permission and guidelines to improvise through faxes. To do so, they adapted their communication practices, moving from the dispassionate communicative genre to interact with improvisers. Table 44 compares ICT use, communicative genres and participation in organizational improvisation.

Table 44. ICT tools, communicative genre, participation in organizational improvisation

ICT tools	Communicative genre	Participation in organizational improvisation
Emails	Strictly dispassionate	None
Faxes	Dispassionate. However, fax senders embrace improvisers' experience and involve their opinions rather than staying neutral	They gave permission and guidelines to improvise
Phones, meetings	Fervent	Full

Our study reveals that ICT tools such as emails, phones and faxes had different influences on organizational improvisation during the 2003 French heat wave crisis response. We explain these differences by the fact that crisis responders developed diverse communicative genres that existed in relation to these tools.

However, the validity of our findings should be discussed. According to the grounded theory, evaluation is critical process (Wells, 1995). Corbin and Strauss enounce five criteria for evaluation of grounded theory studies (2008, p305-30) that refer to: i) the quality and the reliability of data, ii) the consistency of our research as a process, iii) the applicability of the research outputs.

First of all, we triangulated the three sources of data to grant a minimum of data reliability. To validate the consistency of our research process, we focused on the *quality of presentation of concepts*, *logic of reasoning* and relevant *contextualization* (Corbin, Strauss, 2008, p. 306). Iterative discussion with colleague, senior researchers and practitioners who were specialized in IS, organizational theories and health care management enabled us to meet these criteria. By applicability, Corbin and Strauss mean the usefulness of the findings and the extent to which they offer useful insights to participants and researchers (Strauss, Corbin, 2008). Our findings suggest some managerial recommendations in relation to email use that we discussed with practitioners, which supports a minimal level of applicability of the research outputs.

Finally, we assessed the reliability of our findings, as suggested by Gombault (2005, p. 51). We relied on triangulation and abduction to test the coherence of our theoretical framework (De Vaus, 2001). Finally, attaining theoretical and semantic saturation was a technique to grant the completeness of our findings.

Conclusion

Our study provides some additional insights on the conceptual ties between organizational improvisation and ICT use in crisis response. Crisis responders' participation in organizational improvisation can depend on their communicative genres. Based on empirical evidence, this study suggests the importance of interactions and communicative genres when crisis responders have to improvise. Our findings suggest that because of their ICT use, some departments and groups within an organization can stay away for improvisation in spite of having great the potential ability to facilitate improvisation.

This study addresses the relevance of applying the theories of fit to assess ICT support to crisis improvisation. By doing so, it calls for further investigation to enrich the theories of fit in crisis response.

Our findings are consistent with recent academic concern about organizations' reflexivity in relation to ICT use. The 2003 French heat wave illustrates the risk of transforming our means of communication as cold and formal channels, where unexpected news or data remain out of the frame. Likewise some authors stress that electronic communication mismanagement is likely to burden organization's processes (Isaac *et al.*, 2007; Kalika *et al.*, 2007; Tran, 2010).

This paper brings more insight on the organizational resources that are likely to influence improvisation. Other authors have stressed the importance of organizational resources in improvisation, such as organizational memory and information flow (Moorman, Miner, 1998a). However, additional investigation would allow clarifying the relationship between organizational memory and communicative genres.

To conclude, it is important to note that this study does not question the appropriateness of email in crisis response. Examples of efficient use of emails in crisis response are abundant in the literature (Jefferson, 2006a, b; Marincioni, 2007). Rather, we highlight the need to manage our means of communication to enable interactions when a crisis occurs. In

particular, we suggest the need to create virtual spaces that can play the role of garbage can where users feel free to provide new ideas. We expect this research to help managers to develop a better use of technology during improvisation. Interestingly enough, some improvisers managed to adapt their communicative genres around email and faxes. For instance, some of them wrote by hand messages on faxes. By doing so, they mentioned their own action, emotion or opinions and departed from the dispassionate communicative genre. By doing so, they made the content of the message suitable to crisis improvisation. For this reason, we practically recommend to managers to promote other communicative genres than the dispassionate genre in relation to a single media. We further detail managerial recommendations in chapter 4.2.

Annex

Figure 52. An AP-HP fax message

- faire le point avec vos services de réanimation afin de parvenir à maintenir, <u>au minimum</u>, voire à augmenter, les capacités d'accueil initialement prévues pour assurer la prise en charge des personnes âgées en médecine et des patients en réanimation.
- effectuer les retours à domicile ou les transferts des patients hospitalisés dans vos services dès que possible ;
- faciliter l'admission des patients aux urgences en reportant ou annulant des hospitalisations programmées ;
- ouvrir des lits de réanimation avec une activité orientée vers les soins continus pour la prise en charge des personnes âgées souffrant d'hyperthermie.

Je vous serais reconnaissant de bien vouloir me faire part des actions que vous aurez mises en œuvre au niveau de votre établissement et vous remercie, par avance, de votre précieuse collaboration.
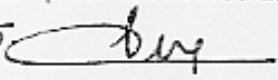
Dominique DEROUBAIX

Figure 53. An DHOS fax message

Par ailleurs, je vous invite à poursuivre les efforts déjà engagés, en vous assurant de moyens suffisants ou adaptés : dotation dans les services de soins, d'hébergement, et d'accueil, de stocks de bouteilles d'eau, de glaçons, de briques réfrigérantes, de ventilateurs, de brumisateurs ainsi que de stocks de linge.

Vous veillerez également, comme cela a déjà été fait, à maintenir une alimentation adaptée à la température.

Certaines structures alternatives à l'hospitalisation ou des établissements de santé de petite taille font appel aux pharmacies hospitalières pour obtenir des solutés massifs, du sérum physiologique, des tubulures de perfusion. Pour cette raison, je vous demande de bien vouloir ajuster vos stocks dans ce domaine afin de répondre aux demandes d'aide éventuelles.

Concernant les secteurs de personnes âgées (long séjour, maisons de retraite), il faut veiller à ce que la prévention de la déshydratation et de l'hyperthermie soient respectées selon les recommandations de la direction générale de la santé. Le personnel soignant doit être tout particulièrement sensibilisé aux différents aspects de prise en charge et surveillance spécifiques des résidents âgés : hydratation, hygiène du corps, tenue vestimentaire.

Par ailleurs, on a pu noter dans certaines régions une augmentation du nombre de décès dépassant parfois la capacité d'accueil des corps. Je vous recommande d'étudier toutes les possibilités permettant d'augmenter ces capacités lorsque cela est nécessaire, en étroite collaboration avec les collectivités locales et les sociétés de pompes funèbres.
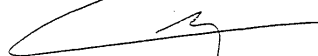
En outre, vous voudrez bien vous référer, lorsque cela est nécessaire, à ma note du 17/08/2003 relative à la prise en charge des surcoûts financiers générés par l'allongement des durées de dépôts des corps

[handwritten text:]

Les équipes soignantes, ainsi que tous les professionnels de l'hôpital ont été fortement sollicités. Ils ont montré dans ces circonstances exceptionnelles la réalité des valeurs de l'hôpital : compétence, disponibilité, solidarité. Ils sont l'honneur de l'hôpital et du service public hospitalier.

Je vous charge de leur transmettre mes félicitations et mes remerciements.

Le Directeur de l'Hospitalisation et de l'Organisation des Soins

Edouard COUTY

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Figure 54. An example of email internal archive

POMAREDE Renée

De: DESENCLOS Jean-Claude
Envoyé: vendredi 8 août 2003 11:39
À: LEDRANS Martine; ISNARD Hubert; SALINES Georges; IMBERNON Ellen
Cc: METTENDORFF Martial; POMAREDE Renée
Objet: TR : COMMUNIQUE DE PRESSE

Importance: Haute

CPchaleur.doc (35 Ko)

        Bonjour,

J'ai été appelé par Yves Coquin sur les problèmes des conséquences de la canicule sur la santé et notamment sur les décès. Bien que lui ayant indiqué que cela n'était pas infectieux il m'a demandé de relayer ce mel au niveau des départements compétents de l'InVS. Il nous demande donc de réfléchir à un système d'analyse rapide de la morbidité grave et des décès imputables à la chaleur.

-----Message d'origine-----
De : COQUIN, Yves [mailto:Yves.COQUIN@sante.gouv.fr]
Envoyé : vendredi 8 août 2003 11:20
À : DESENCLOS Jean-Claude; POMAREDE Renée
Objet : COMMUNIQUE DE PRESSE
Importance : Haute

La chaleur commence à poser de réels problèmes. Nous avons des remontées des DDASS, éparses mais alarmantes sur des cas de décès liés à la chaleur. Voici le projet de communiqué que nous devrions publier dans l'après-midi. Pouvez-vous réfléchir à la mise en place d'une surveillance de ces cas, ou d'un système de recueil avec analyse de cas sur certains sites ? Merci. Si vous avez des suggestions à faire sur le projet de communiqué, n'hésitez pas à me les signaler.

Bien à vous.

                        Y. C.

    <<CPchaleur.doc>>

Figure 55. Another example of email archives

De:	JCarlet@hopital-saint-joseph.org
Envoyé:	mercredi 13 août 2003 13:07
À:	LEDRANS Martine
Cc:	DESENCLOS Jean-Claude
Objet:	Réf. : RE : Réf. : TR : coupd'chaud

7 décès aux urgences tres directement liés à une hyperthermie maligne pour la journée d'hier à St Jo (430 lits). Un malade en rea (52 ans) qui va mourir probablement Le bilan national risque d'etre tres lourd, surtout quand on rajoutera les hyperthermies graves, non malignes, mais en bonne partie responsables de l'aggravation et du deces. Amitiés Jean Carlet

"LEDRANS Martine" <m.ledrans@invs.sante.fr> Pour : <JCarlet@hopital-saint-joseph.org>
cc : "DESENCLOS Jean-Claude" <jc.desenclos@invs.sante.fr>
Objet : RE : Réf. : TR : coupd'chaud
12/08/03 18:07

Merci des informations que vous nous avez données par l'intermédiaire de Jean Claude. Outre, l'enquête de mortalité hospitalière directement attribuable aux coups de chaleur, nous nous proposons à plus long terme de faire une étude sur la mortalité totale voire la morbidité tenant compte notamment les pathologies cardio vasculaires et respiratoires dont on sait qu'elles peuvent être amplifiées par la chaleur. Ses études nécessitent de plus longs délais dans leur réalisation car il faut notamment disposer de données de mortalité codifiées et validées par l'INSERM. Rien n'est encore stabilisé mais une fois les premiers éléments descriptifs de la situation recueillis, nous aurons du temps pour monter des protocoles qui pourraient être internationaux puisque d'autres pays sont touchés et pourraient être intéressés à l'instar de ce que nous réalisons sur pollution atmosphérique et santé. Je reste à votre disposition pour toute info complémentaire que je pourrai vous donner en l'état actuel. Merci encore. Recevez mes salutations distinguées

Summary of the Empirical part

The empirical part responds to the limitations of our second study. We address research questions III and IV in this part.

Chapter 3.1 presents the 2003 French heat wave crisis case from empirical and theoretical perspectives. In this chapter we present the organizations involved in the crisis response and a chronology.

Chapter 3.2 presents our research design of our third study. We follow a grounded theory method to retrospectively analyze the interactions that occurred during the 2003 French heat wave crisis response.

In chapter 3.3, we present the findings of our third study. The concepts of *organizational emptiness*, *fervent* communicative genre and *dispassionate* communicative genre emerged from our data coding. We suggest that organizational improvisation enabled the 2003 French heat wave response network to partly respond to the organizational emptiness that burdened crisis response. However, ICT support to the development of organizational improvisation depended on the communicative genres developed by the crisis responders.

Part 4. Conclusion part: Summary of findings & final discussion

The conclusion part summarizes the findings of each study, puts into perspective these findings and looks ahead for new research challenges. This part is composed of two chapters.

In **Chapter 4.1**, we present a summary of our findings and then detail the final findings of the dissertation.

In **chapter 4.2,** we discuss the contribution of our work. We first suggest some managerial recommendations in relation to ICT use for crisis improvisation. Then we present the theoretical implications of our work. Finally, we examine some limitations of our work and introduce new avenues for research.

Chapter 4.1. Dissertation summary

Introduction

In this chapter we propose a short summary of each of the three articles that compose the dissertation project. This chapter is structured into three sections: In Section 1, we make a quick recall of the dissertation structure and its research questions. Section 2 presents a summary of the findings of each article. Section 3 is structured into two parts. First, we discuss the connections between each article findings. On the basis of this discussion, we present the overall findings of the dissertation. We then provide a synthesis of our research questions and corresponding findings at the end of this chapter.

Section 1.   The dissertation structure and its research questions

The primary research question of the dissertation can be formulated as follows: *"What support does Information and Communication Technology (ICT) offer organizational improvisation during crisis response?"*

The management literature provides both pros and cons about technology support to crisis response. In addition, authors have paid scant attention to improvisation in crisis response, in spite of a developing body of knowledge (Mendonça *et al.*, 2010). As a result we know little about how crisis responders interact and coordinate during crisis improvisation. Answers to the question of whether technology supports crisis improvisation are even scarcer. Finally, managers lack guidelines to use ICT efficiently and to manage crisis improvisation.

Because technology use, improvisation and crisis are multidimensional concepts, the primary research question requires further specification. We clarify our understanding of the three key terms of the primary research question "ICT", "improvisation" and "crisis" in the introductory and theoretical parts of the dissertation (respectively Part 1 and Part 2). By doing so, we also segment our dissertation project into four questions that we address in three studies.

Even though a significant amount of definitions and conceptualizations of crisis are documented in the management literature, our work is based upon specific assumptions in relation to the concept of crisis. We approach crisis through the concept of organizational crisis. In addition we restrict our investigation of organizational crisis to the stages of crisis response and crisis coping. Finally, we focus our investigation on organizational crises provoked by disasters.

Improvisation is a polymorphous concept and has been studied in various settings. A large panel of cases of improvisation can be found in the management literature ranging from routine strategic decision making in theatre (Ford, 2008) to users' adaptations to newly implemented technologies (Brigham, Introna, 2006; Orlikowski, 1996; Orlikowski, Hofman, 1997). Furthermore, authors investigate improvisation from multiple standpoints: as an organizational paradox (Clegg *et al.*, 2002; Vera, Crossan, 2007), as an innovative response to unexpected events (Webb, 2004; Webb, F-R., 2006), or even as a collective capability (Vera,

Crossan, 2005). Researchers have experienced increasing difficulties in making sense of the diversity of academic work on improvisation.

From the analysis of the key terms of the primary research question, we deduce the four following research questions:

    I. How to cope with diversity in research on improvisation?

   II. What possibilities does ICT offer for organizational improvisation in crisis response?

  III. Does ICT fit users' needs with respect to organizational improvisation in crisis response?

  IV. How do users benefit (or not) from ICT when they improvise collectively in crisis response?

We address research question I in the first study. We performed factorial and cluster analyses on a sample of 105 articles to identify divergences among authors' approaches of improvisation.

We address research question II in another study. We analyzed a sample of 15 papers that deal with ICT use for improvisation in crisis response. To do so, we preliminary deduced from existing literature some theoretical propositions on the constituents of organizational improvisation in crisis response.

In a third study, we address both research questions III and IV in a qualitative and retrospective case study, our last paper project. In this study, we completed a grounded theory analysis of email, Internet, fax and phone use by crisis responders of the 2003 French heat wave.

Section 2.   Presentation of findings

In this section we summarize each of our findings that resulted from the three studies.

2.I. Coping with diversity in research on improvisation

The first study focuses on the research question entitled: *How to cope with diversity in research on improvisation?* In this work we propose that diversity stems from divergences between authors with respect to four tasks that compose the research process: i) Evidencing, ii) Focalizing, iii) Contextualizing, iv) Creating knowledge on improvisation. Within each task, the authors' divergences stem from the coexistence of two primary perspectives on improvisation. We list and detail these four tasks and eight perspectives in the following paragraphs.

First of all, authors employ distinct strategies to *evidence* improvisation. Some studies conceptualize improvisation by deductions from previously published definitions and findings. Conversely, other studies propose an original conceptualization of improvisation that they induce from empirical findings or abductively discuss.

Secondly, authors *focalize on* various aspects of improvisation. Some studies deal with collective improvisation in top management teams that design activities. Contrasting with this approach, other studies examine improvisation by individuals from multiple hierarchical layers.

Thirdly, we identify two perspectives in relation to the *contextualization* of improvisation. The former presents improvisation as a response to crisis while the latter suggests improvisation is a way of organizing that supports the development of new capabilities in routine or turbulent settings.

Finally, authors target divergent *knowledge creation* objectives. Some studies build on a unified body of knowledge on the very concept of improvisation. Some other studies aim to offer alternative views of improvisation, either by challenging existing conceptualizations of improvisation or by relating improvisation to other concepts in management.
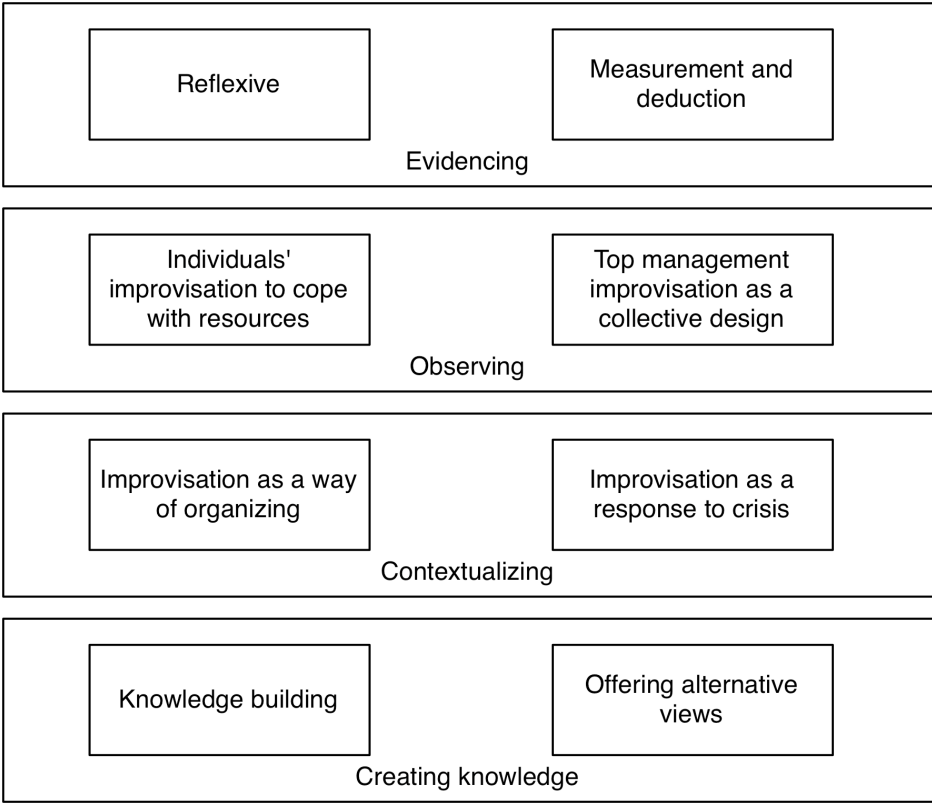

Figure 56. Eight primary perspectives on improvisation

2.II. ICT support to organizational improvisation in crisis response: a literature review and theoretical propositions

In this study, we aim to respond to the research question II, entitled: What possibilities does ICT offer for organizational improvisation in crisis response?

In the first part of this study, we rely on the dynamic capabilities approach to make some theoretical propositions on organizational improvisation. Thus we depict organizational improvisation as a collective process that involves spontaneous deviation from the established use of resources and requires specific interactions among actors who command these resources. Boundary spanning, expertise leadership and minimal structures regulate interactions that take place between crisis improvisers.

In the remainder of this study, we draw on our theoretical propositions on organizational improvisation to evidence the influence of some ICT properties on organizational improvisation in crisis response. First of all, the graphical representation of data during crisis response creates a unique reference that places shared information into a uniform format (Comfort, 1993), making of technology a boundary object. In addition, graphical representation enables fast interpretation and fosters, in our view, spontaneous generation of ideas or spontaneous adjustment. Secondly, modularity supports the deviation of established use of resources by enabling the fast implementation of ad hoc interface. Thirdly, the combination of centralization of data and calculation is a starting point for expertise leadership. Fourthly, combined virtuality and many-to-many communication supports both expertise leadership and deviations from established uses of resources. Fifthly, structured centralization of data enables actors to find information concerning others' past actions, therefore promoting boundary spanning interactions and the development of a common referential. Finally, boundary spanning practices between distant groups cannot exist without immediate and free information replication and exchange (Comfort, 1993). Virtuality also helps to keep shared information consistent in time, thanks to information feedback. Therefore, minimal structures can be initiated and managed by experts (Yuan, Detlor, 2005). In Figure 57, the arrows represent the positive effect of ICT properties on the constituents of organizational improvisation in crisis response.
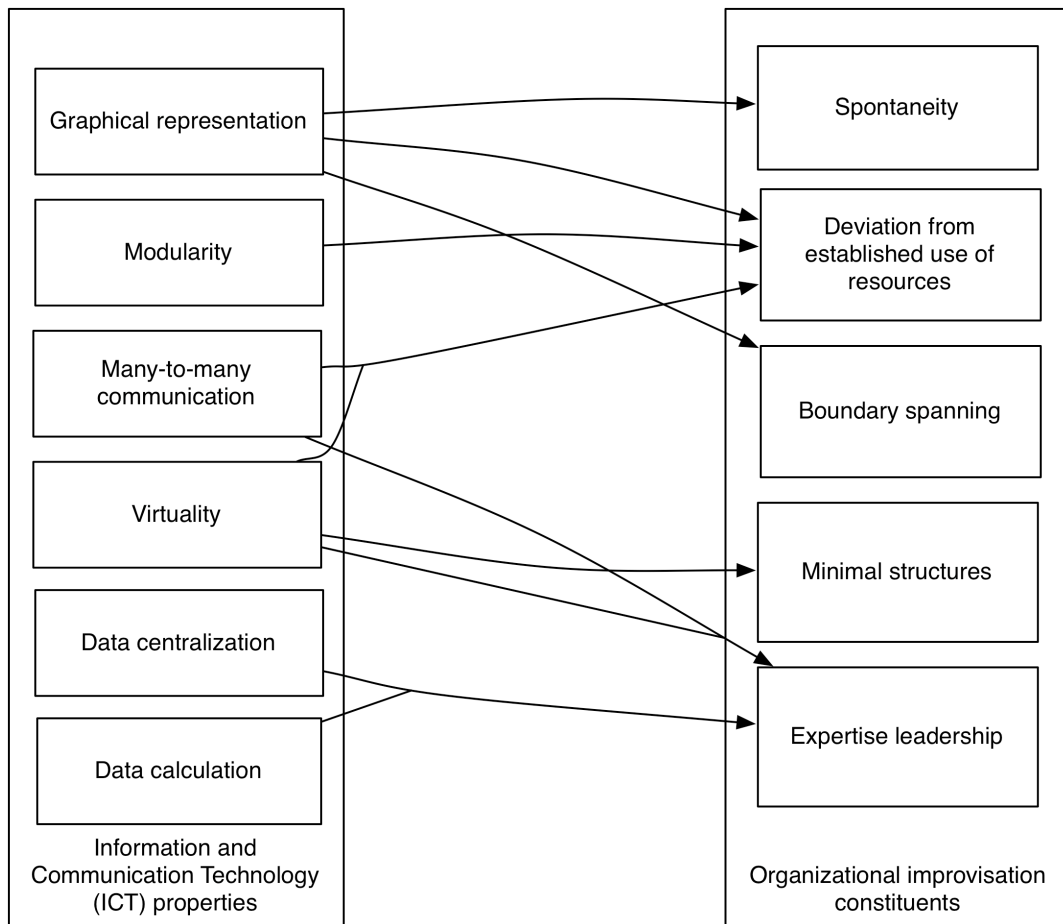
Figure 57. ICT properties and crisis organizational improvisation constituents

2.III. ICT, communicative genres, organizational improvisation and emptiness during the 2003 French heat wave crisis response

The third study responds to the limitations of our theoretical work by taking into account ICT user's contingency.

Our first objective in the empirical part of the dissertation is to respond to research question III entitled: *Does ICT fit users' needs with respect to organizational improvisation during crisis response?* To respond to this research question, we assess whether the ICT services that support interaction between improvisers are adequate. Our point is that the existing theoretical background on ICT requires conceptual enrichment to provide appropriate responses to research question III. The reasons that account for the theories of fit not being adequate to understand whether technology fits to crisis responders' needs are threefold. First of all, the theories of fit do not provide enough description of the task characteristics to distinguish crisis improvisation from other type of tasks. For instance, crisis response in the context of natural disasters involves numerous individuals from diverse organizations. Similarly, the theories of fit overlook some aspects of crisis response that are likely to affect ICT use, such as emotional pressure. Secondly, improvisation is, in it's essence, unpredictable. As a result, researchers cannot evaluate the tasks that will be improvised by advance. Therefore, as a

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deterministic theoretical background, the theories of fit cannot be directly applied to the specific case of improvisation. Finally, the theories of fit make a distinction between the technology characteristics construct and the task construct. However, crisis improvisers can improvise on ICT. For instance, crisis responders can adapt to the technological tools they have at hand, even though these tools are not adequate. Due to the lack of "fit" of the theories of fit to the specific case of organizational improvisation during crisis response, we have led an in-depth investigation of the interactions of crisis improvisers, thereby addressing research question IV, entitled: *How do users benefit (or not) from ICT when they improvise collectively in crisis response?*

In this part of the empirical study, we investigate the ICT tools that were used during the 2003 French heat wave crisis for interaction, e.g. email, phone, Internet and faxes. We include in our inquiry mobile phones because mobile devices are commonly used for coordination in medical settings (Ammenwerth *et al.*, 2000). During the 2003 French heat wave crisis, organizational improvisation took place but did not develop to the highest scale, e.g. the whole response network. While some field actors improvised together by using phones, most administrative actors failed to participate in improvisation despite extensive interaction through emails. Seemingly, improvisers did not benefit from ICT. They either had a low use of emails when improvising collectively, or they hardly improvised while using emails and faxes. Following the grounded theory method, we propose an integrative explanation of the influence of technology on crisis improvisation during the 2003 French heat wave. Our analysis reveals that improvisation constitutes a response to organizational emptiness that can burden crisis response. However, crisis responders' participation in organizational improvisation depended on their communicative genres. The *fervent* communicative genre is characterized by high emotionality, vivid discussion on micro issues and dialogical reasoning. This genre supports organizational improvisation. On the contrary, the administrative actors developed another communicative genre around electronic communication that hindered organizational improvisation within the network. This communicative genre, that we label *dispassionate*, prevented crisis responders from creating a space for the expression of emotions, disorders and creativity. Table 45 presents a synthesis of the findings from our three studies.

Table 45. Article projects: needs and findings

Study title	Needs & objectives	Findings
1. Coping with diversity in research on improvisation	1) Providing a classification theme to compare existing studies on improvisation 2) A clarified view of this existing perspectives on improvisation	Diversity stems from divergences between authors with respect to four tasks within the research process: i) Methods to evidence improvisation ii) Aspects of improvisation under observation iii) Improvisation contextualization iv) Knowledge creation on improvisation
2. ICT, crisis and organizational improvisation: Some theoretical propositions and a literature review	1) Proposing an explanation of how collective improvisation works 2) Investigating the role that ICTs play in improvisation during crisis response.	1) 5 organizational mechanisms compose organizational improvisation in crisis response. Among these organizational mechanism, 3 mechanisms regulate interactions within organizational improvisation. 2) 6 ICT properties promote organizational improvisation by supporting each of the 6 constituents of organizational improvisation in crisis response.
3. ICT, communicative genres, organizational improvisation and emptiness during the 2003 French heat wave crisis response	1) Understanding why the 2003 French heat wave crisis responders did not use ICT for interactions when they improvised 2) Determining whether technological tools under use fitted improvisers' needs during the 2003 French heat wave (FHW) 3) Understanding the influence of ICT use on coordination in crisis improvisation during the 2003 FHW	1) Directly applying existing theories of fit does not provide a clear view of ICT fit to crisis improvisers' needs. 2) The dispassionate communicative genre impeded organizational improvisation during the 2003 French heat wave 3) On the contrary, the fervent communicative genre supported the development of organizational improvisation

Section 3.   *Connections between findings*

In this section, we detail the logical connections between the three studies. We conclude the chapter by presenting the overall model that emerged from our work.

3.I. Our approach to improvisation

The dissertation project proposes a comprehensive investigation on ICT support to crisis improvisation. To do so, we first attempt to make sense of the diversity in research on improvisation. We rely on our analysis of the management literature on improvisation to detail our approach of improvisation in the dissertation project, represented in Figure 58.
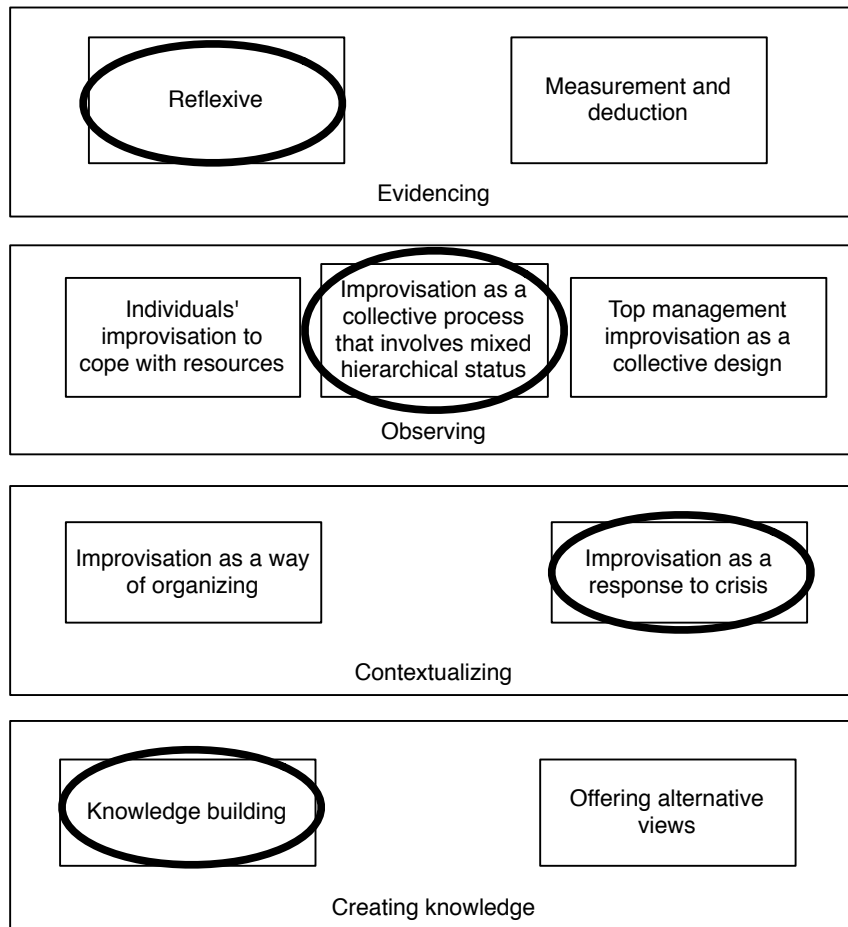
Figure 58. Our approach to improvisation

Our *evidencing* of improvisation follows the reflexive approach. In chapter 2.3 we discuss existing conceptualizations and their limitations to identify the need to identify the role played by interactions in organizational improvisation during crisis response. We then make theoretical propositions that we deductively draw from existing literature. We then complete an in-depth qualitative analysis of improvisation.

With respect to *focalizing*, we diverge from the two main perspectives on improvisation by focusing on improvisation as a collective phenomenon between mixed hierarchical layers.

We *contextualize* improvisation as a response to critical events.

With respect to *knowledge creation*, we primarily attempt to offer additional insights on interactions that compose organizational improvisation and ICT use. Our objective is not to provide additional insights to the existing theoretical body by offering an alternative view of organizational improvisation.

3.II. ICT: Three complementary levels of analysis

In the second study, we examine ICT properties at large and examine ICT generic properties. From this perspective we primarily approach ICT as an set of functionalities that are socially recognized (Orlikowski, Iacono, 2001)

The empirical part of the dissertation brings more focus on the role played by technology in organizations. To do so, we evaluate the technological fit to crisis improvisation. We restrict this part of our investigation to the "interacting" technological function that enables interactions to respond to the specific needs of crisis responders. We then analyze the influence of ICTs on crisis improvisation from a practice-based perspective. To do so, we examine both offline and online interactions of crisis responders. In this part of the dissertation, we focus on email, faxes and phone use.

Each of these perspectives offers a complementary view of technology. The first perspective provides some insights on the common effects of technology on improvisation. Our approach of ICTs is general because our findings result from the use of a common analysis grid to various descriptions of specific cases of crisis responses. However, this study calls for further understanding individual and organizational variables that are likely to influence technological support to organizational improvisation, which calls for the two other perspectives that we adopt in the empirical part of the dissertation.

By investigating ICT and crisis from two different levels of analysis, we offer empirical evidence that the technological tools can have distinct effects on crisis improvisation. Obviously, emails, phones and faxes had distinct effects on organizational improvisation during the 2003 French heat wave. While phones were extensively used between improvisers, email use was associated with scarce improvisation. Furthermore, when improvisers involved other responders into the ongoing improvisation, they were unsuccessful when they contacted them by email or faxes. However new communication practices around faxes emerged during the crisis response, which suggests that crisis responders can adapt their use of ICT tools during crisis improvisation.
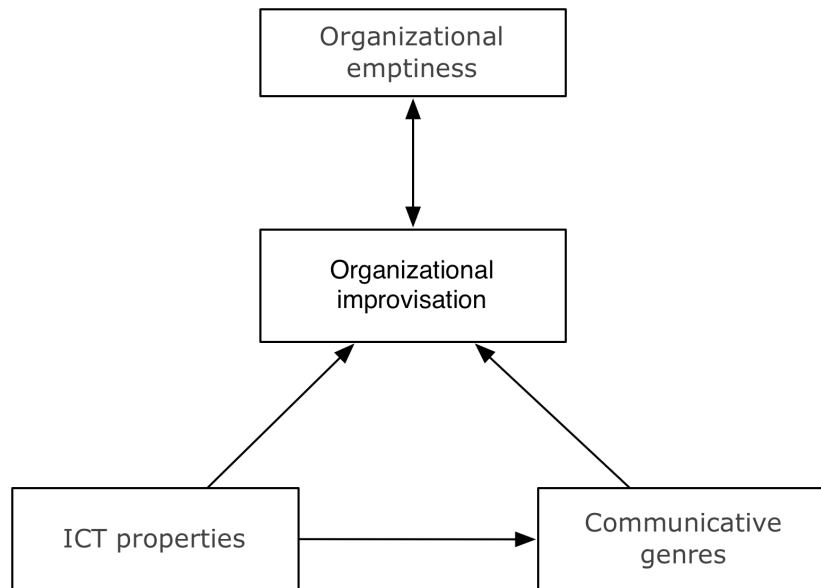
Figure 59. The final model

3.III. Final findings

In this section, we put into perspective theoretical and empirical findings.

Even though some ICT properties have a positive impact on the occurrence of organizational improvisation constituents in crisis response, the effect of technology on organizational improvisation growth is impacted by the communicative genres that have developed within the responding organizations. As our empirical findings suggest, the 2003 French heat wave crisis responders had developed what we label a "dispassionate" communicate genre around emails. On the basis of our empirical findings, we discuss our theoretical propositions on ICT properties' influence on crisis improvisation. We consequently refine our findings on ICT support to crisis organizational improvisation. We suggest that communicative genres develop on both ICT properties and organizational and professional values. Thus communicative genres mediate the effect of ICT on organizational improvisation in crisis response. We develop this point in the following paragraphs.

First of all, communicative practices can distort the benefit of data calculation for crisis improvisers over time. Data calculation refers to the possibility to treat a significant mass of data to support decision making. Data calculation compels users to collect and transmit data and figures. Our analysis of the 2003 French heat wave suggests the importance of figures in the dispassionate communicative genre. As the administrative actors primarily exchanged figures through electronic communication, the expression of their personal emotions and opinions was depreciated in comparison with objective, measurable thus legitimate data. Even though measures are critical to enact emergency procedures, they are not the only type of reliable data. The administrative actors developed the common belief that figures were the most legitimate data to transmit. As a result, figures became a predominant content within electronic and email users developed data hunting practices.

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Secondly, virtuality promotes pioneering new communicative channels but can impede the fast-evolution of existing communicative genres. Virtuality refers to the manipulation of data and information as immaterial inputs. Thus ICT users can easily copy, cut or retrieve information. Combined with modularity, virtuality promotes the quick settling of new communication channels and minimal structures to regulate communication. For example, Google Maps was spontaneously used to exchange information about damaged locations and victims in a harmonized format. However, virtuality implies that individuals are likely to develop rigidities in relation to ICT use. Contrasting with material media, e.g. that does not allow data copy and retrieving without manipulating objects; virtuality prevents ICT users from altering or coupling data with inputs that emerge on material content. On the contrary, material media offer the opportunity to leave traces that are not necessarily sorted or ranged with transmitted data, such as Post Its, written notes or manuscript comments on printed reports. As a result, material media allows crisis responders to use other types of data than the ones previously used. Virtuality can impede the adaptation of communicative genres when users need a routine ICT tool, at the expense of the development of organizational improvisation.

Thirdly, virtuality and many-to-many communication can result in their users developing strategies to protect themselves from superiors and colleagues' criticism. Forwarding an email to collaborators only requires a few clicks, which makes it easy to report one's activity to colleagues and superiors, thereby mitigating the risk of being criticized for information retention. In the summer of 2003, the heat wave crisis responders developed these strategies to show off their own transparency through email use. However, the dispassionate communicative genre influenced the crisis responders to the point that showing off one's transparency became the predominant objective in electronic communication. In addition, the dispassionate communicative genre prevented crisis responders to discuss their emotions and personal opinions.

What we call *narration process* can develop from data centralization. Data centralization offers the possibility of easily retrieving past communication and supports organizational improvisation by enabling crisis responders to jump on the bandwagon. Not only considered to be an opportunity, data centralization can also be perceived as a threat. In the case of the 2003 French heat wave, the administrative actors had assimilated data centralization as a risk of being caught for not respecting rules and procedures. To protect themselves from this risk they primarily reported the tasks they completed in emails, limiting opportunities to discuss ideas about what needed to be done.

Finally, our empirical investigation does not provide evidence of side effects from the dispassionate communicative genre on modularity and graphical representation as ICT properties. In Figure 60, some of the theoretical and empirical findings are represented and connected by bold arrows. In this figure, the thin arrows correspond to the development of the dispassionate communicative genre over the ICT properties that are likely to support organizational improvisation in crisis response.
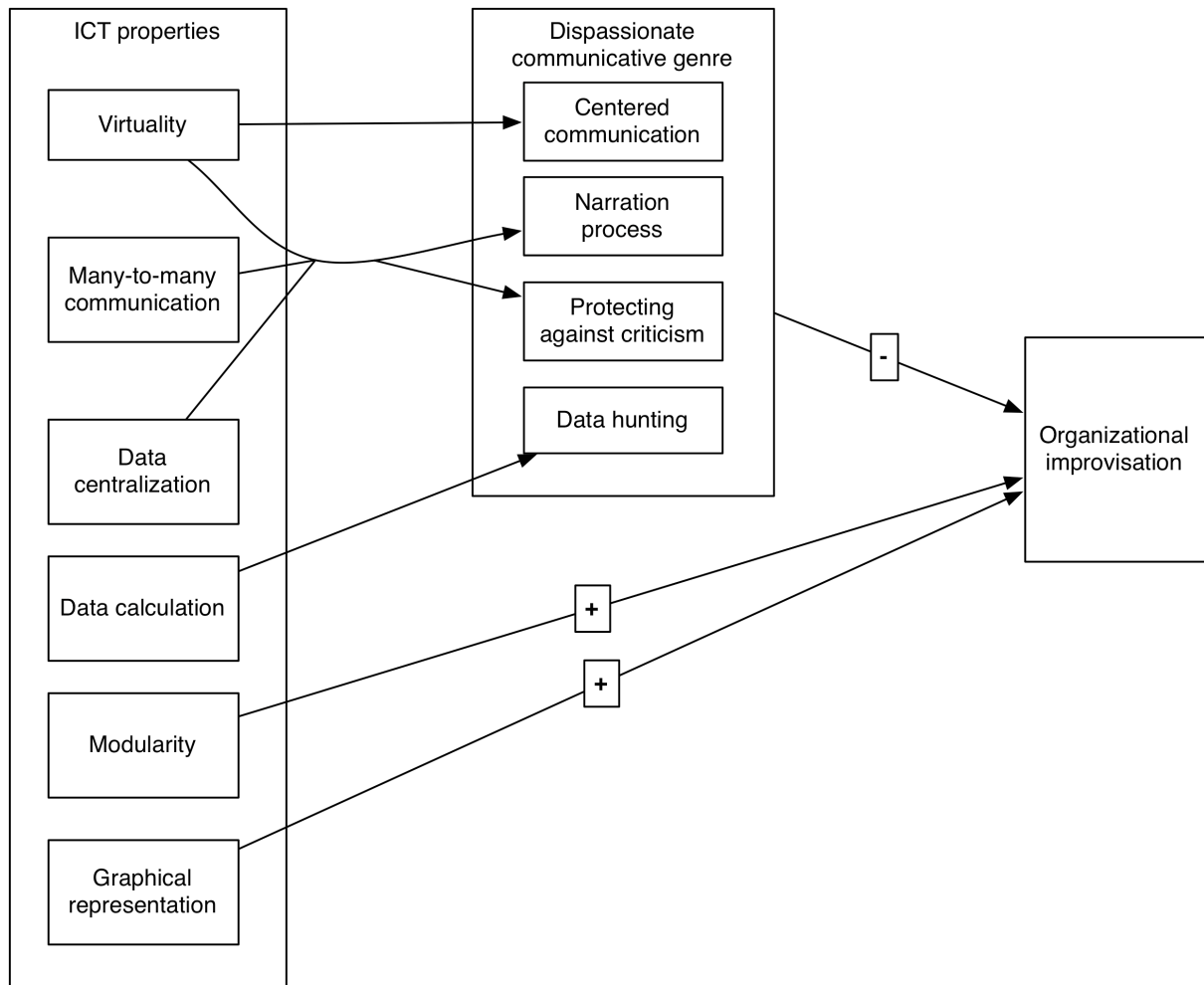
Figure 60. ICT properties and communicative genre effects on organizational improvisation in crisis response

Conclusion

To conclude, the overall model of the dissertation presents a nuanced view of technology support to organizational improvisation in crisis response. ICT properties offer the possibility for crisis responders to improvise collectively. Additionally, ICT users develop communicative genres on the basis of their professional and organizational values. Our empirical investigation suggested that the 2003 French heat wave crisis responders perceived electronic communication as a source of risk. As a result, email use was associated with the objective of enhancing transparency by reporting completed or ongoing processes. Similarly, data calculation morphed into data hunting practices. Such communication practices had a significant influence on improvisation. Finally, crisis responders hardly moved from the dispassionate communicative genre, which is consistent with theories on rigidity threats (Staw *et al.*, 1981).

To conclude, ICT properties are not only features of the technology artifact. They represent opportunities in terms of coordination and control over organizational processes. Over their

technical features, ICT properties have an organizational dimension as well. Our findings are consistent with existing academic work on users' enactement of technology (DeSanctis, Poole, 1994; Orlikowski, 2000; Robey, Sahay, 1996). Table 46 presents an overview of the dissertation research questions and findings.

Table 46. The dissertation research questions and findings

Research question	Findings
1. How to cope with diversity in research on improvisation?	Diversity originates from divergences between authors with respect to four tasks that compose the research process on improvisation: evidencing, recognizing, Contextualizing and creating knowledge on improvisation. We recommend that researchers: 1) Identify their perspectives on improvisation with respect to these four tasks. 2) Identify the similarities between their approach and others authors' approach of improvisation to detect opportunities to discuss their findings with similar research
2. What possibilities does ICT offer for interaction during organizational improvisation in crisis response?	We identify 5 constituents of organizational improvisation We identify 6 ICT properties that support organizational improvisation. However the impact of the ICT properties is mediated by the development of communicative genres on these properties and organizational structure and culture.
3. Does ICT fit users' needs with respect to interaction during crisis improvisation?	Given that crisis response involves numerous individuals and diverse organizations, communication tools are likely not to fit to all crisis responders. However, the theories of fit are not applicable to the specific case of crisis improvisation without conceptual enrichment.
4. How do users benefit (or not) from ICT when they interact to improvise collectively in crisis response?	Our empirical findings suggest that the predominance of the dispassionate communicative genre among email & fax users prevented them from participating in crisis improvisation. Conversely the fervent communicative genre, developed around phone and face-to-face interactions, supported organizational improvisation during the 2003 FHW. Crisis improvisers' benefit from ICT depends on their communicative genres.

Chapter 4.2 Conclusion

Introduction

In the dissertation project we attempt to shed light on ICT support to organizational improvisation in crisis response. The relevance of our work is a core point of our discussion, all the more as we embrace pragmatist principles. According to Lyytinen (1999b), the relevance is *"about what the researcher sees as practice and what elements are relevant in understanding and changing practice"*(p. 25), which makes it important to reflect what is relevant for manager's practice. For this reason, we strain to respond to the managerial needs and the theoretical challenges. For more detail on these points, please refer to chapter 1.1. Section 1 discusses our managerial and theoretical contribution. In section 2 we identify some limitations of our work and propose some directions for future research to respond to these limitations.

Section 1.   Managerial contribution

Our study confirms that improvisation consists of a potentially relevant collective practice to cope with crises. For this reason, we suggest guidelines for managers to recognize and support ongoing improvisation in crisis response. However, it is important for managers not to idealize improvisation as a magical solution to crisis response. Even though we overlook the side effects of improvisation in this work, improvisation can be a disturbing experience for both victims and crisis responders. During the 2003 heat wave, improvisation enabled actors to find solutions to hydrate and care for many of those affected and ultimately save lives. Undoubtedly, improvisation promoted a more efficient crisis response. At the same time, administrative actors who improvised went under a lot of criticism from the public when they used food vans to stock dead bodies, even though improvisation was eventually perceived as necessary and even applauded.

1.I. Improvisation management

We recommend that managers and workers become more familiar with improvisation. This statement is consistent with previous academic work that calls for a better understanding and recognition of improvisation by managers (Barrett, 1998; Ciborra, 1996a; Ciborra *et al.*, 1999; Vera, Crossan, 2005, 2007). Some authors recommended the development of a trial-and-error approach to problem solving (Eisenhardt, Tabrizi, 1995). Other authors rely on theatre and music improvisation as means to develop personal improvisational capabilities (Shaw, Stacey, 2006). We expand on these recommendations by suggesting that managers and workers can learn to identify episodes of improvisation. With respect to crisis improvisation, we suggest that workers can use analysis grids to understand their own improvisation. Figure 61 provides a fictional example of an analysis grid of improvisation that we developed from our findings and that we label "Organizational improvisation roadmap". This figure represents a form that was completed by a nurse who had to improvise an ad hoc solution to respond to the power failure of a building air conditioner in the midst of

a hot summer. We suggest that workers fill the improvisational roadmap forms in the aftermaths of crisis response and have the option to meet other improvising colleagues to share their thoughts on their roadmaps. By doing so, they can enrich a repertory of possible improvisation, thus realizing that improvisation is a part of their daily practices and a support to the emergence of new capabilities, as we suggest in chapter 2.3. In addition, such a collective reflection on improvisation can help managers to promote improvisation within organizations.

Jessica 's improvisation roadmap N° **14**   Date **08/23/05**

Recent events   Air Conditioner power failure

Resources involved in improvisation: Ice, ventilator, masks

What did you do? If you need, you can frame the improvisation scene
[Deviation from established use of resources]

We put ice in the masks & hung them on the
window handle in front of the ventilator

Where did you get the idea? [Evidence of spontaneity]

Don't remember

Did someone provided directions to do that? [Evidence of expertise
leadership]

My boss had the idea of hanging the masks
on the window

Did you improvise alone or with some help? Were your colleagues
helpful? How? [Evidence of interactions]

My boss asked our colleagues to
do the same

Did you work with other improvisers? How? [Evidence of minimal
structures]

We needed plates when ice started to
melt down. We called the kitchen

Did you discuss with them? [Evidence of dialogic reasoning]

With my boss

Additional comments: Need for plates
+ Need to have the beds next
to the window. Not convenient at all!!!

Figure 61. A fictional example of improvisation roadmap

1.II.ICT and communicative genres

Our investigation provides some evidence that ICT investments are worthwhile to support organizational improvisation. However, managers have to handle potential threats to an efficient use of ICT tools when improvisation is needed. More specifically they have to address the potential side effects of user's appropriation of the ICT properties. For instance, they have to prevent email users from overlooking other type of information than measurable data. More generally, they have to detect whether communicative genres burden organizational improvisation and to promote the development of an improvisation friendly communicative genre. Previous academic work provides analysis grids as means to identify communicative genres (Orlikowski, Yates, 1994; Yates, Orlikowski, 2002)

Our empirical investigation suggests that professional and organizational values play an important role in the development of communicative genres. For instance, showing evidencing that one's actions abide by the rules and the procedures is a well-known cultural specificity in the French health care organizations (Morgan, Krone, 2001). There is no surprise then that actors developed a dispassionate communicative genre whose objective is to provide evidence of rules being applied. However, it is important to provide a more nuanced picture of the dispassionate communicative genre: we believe that the dispassionate communicative genre does not have only negative effects on crisis improvisation. Accordingly, we recommend that managers try to support diversity within communicative genres. Our suggestions focus on the management of communicative genres related to ICT use.

First of all we propose that organizations create virtual spaces devoted to informal and discursive interactions. For instance, a specific space on the Intranet can be opened to every organizational member for brainstorming, polls, open discussion on controversial topics and informal sharing about professional experiences. We recommend that managers grant that this space is free of control and arbitrary moderation thanks to an implicit contract or explicit chart with users. Reciprocally, users should engage of using it in a constructive manner, thereby avoiding the mentioning of rumors or vilification. In our view, this virtual space is a possible starting point to promote the fervent communicative genre via electronic communication. However, our suggestion implies security issues. It contradicts Turoff and his colleagues' recommendations (Turoff *et al*., 2004) to rigorously define the users' rights in relation electronic communication. For this reason, we suggest that the use of a virtual space remain secondary to primarily used communication media. By their existence, free virtual spaces can reassure users that they can interact in a fervent genre.

Secondly, we suggest that the use of diverse media for communication is valuable in crisis response. Our investigation suggests that users adapted their communicative genre more or less easily, depending on the media used. If we take a further look at faxes and email use during the 2003 French heat wave, we can find that crisis responders adapted their communicative genres to a more fervent genre by writing on faxes. When mortuary chambers became filled with bodies, administrative directors at the head of the health care national an

regional organizations decided to rent food vans to stock the corpses. They used faxes to communicate directions to hospitals directors on how to transfer dead bodies to food vans they had rented. At that time, they adjusted their manner of expression by writing additional comments by hand on fax letters. Our suggestion contradicts Jennex's recommendation to restrict communication to a unique and secure media (2008). We do agree that communicating through several media can imply the risk of dispersion, misunderstandings, and information overload (Hiltz, Turoff, 1985; Jennex, 2008; Turoff *et al*., 2004). However, the use of multiple media reduces the odds that improvisation will be blocked by communicative genres in crisis response.

As a conclusion to this section, Table 47 presents the managerial needs that we address in this study. For a more complete description of the managerial needs related to our research project please refer to chapter 1.1

Table 47.Managerial needs addressed in the dissertation

Key Issue	Managerial needs	Response
Crises become more and more frequent (Section 1)	The need to multiply potential techniques and resources to face them (Perrow, 2006):	Improvisation is a potentially relevant technique to face crisis. However, it requires care management because improvisation does not necessarily develop to the highest level, depending on crisis responders' communication practices
Technology is a crucial means for coordination in crisis response but is also likely to burden crisis response or at least reduce organizational resilience (Section 2)	The need to evaluate the relevance of technological investment to prepare for crisis response	Technological investments are relevant but their efficiency depends on user's practices primarily.
	The need to develop practices to properly manage ICT and avoid technological pitfalls during crisis response	Manage free virtual spaces to promote alternative communicative genres Use two or three communication media in crisis response
Managers remain skeptical about it and theory develops slowly (Section 3).	Managers need some concrete guidelines about what improvisation is or is not, how to figure and manage it	Crisis responders and managers can use improvisation roadmaps to identify organizational improvisation.
There is no evidence of improvisation being beneficial to crisis response (Section 4).	Managers are reluctant to mindfully monitor improvisation in crisis response.	Improvisation potentially enables important resources leveraging and innovative response to crisis response
ICT support to improvisation is not established. (Section 5)	Managers need good practices to manage tensions between improvisation requirements and ICT infrastructure.	Managers can promote: 1) the development of a fervent communicative genre 2) the adaptability of existing communicative genres

Section 2. Theoretical Contribution

Our theoretical contribution comprises the following points that are presented in three studies:

- Providing an integrative view of the sources of diversity with respect to the concept of improvisation (chapter 2.2)

-	Proposing a definition of organizational improvisation. In particular, we address the lack of knowledge on organizational improvisation by clarifying the role of interactions in this process (chapter 2.3).

-	Suggesting some technology characteristics that could support organizational improvisation in crisis response (chapter 2.3).

-	Understanding ICT use practices and their effects on organizational improvisation during the 2003 French heat wave crisis (chapter 3.3).

-	Providing further insights on the interactive dimension of crisis improvisation by suggesting that communicative genre can leverage or inhibit improvisation during crisis response. By doing so, we hope to provide new insights on technology use in crisis response, which has been an overlooked theme in the MIS field so far (chapter 3.3) As a conclusion to this section, Table 48 presents the theoretical challenges that we address in this work.

Table 48. Theoretical challenges addressed in the dissertation

Key Issue	Theoretical challenges	Responses
Crises become more and more frequent (Section 1)	The need to develop our knowledge on some unexplored aspects of crisis response such as improvisation.	We made a theoretical proposition on crisis organizational improvisation
Technology is likely to burden crisis response or at least reduce organizational resilience (Section 2)	The need to report what makes ICT become an obstacle to crisis response	Our findings suggest that technology is not an obstacle to improvisation but that communication practices that involve ICT tools can hamper organizational improvisation
Managers remain skeptical about it and theory develops slowly (Section 3).	There is the challenge to some inner contradictions to the concept of improvisation. There is the need to develop an integrative view of interactions that occur during organizational improvisation	We make some theoretical propositions on the constituents of organizational improvisation in chapter 2.3.

There is no evidence of improvisation being beneficial to crisis response (Section 4).	There is little explanation of the occurrence of improvisation in critical settings	Our preliminary analysis of the management literature on improvisation suggests that improvisation can endogenously develop over time and/or be triggered by an exogenous event such as in crisis response. Our empirical findings suggest that organizational improvisation development depends on communicative genres.
ICT support to improvisation is not established. (Section 5 + Section 6)	Understanding how people use ICT when they improvise How does ICT use affect improvisation? The need to better understand the nature of ICT use during organizational improvisation	We provide an integrative explanation of organizational improvisation and ICT use during crisis response

Section 3.   Limitations and avenues for future research

3.I. Improvisation

This work only provides limited insights on improvisation. We propose here three possible avenues for further investigation of this topic.

First, additional observation is required on the specificity of improvisation. On one hand, our empirical investigation evidences improvisation as a federating process over organizations. On the other, many authors highlight that improvisation is a situated performance, deeply influenced by local cultural values (Aram, Walochik, 1996; Ciborra, Willcocks, 2006). Further investigation is therefore required to clarify the role of organizational and professional values in the occurrence and development of organizational improvisation. This suggestion brings us back to one of the directions for research that we propose in chapter 2.2 and introduce as the following question: *Does the concept of improvisation refer to a unique phenomenon or a diversity of phenomena?* A possible direction for research could be to adopt an ethnographic design to investigate the different cultural or professional contexts in which improvisation occurs, such as NPD or electronic commerce.

Second, further reflection is required to distinguish effective improvisation from ineffective improvisation. In the previous section, we recommend that managers promote improvisation within their organizations. To promote improvisation, managers have to anticipate the possible side effects of collateral damages due to failed improvisation. However,

organizations lack guidelines to recognize and handle failing improvisation. Further investigation is necessary to find cases of failed improvisation and to identify possible consequences of ineffective improvisation. What is a failed improvisation? What is a successful improvisation?

The third avenue of research related to improvisation addresses the effect of organizational improvisation on organizational structures and culture. We have evidenced some of the constituents of organizational improvisation but we fall short of details on the implications of improvisation on organizational functioning.

3.II. Communicative genres

In this dissertation, we explore the effect of communicative genres on crisis response and crisis improvisation. However, further understanding of the role played by communicative genres in organizations is needed. Our empirical investigation focuses on the effect of communicative genres on organizational improvisation. It identifies two communicative genres that developed around several types of media. During the 2003 French heat wave, the fervent communicative genre supported organizational improvisation. On the contrary, the dispassionate communicative genre led crisis responders to avoid mentioning emotions and opinions in their emails and faxes, even if emotions and opinions were important ingredients of improvisation. Our findings depict the potential negative effect of the dispassionate communicative genre on improvisation. However, one can easily find some positive effects of the dispassionate communicative genre. In particular, the dispassionate communicative genre can help crisis responders to keep distance with their own emotions during crisis response. Even though emotions can leverage personal involvement in crisis response, they are likely to disturb crisis responders, alter their judgment or even hinder their focus in decision-making. Some managers even make desperate decision making under the effect of panic (Starbuck *et al.*, 1978). In addition, keeping crisis responders focused on a specific topic, the dispassionate communicative genre can prevent crisis responders from getting lost in information overload and help them to prioritize. Thus we can formulate various hypotheses in relation to the combination of dispassionate and fervent communicative genres in organizations. We could hypothesize that too much of the fervent communicative genre can impede organizational improvisation (cases A, B and C on Figure 62). An alternate hypothesis could be that a certain amount of fervent interactions are required to support organizational improvisation (case C on Figure 62). Further investigation is required to clarify the effect of the combination of multiple communicative genres on crisis improvisation.
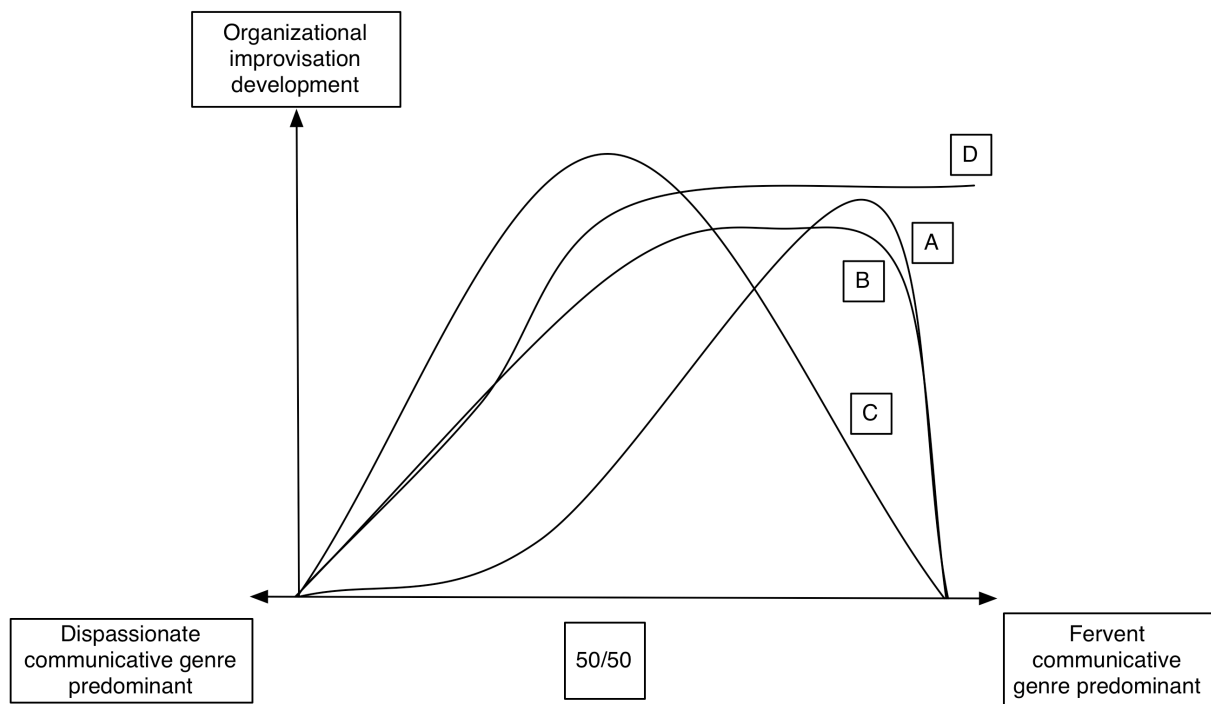
Figure 62. Proportion of fervent and dispassionate communicative genres

3.III. Findings generalizability

The generalizability of our findings can be questioned. At first glance, our findings may not be relevant for improvisation in general. Indeed, our analysis is contextualized and idiographic (Mason *et al.*, 1997). Moreover, it concerns organizations from health care professions and is retrospective. In that sense, one could argue that it provides too little material to enable companies to handle future challenges. As we explain in the empirical part of the dissertation, the response network included a diverse panel of organizations, ranging from hospitals to administration and private companies. Thus our results are not restricted to a specific type of process or organization.

With respect to the retrospective dimension of our work, we agree with Marrou (1954) that knowledge about our past is a major component of our knowledge about our present. Knowing what people did in the past is useful to avoid mistakes in the coming years (Prost, 1996). In addition, we rely on grounded theory process of abstraction to develop extemporal findings, such as the concept of organizational emptiness. In that sense, we view our findings valuable for the present and future of companies. However, the issue of generalizability remains in that there is no warrantee that we can generalize our results to other types of crises than natural disasters provoked by natural hazards. Further investigation on other cases of crisis improvisation would permit comparative approaches to generalize our findings.

3.IV. Improvisation and dynamic capabilities

Fourthly, the conceptual connections between improvisation and dynamic capabilities remain vague. We draw inspiration from the dynamic capabilities approach to make theoretical

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propositions on organizational improvisation (for more detail, see chapter 2.3). Some studies provided empirical support to our theoretical propositions on improvisation (Adrot, Garreau, 2010), suggesting that the dynamic capabilities approach is relevant for a further understanding of organizational improvisation as a collective process.

The dynamic capabilities approach represents one of the prominent theories in strategic management and does not originally deal with crisis response. Dynamic capabilities enable organizations to develop new capabilities in a short delay to maintain a competitive advantage, which has little in common with an organization's effort to survive and face a disruptive unexpected event. As suggested by Wang and Ahmed's definition, dynamic capabilities can be conceptualized as an organizations' *"behavioral orientation constantly to integrate, reconfigure, renew and recreate its resources and capabilities, and most importantly, upgrade and reconstruct its core capabilities in response to the changing environments to attain and sustain competitive advantage"* (Wang, Ahmed, 2007).

However, we argue that the ongoing academic work on routine and dynamic capabilities provides valuable insights on organizational improvisation during crisis response. Consider the ad hoc solutions that emerge from a local improvisation. When improvisation grows organizational, these ad hoc solutions are discussed, repeated and integrated within the organization. In addition, crisis improvisers develop new coordination paths to collectively implement these solutions. For example, during the 2003 French heat wave, some administrative actors adapted their use of faxes to transmit directions in relation to the improvised transfer of corpses. Similarly, hospitals developed new rules to manage the flow of patients. In our view, collective adaptation to implement improvisation outputs corresponds to Zollo and Winter's findings on dynamic capabilities (2002). Further investigation is required to clarify the conceptual ties between improvisation and dynamic capabilities. More specifically, future research could address the two following questions: Is improvisation a dynamic capability? Do dynamic capabilities support crisis improvisation?

3.V. Organizational emptiness

Fifthly, the concept of organizational emptiness emerged from our analysis of empirical data. As we explain in chapter 3.3, numerous authors refer to organizational emptiness more or less explicitly. Research regularly mentions lack, gaps, needs and even the notion of organizational holes, blanks. Clarifying the conceptual ties between organizational emptiness and these concepts is necessary.

Finally, we suggest that organizational emptiness represents an opportunity for improvisation in chapter 3.3. However, we lack knowledge on the role that organizational emptiness play in organizational functioning. In particular, further research could address the following question: *Is emptiness a good thing or a bad thing for organizations?*

Summary of the Conclusion part

The conclusion part provides an overview of the findings of the three studies. In addition, it presents our final findings and their implications.

Chapter 4.1 summarizes each study findings. It then put into perspective the theoretical and empirical findings. By doing so, it proposes our final findings and the final model of the dissertation.

Chapter 4.2 goes further in reflection. We first discuss whether how work responds to the managerial and theoretical challenges that we present in chapter 1.1. We then present our managerial recommendations and the theoretical contribution of our work. Finally, we address the main limitations of our work by suggesting additional directions for future research.

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