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Céline Pieters. The words of robotics : a rhetorical approach. Automatic. INSA de Toulouse; Université libre de Bruxelles, 2020. English. NNT : 2020ISAT0026 . tel-03383805v2

HAL Id: tel-03383805

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THÈSE



En vue de l'obtention du

DOCTORAT DE L'UNIVERSITÉ FÉDÉRALE TOULOUSE MIDI-PYRÉNÉES

Délivré par :

*l'Institut National des Sciences Appliquées de Toulouse (INSA de Toulouse)
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The Words of Robotics: a Rhetorical Approach

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Acknowledgments

Contents

1	Rhetoric and Robotics	5
1.1	On the field of robotics	5
1.1.1	What is a <i>robot</i> ?	5
1.1.2	Through the history of moving machines	6
1.2	The technique of rhetoric	12
1.2.1	<i>Techne</i>	12
1.2.2	The analogy between rhetoric and mechanics	13
1.2.3	Why ancient rhetoric and robotics?	16
2	Movement, Perception and Language	17
2.1	Cognitive approach	18
2.1.1	Language and money	18
2.1.2	A glimpse on the role of movement in humans' perception of robots	18
2.1.3	Traces in natural language	21
2.2	Linguistic approach	25
2.2.1	<i>Telling</i> the world	25
2.2.2	An overview of the influence of language on cognition	26
2.2.3	The problem of ineffability, or <i>How movement resists linguistic coding</i>	27
2.2.4	The function of <i>enargeia</i> , or <i>How actions are made visible through language</i>	33
2.3	Discussion on Movement, Perception and Language	35
3	Lexical ambiguity resolution in robotics	37
3.1	Lexical ambiguity resolution	38
3.1.1	Lexical access during sentence comprehension (David Swinney, 1979)	38
3.1.2	Lexical ambiguity in the context of robotics	39
3.2	Robotics' wording	41
3.2.1	Robot dispositions: a series of <i>confused notions</i>	41
3.2.2	Robot actions : a sample of symbolic language (like in poetry)	42
3.2.3	Discussion on robot dispositions and actions, regarding lexical ambiguity resolution	47
3.3	Dealing with symbolic language and <i>confused notions</i>	48
3.3.1	Various common strategies	48
3.3.2	Among the rhetorical apparatus	52
3.3.3	<i>So what?</i>	53

4	Beyond the words: Rhetoric and Folk Epistemology	55
4.1	Rhetorical styles and Folk Epistemology	56
4.1.1	The notion of <i>style</i> and the field of <i>folk epistemology</i>	56
4.1.2	At one extreme of the spectrum: <i>sensationalism</i>	57
4.1.3	At the other extreme: <i>neutrality</i>	58
4.1.4	Consequences for robotics	60
4.2	Experimental rhetoric at the <i>Cité des Sciences et de l'Industrie</i> (Paris, France)	61
4.2.1	A gathering of roboticists and reporters	61
4.2.2	Conduct of the experiment	62
4.2.3	Conception	63
4.2.4	Results	65
5	Conclusion and Perspectives	75
5.1	Conclusion	75
5.2	Perspectives	79
5.2.1	Through the eyes of the roboticists	79
5.2.2	<i>Ekphrasis</i> of moving machines: the case of the robot Cheetah (MIT)	80
A	Profiles of the fictional candidates (exercice of <i>suasoria</i>)	83
A.1	Candidate 1: François Musia	83
A.2	Candidate 2: Juliette Langlois	84
A.3	Candidate 3: Patrick Schrurk	85
A.4	Candidate 4: Marise Kudo	86
B	Productions: 3min speeches (exercice of <i>suasoria</i>)	89
B.1	Group 1: defendants of François Musia	89
B.2	Group 2: defendants of Juliette Langlois	91
B.3	Group 3: defendants of Patrick Schrurk	92
B.4	Group 4: defendants of Marise Kudo	93
B.5	Additional comments	94
	Bibliography	97

List of Figures

1.1	The rotation of the wheel is transformed into a translation (and vice versa).	6
1.2	The water clocks were based on flows. The problem of the earliest versions was that the flow was irregular (the lower is the water level in the first container, the slower the flow of water is in the second container).	7
1.3	Ctesibius' solution for controlling the diminishing flow consisted in adding a third container between the two existing. Using a float regulator system, the water clock of Ctesibius required no outside intervention between the feedback and the controls of the mechanism.	8
1.4	Transmission of rotation from one circle to another.	13
1.5	The temple gates designed by Heron of Alexandria would open when a fire was lit on the altar, and close as the fire was extinguished [Lloyd 2013].	15
2.1	The <i>football players</i> designed by Rémy Brun for the <i>Fête des Lumières 2016</i> in Lyon, France (see [Brun 2018], fetedeslumieres.lyon.fr).	19
2.2	Luxo Jr., the lamp of Pixar Animation Studios originally created by John Lasseter in 1986 [Buckley 2011].	19
2.3	According to the experiment of Heider and Simmel, the movements of the geometric figures trigger mentalistic descriptions.	21
2.4	Example of an attempt to translate Laban's notation <i>for</i> robots [Salaris 2016]	31
2.5	The company <i>Knightscope</i> commented the event on Twitter with a touch of humour, using a prosopoeia.	34
3.1	The graph of Swinney's results' shows that both "spy" or "ant" were primed at the same short time: as part of recognizing the word, multiple meanings are retrieved, even in conditions where there is a strongly biasing semantic context. At a slightly longer time (3 syllables), the contextually inappropriate meaning (in this case, "spy") is discarded [Swinney 2010].	39
3.2	The robot HRP-2 (LAAS-CNRS Toulouse, 2018).	43
4.1	Representation of the bond between rhetoric and one's conception of rationality.	57
4.2	General description of the three rhetorical proofs in the case of <i>sensationalist</i> discourses.	58
4.3	General description of the three rhetorical proofs in the case of (so-called) <i>neutral</i> discourses.	59

4.4	Extra-technical proofs (data, pieces of evidences,...) are used and incorporated within discourses and are, in this sense, also built through the technique of rhetoric.	60
4.5	Poster of the exhibition “Robots” at the <i>Cité des Sciences et de l’Industrie</i> of Paris (2019)	61
4.6	Presentation handout of the experiment: the profiles of the 4 candidates to be defended, see Appendix A.	63
5.1	Representation of the robot Cheetah (MIT) on <i>rhetoricra2019.ulb.be</i>	80

Introduction

Every new discovery in science and technology leads to use terms and expressions that form the basis of humans' representations. In the fields of robotics and artificial intelligence, the words are borrowed from the vocabulary of the living: the robots are *intelligent, autonomous, moral,...* the robots *decide, learn, look, know, want, think, feel*, etc. Does it mean that contemporary robots are of a different nature than previous moving machines? Or is it only a way of talking? What do we actually mean by to be "intelligent", "autonomous", etc.? Supported by the LAAS-CNRS Toulouse and the ERC Grant Actanthrope, this research does not intend to answer those questions as it proposes instead to seize the problematics of the language of robotics through a rhetorical approach. Indeed, rather than engaging in a search for accurate definitions, a rhetorical study means to adopt a pragmatic point of view on the issue: starting from the observation of actual linguistic uses, we intend to focus and analyze *-what we do when we talk about robots-*. Neither more nor less important or interesting, our choice to discard the idea of capturing the meaning of those words and concepts, is motivated by the will to formulate the problem according to an alternative perspective: what does the lexicon used to talk about robots tell us about the way that we, humans, perceive moving machines? How do humans read robotics? Why do we use those words and not others? Could we find alternatives if we wanted to? How do the discourses about robotics impact the status of the discipline?

Moreover, to study the problematics of the language in robotics through a rhetorical approach means to struck the hornet's nest of one's relation to rationality. Indeed, observing how the *logos* (language, arguments), the *ethos* (personality) and the *pathos* (the emotions sparked within an audience) are built within a discourse, means also to observe the spontaneous ideas and tacit principles that one has about language and knowledge (i.e. one's folkepistemology). That being said, if we must be careful to not simplify the bond between language and thought (indeed, the way we talk does not necessarily or directly reflects the way we think), our discourses produce however always some persuasive effects: the way we talk always impacts the way we will be judged, seen, understood, etc. Such remark is especially important as it highlights the main interest of this research: to better understand how humans perceive and *tell* robotics from their own stance. More precisely, we aim to highlight the perception and representations of the ones who build, program and think the contemporary moving machines, namely the roboticists.

Thesis organization

In the first chapter of this manuscript, we introduce the two main disciplines that are associated within this research. We firstly consider the field of robotics through one of its major feature: motion. Then, we present the discipline of rhetoric in its technical dimension. We also establish the analogy between ancient rhetoric and mechanics before we outline the reasons of the association of classical rhetoric and contemporary robotics.

With the context set, we move on to **Chapter 2** where we focus on the bond between motion and the natural language used to describe robots. Indeed, in order to better understand the role of natural language in the way that humans perceive robots, we take a cognitive and a linguistic approach of the problematics. Following those considerations, the problem of ambiguity in language appears as an important concern in robotics.

In **Chapter 3**, we examine closely the nature of the lexicon used to talk about robots and expose various strategies in use to handle a lexicon of such nature. We observe the limits of those strategies before we explore the rhetorical apparatus for alternative solutions. That being said, we note that the problematics of the language in robotics should be considered beyond the words.

Indeed, in **Chapter 4**, we show that the problematics of the discourses about robotics cannot be reduced to *logos*: they also and inevitably rely on *ethos* and *pathos*. Hence, the question of the discourses in and about robotics is not limited to a problem of communication between experts and non-experts but relates to a deeper layer that addresses one's own conception of rationality. We expose that a *rhetorical style* always embodies implicit ideas and principles about language and knowledge (i.e. one's folkepistemology). We argue that this deeper layer has an impact on the status of robotics as a discipline in the public sphere. Following this observation, we present a rhetorical experiment that we organized at the *Cité des Sciences et de l'Industrie* of Paris. This experiment, based on the exercise of the *suasoria*, aimed to investigate the common criteria on which humans usually base their judgement and interpretation when it comes to discourses about robotics.

Finally, in **the last chapter** dedicated to a general conclusion and to perspectives, we review and discuss the main contributions of this thesis and propose further promising research. More precisely, we expose an ancient and practical rhetorical tool (the exercise of the *ekphrasis*) which is known to trigger mental images and for revealing a subjective and specific perception of a described object. In this way, we suggest a path to explore and capture the specific stance of roboticists towards moving machines: what do roboticists pay attention to when facing robots, and what could we learn from their own perception?

Contributions

Co-edited book

- C. Pieters, J.-P. Laumond, E. Danblon (2019). *Wording Robotics. Discourses and Representations on Robotics*. Springer Tracts in Advanced Robotics (STAR), Vol. 130.

Articles

- C. Pieters (2020). *Ancient rhetoric and robotics*. Accepted for publication in *Gestures and Artefacts: Diachronic Perspectives on Embodiment and Technology*. Springer. The Philosophy of Engineering and Technology book series.
- C. Pieters, E. Danblon, J.-P. Laumond (2020). *Roboticists and Reporters. A rhetorical experiment at the Cité des Sciences et de l'Industrie (Paris, France)*. Accepted for publication in *IEEE Robotics and Automation Magazine*.
- C. Pieters, E. Danblon, J.-P. Laumond (2019). *Beyond the conflict between "Touch" and "Feel" in robotics*, In *Wording Robotics. Discourses and Representations on Robotics*. Springer Tracts in Advanced Robotics (STAR), Vol. 130.

Conference papers

- C. Pieters, E. Danblon, J.-P. Laumond (2018). *How do humans read robotics? A matter of lexical ambiguity resolution*. IROS 2018, IEEE.
- C. Pieters, E. Danblon, J.-P. Laumond (2018). *Rhetorical issues in robotics*. ISSA 2018, 9th International Society for the Study of Argumentation.

Co-organization of workshops

- C. Pieters, E. Danblon, J.-P. Laumond (2019). Workshop "*Rhetoric and Robotics. An experiment to shape the values of the discipline of robotics*". IEEE/ International Conference on Robotics and Automation (ICRA 2019), 23rd of May 2019, Montreal, Canada.
- C. Pieters, E. Danblon, J.-P. Laumond (2018). Workshop "*Robotics and Media*". Cité des Sciences et de l'Industrie, 5th of April 2019, Paris, France.
- C. Pieters, E. Danblon, J.-P. Laumond (2017). Workshop "*Wording Robotics*". The 4th Workshop of Anthropomorphic Motion Factory, 30rd of November-1st of December 2017, LAAS-CNRS Toulouse, France.

Rhetoric and Robotics

Contents

1.1	On the field of robotics	5
1.1.1	What is a <i>robot</i> ?	5
1.1.2	Through the history of moving machines	6
1.2	The technique of rhetoric	12
1.2.1	<i>Techne</i>	12
1.2.2	The analogy between rhetoric and mechanics	13
1.2.3	Why ancient rhetoric and robotics?	16

How do humans talk about robotics? How do the discourses about robotics impact the status of the discipline? To answer such questions, we conduct an interdisciplinary research that combines the discipline of rhetoric and robotics, as well as the domains of linguistics and cognitive sciences. The originality of our research rises firstly from this approach that consists in using ancient rhetoric as a technique in order to shed light on discourses about robots. In this first chapter, we review some historical perspectives on both robotics and rhetoric. We also highlight the motivations of the rapprochement between the two disciplines in the context of this research.

1.1 On the field of robotics

1.1.1 What is a *robot*?

The definition of ‘robot’ itself is a matter for discussion among experts in robotics. Hence, if robotics is often introduced as one discipline, the large number of problematics and methods used in this field of research reflects a wide disparity of points of view within the community of roboticists. This heterogeneity is notably illustrated through the various oral histories of roboticists that have been collected by the IEEE Robotics and Automation Society between 2010 and 2014 [Sabanovic 2015]. In the context of this thesis, we will refer to robots as physical moving machines. We thus consider that the tasks performed by robots in the physical space are executed through movements of locomotion, manipulation, interaction,... Regardless the scientific approach or the methods, the problematics of movement is indeed at the core of the research in robotics; if motion is a characteristic of the living (it

distinguishes a stone from a plant or an animal), movement differentiates also the machine from the tool [Laumond 2020]. Henceforth, the development of the discipline of robotics is intimately bond to the understanding and the control of motion. In the following sections, we review such evolution from the mechanical machines and their repetitive movements, to the information and computer-based technology able to generate adaptive movements.

1.1.2 Through the history of moving machines

• Rotation and translation

The history of robotics begins into the late Neolithic with the invention of the wheel. Used for pottery or transport, the wheel is considered to be the first significant technical work in the history of mankind. The innovation lies in the placement of a circular block of hard material on an axle that transforms the rotation into a translation (and vice versa). The energy is transmitted from humans or beast (see Fig. 5.1). When placed on the horizontal axle, the wheel makes possible to transport heavy loads; when placed horizontally, the wheel turning on its vertical axle makes it possible to control the spinning motion used to shape materials. The oldest wheel found today is a wooden wheel of 70cm of diameter that was discovered in 2002 in Slovenia by a team of archaeologists from the Ljubljana Institute of Archaeology [Gasser 2003]. The device was dated with radiocarbon from 3340-3030 BCE by the VERA laboratory of Vienna.

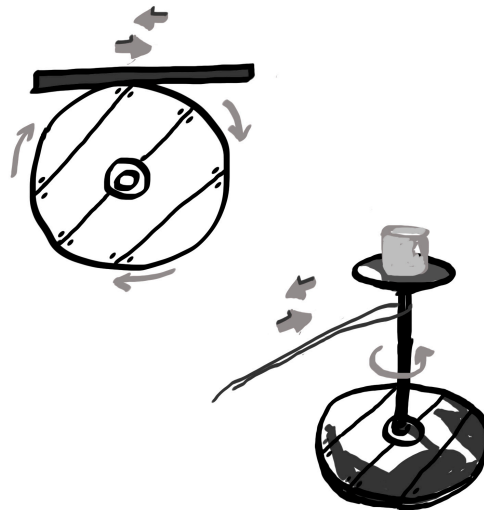


Figure 1.1: The rotation of the wheel is transformed into a translation (and vice versa).

- Regulation

Later on, the first mechanical water clocks (called "clepsydra") were invented in Ancient Egypt. The oldest known water clock was discovered in Karnak in 1904 and is dated from between 1415-1380 BCE, during the reign of Amenhotep III (1390-1352 BCE). The water clocks were based on flows (water, sand, tension of the spring) or on the consumption of a substance (oil lamps, candles) (see Fig.1.2). In both Greek and Roman times, the clepsydra were used notably in courts for allocating periods of time to speakers. In important cases such as when a person's life was at stake, it was filled completely. However, for more minor cases, the water clock was filled only partially. If proceedings were interrupted for any reason, such as to examine documents, the hole in the clepsydra was stopped with wax until the speaker was able to resume his pleading [Mayr 1970].

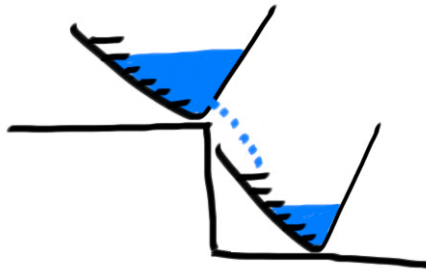


Figure 1.2: The water clocks were based on flows. The problem of the earliest versions was that the flow was irregular (the lower is the water level in the first container, the slower the flow of water is in the second container).

The Greek Ctesibius (285–222 BCE) considerably advanced the water clocks system by controlling the diminishing flow. Thanks to the addition of a third container between the two existing, the flow was made constant and therefore, the water clocks were made more reliable (see Fig. 1.3). Also, Ctesibius used a float regulator mechanism that is considered as the earliest feedback system (see also Fig. 1.3).

In China, a polymath of the Song Dynasty (960–1279 CE) is known as the designer of the biggest astronomical clock tower with hydraulic power, using watch escapement¹. Su Song was one of the most significant Chinese scientists of the time and his treaty on the clock tower *Xiangfayao Xinyin* traveled the ages since its writing in 1092 (and publication in 1094) [Needham 1986].

¹Watch escapement gives impulses to the timekeeping element and periodically releases the gear train to move forward, advancing the clock's hands.

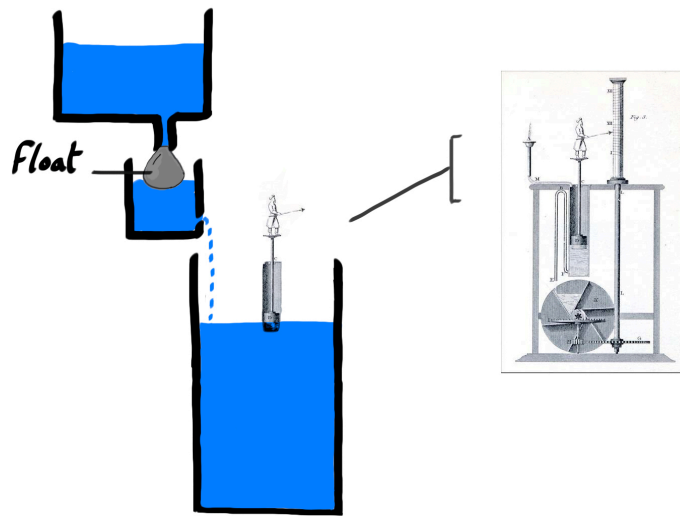


Figure 1.3: Ctesibius' solution for controlling the diminishing flow consisted in adding a third container between the two existing. Using a float regulator system, the water clock of Ctesibius required no outside intervention between the feedback and the controls of the mechanism.

● Movement, energy and the notion of force

In Classical Antiquity, many techniques were developed for military and agriculture purposes, as well as other important inventions today recognized as major contributions to the technical knowledge. For instance, the flying pigeon of Archytas (428–347 BCE) was able to fly thanks to compressed air. It is the first autonomous flying machine of Antiquity to highlight the principles of aerodynamics. Such invention is also noticeable as it marks the clear difference between a tool and a machine: while both take advantage of natural forces (such as gravity), the tools are put in movement through the energy given by humans and animals where the machines use also artificial driving forces (such as steam or compressed air).

The mathematician and engineer Heron from Alexandria (1st Century BE) wrote a dozen of books describing everything that the Greeks knew about technology. In his most famous work *Pneumatica*, he presents theoretical considerations on fluid pressure and describes many mechanical moving machines (statues of drinking animals, various moving objects, trumpets that could sound without human intervention, etc.). In *Automata*, Heron also details a collection of automatic rotating objects and automatic opening and closing doors. These temple gates would indeed open when a fire was lit and would close when the fire was extinguished [Lloyd 2013]. Among the contemporaries of Heron, many considered his writings as a simple manual without great interest. However, if his unfamiliar machines had no practical uses (but to amaze, intrigue or amuse the public), they all embodied

concrete applications of mathematical, physical and geometric principles. Heron himself used these automatons in order to illustrate scientific principles in his classrooms. Like that, thanks to these impressive moving machines, the foundations of automatics were laid: the mechanisms were acting according to their internal structure, the action relied upon a natural (e. g. gravity) or an artificial driving force (e. g. steam or compressed air), and the machines were mobile independently.

That being said, no less important technical achievements were made in other parts of the world. The *Book of Knowledge of Mechanical Processes* of Al-Djazari (1206) is one of the prime examples. The artist, mechanical engineer, mathematician and astronomer Al-Djazari came from a regio today situated in South-East Turkey, and is considered as one of the main figures in the history of techniques. The book describes notably a musical automaton consisting in a boat with four automatic musicians floating on a lake, in order to entertain the guests at royal celebrations [Al-Jazari 1974].

Now, missing many other discoveries, our interest in movement generation brings us straight to the 17th century. The Dutch inventor, mathematician, physician and astronomer, Christiaan Huygens, is a major figure in this aspect as he is largely recognized for his understanding of the laws of motion, impact and gravitation. He was the first one to derive the now standard formula for the centripetal force in 1659 (*De vi Centrifuga* [Huygens 1929]), long before the formulation of the laws of dynamics by Isaac Newton, and before the clear definition of the general notion of force. His theorems were published in 1673 as an appendix to his *Horologium oscillatorium* in which he described the formula of the rigorous isochronism: if the tip of the pendulum travels through a cycloid arc, the oscillation period is constant regardless of the amplitude [Huygens 1986].

● Automaton: motion and the living

Long after the automatons of Al-Jazari, the golden age of machines imitating the living came with the 18th Century. This period produced indeed a wide variety of automatons with repetitive movements, like the famous Digesting Duck of Vaucanson that had the ability to eat kernels of grain, and after a little pause, could relieve itself of an authentic-looking burden. The food was collected in one inner container, and the pre-stored feces were then released from a second. Jacques Vaucanson insisted on the fact that he wanted to show, not just a machine, but a process. While he hoped that a truly digesting automaton could one day be designed, he also specifies that the shown process was only a partial imitation. He wrote: “I don’t pretend to give this as a perfect Digestion. . . I hope nobody would be so unkind as to upbraid me with pretending to any such Thing” [Riskin 2003].

● Machines with adaptive movement (motion regulation)

Yet, passing on many other examples of automatons of the 18th and the 19th centuries (such as the Mechanical Turk, a chess-playing machine (1770) by Wolfgang

von Kempelen made to impress the Empress Maria Theresa of Austria, or the talking machine Euphonia of the German inventor Joseph Faber (1845)), the development of techniques were not only a matter of amusement or to test mathematical and physical principles at that times. The Industrial Revolution that took place from about 1760 to sometime between 1820 and 1840 marks indeed the transition to new manufacturing processes in Europe and the United States.

The rise of the mechanical factory system in this period (going massively from hand production methods to machines) is mainly due to the mastery of the task that consists in transforming steam and water power into mechanical energy. Obviously, the use of steam, air, water, etc. to produce energy and create motion, is not a discovery of the 19th century. Also, both open loop and autoregulated systems had been already explored and developed earlier (considering the water clocks including a feedback control mechanism for instance). Yet, those principles were undeniably perfected with the industrial revolution. For instance, the principle of autoregulation was mastered with the machine of James Watt (built between 1763-1788).

Textiles were the dominant industry of the Industrial Revolution in terms of employment, value of output and capital invested. The textile industry was also the first to use modern methods for production [Landes 1969]. Many of the technological innovations in that field were firstly of British origin (for instance, the Mule Jenny, a machine used to spin cotton and other fibers was invented between 1775 and 1779 by Samuel Crompton). The fabrics made of Indian cotton were very popular and the British entrepreneurs controlled the production and the trade of cotton around the world [Horn 2010]. In France, the process of manufacturing fabrics made a step forward with the Jacquard loom in 1804. Based on earlier inventions, the machine was imagined in order to simplify the process of fabrication of textiles with complex patterns. The movements of the loom were then controlled by a number of punched cards, laced together, with each card corresponding to one row of the design. The rod would pass through the card where it had been punched. This invention is particularly interesting as the information punched cards, controlling a sequence of operations and movements, are important elements in the history of computing hardware. The ability to change the pattern of the loom's weave by simply changing cards was an important conceptual precursor to the development of computer programming and data entry [Essinger 2004]. In the late 19th century, American inventor Herman Hollerith took the idea of using punched cards to a step further when he created a punched card tabulating machine which he used to input data and store information about resident populations in 1890.

In the 20th century, the emergence of the cybernetics which consists in studying information and mechanisms of complex systems, announced a new chapter in the history of moving machines. In 1948, Norbert Wiener defined cybernetics as "the scientific study of control and communication in the animal and the machine" and confirms in this way the interdisciplinary dimension of the field [Wiener 1948]. Cybernetics intends to unify the emerging fields of electronics, automatics and in-

formation theory, and constitutes a useful melting-pot to the elaboration of artificial intelligence, cognitive sciences, psychology, biology, etc. If the limits of cybernetics are hard to establish, one of the main studied concepts is the feedback (i.e. when the outputs of a system are routed back as inputs, as part of the chain of “cause-and-effect” that forms a loop [Ford 2010]. In other words, the system feed back into itself.). Anyway, cybernetics strongly changed history by the fact that the computer-based and information technology was then making machines able to generate adaptive movements.

In 1961, the manufacturing world was once again turned over with the machine *Unimate*, developed by American inventor George Devol as a result of the foresight and business man Joseph Engelberger, the “Father of Robotics”. The first *robots*² were now all over the world; assembling, welding, painting,... in all kind of industries.

● Moving machines in the personal space

Among the technical objects that humans develop in our modern society, some are static objects, like stones, that are used as tools. Others are stationary machines that impacts the world through the movement of a protuberance, just like a plant. We also develop machines that can move from a point A to a point B, on wheels or legs, adapting their movements in the meanwhile according to the environment. From an engineering point of view, these technical objects can remind us the movement of an animal [Laumond 2020]. Yet, does that make the robots of nowadays different? The novelty lies probably in the fact that humans can now experience the movement of machines within their personal space. Indeed, an autonomous moving machines is able to occupy the physical space as it goes ‘in between’ humans themselves, while evoking their own nature. Henceforth, the easy comparison between robots and living organisms become questionable. Is it truly reasonable for our modern and occidental society to challenge the ‘so far quite stable and obvious’ distinction between the living and the machines? At this hour, the answer is clearly a matter of personal opinion that is certainly not the topic of this thesis. Whether reasonable or not, the fact is that the parallel between the living and the machines is made and can be found within humans’ reasoning and discourse about robots. The traces of this parallel within the natural language are at the basis of our reflexion.

● Final considerations on the history of robotics

Trough the history of mankind, technical achievements were made because inventors, artists, mathematicians, engineers and creative of all sorts, aimed to amuse the public, to understand principles and laws of nature, to solve technical problems, to win the war, to improve production methods, etc. In this brief historical

²(The word ‘robot’ was firstly coined by the Czech writer Karel Čapek in his theater play *R.U.R.*)

perspective that grounds the field of robotics, we firstly aimed to show that the understanding and the control of movement within the physical space is at the core of the evolution of techniques. In order to highlight this feature, we thus thoughtfully omitted various aspects of the history of robotics in our description (such as the mythical, literary and science fiction's influences (see for instance [Chabot 2016])). It remains the fact that scientific and technical achievements were made all over the ages, in various places and with many goals, rather than according to a coherent and singular line of evolution. This is not only important in order to grasp the idea that robotics is nowadays a field of many influences and inspirations and that similar problematics have been studied in various contexts and with many different methods. It also exposes the fact that inventions and discoveries have always nourished one another, whether a specific application or a better understanding of the world was pursued.

1.2 The technique of rhetoric

1.2.1 *Techne*

As far as Aristotle was concerned, the discipline of rhetoric was defined as “the art of finding the available means of persuasion in a given case” (*Rhet.*, I.2.1356a [Aristotle(ed.W.Ross) 1924]). In that respect (and despite the fact that rhetoric reached our modern society in the caricatured form of manipulation [Danblon 2013a], [Danblon 2013b], rhetoric is primarily a technique of discovery and invention of arguments. It includes the cognitive and linguistic tasks that consist in passing from general concepts and ideas, to speak and act accordingly in a particular case. This technique serves multiple functions (to deliberate, to testify, to decide, to evaluate, etc.), following the desired application, the intention of the speaker and the institution at hand [Garsten 2009], [Kennedy 1998]. Yet, how are robotics and ancient rhetoric related? Why would it be useful to go back to ancient Greek thought in order to investigate how humans shape the discipline of robotics and formulate ideas about robots? Nowadays, the rapprochement between robotics and rhetoric may seem surprising. However, in ancient Greece, the principles of mechanics and rhetoric were not only compared and inspired from one another but the two disciplines, as well as medicine [Di Piazza 2019], were thought under the similar status of *techne*. Those *technai* shared mental processes and system of concepts as well as ‘the problem of the hinged’ [Sennett 2008]; [Vernant 1965], pp. 310-313). In this section, we revisit ancient mechanics and rhetoric under their status of *techne*³ (i.e. ‘technique’, ‘art’, ‘craft’, ‘efficient action’) as it will support the relevance of the rapprochement that will be made all along this manuscript between the two disciplines. Also, we explore the specificity of the School of Rhetoric of Brussels, which appeals to (re-)use the model of rhetoric of Antiquity for contemporaries concerns.

³As the term *techne* appears to be very difficult to translate into a single equivalent English term, the original Greek term is kept as it stands.

1.2.2 The analogy between rhetoric and mechanics

• Lever and circle in motion

In terms of its form, its vocabulary, its conceptual framing, . . . the theory expressed in *Mechanica* by Aristotle shows many similarities with his treatise of *Rhetoric*. Similar principles are indeed used in both cases and are often mirrored [Vernant 1965]. About mechanics, Aristotle explains for instance that by means of a lever, human's low force can prevail over the much larger force of a heavy mass. Analogically, in rhetoric, he notices that the smallest argument can dominate the largest. Hence, while using natural forces (in mechanics) or spontaneous linguistic and cognitive tools (in rhetoric), both *technai* are presented as able to extend possibilities as well as human abilities; both *technai* use *dunamis* (inherent power).

Also, Aristotle uses the example of the circle in motion: he explains that the points situated at both ends of the diameter of a circle can move, by the same movement, in opposite directions. Consequently, if a circle transmits its rotation to a second one (that touches the first circle at one point only), this second circle will move in the opposite direction (see Fig. 1.4). Besides, the faster the movement of the first one will go, the faster the second one will be driven and will turn in the opposite direction. In rhetoric, the same phenomenon is described by Aristotle: the highest that the strength of the argument of the opponent is, the more unfavorable it becomes as it is used against him. In both cases, Aristotle demonstrates a similar principle of reversal of power (see *Mechanica*, 848 a 30 in [Vernant 1965]).

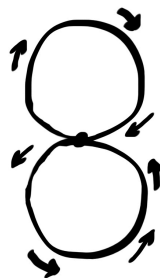


Figure 1.4: Transmition of rotation from one circle to another.

In Antiquity, the rapprochement between the disciplines of rhetoric and mechanics was obvious. Both disciplines (as well as contemporary robotics) induce indeed a similar problem: the amplification of the natural force and the power of reversal carried out by these two *technai* is highly surprising, fascinating and in some cases, alarming. Such effect induces strong feelings about the productions of each discipline (speeches in rhetoric, moving machines (i.e., robots) in robotics, . . .), and shapes the way that both domains are perceived.

- **Halfway between science and experience**

As *technai*, the disciplines of ancient rhetoric and mechanics (as well as other *technai* such as medicine, navigation, . . .), always leave the choice of the rules to follow and the principles to apply to the practitioner. They also ask to fulfill some tasks with multiple variables and to foresee and evaluate alternatives. Considering rhetoric and medicine for instance, Salvatore Di Piazza reminds us that the two disciplines were specifically recognised as sharing “forms of inference and reasoning common to probable practical deliberation, [. . .]” [Di Piazza 2019]. About rhetoric and mechanics, Vernant highlights the rapprochement made by Aristotle between rhetoric and mechanics [Vernant 1965]. An important constraint of the *technai* concerns thus the important question of rule-following. Hence, in the case of a *techne*, the relationship between the rules and their application to the specific and particular cases is crucial. Salvatore Di Piazza reminds this specificity as he places *techne* in between *empeiria* (experience) and *episteme* (science). Indeed, both *techne* and *empeiria* (experience) are based on practical knowledge which is obtained by trials and errors, but only the *techne* is based on stable rules.⁴ At contrary, if both *techne* and *episteme* include stable knowledge, a technique always results in a production whereas science is a speculative discipline. Di Piazza insists on the fact that “a *techne* is intrinsically oriented towards doing ([which consists in] healing and persuading in the case of medicine and rhetoric)” [Di Piazza 2019]. Medicine, rhetoric, mechanics, crafts. . . a *techne* is thus based on a set of relatively stable rules that demand to be allied to experience. The mastery of a *techne* and its reliability depend indeed on one’s ability to adapt the rules despite their fallibility. On this matter, let us note that the fallibility of *technai* is not only due to possible human error or limitations but also occurs because of the nature of the issue itself; a *techne* works precisely on objects that “do not lend themselves to rigorous algorithmic treatment” [Nicomachean Ethics 1094b 11-28, in [Di Piazza 2019]. Persuasion (in the case of rhetoric), healing (in the case of medicine), movement (in the case of mechanic arts), such objects resist intrinsically to a strict grasp.⁵

- **The ‘problem of the hinged’**

The requirement of binding theory and experience in order to master a *techne* implies the need of a device able to apprehend strict rules and principles with a practical dimension, i.e. the need of a hinged. Indeed, without the hinged between rigorous theory and dynamic experience, the rules and principles that are inherent of a *techne* would only degrade in actual fact [Vernant 1965]. In mechanics, if the

⁴This is coherent with Aristotle’s thought [Metaphysics 981 a 7-12], [Nicomachean Ethics, 1139b 14-1140a 23]

⁵In the case of movement, such statement remains accurate today; Latash introduces motor control as the physics of the unobservable objects. Because of their inherent variability, movements of living beings are indeed always hard to capture rigorously. This variability comes from the fact that living organisms change with experience, react to perceivable external stimuli and/or the fact that repeating a task can cause changes of movement as a similar given task is completed [Latash 2008].

technical reality is not considered, the solutions proposed by mechanical models *in theory* are simply impracticable.

To illustrate this point, let us consider the automatic temple gates of Heron from Alexandria that we mentioned earlier (see Fig. 1.5). In his text on *Automatopoietica*, Heron describes that the temple gates would open when a fire was lit on the altar, and close as the fire was extinguished. To be exact, he describes that the altar-fire was lit in order to warm the air inside a container underneath filled with a bit of water. With the expansion of gases, the air would then press the water outside the container to another vessel and would, according to a system of balance, open the doors [Papadopoulos 2007]. What Heron does not say though, is that for the system to actually work, resistance and friction, as well as other forces, would need to be taken into account. An experienced technician nowadays would also wonder for instance how, in ancient Greece, the gears would be greased for these enormous doors to open and close smoothly. In fact, all these considerations can only appear in the mind of the one that already faced such problematic in reality (i.e. one with experience (*empeiria*)). Similarly, in rhetoric, knowing and applying a set of rules are not sufficient in order to sense the adequate argumentation (*logos*), disposition (*ethos*) and emotions to spark (*pathos*) within an audience, in a specific situation. Indeed, gathering the “ingredients” of the discourse do not guarantee to actually produce persuasion.

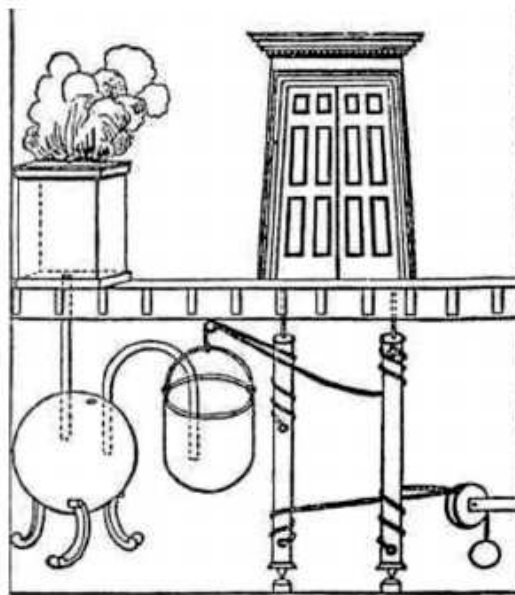


Figure 1.5: The temple gates designed by Heron of Alexandria would open when a fire was lit on the altar, and close as the fire was extinguished [Lloyd 2013].

1.2.3 Why ancient rhetoric and robotics?

The discipline of rhetoric and the mechanical arts share the same status (which is particularly interesting at an epistemological level). That being said, the function of rhetoric (*ergon*) as described by Aristotle, is to “see” or “discover” (*thêôrêsai*) what, in each case, is appropriate in order to persuade an audience [Tindale 2013], [Tindale 2018]. We must here insist on the fact that the function of rhetoric is not the one to learn to know how to persuade; persuasion could otherwise not be separated from manipulation.

In its classical status of *techne*, the discipline of rhetoric refers to a model of rationality where language, emotions and persuasion are not opposed to reason. They are instead thought and used to fulfill a series of functions (to tell stories or testify, to criticize, to decide, to judge, to think in action, etc.). According to Aristotle, rhetoric is both a *dunamis* (an ability) and a *techne* (art, craft): it is an extension of the spontaneous abilities that build relations thanks to the *logos*.

The call for a return to ancient rhetoric in order to handle problems *typically human* has been mainly initiated by Chaïm Perelman (1912-1984) and Lucie Olbrechts-Tyteca (1899-1987) in their treatise of rhetoric, *The New Rhetoric: A Treatise on Argumentation* in 1969 [Perelman 1969]. Their initiative is indeed motivated by the fact that a return to Aristotle’ thought would guarantee a more realistic model of rationality (see also [Aubenque 1963]). That means first of all, a model that is empirical: a model allowing to observe actual rhetorical uses and reasonings, and to consider such as being part of the human nature. Secondly, that means a model where interdisciplinarity is deeply ingrained, as in every humanistic conception of science and society. Such model invites indeed to approach scientific and technological fields while taking into account, not only the results, but the science in the making. The formation of humans’ representations in such process is a matter of “deep rhetoric” [Halryn 2004] that covers multiple aspects of human rationality. Such thought lays the foundations of the School of Rhetoric of Brussels.

Movement, Perception and Language

Contents

2.1 Cognitive approach	18
2.1.1 Language and money	18
2.1.2 A glimpse on the role of movement in humans' perception of robots	18
2.1.3 Traces in natural language	21
2.2 Linguistic approach	25
2.2.1 <i>Telling</i> the world	25
2.2.2 An overview of the influence of language on cognition	26
2.2.3 The problem of ineffability, or <i>How movement resists linguistic coding</i>	27
2.2.4 The function of <i>enargeia</i> , or <i>How actions are made visible through language</i>	33
2.3 Discussion on Movement, Perception and Language	35

In order to evaluate the role of natural language and rhetoric in the way that humans apprehend robotics, we must firstly take note of the impacts of natural language on humans' cognition, and *vice versa*. More precisely, and since we acknowledge motion as one of the main and fundamental features of robots, we focus here on movement's perception and its relation to language.

Humans' perception of movement impacts their representation of the world and the way that they talk about the world. In the case of robotics specifically, does humans' perception of movement impact the way that they talk about moving machines? At contrary, does natural language impact human's perception of the world? Does it change humans' understanding of what a robot is (or not) Depending on the direction in which the relation between movement, perception and language is considered, the observations that can be made answer to very different problematics. Hence, starting from the matter of humans' perception of movement, a cognitive approach makes for instance possible to observe how the human brain attributes intentions to moving objects (or subjects) (see for instance [Perez-Osorio 2019]), and how this cognitive mechanism is revealed through language. From this perspective, the 3 notions are then considered in the following order: firstly, there is the actual

movement, then follows the perception of that movement, and finally, we can find the traces of that perception within the language. Consequently, the problematics concerns the role of movement in the way that humans *perceive* the world. At contrary, considering the relation from the other end of the chain, the focus is then primarily put on language. Such linguistic approach proposes to observe what, within language itself, can explain the specific way in which humans put their perception of movement into words. Eventually, those linguistic reasons impact our perception of moving machines as well. This time, the problematics is about how humans *tell* the world. In this chapter, we propose to review some of the main principles that explain how movement is *decoded* as well as *encoded* through (and in) natural language, and consider the implications for rhetoric and robotics. Exploring such questions is indeed highly interesting as we aim to evaluate the rhetorical problems in robotics.

2.1 Cognitive approach

2.1.1 Language and money

Language is often pointed out as the unique characteristic of humans' cognition when it is considered within the history of the evolution of species (so, from the phylogenetic point of view). Yet, Michael Tomasello reminds us that language cannot be considered as the main driver of the evolution of cognition, just like money cannot be understood as the reason for the economic activity: “obviously, language contributes to cognition and transforms its nature, just like money contributes to the economic activity and transforms its nature, but language does not come from nowhere. [Both money and language] represent social institutions that are symbolically embodied, and that were born from preexisting economics or socio-communicative activities” [Tomasello 2009], [Searle 1995]. This implies that cognition drives language (and *vice versa*). In this section, we discuss the bond between movement, perception and language from a cognitive approach.

2.1.2 A glimpse on the role of movement in humans' perception of robots

If they are well coordinated and situated, only 4 moving dots on a screen can be sufficient to make humans enjoy the performance of a Caribbean dance. Similarly, the movement of 17 dots allows humans to recognize a football player hitting a non-existing ball and eventually, to grasp the feeling of the simulated pain within the fall (see Fig. 2.1) [Brun 2018]. The process of the motion capture (Mocap) exploits obviously such principle as it records movement. In this way (or with similar techniques), we can all watch a *shy*, *nervous*, or *playful* lamp in an animated movie (see Fig. 2.2). The observation of the visual effect created by the dynamic movement of dots on a screen, is on its own highly important when it comes to

consider humans' spontaneous perception of moving machines.¹

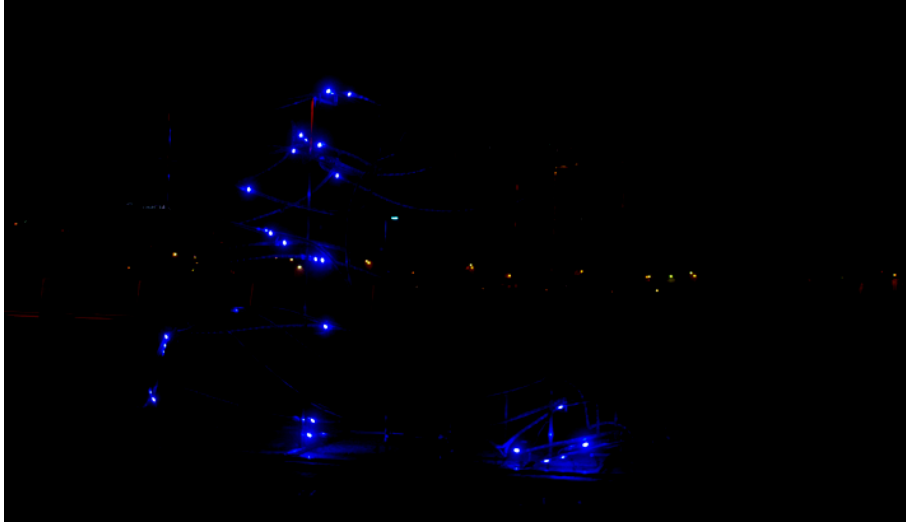


Figure 2.1: The *football players* designed by Rémy Brun for the *Fête des Lumières 2016* in Lyon, France (see [Brun 2018], fetedeslumieres.lyon.fr).

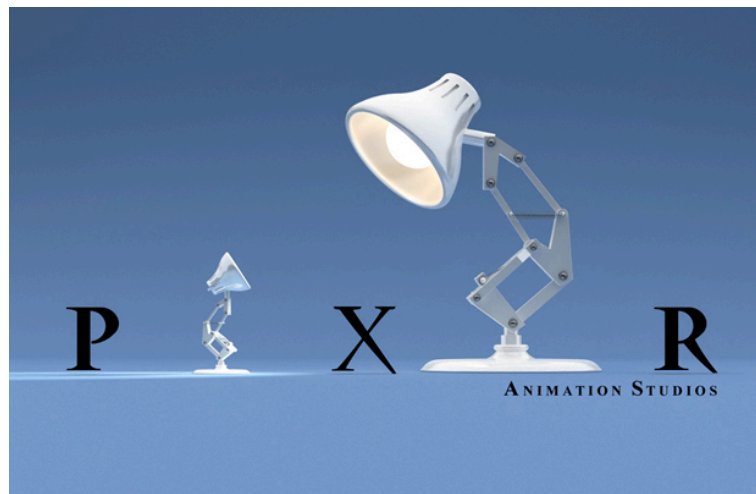


Figure 2.2: Luxo Jr., the lamp of Pixar Animation Studios originally created by John Lasseter in 1986 [Buckley 2011].

- **Shape and motion**

Firstly, the experiments highlight the fact that the animal-like shapes given to some robots do not explain all humans' spontaneous attribution of intentions, mental states, or motivations to objects. The evidence suggests indeed that “robots do not

¹The remaining question concerns the conditions upon which motion creates such effect. The non-repetitive and dynamic properties of the movement seem to be some of the elements involved.

naturally [in the sense of spontaneously] induce the intentional stance in the human interacting partner” [Perez-Osorio 2019]. A study using the manipulation of the Prisoner’s Dilemma² show for instance that the brain areas associated to the attribution of intentions (i.e. to *mentalizing*) which are situated in the medial prefrontal and left temporoparietal junction, were not activated in response to artificial agents, whether they had human-like appearance or not. [Krach 2008] [Perez-Osorio 2019] The role of movement in humans’ understanding of actions (including the ones of embodied artificial agents³) should thus not be minimized. Movement is clearly part of the socio-communication activities that preexist to language (also called preverbal intersubjectivity), such as action imitation, joint visual attention, and sensitivity to intentions related to action or attempted action [Meltzoff 2007]. Besides, Alain Berthoz presents perception as a *simulated action*. In this way, rather than an interpretation of sensory messages, perception is judgement and decision making, and it is anticipation of the consequences of action [Berthoz 2000]. Moreover, the importance of movement in humans’ perception had been already signaled by Lotze in 1852 [Lotze 1852], as he affirmed that “spatial organization of visual sensations results from their integration with a muscular sense”. Later on, the idea that the information that triggers a motor command is used by the brain to recognize movement was proposed by Helmholtz [Southall 1962] (see review in [Berthoz 2000]).

Nevertheless, these consideration share a similar idea: humans’ ability to *read* the world is partly and (importantly) driven by the ability to *read* movements and actions.

● Anthropomorphism as a universal phenomenon

Secondly, the fact that we all *a priori* recognize (more or less rapidly) the body of a dancer as the dots move along the screen suggests that the phenomenon that consists in attributing human traits, emotions, or intentions to non-human entities, is universal and natural (in the sense that it is spontaneous). This aspect is also particularly important when it comes to the perception of the movements of robots as it contradicts *a priori* the common idea that children and vulnerable people are essentially more inclined to attribute intentions to inanimate objects. In fact, attributing intentions to inanimate objects is, at least in the occidental culture and in the folk psychology, often associated to a sign of irrationality or a form of cognitive immaturity that would reflect a lack of education or cognitive development. This intuitive and spontaneous form of ontology remains vivid as it has long been spread by the work of Jean Piaget (among others). However, the acceptance of the notion of anthropomorphism as an

²In games’ theory, the Prisoner’s Dilemma, coined in 1950 by Albert Tucker, refers to a situation where two rational individuals might not cooperate even if it appears that it is in their best interests [Poundstone 1993]

³The notion of embodiment, as a necessary condition for movement in the physical space, marks here the fundamental difference between robotics and artificial intelligence.

erroneous and illegitimate process by which someone attributes human qualities to natural or divine objects has since been largely criticized [Vidal 2012]. In the early 20's, Margaret Mead revised deeply the model of Piaget and the systematic understanding of anthropomorphism as an effect from a simple projection or as the form of an elaborated conceptual construction in order to represent or explain the world, is then completely abandoned by all experts in the 80's. Besides, the anthropologist Stewart Guthrie has also participated actively to the refutation of anthropomorphism as a characteristic of young children, 'primitive' cultures or as a form of religious delusion or irrationality. At contrary, he reminds the universal presence of the phenomenon in all cultures, in every environment and at all ages [Stewart 1993].

2.1.3 Traces in natural language

When the perception of motion leads to attribute intentions to objects, the traces of that cognitive process can be found in language. At least, various studies conclude that the activation of the cognitive process consists in attributing intentions (i.e. the adoption of the *intentional stance* [Dennett 2009] from the fact that the participants of the experiment describe the action of the moving object by using an agentive lexicon, instead of mechanistic terms. We review the methods used in such studies before we explore the alternatives to the *intentional stance* towards moving machines (i.e. the *physical stance* and the *design stance*). Also, we refer to the model of Kahneman [Kahneman 2011] as we question on one hand, the relation between the agentive lexicon and humans' spontaneous perception of robots, and on the other hand, their actual understanding of robots.

• Self-reported and neuroimaging methods

In 1944, Heider and Simmel showed how humans spontaneously attribute intentions to geometric figures moving on a screen. [Heider 1944]

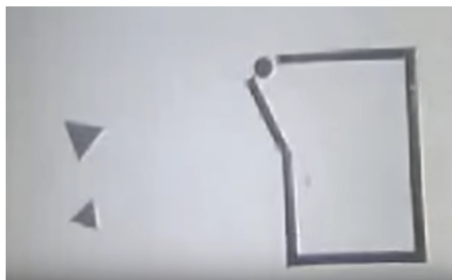


Figure 2.3: According to the experiment of Heider and Simmel, the movements of the geometric figures trigger mentalistic descriptions.

Hence, a series of short animations, each involving a large triangle, a smaller one, and a circle that were all moving around a static rectangle, was presented to the participants. The pattern of the movements (rather than the physical appearance

or properties of the geometric figures) triggered mentalistic descriptions (and the use of *agentive lexicon*): the triangle *continues, attacks, follows*, etc.

The validity of the self-reported method used to evaluate the spontaneous adoption of the intentional stance is however discussed. For instance, critics suggest that in the design of the experiment of Heider and Simmel, participants' descriptions referring to perceived intentionality "might be the result of high order cognitive mechanisms like inference from the questions or the task, rather than the actual observations[Heider 1944], [Scholl 2000]."

Nevertheless, researchers have now methods that bypass that discussion, even though caution must be taken about the meanings given to the results. If the neuroimaging approaches, complemented with questionnaires and semi-structured interviews allow to observe the neural systems underlying *mentalizing* (see for instance[Thellman 2017], [Marchesi 2019], the used methods usually address the need to evaluate specific technologies in very specific contexts (see review in [Gaudiello 2016]).

According to Wykowska, "despite the relevance of abilities like mentalizing or attribution of intentionality in daily life, it has proven to be extremely difficult to evaluate them experimentally. It is clear that while people evaluate the intentionality or behavior on demand, they also automatically reason about mental states" [Perez-Osorio 2019]. This probably also explains why, as K. Dautenhahn suggests, the current work of human-robot interaction (HRI) is characterized by heterogeneity, both in terms of methodologies and measurements used to study technologies and their impact.[Dautenhahn 2007]

Still, in the context of robotics, wherever movement affects the probability to adopt the intentional stance on its own or in combination with other factors⁴, the linguistic traces left by the adoption of the intentional stance, are in all cases considered as clues on humans' spontaneous ways to *perceive* the world.

• *Physical stance, Design stance and Intentional stance*

This being said, the *intentional* stance is, according to Dennett's theory, [Dennett 2009] not the only way to *perceive* events. Humans use different strategies to understand and predict movements and actions such as the *physical* stance and the *design* stance. Before we discuss the questions raised by this distinction, let us revise the definitions of those strategies given by Dennett.

- The *physical* stance refers to the way that humans predict the movement of simple systems, such as a pendulum for instance. It means that humans anticipate the behavior of the system (here, the pendulum) based on the implicit knowledge of the variables that intervene on that system, such as gravity, acceleration, friction, etc. In such case, humans rely on intuitive information on laws of physics and properties of things.

⁴(such as the human-like appearance of the robot, the context in which the actions unfold, the individual priors, etc.)

- The *design* stance on the other hand, is more efficient as humans need to predict and understand the actions or more complex systems than a pendulum. At this level, humans are concerned with such things as purpose, function and design; the prediction of the event is based on the design characteristics of the system and its intended functionality. Adopting this strategy does not require knowledge of the physical constitution or physical laws that govern a system's operations but rely on conventional knowledge and previous assumptions (that are thus non-intuitive). The design stance is active when anticipating the events related to an object (whom humans are aware of the function; like a car), or to an animal or a plant (living things designed by evolution). For instance, humans adopt the design stance as they predict that a bird will fly when it flaps its wings, on the basis that wings are made for flying.
- Finally, comes the *intentional* stance, which is the one solicited when the design stance is not sufficient in order to understand and predict the actions, for instance in the case of a (very) complex system. According to Dennett, this strategy is the most efficient for humans to represent and understand events. By treating a system as a rational acting agent who makes behavioral choices in line with its own goals or with the ways that lead to achieve a goal, humans' predictions pay off generally. About the same bird, when humans predict that the bird will fly away because it knows that the cat is coming and is afraid to get caught, humans adopt the intentional stance.

In short, if attributing intentions to moving objects is an automatic and intuitive cognitive process, the adoption of the intentional stance is not the only possibility either. According to Dennett, the complexity of the system plays an important part in the adoption of one or another strategy[Dennett 2009].

Now, a question emerges about the use of the agentive lexicon and the stances. Is the use of the agentive lexicon exclusive to the adoption of the intentional stance? Could we adopt the design stance towards objects and at the same time, use agentive terms such as “the machine *thinks, follows, etc.*”, spontaneously? In robotics specifically, the use of agentive lexicon among the experts in robotics (within conversations with non-experts but also with colleagues) captured our interest on this matter.⁵ Does it mean that roboticists, who are especially concerned with *purpose, function and design* of robots also adopt the intentional stance towards machines after all? How come experts in robotics both adopt a design stance towards moving machines and talk about robots using an agentive lexicon such as: the robot “*understands* that there are obstacles in his environment”, the robot “*prefers* that it's not too warm in the lab”, etc.?

⁵We did not find here the necessity to gather evidence of such statement as scientific articles and descriptions of conferences in robotics present agentive lexicon regularly.

- **Fast thinking, slow thinking**

Surely, we must be cautious about what we conclude from the linguistic traces found within language. As we will see again in the following section of this chapter (see 2.2.2), a whole set of mind is impossible to grasp through the analysis of the lexicon only. Besides, this statement is clear as we consider the distinction of the two systems of thinking defined by Daniel Kahneman.

Known for his work on the psychology of judgment and decision-making, as well as behavioral economics, for which he was awarded the 2002 Nobel Memorial Prize in Economic Sciences (shared with Vernon L. Smith), one of Daniel Kahneman's central thesis proposes indeed a dichotomy between two modes of thought [Kahneman 2011]: as the System 1 is fast, automatic, frequent, stereotypic and instinctive, the System 2 is slower, effortful, conscious and more deliberative. The Fast System refers to activities such as determining the distance of an object from another, localizing the source of sound, completing the sentence "butter and...", etc., while the Slow System is in charge when digging into our memory to recognize a sound, counting the number of A's in a text, parking in a tight parking space, determining the validity of a complex logical reasoning, etc. Kahneman concludes that humans' decision making based on one or another system depends on coherence, attention, laziness, association, jumping to conclusions, WYSIATI (What You See Is All There Is), and how one forms judgements. [Kahneman 2011]

Consequently, using Kahneman's dichotomy in the case of our concern, the linguistic traces that reveal a cognitive process in System 1 should not be mixed with the deep belief that would be formed in System 2; if the agentive lexicon reveals a process of attributing intentions towards inanimate objects happening in System 1, the deep understanding that one's shape about the object is a matter of System 2. In this way, and to keep on with the analogy between rhetoric and robotics already engaged in Chapter 1, the similarity between the situation of experts in robotics and the specialists in rhetoric is very similar. Hence, rhetoricians who are trained to adopt a technical point of view on discourses can still find themselves in a place where they get convinced by one or another argument. The difference between people who are familiar with the rhetorical technique and the ones who are not, cannot thus be established on the basis that the first ones would be *immune* to persuasion while the others would remain at its mercy. At contrary, far from ignoring the effects that a discourse can have on himself/herself (in System 1), the experienced rhetorician is characterized by his/her agility to pass from spontaneous representations to a technical point of view, and *vice versa*. Similarly, experts in robotics (or any person concerned with the purpose and the design of robots) seem to be able to pass very efficiently (and probably unconsciously) to a technical point of view towards robots. Rather than a matter of ignoring (or denying) the existence of natural and spontaneous cognitive processes in System 1, the expertise lies thus in the ability to pass from one to another point of view. Yet, the following question remains: do roboticists replace the intentional stance by the design stance within System 1 (because of their beliefs and technical knowledge

formed in System 2 for instance)? Or, do people trained in robotics pass so rapidly from System 1 (where the attribution of intentions occurs) to System 2 (where the design stance would be adopted) that they don't even have the feeling that they experience spontaneous cognitive process in System 1? In other words, does the adoption of the design stance actually *inhibits* the intentional stance in such way that it actually blocks the attribution of intention? Or should we consider inhibition as a very efficient and rapid process of passing from one to another system [Houdé 2000]? The examples given by Kahneman to distinguish the two systems and the fact that we still find linguistic traces of agentivity in experts' discourses gives us good reason to think that specialists adopt the universal and spontaneous cognitive process that happened in System 1, while they show a great flexibility to pass from the intentional stance to the design stance. We discuss this matter further in our final conclusion.

Anyway, wherever the roboticists adopt the intentional stance and then the design stance, or that they adopt the design stance directly and only, the result is still the same in terms of language: experts in robotics keep using the agentive lexicon (just like everybody else) to describe moving machines.

Why? Why would humans *perceive* and understand objects according to their function, purpose and design, and yet, continue to use an agentive lexicon to talk about those machines as if they had intentions (even in between humans who share the understanding of robots as non-intentional agents)? Such matter suggests that other reasons can explain (as well) the use of agentive lexicon when describing moving machines: the use of agentive lexicon might not result from (non-linguistic) cognitive activities only, but could also depend on matters that are intrinsic to language itself. The linguistic approach of the relation between movement, perception and language, might bring some possible answers to this assumption.

2.2 Linguistic approach

2.2.1 *Telling* the world

What is inherent to language that could explain the specific way in which humans talk about robots? More specifically, how can we explain -linguistically- the way that humans put their perception of robots' motion into words? Eventually, those linguistic reasons impact our cognitive representation of moving machines, which makes this problematic all the more important.

In this section, we thus focus on how humans *tell* the world. This means that we propose to review linguistic principles as well as a rhetorical function, that can explain the specific way in which physical movements and actions are *translated* into natural language. We explore indeed how motion resists linguistic coding (i.e. the problem of *ineffability* of movement) as humans aim to put movement into words, but also into algorithms (like experts in robotics would do). Moreover, we observe

how the difficulty to express the motion of moving machines can be overtaken by the use of agentive lexicon (the robot *decides, thinks, looks,...* the robot is *intelligent, creative, autonomous, etc.*).

2.2.2 An overview of the influence of language on cognition

Non-human primates and newborns have a cognitive representation of the world that maintain the perceptions that they acquired from experience (mainly sensori motor experiences). When the child starts using linguistic symbols (or other symbolic artefacts), with other intentional agents, he/she overtakes largely the representations based exclusively on his/her experience. Just like in the case of non-linguistic cognitive activities, symbolic representations are characterized by the fact that they are intersubjective, i.e. that they are *shared* with others, and by the fact that they reflect a perspective (a specific way to consider a phenomenon). However, the particularity of the linguistic symbols' acquisition lies in the large amount of ways that the child accesses to analyze the world, i.e. in the variety that language can offer in terms of intersubjectivity. Along the centuries, some of those ways of representing the world have progressively been crystallized into conventional usages within each culture. The more that the child internalizes those analysis, the more is the nature of his/her cognitive representations radically transformed. [Tomasello 2009]

Thus, does the structure and properties of language itself influence the way that humans talk and think about the world? According to Tomasello, the fact is undeniable: "if some authors think that acquiring language does not sensibly modify the nature of the cognitive representation, it's because they only see linguistic symbols as labels, ready to be applied to ideas and concepts that have already been formulated" [Tomasello 2009] Tomasello argues thus strongly against Piaget's thought. Moreover, other authors such as John Lucy (who showed the bond between grammatical categories and cognition [Lucy 1996]) or Stephen Levinson and Asifa Majid (see for instance the study on how language plays a significant role on structuring or restructuring spatial cognition [Majid 2004]), showed the effects that language can have on non-linguistic cognitive processes. Ann and David Premack also supported this statement by observing monkeys trained to language (through the manipulation of ideographic signs) *versus* monkeys with no linguistic training [Premack 1983].

The acquisition of linguistic representations means notably to learn to affect the interest and the attention of another intentional agent with whom we act according to intersubjectivity. It also enlarges the possibilities of categorizing (from categories of perceptual and motor experiences to categories of conceptual representations (as well)), and shapes the memory. Another example is the power of comparison in promoting inductive inferences [Tomasello 2009], [Berthoz 2000]. The influence of the acquisition of language on cognition is thus quite clear.

Many scientists have insisted on the inadequacy of absolute constructivism on this matter⁶. Also, David Premack (among others) warns us against nativism (that recognizes a radical specificity to humans' language). The distinction between apes and humans is clear for Premack but it is not the non-acquisition of humans' form of language that limits apes to be cognitively equal to humans. Such idea can be for instance found in philosophy, as Wittgenstein suggests that "the limits of my language are the limits of my world". *Tractatus Logicus* of Wittgenstein [Wittgenstein 2013], but also within the famous hypothesis of Sapir-Whorf (or *linguistic relativity*). The hypothesis of Sapir-Whorf, that supports the idea that linguistic categories limit and determine mental representations, remains by the way highly controversial.⁷ Many linguists and anthropologists have criticized such conclusion, notably on the basis of the argument that there exist in fact many words in English (or other languages) to designate snow (sleet, slush, flakes, flurries, etc.), but also based on the fact that many words to designate the snow in Inuktitut are actually based on a similar lexical basis. On this matter, see for instance the work of John Steckley [Steckley 2008]. Tomasello insists notably on the fact that the linguistic communication is still the manifestation and the extension (surely, very special) of abilities that allow to participate to joint attention and cultural learning but that the child has already before he/she acquires linguistic symbols and representations [Tomasello 2009].

On the other hand, evaluating the consequences of the use of specific terms on cognition remains also extremely difficult. Besides, in the context of robotics, this difficulty seems even more important as Gentiane Venture notices that "it seems impossible to draw a clear map of how, in general, humans address the robot and talk about it"[Venture 2019]).

Yet, despite the difficulty of a strict evaluation of the impact of language on humans' beliefs, motivations, intentions and cognitive process in general, it is still valuable to better understand what can, within the nature of language, influence the way that humans picture and *tell* the world. Obviously, in the context of this thesis, our interest lies specifically in the linguistic principle and rhetorical function that influence how humans talk and think about moving machines.

2.2.3 The problem of ineffability, or *How movement resists linguistic coding*

With the necessary (yet discussed) condition of considering robots as physical moving machines, one of the problems faced by the field of robotics reflects the one found within studies of biological objects: the simplest movement is effortfully describable, and "taking a biological system apart may not help in understanding

⁶(shortly said, nativism presents language as a strict and only consequence of cognition)

⁷Lee Whorf used notably the example of the single word 'snow' in English *versus* multiple words in Inuktitut (One of the principal Inuit languages of Canada) to conclude that Inuits have probably a better understanding, or more refined perception of snow thanks to the fact that they have numerous ways to describe it; in other words, having a generic representation of 'snow' would probably be unthinkable for Inuits. In this way, Whorf supports the idea that it would be hard to conceive something if there is no specific word for it. [Whorf 1940]

its functioning, unlike, for example, man-made systems such as a television or a computer” [Latash 2008]. Both remarks refer in fact to a problem (or at least a difficulty) to find an adequate language to formulate some concepts or problematics; i.e. a matter of *ineffability*.

• **What is *ineffability*?**

Ineffability — the difficulty or impossibility of putting certain experiences into words. First of all, does such a thing actually exist?

The principle of effability states that every thought or content can be expressed by natural language [Dominicy 1990], [Katz 1978]. Besides, Umberto Eco recognizes that “natural language can express anything that can be thought. A natural language is supposedly capable of rendering the totality of our experience (mental or physical) and, consequently, able to express all our sensations, perceptions, abstractions [...]. It is true that no purely verbal language ever entirely achieves total effability: think of having to describe, in words alone, the smell of rosemary. We are always required to supplement language with ostentions, expressive gestures, and so-called ‘tonemic’ features. Nevertheless, of all semiotic systems, nothing rivals language in its effability [Eco 1995]. Hence, total ineffability have been largely dispelled by many important thinkers by means of arguments that usually have to do with the generativity of language and the augmentability of any lexicon (cf. (see for instance [Tarski 1956] or [Searle 1969] Besides, Searle subscribes to *the principle of expressability* as he specifies that “of course, a given language may not be rich enough to enable speakers to say everything they mean, but there are no barriers in principle to enriching it” [Searle 1969]. Similarly, Lenneberg states robustly that ‘we CAN say anything we wish in any language’, it is just a question of ‘the HOW of communication, and not the WHAT’ [Lenneberg 1953](See review in [Levinson 2014].

This being said, it remains that language can sometimes lack very much expressive power and gives the strong impression that ideas or sensations cannot be formulated into words. Such thing happens for instance when a natural language faces some limits in terms of *linguistic codability*, i.e. when, in a natural language, there exist no word to express a state of affairs or sensation. Clearly, *codability* is in this sense distinct from *conveyability* or *indirect indication* [Levinson 2014]; for instance, (using the example of Levinson, [Levinson 2000]) the color ‘blue’ can be *conveyed* in Yéli Dnye⁸, but only by saying for example: “It has the surface appearance similar to the shallow sea over sand”. In this case, the color ‘blue’ is thus conveyable but uncodable. Similarly, the specific qualities of smells are not lexically codable in English since there are arguably no words that identify the precise properties of smells⁹.

⁸(the language of the inhabitants of the Rossel Island in Papua New Guinea that lacks color terms except for white, red and black)

⁹“Words such as ‘stinky’ and ‘fragrant’ code for affect, not odor attributes, while ‘smells like a rose’ identifies an object as typical source, not an odor quality” [Levinson 2014].

In fact, in general, some senses are more keen to resist to linguistic coding than others: while visual perceptions are generally not difficult to describe, tactile textures are easier to convey than they are actually codable. As for smells, they might be extremely hard or even impossible to even convey. For instance, describing a room or an object is generally rather easy, while the sensation of a texture - “try to imagine the feeling on your tongue if you were to lick a carpet”, must not even have actually been experienced by the readers for the feeling to be quite easily entertained [Brower 1947]. At contrary, smells can only be evoked [Sperber 1986], [Brower 1947].

Because visual perceptions are easily codable (and because of the relative amount of cortex dedicated to vision compared to other senses [Brower 1947], [Berthoz 2000]), vision is thus often thought as the dominant human sense. Indeed, natural language such as English or French have numerous words to describe anything that can be seen, which suggests that humans rely strongly on vision. However, let us remember that if visual perceptions are easier to convey and are less keen to resist linguistic codability, the isolation of vision’s functioning from the other senses is highly troubling as it totally obscures the importance of the transversal organization of cortical functions. Alain Berthoz explores that “this dictatorship of vision” has causes such as “the idea that vision is the most highly developed sense in primates and in humans and that, together with language, it is what makes humans distinctive” [Berthoz 2000]. Moreover, some visual perceptions remain strongly ineffable, such as describing someone’s face (so to identify a person by facial description)[Levinson 2014] or, what concerns us especially in the context of this research: describing movement.

- **Is motion *ineffable*?**

Motion can be described in many words which, besides, are not limited to the lexicon of visual perceptions only; the fact that movement can be appreciated by more than a single sense (in fact, Galileo posited size, shape, quantity and motion, as the 4 *primary qualities*, i.e. 4 qualities that could be both seen and felt) [Marks 2014], means that we also commonly qualify motion as *smooth* or *rough* for instance, so with words referring to the sense of Touch. Although nothing prevents movement to be put into words *a priori* (see previous section *What is ineffability?*), motion resists effability at least at two levels that can be akin to *weak ineffability*, i.e. when translating an utterance from one to another natural language, and to *strong ineffability*, i.e. where no language at all allows to express the sensation and consequently, blocks the coding [Kukla 2004].

In this section, we explore the specificity of the *ineffability* of motion and consider the consequences of such characteristics in robotics. We propose to organize the criteria of the ineffability of movement according to the two main problems that they induce for roboticists, i.e. the scientific problem when generating movement on robots (so when translating motion into algorithms, *for* the machine),

and the rhetorical problem (so when talking about the movement *of* the robot) [Laumond 2018].

1. Translating motion into algorithms *for* robots

- Motion, as part of the sensitive evidence (i.e. all things that comes to us through the senses) [Heller-Roazen 2007], is ineffable in the sense that the nature of what must be expressed is extremely trivial [Danblon 2002].

For instance, if I ask you to put your finger on your nose, I do not have to specify that “objects give resistance” so you don’t collide with yourself. Hence, the ineffability of movement is in this way not a matter of linguistic codability or modelisation, but lies in the difficulty to become conscious of what, as humans, we are generally not (and that we consider as *certain* [Wittgenstein 1969],[Danblon 2002]. We explain this notion below). Searle includes propositions such as “objects give resistance” in humans’ deep *background*, corresponding to our biological equipment.[Searle 1995]¹⁰ Consequently, in the context of robotics, if translating movement into algorithms is certainly not impossible, one of the difficulties for roboticists eventually appears in the definition of the criteria (or tasks) that allow a robot to perform a successful movement. On this matter, an attempt to use existing dance notation as the basis of the programming of robots is particularly relevant (see Fig. 2.4): considering one of the most elaborated dance notation such as the Laban notation where sequences of symbols express movements as defined in the physical space: the notation does not include any informations about the rules integrated in humans’ deep background (indeed, once again, a choreographer has no need to specify to the dancers that they must not collide with their own body for instance).

- Secondly, the ineffability of movement of the living (specifically) lies in the fact that when a motion is observed and its properties measured, the capture of the action in its wholeness is not entailed. Movement is thus also in this way particularly difficult to translate to natural language, as well as to mathematical language.

In fact, considering that living organisms change with experience and react to perceivable external stimuli, variability is a characteristic of the movement of living beings that makes it hard to grasp. Indeed, experimental observations of motion on living organisms are further compounded by the fact that the subjects of the experiment can modify their movements due to the repetition of the given task or the application of external forces; repeating a task may cause changes in the neural system involved in the production of motor actions associated with a given task, and neural signals produced in response

¹⁰Searle distinguishes the deep *background* and the cultural *background*, with the latter referring to our knowledge about how to open a door, sit on a chair, etc.[Searle 1995]

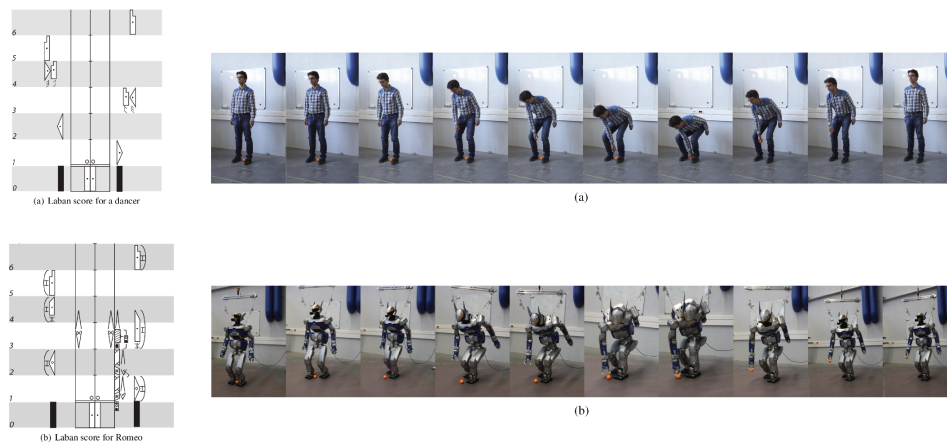


Figure 2.4: Example of an attempt to translate Laban’s notation *for* robots [Salaris 2016]

of a perturbation induce changes in the activity of the muscles [Latash 2008]. Besides, Latash observes that “the successful scientific analysis of movement of inanimate objects has been based on an adequate language reflected in the apparatus of differential equations, which provided the basis for classical physics”. He also introduces motor control as *the physics of the unobservable objects* [M. L. Latash, Synergy, Oxford University Press, 2008].

Moreover, considering that one of the ways to generate movement in robotics is to solve a problem of optimization; indeed, in order to go from point A to point B while respecting the constraints of the system (dynamics, obstacles, etc.), there is often an infinite number of possibilities. Consequently, being able to choose between one possibility among all, would mean to be able to describe exactly the expected motor behavior of the living. However, since such things cannot be done, roboticists minimize a mathematical function that includes a certain meaning (minimum energy to go from A to B, minimum time, etc.), and reduces thus the set of possible solutions to a single one. Such method reveals one of the ways to bypass (but not to solve) the impossibility to characterize motion (i.e. the ineffability of movement). Note that it is only when the solver has completed the optimization that the roboticists literally discovers the solution.

- Finally, a difficulty to translate biological movements to machines can be found at the level of the subjective or private experience felt by an individual, just like in the case of the translation of an utterance from one to another natural language (called in this case *weak effability* [Levinson 2014]).

A typical problem of effability in translation is that the effect produced by the speaker remains mostly or completely elusive. Despite a detailed comment, the translator does not transmit any data on a native English speaker's representation when reading and interpreting a sentence. A full description does not bridge the effect produced by the utterance. Such problem lies in the representational dimension of language as something is irremediably lost in a translation even if semantics (in the technical sense of the terms) is preserved [Dominicy 2011]. The same applies to a paraphrase in a unique language as “Tom is taller than Tim” is not equivalent to “Tim is smaller than Tom” in the representation of the reader. In this sense and by analogy, a singular movement (such as the famous *grand jeté* of the dancer Nijinsky as he left the scene in the “*Spectre de la rose*” (1911) [Brandstetter 1998]) is hardly conveyable, even though the motion itself can be simulated in the physical space.

2. Describing the movement *of* robots

As we have seen above, the ineffability of motion lies in the difficulty to grasp what we are not spontaneously conscious of (i.e. what related to sensitive evidence), and we must add: in the difficulty to justify what we are normally *certain* of, such as “objects give resistance” or to use Wittgenstein's example, the fact that as humans, we have a body [Wittgenstein 1969]. In fact, the specificity of propositions referring to sensitive evidence (i.e. what is evident by the senses) or to *Certainty* (i.e. that are related to what humans are *certain* of, consciously or not, such as the position of their own body parts) lies in the fact that they cannot be argued or justified [Wittgenstein 1969]. Such statement appears especially obvious as we talk about propositions referring to our own proprioception: Wittgenstein already wondered how to convince somebody that he or she has a body if he/she is persuaded that he/she doesn't have one [Wittgenstein 1969]. Emmanuelle Danblon reminds us that the impossibility to justify the propositions that refer to humans' own perception can be explained by the fact that such proposition is not, in the first place, the result of an inductive inference. (See a complete review on evidence and *certainty* in [Danblon 2002]). Henceforth, what is *sensorially evident* or *certain* appears also true (at least, within the System 1 of Kahneman [Kahneman 2011]). In terms of rhetoric, such proposition is qualified as a *tekmerion*; i.e. an indubitable proof about which there is no need to argue [Danblon 2009]. Describing the movement *of* robots is here ineffable in the sense that humans *don't do it*. In other words, motion is in this case codable but is simply *not coded* at all.

Besides, most of the time, as humans want to communicate about a specific movement, they show the movement to one another (i.e. they reproduce a movement with their own body, instead of describing it with words).

● **Final considerations about *ineffability***

As motion can be both seen and felt, humans have many words at hand to evoke movement and its properties. Yet, even if we can convey many ideas about movement, the notion still resists linguistic coding in various ways.

Mainly, the ineffability of motion lies in the difficulty to grasp what humans are not spontaneously conscious of (i.e. what relates to the senses) and to question what we are normally *certain* of (i.e. what relates to our own proprioception). For instance, humans are usually *certain* that they still have their hands even though they are behind their back and that they cannot see them. For this reason, the coding of movement is not only made complicated when motion must be expressed in a natural language such as English or French, but seems also to give some trouble to roboticists aiming for expressing movement through mathematical language. Also, in addition of this relatively *strong effability* (i.e. when no language at all allows to express a sensation), motion faces some problems related to *weak ineffability* (i.e. when translating an utterance from one to another natural language). Indeed, a singular motion is hardly conveyable since something (like the private experience when facing one or another movement) is irremediably lost [Dominicy 2011], [Kukla 2004].

In any case, as motion resists the principle of effability, a strong (feeling of) struggle remains when it comes to actually formulate movements into words. Consequently, and because such problem must be overpassed for reasons of *expressability*, humans describe rather actions. For instance, we say: “The tennis player hit the ball”, rather than, “The tennis player raised his right arm, made a dynamic movement from up to down, etc.”

In the following section, we observe how, in the context of robotics, the ineffability of motion is overpassed by the description of robot actions, and more specifically, by the use of the agentive lexicon which *shows* movements, in a very efficient way.

2.2.4 The function of *enargeia*, or *How actions are made visible through language*

Even if the task of talking about robots’ motions (and so about robots’ actions) is complex due to the relative ineffability of movement, humans still need, in order to discuss robotic matters and give sense to robots performances, a common lexicon that allows quick and efficient representations of robotic movements and actions. Hence, robotics borrows (spontaneously or in a thoughtful way) various words that are usually used to describe living beings’ body and mind. The machines *make decisions, learn, help,...* They are also *tired, bothered, willing or not, intelligent, autonomous, etc.* In fact, the agentive lexi-

con is particularly efficient and convenient to depict robotic actions and behaviors as they appear obvious for everyone. This can be explained by the fact that the agentive lexicon produces the effect of *enargeia*, i.e. an effect of clarity or visibility. The *discursive* evidence echoes here the sensitive evidence. To support this statement, let us consider the case of the surveillance robot K5 designed by *Knightscope* found in 2017 in the fountain of a mall in Washington. Among many other journalists and internauts who reported the event, a journalist stated for instance:

“In the United States, a security robot jumped into a fountain” [Sciences et Avenir, 18th of July 2017 (trad.)]



Figure 2.5: The company *Knightscope* commented the event on Twitter with a touch of humour, using a prosopoeia.

In this case, the robot K5 “jumped” (not “fell”) into the fountain, i.e. the robot K5 goes alone towards the fountain, dives into the water and sinks. “Jumping” directly rejects other meanings in terms of representations: no one pictures the robot being pushed into the water, or falling on the ground and rolling into the bottom of the pool. The representational dimension of the agentive language is at the source of the effect of *enargeia*, which gives a fast and direct access to the action. Precisely, according to Aristotle and thereafter to the antique language theorists, the primary function of discourse is the *enargeia*, i.e. the rhetoric practice of making facts visible through language. This concept is usually translated from ancient Greek as “clarity” or “visibility” since the discourse must *show* above all.

This being said, if the agentive lexicon (and its effect of visibility) is useful and effective in order to overpass the problems of effability raised by robots motion,

the important representational dimension of the agentive lexicon can also trigger questions about the status of the robots motion; *Did the robot K5 have a reason to jump into the water? Did humans lose control?* The effect of visibility often comes with an effect of validity: what sounds right also sounds deeply true, correct and adequate (see previously the reference to motion as a *tekmerion*). Hence, on one hand, the representational dimension of the agentive lexicon allows humans to *see* the situation and consequently, to *convey* the motion of the robot K5 through language, and on the other hand, it creates an effect of validity which can eventually bring confusion. Such problem is typical from the cases where sensations are conveyed and not coded linguistically (*per se*), just like in the case of the color 'blue' in Yéli Dnye that we mentioned earlier. On such notion, Levinson and Majid observe [Levinson 2014]:

- “(a) a degree of approximation (does the speaker have a precise blue shade in mind?)
 (b) a much greater latitude for interpretation,
 (c) much more reliance on background shared experience (how shallow a sea does the speaker have in mind?), and
 (d) much more room for entire misconstrual (perhaps texture rather than color is what is in the speaker’s mind).”

In the same way, saying that a robot *jumps* into the water allows on one hand to communicate motion, but also brings a greater latitude of interpretation.

2.3 Discussion on Movement, Perception and Language

In this chapter, we observed firstly the role of movement in the way that humans *perceive* moving machines. The human brain attributes intentions to moving objects and this cognitive mechanism is revealed within language. Secondly, we questioned the relation between movement, perception and language from a linguistic approach and observed how humans *tell* the world. In this case, we discovered what, within language itself, can explain the specific way in which humans' put their perception of movement into words. Hence, we highlighted the fact that, in robotics, the relative ineffability of motion is solved by the use of the agentive lexicon. In this way, humans overpass the (feeling of) struggle when it comes to express movements and produce a convenient and efficient effect of *enargeia* that makes anyone see what they are talking about.

Now, does humans' perception of movement explain the way that they talk about moving machines? In other words, does adopting the intentional stance mean necessarily to use the agentive lexicon to talk about robots? Or, at contrary, does the properties of natural language itself explains why we use such words (whether we attribute intentions to robots or that we adopt a design stance)? Following our observations in this chapter, the answer is both: as the cognitive approach introduces the intentional stance as the reason why we use those words in

the first place, the linguistic explanation gives us reason to assume that we cannot do otherwise. At least, the linguistic perspective explains why we keep using the agentive lexicon despite its important representational dimension.

That being said, the agentive lexicon used to talk about robots appears often problematic to many roboticists who find it very approximative, ambiguous, or even misleading. For this reason, some experts are tempted to radically reject the use of such words in robotics, or even to forbid it (at least when talking with non-experts). Anyway, as we will see in section 3.3.1, the history of language tells us firstly that linguistic uses always impose themselves, even if opposed. Also, the assessment risks to be particularly negative in the long-term as this strategy might encourage the development of conspiracy theories. Indeed, the need to control one's discourse may be understood as: "we have something to hide". We discuss the problem of such rhetorical strategy in the following chapter, but we must, for now, investigate the status of the words used in robotics. What are those words? Are they actually *ambiguous*? Can this apparent ambiguity be solved?

Lexical ambiguity resolution in robotics

Contents

3.1	Lexical ambiguity resolution	38
3.1.1	Lexical access during sentence comprehension (David Swinney, 1979)	38
3.1.2	Lexical ambiguity in the context of robotics	39
3.2	Robotics' wording	41
3.2.1	Robot dispositions: a series of <i>confused notions</i>	41
3.2.2	Robot actions : a sample of symbolic language (like in poetry)	42
3.2.3	Discussion on robot dispositions and actions, regarding lexical ambiguity resolution	47
3.3	Dealing with symbolic language and <i>confused notions</i> . . .	48
3.3.1	Various common strategies	48
3.3.2	Among the rhetorical apparatus	52
3.3.3	<i>So what?</i>	53

The agentive lexicon used to describe robot actions and behaviors fulfills a useful function that consists in allowing human beings to feature objects (and the world in general) at their own level. Ironically, this same lexicon raises the fear that an inadequate phraseology might lead to category mistakes or at least, might encourage some absurd extrapolations and some confusion between robots and living organisms [Dominicy 2019]. For this reason, the words *intelligence*, *autonomy*, *learning*, *decision*, *intention*,... are usually depicted as *ambiguous* by any person who considers moving machines as non-intentional agents. What are actually those words? Are they some rhetorical figures (as metaphors or metonymies) or does their literal meaning reveal actual qualities of robots? Are those words actually *ambiguous*? In this chapter, we firstly revisit the question of the lexical access during sentence comprehension as we aim to question how humans solve ambiguity in language in general. We then observe that the ambiguity of the agentive language used in robotics is likely to be of a specific nature. Indeed, the words used to describe robotic performances include a degree of ambiguity that the human brain should solve without difficulty. However, the language used in -and about- robotics, seems

to escape from the ordinary processing of lexical ambiguity resolution. Throughout this chapter, we support the fact that there is much to gain in understanding linguistic uses: we investigate the status of the words used to describe robots and evaluate the eventual problems that they raise for the discipline of robotics. Finally, and after having shed some light on the potential of those words and the mechanisms involved, we examine various options in order to handle such lexicon in the context of robotics.

3.1 Lexical ambiguity resolution

3.1.1 Lexical access during sentence comprehension (David Swinney, 1979)

How do humans access the meaning of words? In this section, we firstly focus on the problem of the lexical access during sentence comprehension [Swinney 1979] in order to better apprehend the question of how humans usually solve ambiguity in language.

In the late 70's, David Swinney considered the effects of the context during a sentence comprehension. He noticed firstly that ambiguous words occur far more often than people realize. Also, he raised the fact that humans are excellent in lexical ambiguity resolution: people figure out which meaning is intended so naturally that they rarely notice any ambiguity. Following these observations, Swinney comes to question the matter of lexical ambiguity in this way: do people access all meanings of words and then, sort it out, or do they access one meaning and only according to the context? For the purpose of his investigation, subjects listened to pre-recorded sentences that contained ambiguous words. These words were equibiased, i.e. that there were 2 possible meanings for each ambiguous word and one meaning was not favored over the other in common speech. The subjects were informed that they would be tested on their comprehension of these sentences. Subjects were for instance presented with the sentence:

“Rumor had it that, for years, the government building had been plagued with problems. The man was not surprised when he found several bugs in the corner of the room.”

In this case, the word “bugs” could mean “insects” as much as “surveillance”. With a delay corresponding to 3 syllables from the auditory ambiguous word stimulus, either “ANT”, or “SPY”, or an unrelated word such as “SEW”, or even a non-word, was flashed on a screen. The subjects were asked to decide, as quickly as possible, whether the string of letters formed a word or not. In the meanwhile, context conditions varied from no biasing context (as above) to strongly biased context, leading the listeners towards one meaning or another. For instance:

“Rumors had it that, for years, the government building had been plagued with problems. The man was not surprised when he found several spiders, roaches and other bugs in the corner of the room.”

Swinney claimed that if a person activates both meanings of an equibaised ambiguous word simultaneously, the response times should be the same regardless of which meaning is primed by the stimulus. However, if one meaning is activated, then the response time should be faster for the priming of that meaning. As we see in Fig. 3.1, results indicated that subjects accessed multiple meanings for ambiguous words, even when faced with strong contexts that specified a single meaning.

Swinney could conclude that both meanings of the ambiguous prime word were initially retrieved, and then only, the contextually inappropriate meaning was quickly discarded. Word recognition is consequently modular, rather than interactive. Basically, ambiguity characterizes natural language, and humans are designed to treat efficiently this specificity.

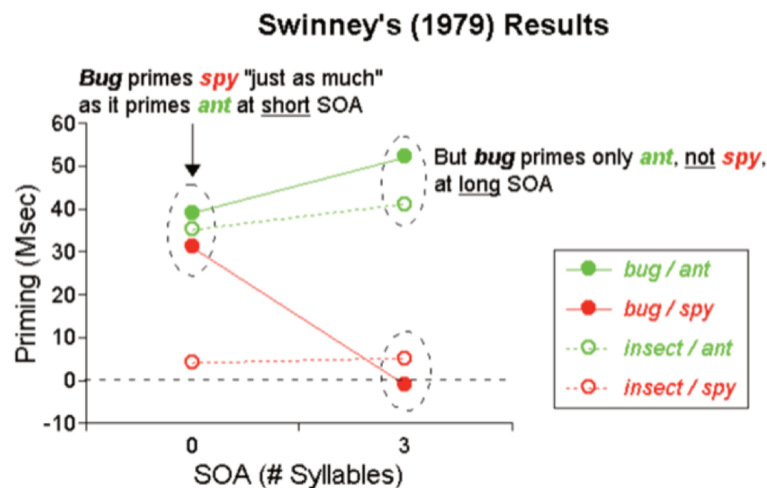


Figure 3.1: The graph of Swinney’s results’ shows that both “spy” or “ant” were primed at the same short time: as part of recognizing the word, multiple meanings are retrieved, even in conditions where there is a strongly biasing semantic context. At a slightly longer time (3 syllables), the contextually inappropriate meaning (in this case, “spy”) is discarded [Swinney 2010].

3.1.2 Lexical ambiguity in the context of robotics

Now that we have revisited the problem of lexical ambiguity in a general context, we are ready to consider our concern in robotics. Indeed, are the words used to described robots *ambiguous*? If yes, can we solve such ambiguity, i.e. can a lexical context force a veto to apply on the inadequate meaning?

Answering such matter means to postulate that if the Swinney Test was to be taken with the *ambiguous* lexicon used in robotics (for instance the word “intelligent”), the subjects of the experiment would first access both meanings (intelligent as “smart” like in “smartphone” (i.e. as *machinelike*), as well as intelligent as “clever” or “wise” (i.e. as *lifelike*)). Then only, one or another meaning would be selected thanks to the context.

However, there are at least two problems about this postulate:

- First of all, assuming that the word “intelligent” (for instance) could both mean “smart” or “clever”, is missing the fact that, in the first place, being *intelligent* can be akin to a full spectrum that can be compared to a color palette.

Such observation echoes for instance various studies about people’s judgements in the context of robotics. Indeed, adults considers robots as machines, but “alive enough” to substitute people when they lack the ability to do something [Wykowska 2014]. Also, Gaudiello and Zibetti commented: “after interacting with a robot, both adults and children seem to treat it as an intelligent entity, but intelligent in a unique way, which is different to the way that living or non-living entities are intelligent” [Gaudiello 2016]. Such notion seems thus to involve degrees instead of being a matter of *all-or-nothing*. Consequently, we rather face here a matter of *vagueness*¹, than a problem of lexical ambiguity that could be solved thanks to a veto.

- Secondly, the role of the context in the comprehension of a sentence about robots is not always clear. For instance:

“The robot knows how to take the ball on the floor since it calculated the trajectory of its movements.”

Despite a relatively technical context, the sentence still leaves here the reader with another possible interpretation than “*the robot knows which movements to make in order to grasp the ball in the sense that the results of the calculations are integrated within the system*”. It is also possible to read “knowing” as: “*the robot knows how to take the ball on the floor in the sense that his knowledge could also give him the possibility to take a knife on a table, and what more?*”

This interpretation is indeed semantically acceptable, even though many experts in robotics will agree on the fact that such transfer of tasks is not as easy to do than it is to say. In that respect, Daniel Wolpert notices that while it took a doctoral research of 3 years for a robotic arm to pour water into a glass, it took another 3

¹David Tuggy characterizes vagueness as a linguistic phenomenon, where “two or more meanings associated with a given phonological form are [...] united as non-distinguished subcases of a single, more general meaning” [Tuggy 1993].

years to make the same robot do something else [Wolpert 2010]. By the way, such example illustrates the common problem of *generalization* in robotics. Transferring a task such as “taking a ball” into “taking a knife” (or “taking any other object”) is indeed not as easier for robots than it is for instance for humans (who actually have a *deep background* [Searle 1995]. See earlier, section 2.2.3, *Is motion ineffable?*).

Now, how can we explain that a biased context does not discard the inappropriate meaning in such sentence?

3.2 Robotics' wording

3.2.1 Robot dispositions: a series of *confused notions*

In order to better understand the status of the *ambiguity* of the lexicon of robotics, we must further investigate the nature of those words. In the meanwhile, we concede a primary categorization of this lexicon as we analyze the robot dispositions and the verbs of actions.

Regarding the lexicon of robot behaviors or *dispositions* (such as the words: *intelligent, autonomous, creative, conscious, etc.*), we have seen in the previous section that the concept of lexical ambiguity lacks in covering all aspects of the problem.

Generally, when the lexical ambiguity is not solved, it is due to the fact that the inadequate meaning cannot be discarded. In the case of the robot dispositions, the lexical activation of each possible interpretation for a given word cannot be cleared in the first place. As we observed earlier, being alive seems to involve degrees instead of being a matter of all-or-nothing, and this statement is reflected in our inability to define the full range of meanings of a given word (as intelligent is not -just- “smart” *versus* “clever”). Moreover, opposing qualities according to the living *versus* inanimate objects is already an obvious cultural bias. On this matter, Gentiane Venture reminds us for instance that, in Japanese, and according to Yamamoto [山本雅子, 存在表現「ある」「いる」の意味—事態解釈の観点から—, 言語と文化: 愛知大学語学教育研究室紀要], the choice between “ある” (aru) and “いる” (iru), i.e. “to be”, is rather made according to sentient *vs* insentient than living *vs* inanimate [Venture 2019]. Consequently, at a semantic level, the words used to describe robot dispositions are thus not *ambiguous*, but are rather characterized by *vagueness*. At a pragmatic level, this means that the robot dispositions lead to incompatibilities or conflicts. In rhetorical terms, they are akin to what Chaïm Perelman defined as *confused notions*; a *confused notion* is a context-dependent notion that changes depending on socio-historical developments [Perelman 1980]. Those notions cannot be determined once and for all by the identification of a supposedly essence of the notion.

With this in mind, one may wonder why using a series of (if not *ambiguous*) *confused* notions in order to describe robot dispositions (or in fact, in any other context). Actually, the use of confused notions proves to be essential in some cases of deep disagreement. For instance, in public international law, confused notions can be a necessary condition in order to agree on a legal text gathering nations with distinct (even maybe incompatible) ideologies. Using confused notions allows to agree on the formulation (and so, to adopt the legal text), while at the same time, allows the disagreement about the interpretation of the notions. In order to highlight such idea, let us consider the case of the Universal Declaration of Humans Rights, written in 1948 [Perelman 1966], [Danblon 2013a].

In the introduction of the text published by Unesco, Jacques Maritain specified that if the rules that could be formulated are “diversely justified by each, [they] are, for each other, principles of action that are analogically mutual”². In other words, all signatories found an agreement on the words to use in the legal text (i.e. that the agreement was based on confused notions that allow multiple interpretations), while keeping the right to interpret them in their own way. However, in the case of a litigation, the individual intentions of each parties would then have to step aside as the Court would define the authorized interpretation in the specific case. For the legal text to be efficient, everyone would then have to comply with the decision of the Court.

In the context of robotics, the words used to describe robot dispositions appear to work in a similar way: talking about *intelligent* or *autonomous* machines allows humans to discuss legal, technical, scientific matters (etc.), despite the multiple possibilities of how to interpret such notion.

3.2.2 Robot actions : a sample of symbolic language (like in poetry)

Most of the verbs describing the actions of robots do not allow multiple interpretations (such as the robot “moves, goes, climbs, walks, sees, speaks,...”) do not appear neither ambiguous nor approximative. Yet, others like the robot “*decides, learns, helps, looks, recognizes, knows, talks,...*” may prove to be problematic in terms of selecting the adequate meaning. In fact, the absence of veto on one given meaning is typical from discourses that mobilize massively a representational dimension which, as Marc Dominicy specifies, is the case in poetry [Dominicy 2011]. Indeed, many poets widely use symbolic language³, leaving each reader with his own opinion on the interpretation to prefer. Regarding this matter, Dominicy observes that the human being is an interpretative animal: humans rush to one interpretation, then argue with the persons who do not share it. Consideration should be rather given to the process involved in the production of the text, before choosing one

²Trad. of [Maritain 1949]: “[les règles formulées], diversement justifiées par chacun, sont pour les uns et les autres des principes d’action analogiquement communs”.

³(symbolic in the way that a symbol articulates a second meaning with the prime)

interpretation [Dominicy 2011]. Let us thus follow this advice and consider the mechanisms involved within the agentic lexicon used to talk about robot actions. For this purpose, we refer to 3 study cases: in the first situation, the task given to a robot is “*to climb the stairs*” while in the second case, we consider the problem of the speech acts. Finally, the last situation refers to a case where the task of the robot is “*to go from location (A) to location (B)*”.

- **Situation 1 : “Climbing the stairs”**

In this situation, a programmer intends that the robot HRP-2 (see Fig. 3.2) climbs the stairs. Consequently, as we say that:

(1) *The robot HRP-2 climbs the stairs,*

it means;

(1') *This robot's programmer intends that, if a certain set of conditions C is fulfilled, then the robot's movements will take it at the top of the stairs* (see p.52 in [Dominicy 2019] for a similar example about robots opening doors)



Figure 3.2: The robot HRP-2 (LAAS-CNRS Toulouse, 2018).

The example (1) illustrates a metonymy as it holds a relation between the robot (the source) and its signatory, i.e. the programmer (the target). Now, if we consider the case where the robot doesn't climb the stairs (even though the programmer still intends that it does it)⁴. We can then refer to the situation by saying (2) or (3);

(2) “*The robot doesn't climb the stairs*”

(3) “*The robot doesn't want to climb the stairs*”

What is the difference? What does (3) say that (2) does not? Example (3) is a conceptual metaphor and includes thus a wider representational dimension. In fact, a conceptual metaphor involves a relation between a source-concept and a target-concept. Marc Dominicy opposes the conceptual metaphors such as (4) to the image metaphors such as (5):

⁴The proposition, in its negative form, is indeed more efficient to illustrate our following point.

(4) “*Thoughts are summer lightning*”

(5) “*My wife [...] With an hourglass waist*”⁵

While “*My wife*” is associated to an image, “*Thoughts*” are related to the concept of “summer lightning”. Consequently, while the conceptual metaphors can support further non-perceptual analogies derived from semantic or encyclopedic entry of the (complex) concept, image metaphors cannot [Dominicy 2019]. In other words, if (5) is a figurative way to say -only- (and nothing else) that *my wife* has a very-narrow waist but a large-hipped figure, we can say, at contrary, that (4) is a way to convey the idea that *thoughts* may kill you, or that they are beautiful and scary at the same time, or that they are endless, etc. [Dominicy 2019].

Because the representational dimension is wider, the possibilities to express something (via the conceptual metaphor) are also numerous. The potential of conceptual metaphors lies indeed in the fact that they can involve, for instance, a reason for human beings to perform a certain action or to entertain a specific belief, in a “very compactness of thought and expression” [Dominicy 2019]. The utterance (6) is in that sense typical:

(6) *My car refuses to start*

Such sentence is an example of a phenomenon called “coercion” as one word coerces another word to have a different meaning from its usual one. Aspectual verbs coerce their arguments into denoting some sort of event [Asher 2011]. Indeed, the use of the verb “to refuse” gives to the verb “to start” an iterative aspect.⁶ If instead of (6), I say only that “*my car doesn’t start*”, the idea that I already tried several times but that it still doesn’t start, is not conveyed at all.⁷

In a similar way, in the statement (3) (“*The robot doesn’t want to climb the stairs*”, the conceptual metaphor involves, in a very quick and efficient way, a reason for the audience to entertain the belief that there is an usual problem, and for instance, to require the patience of this assembly. The general mechanism of “personification”, such as in this example, allows to produce what Searle calls “*as-if Intentionality*” [Searle 1995]. Such process underlies the machines as people, and events as action, which appears very compact and efficient [Dominicy 2019].

Yet, if a similar metaphorical mechanism is in use in (3) and (6) (both the robot and the car refuse to do something), the representational dimension is still wider in

⁵Translation of André Breton, “L’union libre”: “Ma femme [...] à la taille d’un sablier”, from John C. Stout [Stout 2018].

⁶Such statement is indeed an efficient way to entertain the believe that *I tried several times to switch it on but it still does not start* and gives a reason for human beings concerned *to better go and catch the bus*.

⁷Besides, to start a car is typically to start the running of the car’s engine and is an example of coercion on its own. Nicolas Asher notes that “most people can distinguish between largely automatic interpretations that these predications seem to entail and those that require more conscious effort” [Asher 2011]. The fact that this distinction is made possible due to a mark of information inherent to the predications or that it is the result of inferred afterwards background (i.e. nonlinguistic beliefs) has not yet been clarified.

the case of the robot. In order to capture the difference between *the robot doesn't want to do something* and *the car doesn't want to do it*, we consider the statements (7) and (8):

(7)

(i) *The river [Scamander] fights with Achilles*

(ii) *The [Dodona] oaks spoke the prophesis of the oracles*

(iii) *The car [Christine] flips on its lights and restores itself to showroom quality, then, driving itself, keeps on with the mission [Dominicy 2019]*

In (7), we clearly observe the mythical or fictional aspect of the examples. At contrary, in (8), such finding is not necessarily so obvious:

(8) *The robot [HRP-2] flips on its light, repairs itself, then, walking on its own, keeps on with the mission*

The particularity of the fictional or mythical examples (7) is that the statements are not evaluated as true because they violate our empirical beliefs (such as the fact that a river cannot actually fight a man, that a tree cannot speak, or that a car cannot suddely decides to take action). At contrary, our empirical beliefs are challenged when it comes to robots. In this way, (8) and (3) ("*The robot doesn't want to do something*") appear quite different from (6) ("*the car refuses to do something*").

One common explanation for such matter is the influence of mythology, literature and cinema. Certainly, science fiction has given many reasons for humans to challenge their empirical beliefs about robots. However, this argument does not sound satisfying as we also commonly face, in novels and movies, some trees being able to advise humans or to raise an army for instance. We explore other cases in order to shed light on this matter.

- **Situation 2 : "Speech acts"**

The fact that humans' empirical beliefs are challenged when it comes to robots (and not in the case of trees or books for instance) seems far from absurd if we consider propositions including objects and speech acts. Considering the following statements:

(10) "*The book demands attention to anyone interested in engineering*"

(11) "*The robot demands attention to anyone interested in engineering*"

Just like in (7), it is here impossible to believe that a book is *actually* demanding attention, without violating our empirical beliefs.⁸ At contrary, humans' empirical beliefs are not -necessarily- violated in (11). There exist indeed many robots which

⁸The fact that this figure is a prosopopeia is clear for everyone. On this matter, see [Chabot 2019] and [Kissine 2013].

can actually accomplish a speech act such as: “*Please, pay attention to me*”. The synthesised voice in the metro is another example.

Moreover, utterances such as “the robot demands, decides, wants, etc.” are lexicalised, just like examples (6) or (10), i.e. that humans process the figure “online” [Dominicy 2019] and do not spontaneously realize that they face a rhetorical figure. Henceforth, without considering any influence from science fiction, it is way less obvious to consider (3) or (11) as fictional examples.

• **Situation 3 : “Going from location (A) to location (B)”**

A second argument is that, contrarily to a car (or to a teleoperated robot driven by humans for instance), the statement “to decide” can actually be attributed to a robot.

In this situation, a programmer intends that the robot HRP-2, which is situated in a location (A), goes to another location (B). In the way between (A) and (B), there is a staircase. (A) and (B) are both situated at sea level. In this case, nothing has been explicitly programmed by the roboticist so that the robot would climb up and down the stairs in order to reach location (B). Consequently, we cannot consider *a priori* that (12) means (12’):

(12) *The robot decides to climb the stairs [in order to reach location (B)],*

(12’) * *This robot’s programmer intends that, if a certain set of conditions C is fulfilled, then the robot’s movements will make it goes up and down the stairs [so that it can reach location (B)]*

Indeed, the robot can well select another path such as going around the stairs in order to reach (B). The decision-making process can be reasonably attributed to the robot’s calculations. Consequently, (12) should, in this situation, be formulated as (12’):

(12’’) “*This robot’s programmer intends that, if a certain set of conditions C is fulfilled, then the robot’s movements will take it to location (B) [knowing that the programmer himself or herself does not know which path will be determined by the calculations.]*”

The programmer himself or herself can be *surprised*⁹ by the path and the movements that are determined by the robot. Can we still consider that “*the robot*

⁹The utterance “to be surprised” illustrates here again the common problem that can be encountered while talking about robots. Indeed, the tension between fear and fascination is underlying the utterance “to be surprised”: both the following interpretations are semantically acceptable: “the programmer is surprised by the movements in the way that he thought that the tasks that he or she programmed into the robot should have made the robot take the stairs (but in fact, he or she forgot a constraint (see the problem of optimisation in 2.2.3)” *versus* “the programmer is surprised in the sense that the robot took some liberties with the original programming.” However, there is no other better or *neutral* word to be used in this case.

decides [...]” is a conceptual metaphor? Should we read it literally? In our humble point of view, neither the metaphorical reading nor the literal meaning is satisfactory. However, the metonymic reading seems the most appropriate as the signatory of the (high level) task is still the roboticist. Yet, our main problem here is not to answer such question. Our argument lies indeed in the fact that the meaning of “*to decide*” is not so easy to determine, even by experts. Indeed, if roboticists can obviously find and interpret clues that will help them to guess who *decides* what and how things are done, they cannot -necessarily- determine everything about the kinematics only by looking at a walking robot for instance: is the movement calculated online or offline? Is the control in position or torque?

Consequently, if the decision-making process can be attributed to a robot (even if the signatory is still at first, the roboticist or the operator), the fact that the empirical beliefs of humans are challenged should not be automatically associated to a sign of immaturity or credulity. Also, if the possibilities are wide in terms of interpretation of robot actions and the rhetorical figures hard to determine (metonymy? conceptual metaphor? or literal meaning?), we observe that it is firstly because moving machines themselves challenge humans' empirical beliefs, rather than because words are supposedly ambiguous or misleading.¹⁰ Indeed, our observations in situations 2 and 3 give us reason to think that the words used to describe robot actions do neither allow nor encourage the confusion about the status of robots (if not already there). This being said, the high representational dimension of those words, by allowing multiple interpretations, cannot either block or discard meanings.

3.2.3 Discussion on robot dispositions and actions, regarding lexical ambiguity resolution

The analysis of the mechanisms involved within the agentic lexicon used in robotics shows that robot actions and dispositions can refer (at least) to metonymies (that highlight the relation between robot actions and its signatory, the roboticist), as well as to conceptual metaphors (that involve a source-concept to a target-concept). This being said, as humans' mind favors compactness of thought and expression, metaphorical readings have much more chance to be preferred. Compared to one another, metonymic readings have indeed little chance to be preferred spontaneously to conceptual metaphors as metonymic readings rely on “a rational ground whose linguistic formulation does not belong to ordinary language” [Dominicy 2019] (see statements (1'), (12'), (12'')). Also, the metonymical interpretation is only possible for the one who is already convinced by the theory.¹¹[Hallyn 2004].

Yet, the metaphors-concepts should not be considered as the source of the confusion about the status of robots: if it is true to say that that the high representational

¹⁰Now, to ask why robots challenge humans' empirical beliefs in the first place, is a matter beyond our knowledge. Such issue demands certainly the expertise of philosophers and psychologists (among others).

¹¹For instance, in order to read (1) as (1'), we must already be convinced that the primary intention belongs to the roboticist and not the robot itself.

dimension of metaphors-concepts is responsible for the absence of veto on the inadequate meanings, the fact that the notion itself admits various interpretations depends on humans' own empirical beliefs. In other words, the lexicon is here at the disposal of humans so that they can express their own beliefs about robots. Besides, conceptual metaphors prove also to be as useful as the effect of *enargeia* that they produce (see 2.2.4): they have the potential to involve an implicit reason for humans to perform a certain action or to entertain a specific belief (as explained about (6)). Also, metaphors are recognised to structure (complex) ideas and concepts [Lakoff 2008].

With this in mind, we evaluate the strategy that have been considered to deal with notions involving a high representational dimension and explore their limits.

3.3 Dealing with symbolic language and *confused notions*

3.3.1 Various common strategies

- **Dismissing the agentive lexicon**

Out of the previous sections, we observe that, despite the problem of effability in the representations of robot actions and dispositions, humans have the need to formulate thoughts, theories, concepts and ideas about robots (see 2.2.3). If the agentive lexicon proves to be useful as it produces an effect of *enargeia* that makes the situation *visible* for everyone (see 2.2.4), the words used to describe robots do not help in terms of discarding inadequate meanings. In this section, we firstly investigate the common strategies that are considered to handle symbolic language and confused notions in robotics. Thereafter, we explore the rhetorical apparatus in order to find alternative strategies at the level of the *logos*. We begin by discussing the strategy that consists in dismissing the agentive lexicon: if the use of the agentive lexicon leaves the possibility for inadequate interpretations when talking about robots, why not to dismiss or avoid systematically those words in the context of robotics? Why not to opt for literal expressions rather than for implicit meanings conveyed through rhetorical figures?

- *Limits:*

First of all, it is simply unreasonable for humans to constantly formulate sentences such as (1'), (12'), (12'') when it would be enough to convey the same idea in a more efficient and clear way. Thereafter, the idea of rejecting those words systematically contradicts the tendency found within the history of language where linguistic uses always impose themselves, even if opposed.¹² Moreover, a strict opposition to the use of the agentive lexicon risks to have the opposite effect over time: while the roboticist who feels uncomfortable to use these

¹²The victory of a lexicon on another depends on the actual use of the words rather than on the decision of an individual speaker. In this way, the word "cybernetics" has lost the battle against "artificial intelligence" for instance.

words will stop to communicate (*a priori*, the roboticist who is today worried about doing wrong, will apply literally and strictly the principle of cautiousness in the future), the roboticist who will try to forbid the use of this lexicon and impose forcibly the idea that a machine is -not- intelligent, will only encourage the development of conspiracy theories.

● A better technical and scientific education

As the use of the agentive lexicon is hard to avoid when talking about robots, what else could be done so that humans select the meaning that is meant by the speaker? Among scientists, many propose spontaneously the strategy of a better or more important science and technical education of the society. Following this, the ideal society would be composed by “citizen-experts” or at least, citizens who knows enough about the techniques and technology so that they could discard the inappropriate interpretations (science fiction *versus* technical achievements).

- *Limits:*

On this matter, let us consider the case of a study about citizen-science education where the knowledge of participants about birds’ biology was scaled before and after they received a short education on cavity-nesting birds [Brossard 2005]. The participants were asked to evaluate a series of statements such as:

- “Most songbirds lay one egg per day during the breeding season.”
- “All birds line their nest with feathers.”
- “Humans can handle nestlings with little fear of the nest being abandoned by the adult birds.”
- “Some birds need supplemental calcium to produce eggs. [...]”
- Etc.

The results of the investigation show that if participants’ knowledge of bird biology increased thanks to the training, no statistically significant change in participants’ understanding of the scientific process, attitudes toward science and environment could be detected.

This study of citizen attitudes towards birds and environmental issues reminds us, among many others, the limits of a widely held belief in academic circles. Today known as the *knowledge-deficit* model, the main aspect of this belief relates to the idea that the public’s confusion between myths and realities about science and technologies is due to ignorance and would disappear if only scientists provide them with clearly transmitted information (and thus, with clear (and non-ambiguous) words). Although popular, this model has been largely discredited in the Anglo-American research in science communication. For instance, Scheufele reports that “we have decades of research in social psychology, political science and risk communication

that suggests that knowledge plays a marginal role at best in shaping people's opinions and attitudes about science and technology" [Scheufele 2006].

For such reasons, we have good arguments to believe that more scientific knowledge does not allow to reduce the range of possible meanings of a conceptual metaphor. If scientists are keener to prefer the same meaning, it is very likely because they are part of a same community (see Chapter 4 about the will of scientists to stand out from *charlatans*).

• The concept of framing

At the contrary of the deficit model, another model, often referred to as the *low-information rationality* [Popkin 1994], aims also to describe how citizens interpret scientific and technical matters. However, in this case, the problem is not introduced as the results of a lack of factual science (like suggested by the deficit model), but by ideological predispositions and influences from mass media and people's tendency of making cognitive shortcuts. The model assumes that human beings are cognitive misers and minimise the economic costs of making decisions and forming attitudes. It explains the gap between non-experts and experts to grasp specific scientific issues as a result of the fact that non-experts, facing a complex topic in which they are not specialist, "rely on cognitive shortcuts or heuristics to efficiently shift through large amounts of information and to form attitudes about these issues" [Scheufele 2006]. From this accurate observation, the concept of framing appears thus as an efficient strategy in order to convey a specific message. The research of Kahneman and Tversky [Tversky 1981]¹³ on the notion of framing has indeed demonstrated that individual decisions are systematically affected by the way in which problems are presented.¹⁴

However, using the strategy of framing complex concepts and ideas on its own faces at least two flaws that should not be minimized.

- *Limits:*

First of all, if the deficit model has clearly been proven inefficient to describe the tension between fantasies and realities in citizens' understanding of scientific issues, Scheufele's study on laymen's vision of nanotechnology concedes about the low-information rationality that "the less expertise citizens have on an issue initially, the more likely they will be to rely on cognitive shortcuts or heuristics" [Scheufele 2005].

¹³(for the latest version of the theory, see [Kahneman 2011])

¹⁴They present an experiment during which students have to imagine that an epidemic has been declared in their country. The students must indicate which policy seems the most reasonable to them. One group of students must choose between saving 200 out of 600 people for sure and one chance in three to save the 600 people. Another group of participants is offered the same choice but with a different wording (choose between letting 400 people die or two out of three chances of 600 people dying). Although the mathematical expectation is the same in all cases and the two solutions are equivalent, the decision differs according to the wording. When it comes to "saving" lives, participants adopt a risk-averse attitude and choose the first solution (saving 200 people) while if it is a matter of letting the sick "die", they prefer to have a one-in-three chance of saving them all while taking the risk of letting 600 people die [Tversky 1981].

Therefore, if increasing factual science does not prove itself to modify public's relation to science and technologies, a strong bond between knowledge and opinions is still observed. Indeed, citizens' effort to develop an in-depth understanding of scientific issues and overcome the spontaneous cognitive shortcuts and heuristics is higher with subjects that already have some knowledge about the issue. Furthermore, if improving factual science does not offer convincing results, practical knowledge has already shown very promising results about the way participants evolve in their beliefs and attitudes. For instance, Gaudiello and Zibetti's study showed that the practice of robotics such as building robots and learning to program them, has an impact on people's point of view on machines [Gaudiello 2016].

Secondly, understanding how citizens form opinions and attitudes about scientific and technical issues should never become a tool to disempower citizens themselves. Using strategies based on the model of low-information rationality are however highly exposed to this risk. Indeed, based on the fact that non-experts rely on cognitive shortcuts, the solution of framing confines media and scientists in a position where they must decide on what frame to use on their audience, according to the underlying audience interpretative schema such as religious beliefs, moral values, etc. Obviously, this concept could be used with good, as well as bad intention, and is thus not essentially condemnable. Yet, if the concept is utterly coherent, the main issue of posing the problem from this angle remains in the fact that citizens are passive agents whom a method is applied to. If society wishes for science communication to be effective, it is hardly comfortable to impel scientists to use methods where citizens have no role to play. Besides, in a general context where the status of experts seems to be more and more challenged, the concept of framing sounds rather counter-productive. As an illustration, see for instance the following comment made about Prof Ernst, a Belgian expert in nuclear industry who received the Blondel Medal in 2018 [Ernst 2017]:

“(...) Not sure that Mr Ernst's answer, tinged with superiority and arrogance, will make the debate go forward or give a good image of scientific “experts”...”¹⁵

This example is especially relevant as the simple fact of using quotation marks on the word “expert” show how the status of experts is not *a priori* admitted by the public, even though the Professor is largely recognized by the community of experts (the Blondel Medal is awarded each year in France by the Société de l'Électricité, de l'Électronique et des Technologies de l'information et de la communication (SEE) in recognition of outstanding research work in the field of science and the electrical industry in the broad sense).

Moreover and similarly to the strategy of rejecting strictly the agentive lexicon to talk about robots, the solution of *framing* concepts and ideas might play a significant role in the success of conspiracy theories. Indeed, if adapting the discourse to the audience in each situation is a general condition for

¹⁵Trad. from: “(...) Pas sûr que cette réponse de Mr Ernst, teintée de supériorité et d'arrogance, fasse avancer le débat ou donne une bonne image des « experts » scientifiques...”

a speech to be efficient, the concept of framing proposes to fulfill that condition while losing the possibility to develop trust between experts and citizens.

Last but not least, Baudouin Jurdant highlights the fact that the only idea of considering the problem as a “gap” between the scientists (*the ones who know*) and the public (*so-called ignorant individuals*), is already highly questionable. Nowadays, it is common to associate the necessity of putting science into words to a demand that would come from the people willing to be aware of the scientific discoveries and the technical achievements (especially when potential or actual risks are sensed or observed (nuclear, climate change, integration of AI and robotics, etc.)). However, the need for science and technology to be understood by the public and to be integrated in the human culture comes historically from science itself [Jurdant 2006].

To sum up, if the concept of framing ideas and concepts describes accurately the role of language in decision-making (or at least in spontaneous decision-making), the foundations of such strategy raise ethical problems and reflect a limited vision of the role of popularization.

3.3.2 Among the rhetorical apparatus

Apart from the previous strategies, are there other solutions available? Among the rhetorical apparatus, Chaïm Perelman and Lucie Olbrechts-Tyteca distinguish the technique of the *dissociation of notions*, which, without defining the notions, responds to the problem of incompatible opinions about those notions [Perelman 1969]. In fact, looking for a precise and sharp definition of the notions in order to clarify the lexicon is another common strategy used in robotics (see for example about “moral machines” [Hunyadi 2019], about “ethical agents” [Moor 2006]). However, if definitions are useful for roboticists to define their work more finely (so, at a semantic level), they are inappropriate when it comes to handle notions that lead to deep disagreement at a pragmatic level [Fogelin 2005]. Hence, even if defined finely, the notions can still lead to incompatibilities or conflicts once faced with a particular case. Under such scenario, the technique of the dissociation of notions proves at contrary to be an efficient tool [Gross 2002], [Danblon 2002].

The argumentative technique of dissociation consists in dividing a single notion into two separate notions which are - in most cases - the object and its exception (oxymoronic relationship) [Van Rees 2008]. The result of a dissociation is for instance: *apparent freedom* and *real freedom*. The technique aims to produce an effect of evidence out of the argument (i.e. the discursive evidence) as it echoes perfectly the purpose of the speaker: “there is only one freedom, it is the real one”. Consequently, as this technique enlightens the meaning of the notion in a specific case and in a specific context, it could also be dissociated in another way for another case, according to different needs. Underlying the technique of the dissociation, the aim of the argumentation is to lead to a decision about a particular case, rather than to result in a general consensus. Consequently, the success of the dissociation will

also depends on the ability of the orator to successfully justify a specific meaning to a given audience in a specific context.

Such technique already proved its effectiveness in multiple fields where discourses are recognized as influent (politics, legal affairs, etc.). However, Emmanuelle Danblon notes that the technique of the dissociation, as it is presented by Perelman et Olbrechts-Tyteca, is based on the traditional dichotomy of *appearance* and *reality*: one of the terms of the dissociation is *apparent* (and so, deceptive), while the other is *real* as it is closer to the facts. Yet, the criterion that governs the dissociation cannot be the one of the appearance *versus* reality, or in other words, the *illusion* versus the *facts*.¹⁶ The notions needing to be dissociated are indeed not raw facts, but are social facts [?]. The criterion of appearance (*vs* reality) presents thus an inconsistency at an epistemological level. Such problem might block the discursive evidence that it is supposed to produce in order to create a persuasive effect. This is particularly visible in the context of robotics as the dissociation of the confused notions could result for instance in *simulated* intelligence *vs* *real* intelligence, *apparent* autonomy *vs* *real* autonomy, or (in the case of the symbolic language referring to robot actions) *apparent* decision *vs* *real* decision, *simulated* talking *vs* *real* conversation, etc. Indeed, as the dichotomy between appearance and reality is at the core of the problem of the possible confusion about robots, the dissociation cannot be efficient on such basis.

A corpus-based investigation would be necessary in order to explore an alternative criterion to the one of *appearance* versus *reality*. However, the criterion of responsibility (for instance *responsible* autonomy *vs* *blind* autonomy, *sensible* intelligence *vs* *blind* intelligence) seems like an interesting tool for dissociating notions in the context of robotics.

3.3.3 *So what?*

On one hand, the robot dispositions leads to incompatibilities and conflicts since they cannot be defined once and for all. The lexicon of robot dispositions can be identified as *confused notions* [Perelman 1969]. On the other hand, robot actions resist lexical ambiguity resolution despite a biased context. Similarly to the symbolic language in poetry, the veto does not apply on the inadequate meaning. Consequently, multiple meanings remain acceptable and humans stand with their opinions and (scientific) arguments as only tools to give sense to their observations.

Among the strategies that are commonly used to handle such lexicon, the technique of dissociation of notions proves to be effective. This rhetorical technique allows indeed to bypass incompatible opinions. However, an efficient rhetorical strategy cannot be limited at the level of the *logos*. Besides, arguments are never

¹⁶On this matter, Fernand Hallyn reminds by the way that the retrograde aspect of such notion within argumentation. Many major scientists of the past have rejected observations, in the name of *illusion*, in order to save their own theory (for instance, Galileo refused to situate comets beyond the moon and even described them as optical illusions)

completely set apart from the other components of every discourse: the *ethos* (i.e. the personality) and the *pathos* (i.e. the emotions that arise within the audience). Consequently, and since the effects created by the discourse depend on the orator's efficiency, the matter is an object of study for the field of rhetoric in its entirety.

Beyond the words: Rhetoric and Folk Epistemology

Contents

4.1	Rhetorical styles and Folk Epistemology	56
4.1.1	The notion of <i>style</i> and the field of <i>folk epistemology</i>	56
4.1.2	At one extreme of the spectrum: <i>sensationalism</i>	57
4.1.3	At the other extreme: <i>neutrality</i>	58
4.1.4	Consequences for robotics	60
4.2	Experimental rhetoric at the <i>Cité des Sciences et de l'Industrie</i> (Paris, France)	61
4.2.1	A gathering of roboticists and reporters	61
4.2.2	Conduct of the experiment	62
4.2.3	Conception	63
4.2.4	Results	65

In order to evaluate the role of natural language and rhetoric in the way that humans apprehend robotics, we have considered the bond between movement, perception and language (see Chapter 2) and studied the nature of the agentive lexicon used to talk about robots (see Chapter 3). However, the problematic carries on beyond the question of the words used to describe robots. In this perspective, this chapter firstly supports the fact that the core of the problematic about natural language in robotics is a rhetorical matter which is related to a deeper layer: the one of humans' own conception of rationality. Firstly, we show that the problem of the language of robotics engages not only the *logos* but the three rhetorical proofs and the relation between them. Secondly, a *rhetorical style* embodies implicit ideas and principles about language and knowledge, i.e. one's folk epistemology [Gerken 2017] [Heintz 2010]. Following this observations, we expose a rhetorical experiment aiming to investigate the common criteria on which humans usually base their judgement and interpretation when it comes to discourses about robotics. More precisely, this experiment gathered roboticists and reporters in the context of the exhibition on “*Robots*” at the *Cité des Sciences et de l'Industrie* of Paris.

4.1 Rhetorical styles and Folk Epistemology

4.1.1 The notion of *style* and the field of *folk epistemology*

In 1994, the specialist in communication Yves Jeanneret set forth his ideas about discourses on robotics and artificial intelligence [Jeanneret 1994]:

“[...] each article openly places itself in the perspective of the mythical discourse, whether it aims to echo or to contest it. [...] The discipline derives its ambiguity, but also its prestige, from this bond to the myth. Moreover, it is the myth that can explain why we fund highly speculative research that yet are not be considered as a gratuitous act.”

The myth invoked by Jeanneret refers to a humanity being able to recreate itself via the technique. It finds notably its roots in Ancient Greece with Hepahistos [Laumond 2012]. With this statement, Jeanneret points out the fact that the matter of the discourses about robotics covers more than a problem of popularization: it affects also the status of the discipline itself. Jeanneret specifies that the myth is inevitably attached to the discipline of robotics and that there exist various strategies or *styles* to address it.

The notion of *style* has long been associated to literary adornment (*ornatus*) [Van Eemeren 2019]. However, we refer here specifically to the *argumentative style* as described by Frans H. van Eemeren: “a complex notion that is instrumental in the pursuit of effectiveness in convincing the addressee of a certain standpoint” [Van Eemeren 2013]. In this way, van Eemeren links the notion of style to the properties of argumentative discourse and so, to rhetoric. This acceptance of the notion allows us to investigate various *rhetorical styles* through the description of the 3 rhetorical proofs (*logos, ethos, pathos*), and to evaluate the bond of those *styles* to one’s folk epistemology (see 4.1). We use the term “folk epistemology” to specify that the scope of this notion is not epistemology as traditionally understood by philosophers. Indeed, while epistemology is concerned with the theories of knowledge and rationality, the field of folk epistemology approaches the epistemic notions (such as language, knowledge, reason, intuition, etc.) from people’s point of view. In other words, folk epistemology observes how people evaluate epistemic notions and the processes involved in such evaluation [Heintz 2010]. In this way, the folk epistemology is concerned with the tacit principles and presuppositions that underlie and guide our everyday cognitive and linguistic practices [Gerken 2017]. The term “folk” refers to an established tradition in psychology that investigates “naive” or “folk” theories that ground the cognition of specific domains: folk physics, for instance, refers to the way that humans conceptualize the physical world and their interaction with it, from their own sensitive experience [Lakoff 2008], [Fauconnier 2008], [Talmy 2000]. For instance, one may conceptualize the fact of walking as a penetration in a *space* that is situated in front of him/her (and not as a lost of balance) [Berthoz 2000].

Therefore, based on the following acceptance of the notions of *style* and folk epistemology, we are now ready to begin our investigation. In the following sections, we describe two very typical rhetorical styles found in robotics, and explore the implicit ideas and principles that are embodied within those two rhetorical strategies.

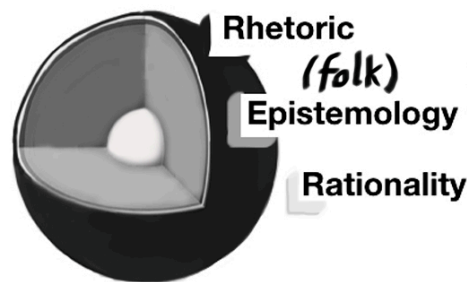


Figure 4.1: Representation of the bond between rhetoric and one’s conception of rationality.

4.1.2 At one extreme of the spectrum: *sensationalism*

Among the rhetorical strategies that can be found within discourses about robotics, one is to exploit the myths fully, and to foster the confusion between humans and machines. On the other extreme of the spectrum, the strategy consists at contrary in ignoring the myths and fantasies knowingly, and to limit the discourse to procedures as much as possible.

When the myth is fully harnessed within a discourse, robots being the future of humanity appear as a presumed prior knowledge, and robotics is thus tacitly introduced as a discipline that aims to bring robots to life. Considering a quote of D. Lenat:

“We look back on pre-linguistic cavemen and think “they weren’t quite human, were they?”. In much the same way, our descendants will look back on pre-AI homo sapiens with exactly that mixture of otherness and pity” (in [Shasha 1998]).

In this case, the argument does not only presumes the existence of a future where humans and AI would be intimately bond (placing robots on the line of the human evolution), but assumes also the idea of cavemen being cognitively inferior to humans of nowadays.¹ From a rhetorical point of view, a general picture of

¹This assumption has been largely criticized (among others, see [Villa 2014]).

this position can be depicted through the three rhetorical proofs that constitute every discourse (*logos* (language, arguments,...), *ethos*, (disposition of the orator), and *pathos* (emotions aroused within the audience) as follows: the *logos* is chosen with an intention to blur and comes along with an *ethos* of guru or mad scientist. The discourse sparks the emotions of fear and fascination (see Fig. 4.2).

In that respect, the rhetorical style that can be portrayed *grosso modo* through the description of the *logos*, *ethos* and *pathos*, refers to a conception of rationality that can be akin to a representative trend in every discipline. This style, commonly referred to as *sensationalism*. It is often criticized in a very similar way as the *postmodernist* trend: “First of all, the immoderate and vindicated use of metaphors (reputedly vague) to denote complex phenomena of social reality. Then, an inadvertent exit from the disciplinary area which is judged weak and inadequate according to the canons of modern science. Finally, a generalized imposture that claims to raise vagueness as a criterion of complexity and a powerful sign of intellectual interest” [Danblon 2016].

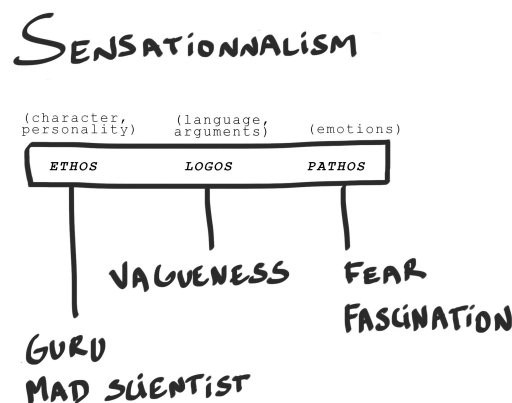


Figure 4.2: General description of the three rhetorical proofs in the case of *sensationalist* discourses.

4.1.3 At the other extreme: *neutrality*

On the other extreme, one strategy is to rely on mathematical demonstrations and technical descriptions and to adopt a *neutral* style. From this point of view, discourses converge towards a rhetorical practice that can be portrayed as follows: at the level of the *logos*, the rhetorical figures are avoided at any cost², while the two other rhetorical proofs are put aside: a neutral *ethos* is seen as the ideal and scientists minimize their own emotions, as well as the ones of their audience (*pathos*), (see Fig. 4.3).

²(we have already seen the limits of such strategy in 3.3.1

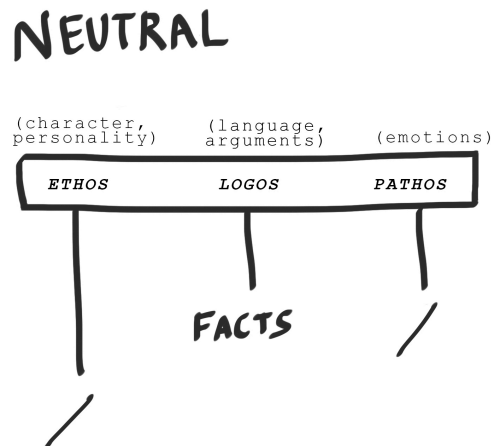


Figure 4.3: General description of the three rhetorical proofs in the case of (so-called) *neutral* discourses.

Compared to mathematic formula, statistics, numbers, etc. that traditionally vehicle the idea of objectivity, words are often considered in this case as a subjective bias that must be put aside. This dualistic conception appears for example in medicine through the well-known “*Every patient lies*”. From this point of view, language and emotions, both linked to the notion of persuasion, are spontaneously designated as a source of confusion and misinterpretation. As Naomi Oreskes states, scientists especially, are raised in such idealistic conception of rationality [Oreskes 2013]; within the scientific circles, showing your emotions supposes to lose the ability to evaluate the data [Oreskes 2013]. The motto is then to discard the subjectivation within reasoning and discourses, and to limit informations to data. In such way, the *neutral* style refers to implicit ideas and principles that can be akin to a reductionist posture. Also, it conveys an idealistic conception of language.

Data and facts appear at first as being able to close the debate and to “speak for themselves” (*if they are given to people that can understand them, everyone will then agree on what they mean*). However, they are always a matter *typically human*; despite mathematics being introduced as neutral and science as having no ideology, it is only when numbers are used as proofs within a reasoning and/or a debate, that they acquire meanings and value. In the *Rhetoric* of Aristotle, statistics (to name only one of a kind) are categorized as *extra-technical proofs*, i.e. that they are not provided by our personal means, but are given [and are therefore opposed to the technical evidence that] can be provided by the method and our personal means [Aristotle(ed.W.Ross) 1924]. Aristotle adds that for the purpose of persuasion, the former can be used while the latter must be invented, i.e. constructed by the triad of *ethos*, *pathos* and *logos*. Even if such extra-technical proofs are valued for their objectivity (we talk about “pieces of evidence” in juridical contexts or “data” in science), they are also at the orator’s disposal and consequently, are used and in-

corporated by the orator to become *rhetorical proofs*. They are in this sense, also built by the technique of rhetoric [Danblon 2009]. Following this, whether roboticists expose scientific results to their peers or as they provide technical explanations to the public, their reasoning and discourse always involve words, dispositions and emotions (i.e. the three rhetorical proofs), see Fig. 4.4.

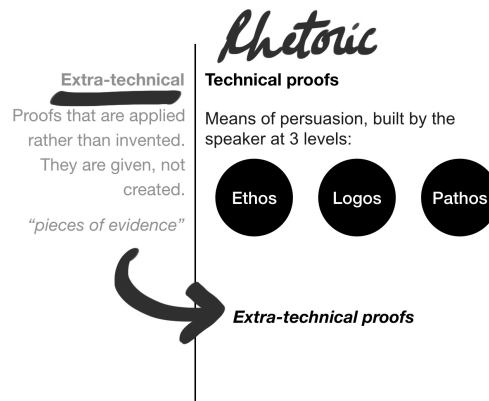


Figure 4.4: Extra-technical proofs (data, pieces of evidences,...) are used and incorporated within discourses and are, in this sense, also built through the technique of rhetoric.

4.1.4 Consequences for robotics

The previous considerations reflect obviously a general observation of two very typical styles. It remains that they allow us to address the question of implicit folk epistemologies and to open the debate about the discipline of robotics and its status. On one extreme, robotics comes out as a fraud when introduced with *sensationalism*. On the other extreme, as the *neutral* style has no particular rhetorical effect, the discipline of robotics is rather made arcane than it is clarified or *demythified*.

The *postmodern* folk epistemology conveyed through discourses about robotics is often severely criticized by the experts in robotics. However, it is also the one that monopolizes the public debate. At the contrary, the reductionist tendency that seeks for neutrality and for avoiding any symbolic language to the benefit of technical descriptions and demonstrations, is not efficient. In addition of that, this posture brings implicit assumptions about language that support an erroneous conception of language and rationality, as well as it constraints the scientists themselves in their use of words.

In order to sense what rhetorical style could be both efficient and accurate in the context of robotics, we must firstly better understand the criteria on which humans make their own ideas and presuppositions about one rhetorical style. For

such reason, we organized a rhetorical experiment at the *Cité des Sciences et de l'Industrie of Paris*. In this context, we chose to investigate the common criteria on which roboticists and reporters usually base their judgement and interpretation. Being among the main actors for the representation of the discipline of robotics within the society, roboticists and reporters appeared as an interesting group to gather in order to perform this rhetorical experiment.

4.2 Experimental rhetoric at the *Cité des Sciences et de l'Industrie* (Paris, France)

4.2.1 A gathering of roboticists and reporters

In the spring of 2019, the *Cité des Sciences et de l'Industrie* (CSI) launched a new permanent exhibition on “Robots” that introduces various machines and questions the challenges related to their integration into humans’ everyday life (see Fig. 4.5).



Figure 4.5: Poster of the exhibition “Robots” at the *Cité des Sciences et de l'Industrie* of Paris (2019)

The CSI is part of *Univscience*, the biggest science museum of Europe. *Univscience* is recognized as a specialised institution when it comes to fostering scientific and technical culture [Univscience 2015]. As part of the exhibition dedicated to robots, a committee of experts in robotics coming from various institutions was constituted. This group of experts was the one to participate to the rhetorical experiment. Additionally, the press conference announcing the exhibition at the CSI attracted various science journalists, some of whom volunteered for the experiment. In this section, we describe the content of the exercise and the reasons and conditions under which this protocol was built. We also discuss the outcome of the experiment.

4.2.2 Conduct of the experiment

All the subjects of the experiment were first welcomed in a similar room in order to attend to a short presentation on the discipline of rhetoric. Thereafter, the participants were informed that they were going to practice a rhetorical exercise: we invited them to take part of a simulated contest of journalism supposedly organized by a large laboratory in order to benefit from an exclusive interview about a major discovery in robotics. Indeed, the participants took note of the following story line:

“A major discovery in robotics”

Story line

“Spring 2019. A major scientific and technical problem was solved in the department of robotics of an important laboratory of research.

This discovery was made by a PhD student while working on a quadruped robot of a new kind. Such innovation could revolutionize the discipline of robotics but nothing more is said about it,... for now!

In fact, the directors of the lab mistrust the media when it comes to share scientific results, and especially the results in the field of robotics and artificial intelligence. Therefore, the laboratory decided to organize a contest between various journalists. The best candidate will benefit from an exclusive interview from the researchers of the lab.”

For the needs of the exercise, the participants were divided into 5 groups (all mixing roboticists and journalists): 4 groups were asked to argue for the case of one fictional candidate (either François, Juliette, Patrick or Marise). The 5th group was designated as the jury of the contest. The jury had the task to rank the candidates and to justify its decision in front of the assembly. The participants could not choose to be in the jury or in one of the groups of defenders, neither than they could choose the candidate to defend. It was explained to the participants that the reason why the candidate to defend was imposed was that the resulting argumentations should not necessarily reflect roboticists and journalists’ own personal opinions about rhetorical styles. The latter criteria was a deliberate and highly important strategy in the constitution of the rhetorical exercise (see section 4.2.3). The groups of defendants had 30 min of

preparation before they were invited to present a 3 min speech in favor of their candidate. The jury was then allowed to ask up to two questions to each group. In order to prepare the defense of their candidate, each group had access to a brief resumé of all 4 candidates as well as a (supposedly) previous printed publication about the same event: the arrival of the new robot “Pyrène” at the LAAS-CNRS Toulouse, in 2017 (see 4.2.2 and (see Appendix A).

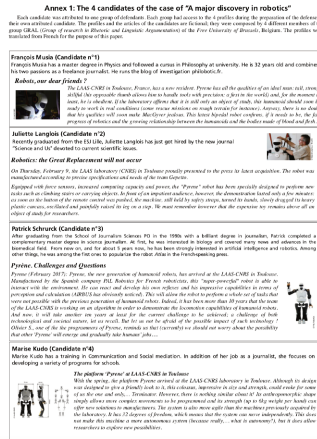


Figure 4.6: Presentation handout of the experiment: the profiles of the 4 candidates to be defended, see Appendix A.

4.2.3 Conception

- The ancient exercise of *suasoria*

The fictive situation in which the participants were put through is based on the ancient exercise of the *suasoria* (i.e. to advise the audience in favor or against a situation or a proposition). The exercise of the *suasoria* simulates discourses of the deliberative genre since it places the speaker in the position of the adviser in the context of public affairs [Fairweather 1981], [Winterbottom 1980]. Such exercise was practiced regularly by pupils in the Ancient Greece and Rome, as part of a relatively homogenous set of exercises called *progymnasmata* (“preparatory exercises”) [Kennedy 1998]. Indeed, since its very beginning, rhetoric has been taught through an association of theory and practice. The exercises were designed to practice basic rhetorical skills and prepare the students for the declamations (namely the ultimate step of the training that consisted in composing complete speeches in more or less real circumstances). Thanks to recent editions and studies, our knowledge of this training has been deeply updated and has drawn the interest of contemporary scholars. Various experiments in various European countries (Belgium, France, Sweden, Switzerland, etc.) and in the United States, (re)-used these exercises in contemporary trainings (in argumentation, rhetoric and citizens education). With encouraging results, this has given birth to the research field of experimental rhetoric.

- Objectives

In the case of the experiment of the CSI, the main objective was not the training of the participants in rhetoric: as an art, a *techne*, the technique of rhetoric includes a practical dimension that demands time and repetition in order to show improvement [Sennett 2008].³ Yet, making the participants practice a rhetorical exercise (rather than to participate to a classical debate) was still essential in order to identify the criteria on which the debate over the status of robotics is based.

During the time of the exercise, i.e. the time of the practice of the technique, the matter of one's opinion is neutralized: the aim of the participants is indeed to build arguments for any given position. Hence, in order to find arguments for or against an imposed topic, one's own judgement about the issue must be suspended. That being said, practicing the defense of contrary positions in the context of an exercise is certainly not a call for manipulation or a claim that all positions are worth one another. Besides, the philosopher of sciences Karl Popper attached great importance to this matter as he describes the critique (and not the search for truth) as the most rational attitude at an epistemological level, as well as the most salutary at a political level [Popper 2014]. According to Aristotle, such practice is about anticipating the opponent's arguments: "[...] the orator should be able to prove opposites, as in logical arguments; not that we should do both (for one ought not to persuade people to do what is wrong), but that the real state of the case may not escape us, and that we ourselves may be able to counteract false arguments, if another makes an unfair use of them]" [Rhét, I, 1, 1355a], [Aristotle(ed.W.Ross) 1924].

Finally, because the participants must -themselves- invent arguments to defend one position (rather than listening to a theoretical presentation), there is also a possibility that they would better understand how a position that they deeply disagree with, can yet be chosen. The conditions under which a controversy takes place can thereby strongly improve.

- Content: the profiles of François, Juliette, Patrick and Marise

The profiles and the articles of the candidates were created by the *Group of research in Rhetoric and Linguistic Argumentation* (GRAL) of the Free University of Brussels, Belgium, and are purely fictional. Those profiles were created according to 4 major positions that are commonly taken up in order to address the component of the myth in robotic [Jeanneret 1994]. We have already discovered two of those 4 positions in the section 4.1. Indeed, as one of the strategy is to fully exploit the myth and every opportunity is then taken to maintain the ambiguity between humans and machines, the other extreme consists in ignoring the component of the myth: the speakers give in this case very pragmatic definitions of robotics and tend to describe the discipline through a set of procedures.

³On this matter, the aphorism of Hippocrates is particularly relevant: *Ars longa, vita brevis* (trad. Art is long, life is short).

In between those two extremes, Yves Jeanneret indicates the speeches or texts that reveal an ambivalent strategy: sometimes, they share the dream of *human-like* and *intelligent* robots, other times they clearly mark the limits and the differences. This ambivalence means that the speaker oscillates between the two previous strategies. Finally, Jeanneret points out the strategy that consists in deconstructing the myth within the discourse itself [Jeanneret 1994]. The 4 fictional articles (see Appendix A) aim at illustrating those various solutions for greater or less.

4.2.4 Results

• Productions of the groups

If the experiment gathered a total of 18 individuals and was not (yet) repeated, the roboticists and journalists of the experiment at the CSI have already highlighted many common criteria on which the controversy about rhetorical styles is based. The 3min speech of the 4 groups were recorded and transcribed (see Appendix B).

• Analysis

For a matter of consistency, we extracted and observed two types of assertions from all defendants' 3 min speech: the arguments in favor of the defendants' own attributed candidate (in rhetorical terms, we talk then about confirmation), and the arguments against one candidate's rhetorical strategy (i.e. the refutation).

To start with a general observation, we note that, in order to defend their respective imposed candidate, all the participants based primarily their argumentation on the criterion of Utility (*versus* harms). Besides, such criterion deserves, at this stage, to be described more precisely: it corresponds to what the traditions calls a *topos*, i.e. a "place from where arguments can be obtained" [Ferry 2014]. The *topos* of Utility is one of the main *topoi* of the deliberative genre since, in this case, humans are mainly concern about exposing what is *useful* or at contrary, *harmful* for the society.⁴

Through all tables (see Tables 4.1, 4.2, 4.3, 4.4, 4.5, 4.6), we observe that the participants referred to the *topos* of the utility in various ways. At the level of the *logos*, the **clarity(/ambiguity)** of the lexicon of robotics, as well as the matter of **efficiency** were discussed. Also, the participants relied on the *ethos* of the candidates through the question of the **credibility(/discredit)** and the **reliability**. This latter notion is especially important since Aristotle defines it as a necessary condition for any speaker willing to produce persuasion [Aristotle(ed.W.Ross) 1924]. Finally, the productions of the participants showed that the *topos* of Utility(*vs* harms) was also explored at the level of the *pathos*: while **enthusiasm** was presented as favorable, the emotion of **fear** was at contrary introduced as detrimental.

⁴The deliberative genre is one of the three rhetorical genres defined by Aristotle: it adresses the general assembly in order to making decisions about coming problems. The two others are the *judicial genre* (referring to the context of a trial where judgements must be made about past events) and the *epidictic genre* (where discourses aim to blame or praise).

Table 4.1: Confirmation (candidates 1 and 2)

	<i>Topos</i>	Proof
Candidate 1 (François)	Efficiency (1) Credibility (2)	<i>logos</i> <i>ethos</i>
<i>Excerpt:</i> “So maybe when you read his article, you thought, well, he’s anthropomorphic and maybe it bothered you, but we feel like it’s voluntary (1). He is someone who knows how to take his reader by the hand, the title is catchy (1), he brings the reader to him (1), but at the same time he is solid on the subject (2). He talks about “bipedal robotics”, “opposable thumbs”, [...]” (2)		
	Enthusiasm (1) Relevancy (// Reliability) (2) Efficiency (3)	<i>pathos</i> <i>ethos</i> <i>logos</i>
<i>Excerpt:</i> “He is enthusiastic about research but not too enthusiastic about it either (1) (3), he raises ethical issues and actually wonders what a human-robot world will look like (2), that’s what the public is interested in (1) (3).”		
Candidate 2 (Juliette)	Clarity (1) Reliability (2)	<i>logos</i> <i>ethos</i>
<i>Excerpt:</i> “She shows critical thinking (2) about robotics [...]. On the other hand, she keeps a factual look (1)(2) at what robots can do today; what they are already doing.”		
	Transparency (// Clarity) (1) Reliability (2)	<i>logos</i> <i>ethos</i>
<i>Excerpt:</i> “Being roboticists, we don’t want to give the image that robotics is extremely easy and that it can be done quickly (1). It takes money, it takes time before robots do what we want them to do (1). So it would be a bad strategy to give a false impression of their success today (1) (2). On the contrary, by showing the difficulty and the value of your work, it helps you for the future (1) (2). And any other sensational presentation would in fact be misleading to the public and would be unworthy of the work.”		

Table 4.2: Confirmation (candidate 3)

<i>Topos</i>	Proof
<p>Candidate 3 (Patrick) Reliability</p> <p><i>Excerpt:</i> “He is also able to emphasize the work of the laboratory, and I think this is important for you. He knows how to insist on functional developments, on current events, but he does not forget to situate the work of the laboratory in its own context of time, which is a long time, the time of research, which is not always the time of journalism.”</p>	<i>ethos</i>
<p>Clarity (1) Credibility (2)</p> <p><i>Excerpt:</i> “For several years, he has specialized in robotics and artificial intelligence (2). As the result, he is able (and I would like to stress this because it is quite rare) to engage in a process of popularization without using sensationalism, references to fiction or metaphors (1) (2).”</p>	<p><i>logos</i> <i>ethos</i></p>
<p>Reliability</p> <p><i>Excerpt:</i> “Finally, he knows how to give the floor to researchers, which is necessary, even if it is not often done. He quoted Olivier’s words about development and current issues.”</p>	<i>ethos</i>

Table 4.3: Confirmation (candidate 4)

	<i>Topos</i>	Proof
Candidate 4 (Marise)	Structure of the text (1) Reliability (2)	<i>logos</i> <i>ethos</i>
<i>Excerpt:</i> “Marise Kudo’s article is an example of what you want to have (2): she made a concise text where in the first part of the text, she presents the common feeling towards the robot and then, she organized her text in an intelligent way by saying that : ok, there is this feeling, but look in fact, we come back on earth, it is [just] a machine (1). And this machine, that’s what it can do.”		
	Reliability, Credibility	<i>ethos</i>
<i>Excerpt:</i> “She is a person who is concerned about giving scientific details, it is once again about focusing on specific elements. As the image illustrates, for example, she chose a figure which gives elements of measurement and structure of the robot’s configuration of joints, and so here she thought it was important to give, not a huge list of data but a certain amount, such as holding 6kg, which is in fact an exceptional thing.”		
	Clarity	<i>logos</i>
<i>Excerpt:</i> “It is not a ‘robot’,... she took the trouble to use the word ‘platform’ to make people understand that it is an object for scientific research, she completely takes the imagination out because we don’t need that here. We have to present the quality of your scientific results and therefore, she will certainly be the person who will succeed in this task.”		
	Enthusiasm	<i>pathos</i>
<i>Excerpt:</i> “And, what is important is to end on a positive side; saying that in any case, this machine will allow researchers to explore new possibilities”.		

Table 4.4: **Confirmation and Refutation (General Comment)**

(Confirmation/Refutation)	<i>Topos</i>	Proof
General comment about all candidates (Part of the defense of Candidate 2)	Efficiency (1)	<i>logos</i>
	Inconstancy (vs Reliability) (2)	<i>ethos</i>

Excerpt: “Congratulations for this wide selection of journalists that represents very well the various sensibilities of that can be found within the media. On one hand, we have two people who are close to their audience (1) but who could let themselves go into a certain sensationalism that reinforces stereotypes (2), which is absolutely not the image that your laboratory wants to give about its work. On the other hand, we have a profile of experienced journalists who may favor certain aspects of this research due to their own interests (2) and also, presuppose some knowledge to the public that it does not necessarily possess. (1)”

Table 4.5: Refutation (candidates 1 and 2)

	<i>Topos</i>	Proof
Candidate 1 (François)	Vagueness (<i>vs</i> Clarity) (1)	<i>logos</i>
	Inadequacy (<i>vs</i> Quality) (2)	<i>logos</i>
	Discredit (<i>vs</i> Credibility) (3)	<i>ethos</i>
<i>Excerpt:</i> “François Musia, clearly, is a person who leaves an important part to the imagination (1), so we can see for example, about the choice of the illustration,... this image brings out a mystical aspect, the words in the text will reinforce the imaginary side, the link with humans, the confusion (1),... this is clearly not what you are looking for (2) (3) since you want to convey a precise and clear message on a scientific content (2).”		
Candidate 2 (Juliette)	Status of the discipline	<i>logos</i>
	Inadequacy (<i>vs</i> Quality) (1)	<i>logos</i>
	Fear (2)	<i>pathos</i>
<i>Excerpt:</i> “ [...] Juliette Langlois, clearly, is very negative about robotics (1). She proposes an anxiety-provoking title, she plays on the emotion of fear (2) and we can feel, within her description, that she aims to devalue the scientific research (1).”		

Table 4.6: Refutation (candidates 3 and 4)

<i>Topos</i>	Proof
<p>Candidate 3 (Patrick) Irrelevancy (<i>vs</i> Reliability)</p> <p><i>Excerpt:</i> “His description is interesting about the qualities of the robot,... but he started on digressions that have nothing to do with the subject. He talked about social problems, employment problems, and in fact the robot itself is not well promoted; not well explained. I think we deviate; we don’t focus on the subject.”</p>	<p><i>ethos</i></p>
<p>Inefficiency (<i>vs</i> Efficiency, <i>logos, pathos</i> Quality)</p> <p><i>Excerpt:</i> “Patrick Schurck, his title... I’ve never seen such a bad title, well, it’s not very catchy and ok, maybe it’s a detail but the goal when you’re a journalist is still to get the reader to come to you and your article.”</p>	
<p>Candidate 4 (Marise) Discredit (<i>vs</i> Credibility)</p> <p><i>Excerpt:</i> (Question of the jury); “Why does Marise Kudo get carried away by quantitative data and completely forget the conditions under which the robot can qualitatively change or transform a situation?”</p>	<p><i>ethos</i></p>
<p>Candidates 1,3 and 4 Discredit (<i>vs</i> Credibility)</p> <p><i>Comment from the defendants of Candidate 2 (Juliette):</i> “We all complain,... All roboticists complain about the verbal escalation we see in the press, ... with all the impacts that media can have on researchers,... who then are unfortunately forced to maintain the scale.”</p>	<p><i>ethos</i></p>

• Discussion

The status of robotics is shaped through discourses, on the basis of various criteria that we have identified within the framework of this experiment. Those criteria, called “*topoi*”, involve the 3 rhetorical proofs and the relation between them. For instance, we observe that the quality and the clarity (*logos*) of the discourse are closely bond to the problem of the reliability of the speaker (*ethos*). Also, the matter of efficiency of the *logos* goes hand in hand with the *pathos* which impacts the value of the work of roboticists in the eyes of the audience. Interestingly, the *topoi* explored by the participants are very close to the 4 categories introduced by Paul Grice as an elaboration of the Cooperative principle: Quality, Quantity, Relevance, Manner. The principle of Cooperation describes how people achieve, in general, effective conversational communication in common social situations. More precisely, it presents how listeners and speakers act cooperatively and mutually accept one another to be understood in a particular way [Grice 1989].

In addition of this, it is also interesting to note that the productions of the participants pointed out the qualities of the 4 different strategies to represent robotics (and not only the issues). Indeed, in order to convince the jury of their own case, the groups focused on showing the utility of the rhetorical style of their imposed candidate. This aspect is especially beneficial as it allowed the participants to become aware of the variety of means that are available in order to represent robotics: beyond deconstruction and critical thinking towards the discourses of the candidates, the participants shed light on possible alternatives to *sensationalism* or *neutrality*. Hence, according to the arguments built by the participants in the contexte of the CSI’s experiment, an accurate and efficient rhetorical strategy could be found by aiming at such *target*⁵:

The discourse should be clear while raising the interest of the audience. The informations given about the scientific research should be precise and with details, but without however affecting the efficiency of the discourse. The speaker ought to prove his or her reliability through those relevant details, as well as his or her credibility. Also, if the speaker mentions social problems related to the integration of robots into the society, he or she should do it in a way that it does not compromise his/her reliability. The discipline of robotics should be valued through the presentation of positive aspects of the scientific reserach but also through the complexity of the work and the errors or failures. In this case, the speaker will still be cautious not to depreciate the work in robotics. Finally, the speaker should avoid to raise fear within his/her discourse as it may harm the status of the scientific research itself. He or she will rather encourage enthusiasm towards scientific an technological discoveries in robotics but once again, with such accuracy that it maintains the reliability of the speaker.

⁵According to Aristotle, rhetoric being one of the *technai stochastikai*, is associated to the noun *stochos* which originally indicates “the target”. The verb is therefore “to aim”, “to aim at the target” (see [Di Piazza 2019]).

The formulation of the results of the experiment through this specific form could be understood as a prescription: the *topoi* presented in such way appear like a series of rules to be followed in order to produce an efficient speech. However, similarly to Grice's maxims, we would rather consider this statement as a series of assumptions about listeners' expectations towards a debate about robotics.⁶ Besides, the informal feedbacks of the participants about the experiment at the *Cité des Sciences et de l'Industrie* allow us to highlight what the Greeks had already noted about the practical dimension of rhetoric: the practice that consists in figuring out the available and efficient means of persuasion in a specific case, helps the speakers to become aware of their own spontaneous rhetorical strategies⁷. In other words, practicing some rhetorical exercises (such as the *progymnasmata*), favors the adoption of a reflexive point of view on one's own rhetorical practices. The process through trial and errors (which is typical of *technai*) plays thus a major role for the discipline of rhetoric [Allen 1994].

⁶We must note that the question whether norms are regulatory or prescriptive is rather complex, and far from settled.

⁷The rhetorical experiments that have been organized previously and in other contexts than robotics (in medicine, law, biology and general education) show similar observations (see the works of the group GRAL (ULB)).

Conclusion and Perspectives

Contents

5.1	Conclusion	75
5.2	Perspectives	79
5.2.1	Through the eyes of the roboticists	79
5.2.2	<i>Ekphrasis</i> of moving machines: the case of the robot Cheetah (MIT)	80

5.1 Conclusion

As attested by its Latin roots, *movere* refers firstly to various definitions of the moving; “to move”, “to put in motion”, that is to say to a capacity to generate motion in the physical space. Secondly, *movere* covers some psychological aspects: it is used in the sense of “to affect”, “to move someone”, which takes the perception of the movement into account [Oxford Latin 1982].

Although the translation of *movere* from Latin does not tell us whether the Ancients considered the meanings as being independant or intrinsically linked to one another, it is common, in the context of robotics, to distinguish (if not separate) the problematics of the generation of movements from the question of the perception of moving machines. The generation of movement is commonly introduced as the roboticists’ job: experts in robotics solve scientific and technical problems in order to produce motions of machines. Whereas the perception of the movement is a matter for humans in general: people are affected by the movements of machines¹ and seek to interpret the performance of robots.² From this point of view, roboticists would commit solely to solve technical problems without including any intention to produce *natural* effects in their brief. Consequently, if the robots affect one in such way that they are perceived as being possibly *intelligent* machines (that are able to *want* something, to *decide*, to *think*, to

¹In section 2.1.2, we have seen that motion (besides anthropomorphism) is one of the main feature that triggers the intentional stance on objects.

²The field of Human-Robot Interaction (HRI) is known for studying such matter. HRI focuses on users’ representations of robots (i.e. the mental images that are built when facing actual machines or by imagination). The methods used usually address the need to evaluate specific technologies in specific contexts and involve complementary fields such as cognitive psychology or anthropology [Kahn 2011].

understand, to feel, etc.), the general tendency is to refer to this affect as a *problem of perception, a subjective interpretation, an illusion or a confusion between fiction and reality*. By the way, roboticists express their concern about citizens' representations of robots (see for instance [Brooks 2017]), as well as about the words used to talk about robots [Laumond 2019]. Those words, borrowed from the vocabulary of the living, raise the fear that an inadequate phraseology might lead to category mistakes or at least, might encourage some fantasies or confusion between robots and living organisms [Dominicy 2019].

On this matter, we have seen that the wide representational dimension of the lexicon of robotics cannot be considered as the source of that potential confusion: while those words allow multiple interpretations³, the robots' performances allow firstly and foremost to challenge humans' empirical beliefs (see *Situation 2* and *Situation 3* in 3.2.2). Also, we must take into consideration that the vocabulary of the living allows to bypass the (feeling of) struggle that humans experience when it comes to describe robots' performances. Motion is indeed relatively ineffable: while it can be both seen and felt and that humans have many words at hand to evoke movement and its properties, the notion still resists linguistic coding in various ways (see section 2.2.3). For reasons of expressability, humans describe thus actions rather than movements (see [Davidson 2001]). Moreover, in the context of robotics, the vocabulary of the living fulfills the primary function of language, namely the *enargeia*: the agentive lexicon produces a convenient and efficient effect of visibility that makes anyone *sees* what we are talking about (see section 2.2.4).

For such reasons, we can hardly avoid using the agentive lexicon whether we believe that a robot is actually *intelligent* or not; wherever we adopt an intentional stance or a technical stance towards robots (on the matter of the stances, see section 2.1.3). In addition, rejecting this vocabulary might produce potential perverse effects: the need to control one's discourse may be understood as: "we have something to hide", and facilitates the development of conspiracy theories (see section 2.3). Besides, using quotation marks with a word such as *to decide* for instance, has a similar effect. The use of quotation marks insist on the fact that the word accepts multiple interpretations⁴ although one means precisely to distance himself from the danger of extrapolation.

That being said, the study of the lexicon in robotics highlights primarily the fact that the problematics of this language is situated beyond the semantic level: humans' own conception of rhetoric and knowledge is directly involved, which refers to an epistemological layer.

The discourse of robotics is characterized by the criteria of the resemblance between the machines and the living organisms (see 4.1.1; Jeanneret refers to this bond through the question of the myth [Jeanneret 1994]). Whether the speaker

³(despite a biased lexical context that aims to lead the reader to prefer a technical interpretation for instance)

⁴We talk about *vagueness* in the case of the robot dispositions such as *intelligent* (see section 3.2.1)

intends to confirm this resemblance in a *sensationalist* style (see section 4.1.2), or to discard it through a seek for neutrality (see section 4.1.3), his or her construction of the *logos*, the *ethos* and the *pathos* is built from this parallel between robots and the living organisms. Hence, the discourse of robotics falls within a specific epistemology of the representation that is, to our view, the source of our problem.

The conception of the representation that we refer to⁵, is the one triggered when the affects towards robots are described as *matters of perception* or *illusions*⁶; it is the one inherited from a Platonic view of the *mimêsis* (imitation)⁷, that is, in its negative definition. According to Plato, the art of imitation (*hê mimêtikê*) refers indeed to the fabrication, not of realities, but of illusory replicas that allude to pure “semblance” [Vernant 1965]. From this point of view, painting is reduced to a bariolage of colors, rhetoric to a bariolage of words and rythms [Vernant 1965] and, to complete the analogy engaged in Chapter 1 (see 1.2.2), robotics would thus be reduced to a bariolage of gadgets. Briefly said, the disciplines that represent, imitate or simulate, would be nothing but disciplines of the “make-believe”. At an epistemological level, such point of view is highly problematic.

Firstly, the Platonic conception of the representation denies the heuristic value of *mimêsis*: the imitation as a process of discovery or as an access to knowledge, is clearly rejected. In fact, the notion of the "make-believe" itself is in total contradiction with the very functions of the discipline of rhetoric⁸, and the research in robotics. Biomimetic and biohybrid systems (namely, the human-like or animal-like robots) are not (for the most part [Di Piazza 2019]) conceived as duplicatas of their model in a cosmetic way⁹. Furthermore, the process of imitation eventually allows to understand the key principles that endow living beings (see for instance the study on the role of the head in the production of voluntary spatial actions [Bailly 2018]). In this way, to take away the heuristic value of the imitation makes impossible to dissociate rhetoric from manipulation (see section 1.2.3), or robotics from being a fraud.

Secondly, this view of *mimêsis* brings the question of the ontological status of the representation to the foreground. Opposing the copy to its model (i.e. the false to the true; the fiction to the reality; the visible to the invisible) would indeed demand to define those notions: both themselves and in relation to each other [Vernant 1965], [Schaeffer 1999]). In robotics, this means that, in order to clarify the differences between the categories, the status of the robots *versus* the living

⁵(Vernant talks about the image [Vernant 1965])

⁶(or when blaming the *figurative* images of the metaphors)

⁷(or at least from the (possibly simplistic) interpretation of our modern society about Plato’s thought; Vernant describes Plato as both the liquidator and the heir of ancient Greek culture [Vernant 1965])

⁸See the section dedicated to the *techne*, in 1.2.1

⁹To name only few examples; the salamander robot demonstrates locomotion modes based on central pattern generators [Ijspeert 2007], the gecko robot’s leg coating texture reproduces adhesion abilities [Menon 2004], the humanoids robots are designed to reproduce bipedal walking [Naveau 2016].

should be argued. In that case, the experts in robotics are the ones to have the burden of the proof: they would be the ones responsible for proving to the society that a robot is not *intelligent* for instance. Clearly, such way of approaching the problem can only result in an impasse¹⁰ and is ammunition to conspirationism.

Thirdly, this understanding of *mimêsis* is especially problematic since it is at the basis of the solutions that are thought in order to improve the relation of citizens to the discipline of robotics. Because this point of view brings the need to distinguish the false from the true (; the *subjective interpretation* from the *objective understanding*), the call for a better and more important scientific education of the society¹¹ appears as the best solution. However, and while the benefits of acquiring scientific and technical knowledge must certainly not be depreciated¹², it is certainly not the best angle to formulate the problem through the idea of a “gap” between the scientists (*the ones who know*) and the public (so-called *ignorant individuals*)¹³.

Besides, in the context of rhetoric, we have seen that the difference between people who are familiar with the rhetorical technique and the ones who are not, cannot be established on the basis that the first ones would be immune to persuasion while the others would remain at its mercy (see *Fast thinking, slow thinking* in section 2.1.3). On the contrary, experienced rhetoricians are characterized by their agility to pass from fast, automatic, stereotypic and instinctive representations (System 1) to a slower, effortful, conscious and more deliberative point of view (System 2), and *vice versa* [Kahneman 2011]. Similarly, experts in robotics seem to be able to pass very efficiently (and probably spontaneously) to a technical point of view towards robots (or design stance)¹⁴. Expertise would thus rather lie in one’s ability to *inhibit* in the sense of [Houdé 2000] and [Berthoz 2020], i.e. in the great flexibility to pass from the intentional stance to the design stance.

To sum up, in an effort to shape the status of robotics as a scientific and technical discipline, our (spontaneous) folk epistemology¹⁵ of the representation must therefore be revisited. Certainly, our discourses and representations about robots would gain to be built from a point of view where the fiction and the reality are not conceived as two exclusive and opposed domains, but as two forms or two levels of reality that intermingle and coexist with each other [Vernant 1965], [Schaeffer 1999]. In this way, one’s perception always refers to a *particular* way of

¹⁰By the way, the exercise of the dissociation of notions in section 3.3.2, had already pointed out a possible inconsistency at this level.

¹¹(see *A better technical and scientific education* in section 3.3.1)

¹²We have seen for instance that citizens’ effort to develop an in-depth understanding of scientific issues and overcome the spontaneous cognitive shortcuts and heuristics, is higher with subjects who already have factual knowledge about the issues, see section (see *The concept of framing* in section 3.3.1)

¹³(see *The concept of framing* in section 3.3.1)

¹⁴The fact that we still find linguistic traces of agentivity in experts’ discourses gives us good reason to think that specialists do not actually block the cognitive process of attribution of intentions (see again 2.1.3). By the way, roboticists still experience the *natural* motions of machines despite their technical knowledge.

¹⁵On the notion of folk epistemology, see section 4.1.1

looking at things [Schaeffer 1999] and the roboticist’s expertise can be presented as one of those *particular* gazes [Tindale 2013], [Goyet 2017]. Now, the questions remain: what do experts in robotics pay attention to when facing machines, and what could we learn from their own *particular* perception?

5.2 Perspectives

5.2.1 Through the eyes of the roboticists

In order to grasp the concrete issues related to new technologies, our hypothesis is that the society would benefit from learning about *how* the roboticists *look at* machines. Therefore, we need first to better understand the specificities of the roboticists’ gaze¹⁶.

This purpose means to determine how the experts in robotics *perceive*. Yet, how can we capture such thing as a point of view; “a way of looking at” ? To this end, we propose once again to use the technique of rhetoric in its experimental dimension (see section 4.2.3).

Previously, we noted that the technique of rhetoric was practiced in Ancient Greece through a series of preliminary exercises called *progymnasmata* [Kennedy 1998]. Those exercises aimed to improve citizens’ abilities to perform verbally a reasoning or felt emotions, to argue for or against a thesis as well as many other qualities that would allow to raise one’s own voice in the public domain. Among the 14 preliminary exercises described in the ancient manuals, one is the *ekphrasis*; a vivid description aiming to put an object, a person or a scene “in front of the eyes” and to produce the *enargeia* (see section 2.2.4). It refers to the art of making listeners and readers *see* in their imagination, through words alone [Webb 2016]. Our further research will consist in analyzing the discourses about robotics using this rhetorical category of description (*ekphrasis*) as a starting point.

This future research implies to gather and analyze several descriptions of robots (*ekphraseis*), produced by experts in robotics. In this way, we aim firstly to discover an alternative criterion to the one of the “semblance” when representing and talking about robots. More precisely, we wish to verify an intuition on this matter. Our hypothesis is that roboticists are likely to establish the bond between the living and the machines on the basis of the notion of *eikos* (“likelihood”) in its traditional understanding [Kraus 2006], [Di Piazza 2012]. In that case, “to be similar” means “to be similar to what is known”, in judgements about whether an account is possible or an event occurred [Hoffman 2008]. Also, “to be similar” can be understood as “to be similar to what is socially expected” in judgements about appropriateness [Hoffman 2008]. Building the parallel between the living and the machines from the criterion of *eikos* might allow us to produce the *enargeia* in discourses about robots, without provoking counterproductive emotions such as fascination and fear.

¹⁶We refer here to the rhetorical gaze [Tindale 2013].

Secondly, the practice of *ekphrasis* might show some pedagogical value, both for roboticists themselves and citizens; the exercise of the *ekphrasis* allows one to become aware of his or her own conception of the representation in a reflexive point of view [Dainville 2020].

5.2.2 *Ekphrasis* of moving machines: the case of the robot Cheetah (MIT)

In the context of the ICRA conference of 2019 in Montreal, Canada, we conducted a preliminary experiment on the practice of *ekphrasis*. Our workshop, organized in collaboration with Gentiane Venture from the *Tokyo University of Agriculture and Technology*, gathered several roboticists who each produced a vivid description of the robot Cheetah (MIT) based on a video that was broadcast during the event (see rhetoricra2019.ulb.be/rhetorical-experiment/).

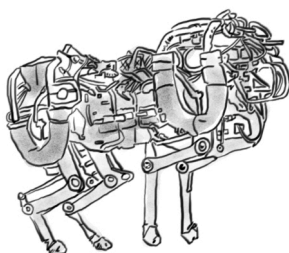


Figure 5.1: Representation of the robot Cheetah (MIT) on rhetoricra2019.ulb.be

In order to induce the participants of the experiment to produce this specific type of description, we invited them to write a letter to a (fictional) colleague who had become blind due to his old age; this condition forced the participants to describe the robot in details and to focus on sharing their reaction and emotions towards the robot’s performance. This scenario aimed to encourage the participants to describe the robot following a search for accuracy (in the sense that the written production would reflect the author’s own perception, both technical and subjective¹⁷). The exercise was preceded by a general presentation of ancient rhetoric and its technical nature, and followed by a debriefing of the experiment.

The productions of roboticists gathered during this event are not yet sufficient in order to draw conclusions. However, this first test allows us to make some relevant observations. Firstly, we can evaluate the necessary conditions for the success of such experiment¹⁸. Secondly, it seems interesting to propose the same experiment to another party, namely to biologists. As we aim to discover an alternative criterion to the one of the “semblance” for representing and talking about robots, we can

¹⁷(i.e. the gaze in the rhetorical sense of the term [Tindale 2013], [Goyet 2017])

¹⁸(number of participating roboticists in order to include a certain diversity in terms of profile; number of signs of the textual production so that the content includes enough details and micro details that are likely to produce mental images.)

learn from the gaze of both experts in robotics and specialists of the living; on itself and in comparison with each other. The *ekphraseis* of roboticists and biologists might lead us to find linguistic and rhetorical clues of the notion of *eikos*.

With this upcoming research project, we hope to contribute to the knowledge and the relevance of the rhetorical practice in a contemporary and scientific context. We also aim to lay the foundations for an epistemological reflection on the status of the discipline of robotics, through a practical dimension.

Profiles of the fictional candidates (exercice of *suasoria*)

Each candidate was attributed to one group of defenders. Each group had access to the 4 profiles during the preparation of the defense of their own attributed candidate. The profiles and the articles of the candidates are fictional, they were composed by 4 different members of the group GRAL (Group of research in Rhetoric and Linguistic Argumentation) of the Free University of Brussels, Belgium. (*Original language: French, Photos copyright: 1. LAAS-CNRS, 2. Regis Duvignau/Reuters, 3. PAL Robotics, 4. LAAS-CNRS*)

A.1 Candidate 1: François Musia

François Musia studied Physics in the university, before he followed a cursus in Philosophy. He is 32 years old and combines his two passions as a freelance journalist. He runs the blog of investigation philobotic.fr.

Robots, our dear friends ?

The LAAS-CNRS in Toulouse, France has a new resident. Pyrene has all the qualities of an ideal man: tall, strong, skillful (his opposable thumb allows him to handle tools with precision: a first in the world) and, for the moment at least, he is obedient.



If the laboratory affirms that it is still only an object of study, this humanoid should soon be ready to work in real conditions (some rescue missions on rough terrain for instance). Anyway, there is no doubt that his qualities will soon make MacGyver jealous. This latest bipedal robot confirms, if it needs to be, the fast progress of robotics and the growing relationship between the humanoids and the bodies made of blood and flesh.

- Original version (French)

François Musia a entamé des études supérieures en physique, avant de se tourner vers la philosophie. À 32 ans, il concilie aujourd'hui ses deux passions en tant que journaliste Freelance et anime avec succès son blog d'investigation philobotique.fr.

8Appendix A. Profiles of the fictional candidates (exercice of *suasoria*)

Un "ami" qui vous veut du bien?

"Le LAAS-CNRS de Toulouse a un nouveau pensionnaire. Pyrène a tout de l'homme idéal : grand, fort, habile (son pouce opposable lui permet de manipuler des outils avec précision : une première mondiale) et, pour le moment au moins, obéissant. Si le laboratoire affirme qu'il n'est encore qu'un objet d'étude, cet humanoïde devrait bientôt être prêt à intervenir en conditions réelles (on nous parle déjà de missions de sauvetage sur terrain accidenté) et nul doute que ses qualités auront tôt fait de faire pâlir d'envie MacGyver en personne. Ce robot bipède dernier cri confirme, si besoin en était, la rapidité des progrès de la robotique et la proximité de plus en plus importante qui s'établit entre les humanoïdes et les hommes de chair et de sang."

A.2 Candidate 2: Juliette Langlois

Recently graduated from the ESJ Lille, Juliette Langlois just took a position in a new journal "Science and Us" devoted to current scientific issues.



Robotics : the Great Replacement will not occur

On Thursday, February 9, the LAAS laboratory (CNRS) in Toulouse proudly presented to the press its latest acquisition. The robot was manufactured according to precise specifications and needs of the team *Gepetto*.

Equipped with force sensors, increased computing capacity and power, the "Pyrene" robot has been specially designed to perform new tasks such as climbing stairs or carrying objects. In front of an impatient audience, however, the demonstration lasted only a few minutes: as soon as the button of the remote control was pushed, the machine, still held by safety straps, turned its hands, slowly dragged its heavy plastic carcass, oscillated and painfully raised its leg on a step. We must remember however that the expensive toy remains above all an object of study for researchers.

- Original version (French)

Fraîchement sortie de l'ESJ de Lille après un brillant parcours, Juliette Langlois vient de décrocher un poste dans une nouvelle revue « la Science et Nous » consacrée à l'actualité scientifique.

Robotique : le grand remplacement n'aura pas lieu

"Ce jeudi 9 février, le laboratoire LAAS (CNRS) de Toulouse présentait fièrement à la presse sa dernière acquisition, fabriquée selon un cahier des charges précis pour l'équipe Gepetto. Doté de capteurs d'efforts, d'une capacité de calcul et d'une puissance accrues, le robot « Pyrene » a été spécialement conçu pour réaliser de nouvelles tâches telles que monter un escalier ou porter des objets. Devant un

public impatient, la démonstration n'a pourtant duré que quelques minutes : au signal lancé par la télécommande, la machine, toujours retenue par des sangles de sécurité, tourne des mains, traîne à petits pas sa lourde carcasse de plastique avec un hanchement d'équilibriste, ou hisse péniblement sa jambe sur une marche. Force est de constater que l'onéreux jouet reste avant tout un objet d'étude pour les chercheurs."

A.3 Candidate 3: Patrick Schruk

After graduating from the School of Journalism Sciences PO in the 1990s with a brilliant degree in journalism, Patrick completed a complementary master's degree in science journalism. At first, he was interested in biology for a long time and covered many news and advances in the biomedical field. From now on, and for about 5 years now, he has been strongly interested in artificial intelligence and robotics. Among other things, he was among the first ones to popularize the robot Atlas in the French-speaking press.

Pyrène. Challenges and Questions

Pyrene (February 2017): Pyrene, the new generation of humanoid robots, has arrived at the LAAS-CNRS in Toulouse. Manufactured by the Spanish company PAL Robotics for French roboticists, this "super-powerful" robot is able to interact with its environment. He can react and develop his own reflexes and his impressive capabilities in terms of perception and calculation (that AIRBUS has obviously noticed) will allow it to perform a whole set of tasks that were not possible with the previous generation of humanoid robots. Indeed, it has been more than 10 years that the team of the LAAS-CNRS team has been working on an algorithm in order to demonstrate the locomotor capabilities of humanoid robots. And now, it will take another ten years at least for the current challenge to be achieved; a challenge of both a technological and societal nature, let us recall. But let us not be afraid of the possible impact of such technologies! Olivier S., one of the the programmers of Pyrene, reminds us that (currently) we should not worry about the possibility that other 'Pyrene' will emerge and gradually take humans' jobs....



- Original version (French)

Après de brillantes études de journalisme à l'Ecole de Journalisme Sciences PO dans les années 90, Patrick a suivi un master complémentaire en journalisme scientifique. Dans un premier temps, il s'est longuement intéressé à la biologie et a couvert beaucoup d'actualités et avancées dans le domaine bio-médical. Désormais, et depuis 5 ans environ, il s'intéresse fortement à l'intelligence artificielle et à la robotique. Entre autres, il fut parmi les premiers à populariser les découvertes relatives à Atlas dans le monde francophone.

Pyrène, des défis et des questions

Appendix A. Profiles of the fictional candidates (exercice of *suasoria*)

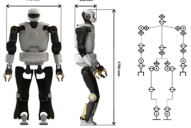
"Pyrène (février 2017) : Pyrène, le robot humanoïde nouvelle génération est arrivé au LAAS-CNRS de Toulouse. Fabriqué par la société espagnole PAL Robotics pour les confrères français, ce robot « superpuissant » est capable d'interagir avec son environnement. Il a le pouvoir de réagir et de développer ses propres réflexes et ses impressionnantes capacités en termes de calcul d'actionnement et de perception (qui n'ont d'ailleurs pas échappé à la société AIRBUS) lui permettront d'exécuter tout un ensemble de tâches qui n'étaient pas réalisables avec la génération précédente de robots humanoïdes. En effet, cela fait plus de 10 ans que l'algorithme développé par l'équipe du LAAS-CNRS travaille à démontrer les capacités locomotrices des robots humanoïdes. Et désormais, il faudra une autre dizaine d'années minimum pour que le défi actuel soit atteint ; défi tant d'ordre technologique que sociétal rappelons-le. Mais, n'ayons crainte face au possible impact de telles technologies ! Olivier S., le programmeur de Pyrène nous rappelle qu'(actuellement) il ne faut pas s'inquiéter de la possibilité que d'autres Pyrènes voient le jour et remplacent progressivement la main d'œuvre humaine. . . "

A.4 Candidate 4: Marise Kudo

Marise Kudo has a communication training in Social mediation. In addition of her job as a journalist, she focuses on developing a variety of programs for schools.

The platform 'Pyrene' at LAAS-CNRS in Toulouse

With the spring, the Pyrene platform arrived at the LAAS-CNRS laboratory in Toulouse. Although its design was designed to give a friendly look to it, this colossus, impressive in size and strength, could evoke for some of us the one and only, ... Terminator. However, there is nothing similar about it! Its anthropomorphic shape simply allows more complex movements to be programmed and its strength (up to 6kg weight per hand) can offer new solutions to manufacturers. The system is also more agile than the machines previously acquired by the laboratory. It has 32 degrees of freedom, which means that the system can move independently. This does not make this machine a more autonomous system (because really, ... what is autonomy?), but it does allow researchers to explore new possibilities.



- Original version (French)

Marise Kudo a une formation en communication à orientation "médiation sociale". S'il lui arrive de travailler comme journaliste, elle se consacre plutôt à l'élaboration de programmes scolaires divers.

La plateforme Pyrène au LAAS-CNRS de Toulouse

"Avec le printemps, c'est la plateforme Pyrène qui est arrivée au laboratoire LAAS-CNRS de Toulouse. Bien que son design ait été pensé afin de lui donner un air

sympathique, ce colosse, impressionnant de par sa taille et de sa force, pourrait évoquer pour certains son équivalent du cinéma, nul autre que Terminator. Pourtant, rien à voir ! Sa forme anthropomorphe permet simplement de programmer des mouvements plus complexes et sa force (jusqu'à 6kg de poids par main) peut offrir de nouvelles solutions aux industriels. Le système est aussi plus agile que les machines précédemment acquises par le laboratoire. Il possède 32 degrés de liberté, c'est-à-dire autant de possibilités pour le système de bouger indépendamment. Cela ne fait pas de cette machine un système plus autonome pour autant (car qu'est-ce que l'autonomie?), mais il permet en tout cas aux chercheurs d'explorer de nouvelles possibilités."

Productions: 3min speeches (exercice of *suasoria*)

B.1 Group 1: defendants of François Musia

(*Original version in French below*) “[Inaudible] ... these four journalists who deserve to have the scoop and the exclusivity of this scientific research. François Musia, in two words, is clearly the most enthusiastic about the aspects of scientific research: he is the only one who has the necessary hindsight. I will explain this in a moment, but first, I will explain the risks that you would take with the other candidates, because after looking at their profiles and a previous articles, I would like to draw your attention to their weaknesses. Juliette Langlois, clearly, is very negative about robotics. She has an anxiety-provoking title, she plays on the emotion of fear, and you can tell from her description that she is devaluing scientific research. About Patrick Schurck,... his title,... I’ve never seen such a bad title, well, it’s not very catchy. And ok, it’s maybe a detail but the goal when you’re a journalist, is to make the reader come to you and to read your article. To be concrete, there’s not much,... you really have the impression that he doesn’t know what he’s talking about,... “it will take us 10 years to do this”, “it will take us 10 years to do something else”, but to do what? At the end of the article we still don’t understand, it’s really difficult. Then, Marise Kudo, she’s very basic, there’s no title. It’s really laborious. How can we explain it? Simply because she doesn’t know what she’s talking about. You can feel it, there are only unimportant details,... Well ok, there’s “6kg”, there’s “32 degrees of freedom” but we wonder if she doesn’t confuse the degrees of freedom of a robot’s axis with human autonomy. Frankly, it’s confusing. And the bottom line,... we still don’t know what it is at the end of the article. What’s the purpose of that robot Pyrène that came into the lab? We don’t know what it’s for. It’s a bit shocking to talk about scientific research without explaining what it’s for. I suppose that you want that the journalist who you will trust for presenting your research, will explain to the public what this research is going to be used for, and that’s where François Musia is really the journalist you need. Maybe when you saw his article, you thought, well, he’s anthropomorphic and maybe that bothered you. But you can tell this is deliberate. He’s someone who knows how to take his reader by the hand, he’s catchy in his headline, he brings the reader to him, but at the same time he’s solid on his subject. We talk about “bipedal robotics”, “opposable thumbs”, he’s someone who uses terms in physics; he knows science, you can feel it. He’s enthusiastic about research, but not too enthusiastic about it either. He raises

ethical issues and actually wonders what a human-robot world is going to look like; that's what the public is interested in. He's someone who takes a step back when he talks about robotics. I would also like to draw your attention to his medium, which is a blog. It's interesting because in the blog, you're really in the discussion with your audience. You look at the comments, you look at the reactions of the public, so it's someone who knows how to anticipate how the public will react to his publications. For me, he's really the one who has the knowledge and the necessary hindsight to promote your research. Thank you."

(French version:) "[Inaudible]... ces 4 journalistes qui méritent d'avoir la primeur et l'exclusivité de cette recherche scientifique. François Musia, en deux mots, c'est clairement le plus enthousiaste sur les aspects de recherche scientifique: c'est le seul qui a le recul nécessaire. Je vais vous expliquer cela dans un instant mais je vais d'abord vous expliquer les risques que vous auriez à prendre les autres candidats, car après avoir observé le profil et un article précédent de chacun des autres journalistes, je me permets d'attirer votre attention sur leurs défauts. Juliette Langlois, clairement, est très négative vis à vis de la robotique. Elle a un titre anxigène, elle joue sur la peur et on sent bien dans sa description qu'elle casse la recherche scientifique. Patrick Schurck de son côté,... son titre,... J'ai jamais vu un titre aussi nul, enfin bon, c'est pas très accrocheur. Et ok, c'est peut-être un détail mais le but quand on est journaliste, c'est quand même de faire venir le lecteur à soi et à son article. Et dans le concret, il n'y a pas grand chose, on a l'impression vraiment qu'il ne sait pas de quoi il parle,... "il nous faudra 10 ans pour faire ceci", "il nous faudra 10 ans pour faire autre chose", mais pour faire quoi ? A la fin de l'article on a toujours pas compris, c'est vraiment besogneux. Ensuite, Marise Kudo, elle est ras des pâquerettes, il n'y a pas de titre. C'est vraiment laborieux. Et s'il n'y a pas de titre, c'est pourquoi? Tout simplement parce qu'elle ne sait pas de quoi elle parle. On le sent, il n'y a que des détails sans importance,... Bon ok, il y a "6kg", il y a "32 degrés de liberté" mais on se demande d'ailleurs si elle ne confond pas les degrés de libertés d'un axe robotique avec l'autonomie humaine. Franchement, ça pousse à la confusion. Et le fond du sujet,... on ne sait toujours pas ce que c'est à la fin de l'article. A quoi sert ce robot Pyrène qui est arrivé au labo? On ne sait pas. C'est quand même dramatique de parler d'une recherche scientifique sans expliquer à quoi elle sert. Je suppose que vous avez envie que le journaliste à qui vous allez confier la primeur de votre recherche explique bien au public à quoi va servir cette recherche et c'est bien là où François Musia est vraiment le journaliste qu'il vous faut. Alors peut-être que, quand vous avez vu son article, vous vous êtes dit, tiens il est anthropomorphe et peut-être que ça vous a gênés, mais on sent bien que c'est volontaire. C'est quelqu'un qui sait prendre son lecteur par la main, il est accrocheur dans son titre, il amène le lecteur à lui, mais en même temps il est solide sur son sujet. On parle de "robotique bipède", de "pouces opposables", c'est quelqu'un qui utilise des termes en physique; il connaît les sciences, ça se sent. Il est enthousiaste vis à vis de la recherche mais pas trop non plus. Il pose des enjeux éthiques et se demande effectivement à quoi

va ressembler un monde humain-robot, c'est bien ce qui intéresse le public. C'est quelqu'un qui pose le recul nécessaire quand on parle de robotique. Je me permets aussi d'attirer votre attention sur son média, c'est un blog. C'est intéressant parce que dans le blog, on est vraiment dans la discussion avec son public. On regarde les commentaires, on regarde les réactions du public donc c'est quelqu'un qui va savoir anticiper comment le public va réagir à ses publications. C'est vraiment pour moi celui qui a les connaissances et le recul nécessaires pour faire valoir votre recherche. Merci.”

B.2 Group 2: defendants of Juliette Langlois

(Original version in French below) “Congratulations for this wide selection of journalists who represent very well the various sensibilities that can be found within the media. On one hand, we have two people who are close to their audience but who could fall into a certain sensationalism that reinforces stereotypes, which is absolutely not what your laboratory wants to represent its work. On the other hand, we have a profile of experienced journalists who may favor certain aspects of this research due to their own interests and, who may presuppose knowledge to the public that it does not necessarily possess. This is why we propose Juliette Langlois, she is young, she is brilliant, she comes from the best school of journalism in the North of France, in Lille, which is very well known. She is part of this young generation on which it is important to rely if we want to renew the image of robotics and the public's view of this scientific discipline in the years to come. Beyond these considerations, there is another quality that should convince you. She shows a critical distance towards robotics and artificial intelligence. Moreover, she keeps a factual look on what robots can do today, what they are already doing. She knows how to question the purpose and the cost of robotics. For us, and no doubt for you, she is the best journalist in order to offer you the perfect platform to defend the realities and future of robotics.”

(French version:) “Bravo pour ce choix riche de journalistes qui représente bien les différentes sensibilités journalistiques qu'on peut trouver. D'un côté, on a deux personnes qui sont proches de leur public mais qui pourraient se laisser céder à un certain sensationnalisme qui renforce les stéréotypes, ce qui n'est absolument pas ce que votre laboratoire veut donner comme image de son travail. De l'autre côté, on a un profil de journalistes expérimentés qui risquent de favoriser certains aspects de cette recherche dû à ses intérêts propres et d'autre part, de présupposer des connaissances au public qu'il ne possède pas forcément. C'est pourquoi on vous propose Juliette Langlois, elle est jeune, elle est brillante, elle sort de la meilleure école de journalisme du Nord de la France, de Lille, qui est très réputée. Elle fait partie de cette jeune génération sur laquelle il est important de miser si l'on veut renouveler dans les années à venir, l'image de la robotique et le regard du public sur cette discipline scientifique. Au-delà de ces considérations, c'est une autre qualité qui devrait vous convaincre. Elle fait preuve d'une distance critique vis à vis de

la robotique et de l'intelligence artificielle. D'autre part, elle conserve un regard factuel sur ce que les robots peuvent faire aujourd'hui, ce qu'ils font déjà. Elle sait s'interroger sur la finalité et le coût de la robotique. Pour nous, et sans doute pour vous, c'est la meilleure journaliste pour vous offrir une tribune parfaite pour défendre les réalités et les devenirs de la robotique."

B.3 Group 3: defendants of Patrick Schruk

(Original version in French below) "We are here to present the candidacy of Patrick Schruk, hoping that he could have the chance and the honour of presenting your recent research. Patrick has a very prestigious background in journalism, which he completed with a training in science journalism. I believe this proves his seriousness and determination. For several years, he has specialized in robotics and artificial intelligence. As the result, he is able (and I would like to stress this because it is quite rare) to engage in a process of popularization without using sensationalism, references to fiction or metaphors. Patrick is truly a man of information, he focuses on describing the real, he relies on facts and he shows, in his recent articles, his expertise about the issues of scientific research, including the industrial outlets that are necessary and that are part of research. He is also able to emphasize the work of the laboratory, and I think this is important for you. He knows how to insist on functional developments, on current events, but he does not forget to situate the work of the laboratory in its own context or time, which is a long time, the time of research, which is not always the time of journalism. Finally, he knows how to give the floor to researchers, which is necessary, even if it is not often done. He quoted Olivier's words about development and current issues. I will conclude by saying that he knows and will know how to value the contribution of companies when they participate in the scientific research and, in doing so, he generally knows how to take into account and inform the public of the social issues at stake. For these reasons, I highly recommend Patrick."

(French version:) "On est là pour vous présenter la candidature de Patrick Schruk pour qu'il ait la chance et l'honneur de présenter vos récentes recherches. Patrick est issu d'une formation en journalisme très prestigieuse de sciences po qu'il a complétée par une formation en journalisme scientifique, ce qui je crois démontre son sérieux et sa détermination. Depuis plusieurs années, il s'est spécialisé dans la robotique et l'intelligence artificielle. A ce titre, il est capable, et je tiens à le souligner car c'est assez rare, de s'engager dans une démarche de vulgarisation sans avoir recours, ni au sensationnel, ni aux références à la fiction, ni à des métaphores. Patrick est vraiment un homme d'information, il s'attache à décrire le réel, il s'appuie sur des faits et il montre dans ses articles récents sa maîtrise des enjeux de la recherche, notamment les débouchés industriels qui sont nécessaires et qui font partie intégrante des recherches. Il est aussi capable de faire ressortir le travail du laboratoire, et ça je pense que c'est important pour vous, il sait insister sur les développements fonctionnels, sur l'actualité mais il n'oublie pas de

restituer les travaux du labo dans le temps, qui est un temps long, le temps de la recherche, qui n'est pas toujours le temps du journalisme. Il sait enfin donner la parole aux chercheurs, ce qui est nécessaire, même si ce n'est pas souvent effectué. Il cite les mots d'Olivier à propos du développement et des problèmes actuels. Je terminerai en disant qu'il a su et qu'il saura valoriser la contribution des entreprises lorsqu'elles participent en amont ou en aval aux travaux de recherche et ce faisant, il sait généralement prendre en compte et informer le public des enjeux sociaux des recherches qu'il présente. Pour ces raisons, je ne saurais trop vous recommander Patrick."

B.4 Group 4: defendants of Marise Kudo

(Original version in French below) "Thank you for soliciting us for this contest. So it is a major scientific event and the objective is to communicate on the content of this result. We need to clearly understand what the message is; you will determine the journalist who will be the best to do so. You have selected four journalists: the first one, Francois Musia, clearly, is a person who leaves an important part to the imagination, so we can see for example, about the choice of the illustration,... this image brings out a mystical aspect, the words in the text will reinforce the imaginary side, the link with humans, the confusion,... this is clearly not what you are looking for since you want to convey a precise and clear message on a scientific content. Other journalists have more talent in that sense. Juliette Langlois manages to do so, but we can see that she is just out of school and what she has written to present the robot Pyrène is clearly pejorative, highlights negative aspects, and as she tries to be clear about the scientific content, she completely devalues the work and I think that is not what you are looking for. Beside that, Patrick Schurk also made a presentation that is interesting on the qualities of the robot but he went on digressions that have nothing to do with the subject. He talked about social problems, employment problems, and in fact the robot itself is not well put forward, not well explained. And here, I also think that we're deviating, that we're not focused on the subject. The fourth one, Marise Kudo, is an example of what you want to achieve: she made a concise text where in the first part of the text, she presents the common feeling towards the robot and then, she organized her text in an intelligent way by saying that : ok, there is this feeling, but look in fact, we come back on earth, it is [just] a machine. And this machine, that's what it can do. It's not a robot, she took the trouble to use the word 'platform' to make it clear that it's an object for scientific research, she completely takes the imagination out as we don't need that here. You want to present the quality of your scientific results and therefore, it will certainly be the person who will do it best. Just look at the last sentence of her text: it clearly questions the notion of autonomy which must be taken with care (and therefore once again, she does not start with a parallel with humans, but focuses on a clear scientific problem). So I think it will be the person who will be the best equipped to communicate about your scientific result."

(French version:) “Merci de nous avoir sollicités pour cet évènement. Alors il s’agit d’un évènement scientifique majeur donc l’objectif est de communiquer sur le contenu de ce résultat. Il faut clairement comprendre quel est le message et cibler, en fonction de ça, le journaliste qui sera le mieux capable de le faire. Vous avez sélectionné 4 journalistes: le premier, Francois Musia, clairement, est une personne qui laisse une part importante à l’imaginaire donc on peut voir par exemple que pour le choix de l’illustration, . . . cette image fait apparaître un aspect mystique, les mots qui sont dans le texte vont renforcer le côté imaginaire, le lien avec l’homme, la confusion, ce n’est clairement pas ce que vous recherchez puisque vous recherchez à faire passer un message précis et clair sur un contenu scientifique. D’autres journalistes ont plus de talent dans ce sens-là. Juliette Langlois y parvient mais, on voit qu’elle est fraîchement sortie d’une école et ce qu’elle a écrit pour présenter le robot Pyrène est clairement péjoratif, met en avant des aspects négatifs, et si elle cherche à être claire sur le contenu scientifique, elle dévalorise complètement le travail et je pense que ce n’est pas ce que vous recherchez. A coté de ça, Patrick Schruk a fait aussi une présentation qui est intéressante sur les qualités du robot mais il est parti sur des digressions qui n’ont rien avoir avec le sujet. Il a parlé de problèmes sociaux, de problèmes d’emploi, et en fait le robot lui-même n’est pas bien mis en avant, pas bien explicité. Et là je pense aussi qu’on dévie, qu’on est pas centré sur le sujet. La 4ème, Marise Kudo est un exemple de l’exercice que vous voulez réaliser. Elle a fait un texte concis où dans la première partie du texte, elle présente le ressenti face à ce robot et, elle a structuré son texte de manière intelligente en disant; face à ce ressenti, regardez en fait, on revient sur terre, c’est une machine. Cette machine, voilà ce qu’elle sait faire. Il s’agit non pas d’un robot, elle a pris le souci d’utiliser le mot ‘plateforme’ pour faire comprendre que c’est un objet de recherche, pour couper complètement l’imaginaire parce qu’on a pas besoin de ça ici. Il faut présenter la qualité de votre résultat scientifique et donc, ce sera certainement la personne qui va y parvenir le mieux, comme l’illustre la dernière phrase de son texte: elle fait clairement apparaître la question de l’autonomie qui doit être prise avec précaution (et donc une fois de plus, ne pas partir dans le fait de faire le parallèle avec l’homme, mais se concentrer sur un problème scientifique clair). Je pense que ce sera donc la meilleure personne qui sera la mieux armée, pour communiquer sur votre résultat scientifique.”

B.5 Additional comments

The discussion that followed the exercice brought some interesting comments that we transcribed here in order to include them in our analysis (*French version below*).

- **An organizer of the experiment :** “First of all, let’s remember that the ranking is not the goal of the experiment today.”

- **A defendant of the chosen candidate (François Musia):** “Yes, but it would be interesting to better understand the choice of the jury because, even us, we are surprised by the result. [laughter]”

- **Other participant:** “ Yes, I think that all the roboticists in the room, they have absolutely no desire to meet this kind of journalists. These journalists, they are precisely the ones that we want to avoid. We have a huge problem of rhetoric because the jury selected exactly the ones that we do not want to give interviews to.”

[...]

- **One of the defendants of the Candidate 2 (Juliette):** “We all complain,... All roboticists complain about the verbal escalation we see in the press, ... with all the impacts that media can have on researchers,... who then are unfortunately forced to maintain the scale.”

[...]

- **Question of the jury:** “Why does Marise Kudo get carried away by quantitative data and completely forget the conditions under which the robot can qualitatively change or transform a situation?”

- **Answer from a defendant:** “She (Marise) is a person who is concerned about giving scientific details, it is once again about focusing on specific elements. As the image illustrates, for example, she chose a figure which gives elements of measurement and structure of the robot’s configuration of joints, and so here she thought it was important to give, not a huge list of data but a certain amount, such as holding 6kg, which is in fact an exceptional thing. [...], what is important is to end on a positive side; saying that in any case, this machine will allow researchers to explore new possibilities.”

(*French version:*) La discussion qui a suivi les discours a apporté des commentaires intéressants que nous avons sélectionnés dans le cadre de notre analyse.

- **Un des organisateurs de l’expérience:** “Tout d’abord, j’aimerais rappeler que le classement des discours n’était pas l’objectif de l’exercice aujourd’hui.”

- **Un membre du groupe ayant défendu le candidat sélectionné par le jury (François Musia):** “Oui, mais ce serait intéressant de mieux comprendre le choix du jury parce que même nous, nous sommes surpris.”

[...]

- **Un autre participant:** “Je pense que tous les roboticiens dans la salle, on a absolument pas envie de rencontrer François et Marise. Ce sont justement les journalistes qu’on veut éviter. On a un énorme problème de rhétorique parce que le jury a sélectionné ceux à qui on ne veut surtout pas donner d’interviews.”

[...]

- **Un membre du groupe pour la défense du candidat 2 (Juliette):** “On se plaint tous, tous les roboticiens se plaignent de l’escalade verbale à laquelle on assiste dans la presse, avec tous les impacts médiatiques que ça peut avoir pour les chercheurs qui sont obligés de maintenir l’échelle malheureusement.”

- **Question du jury:** “Pour quelles raisons Marise Kudo se laisse-t-elle emporter par des données quantitatives en oubliant complètement les conditions dans lesquelles le robot qualitativement peut changer ou transformer une situation? Est-ce que vous pensez qu’elle est capable de s’affranchir du quantitatif pour avoir un jugement qualitatif?”

- **Réponse d’un membre du groupe 4:** “Alors, vous avez tout à fait raison de mettre l’accent sur l’aspect qualitatif *versus* quantitatif, parce que c’est une personne qui a le souci de donner des détails scientifiques, il s’agit ici une fois de plus de se recentrer sur des éléments précis. Comme l’illustre l’image par exemple - la figure qu’elle a choisie qui donne des éléments de mesure et de structure de la configuration articulaire du robot-, et donc ici, elle a pensé qu’il était important de donner, non pas une énorme liste de données mais un certain nombre comme par exemple le fait de tenir 6kg à bout de bras, qui est quand même quelque chose d’exceptionnel qui montre les qualités de ce robot. [...], ce qui est important, c’est de terminer sur une note positive; c’est de dire que dans tous les cas, cette machine va permettre aux chercheurs d’explorer de nouvelles possibilités.”

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