Words as Tools and the Problem of Abstract Word Meanings

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Abstract

This paper proposes an extension of existing embodied views of cognition in order to account for the linguistic experience and its complexity. We claim that embodied views should be extended in order to consider not only language grounding but the social and normative aspects of language as well. Motor resonance mechanisms based on mirror neurons are a necessary but not sufficient component of this. We will argue that words cannot be conceived of as mere signals of something but also as tools that allows us to operate in the world. On this basis, we formulate a theoretical proposal that addresses one of the critical problems embodied views face: the problem of the so called "abstract concepts". Our proposal extends embodied views assuming *two* simultaneous cognitive sources for word meanings; an individual one, the embodied individual experience, and a socially embodied one. While for words having a concrete referent labels are "attached" to concepts formed on the basis of sensorimotor individual experience, the same situation does not hold in the case of meanings of abstract words. In the latter case the cognitive source is still embodied, but primarily in the *use* of the social word/tool. Thus abstract words represent a means to collect a variety of sparse bodily and situational experiences.

Keywords: concepts; meanings; sensorimotor grounding; social grounding; language and society.

Introduction

We are accustomed to consider words and sentences as a medium through which we *indirectly* refer to objects and actions in the world. The experience of these things and actions are what we are interested in during the use of words and sentences. Here we claim that words are not mere *signals* of something. On the contrary, we propose that words and sentences must be intended as *things/tools* of direct experience; in the use of words and sentences a kind of experience of its own is carried out (Austin, 1962). In particular, following Wittgenstein, we conceive the words of a language as a set of *tools*; each word acts as a specific tool that allows the user to specify a kind of *activity*: «Think of the tools in a tool-box: there might be a hammer, pliers, a saw, a screw-driver, a rule, a glue-pot, nails and screws. – The functions of words are as diverse as the functions of these objects. (And in both cases there are similarities). Of course, what confuses us is the uniform appearance of words when we hear them spoken or when we meet them in script and print. Words in their *application* are not presented quite so clearly. Especially from a *philosophical perspective*» (*Philosophical Investigations*, I, § 11; perhaps we could

critically say that the *same* problem is presented to us especially in the study of *psychology* or *neurology* of language). We assume that *all* forms of human cognition are based on bodily experiences; this implies that we also consider the so called "abstract" forms of cognition as forms of bodily experience. The point we want to establish is that such "abstract" forms of cognition are mediated by the words of natural languages. We argue that an "abstract" form of cognition is only possible through the mediation of a specific modal entity, that is, the sound or the gesture that expresses a word. But this is not the whole story. Namely, words are embodied not only because we utter them and accompany them with gestures, but also because they are real extensions of our body, they are tools that allow us to act and operate in a social context (Clark, 2006a, 2006b; Mirolli & Parisi, in press). We think that such an assumption can help us to solve at least *one* of the classical problems that afflict every embodied theory of language, namely the problem posed by the meaning of so called abstract words, such as *freedom*, or *God*. In particular, we are interested in showing that a comprehensive bodily theory of human cognition has to simultaneously take into account the following elements: 1. bodily individual sensorimotor experiences; 2. the language we communicate in while growing up in a human community; 3. the precise uses of our natural language *and* how this impacts on our cognitive activities and thus in everyday life.

Limits of embodied cognition views on word meanings

According to embodied theories of language and the simulation view, in order to understand and correctly use the word "bicycle" one needs to recruit the same sensorimotor system involved while experiencing a bicycle. Language comprehension entails a mental simulation of the situation described through language; thus words guide action, activating online "simulations" that help us to interact with objects and entities in the environment (Gallese, 2007; Zwaan, 2004). The neural substrate for this idea of simulation resides in the recent neurophysiological discovery, in the F5 area of the premotor cortex of monkeys and in humans, of two kinds of visuomotor neurons: canonical and mirror neurons (for a review see Rizzolatti & Craighero, 2004). Many studies support a link between the mirror neuron system and language processing.

Despite the impressive amount of evidence collected in the last years (for reviews see Barsalou, 2008; Borghi, 2005; Fischer & Zwaan, 2008; Martin, 2007**;** Pulvermüller, 2005),

embodied views of concepts and language still have a series of problems to face. Here we will focus on two of these problems.

a. The social nature of language. We claim that embodied theories of cognition have not sufficiently considered the embodied and social experience of being exposed to language, and the impact this experience has on individual cognitive activities. The discovery of mirror neurons and of motor resonance phenomena has contributed to shed a new light on the role of social aspects of cognition (Gallese, 2007). However, in our opinion this should be complemented by an analysis of how conventional and mainly non individual (psychological) aspects of language may impact on cognition. This research should be further supported by an analysis of how words can be seen as tools and as types of "affordances". With this claim we do NOT intend to suggest that research on language has not had any focus on social aspects. Many studies, in particular in the fields of anthropology and cognitive linguistics, have underlined the importance of social use in language (e.g., Tomasello, 2005; Moll & Tomasello, 2007; Clark & Krych, 2004 ; Clark & Brennan, 1991; Pickering & Garrod, 2004). Additionally, in the last number of years within the field of embodied robotics the issue of social situatedness and of social and communicative aspects of language has been a focus of attention (e.g., Lindblom & Ziemke, 2003; Puglisi, Baronchelli & Loreto, 2008; Steels, 2006). It is surprising that this interest for social aspects of language is still not widespread in the field of cognitive neuroscience of language. This is probably also due to an empirical fact: the majority of the studies of cognitive neuroscience focuses on language comprehension rather than on dialogue. However, we believe it is important to emphasise an argument in favour of an appreciation of both the embodied AND social experience of being immersed in a linguistic world.

b. Abstract words and logical elements of language. It is still unclear how embodied theories can develop a complete account designed to explain the meaning of abstract words and logical elements of language. As detailed below, we believe this issue cannot be solved by collecting further experimental evidence. Rather, through reframing some aspects of the current embodied theories in order to solve this issue.

Our Proposal

Words as social things / tools In order to try to find a possible solution for these problems, we propose an extension of existing embodied theory of language. We feel that a thorough *embodied* theory of language not only needs to take into account *individual* and grounded experience, but specifically *human* embodied experience which is the experience of being embedded in a social context/world made of specific social entities, the words of our ordinary languages. The main idea is to consider words and sentences as things/tools we use in our ordinary life experience. More specifically, the idea is to consider words and sentences as *social* things/tools.

To us the main problem with the existing embodied theory of language is that they do not fully account for the social aspect of language. We believe that the discovery of mirror neurons has greatly contributed in highlighting the social aspects of the linguistic experience. However, even if mirror neurons might well represent the basis for our social linguistic experience, we think this is probably not the whole story.

Namely, notice that when we speak about the social character of language we are not only relying on the motor resonance phenomena induced by *mirror neurons*; we are also referring to the specific human experience of a precise class of *things* (words and sentences, for example, but also moral rules and the like) that are known as *normative things*. We can use a normative thing in a competent way only if we take into account the *social rule of use* that regulates it. Whereas a usual thing is something that we can use individually, as if each of us was a lonely Robinson Crusoe. By comparison, a normative thing is something whose use is either correct or incorrect. We define a use as *correct* if it respects the social norm that regulates such a use; it is *incorrect* when it violates such a rule. This implies that a normative thing is used by individuals but through a norm that it is not individual in its very nature. A normative thing can be used only when following a social rule. The force of this social rule exceeds the power of each individual that follows such a rule (Durkheim, 1895). We do not intend to claim that this normativity is limited to words. Rather, some kind of normativity can be extended to the use of artefacts as well, and it can be more generally extended to various forms of procedural knowledge. Namely, our idiosyncratic experiences are not reflected in the way in which we use words, nor in the way we use artefacts. In some respects, words and artefacts can be equated. Consider for example the way we use a handle to open a door. In certain respects the way each of us represent the concept of the word 'handle' is not relevant, as we all must converge in using the handle in an appropriate way, i.e. in a way that allows us to open a door, that is, the socially correct way to use the handle.

The main difference between a mirror neurons based theory and a norm based theory is that in the first case there is no possibility (if the observer's brain is healthy) that the resonance between the two brains (actor and observer) does not occur; in the second case, on the contrary, such a possibility is always present. A *norm* is a rule that I *can* follow, but it is a perfectly admitted move not following the rule. While a mirror neurons based relation only admits the establishment of some kind of resonance between the organisms who participate in such relation (if the organisms are healthy), in the norm case there is no logical restriction. From this point of view *mirror neurons* are necessary but not sufficient for developing the thorough theory of language we are looking for. Mirror neurons neurologically explain how a *resonance* between different individuals can be established. While I perform some gestures, you can bodily 'understand' them without any explicit or conscious

thought about them. Surely this is an important and basic form of social connection between individuals, but the normative connection we are thinking of is quite different from this one. A mirror neurons based theory is not a social relation in the previous sense, just because it is automatic, and you cannot avoid being involved in the physiological consequences that it causes. A word is a material/modal thing but is also a social and *normative* thing. If we add this social and normative component to the usual embodied theory of language we can begin to solve the problem of abstraction. A word is a tool we make things with; but while the word is a modal entity, it allows us a productive form of activity, for example thinking. The character of language activity is linked to the normative and social character of language. This allows us to use words even when the situations where we have learned to use them do not occur.

Synthesis of the proposal To resume, we are looking for a thorough embodied theory of language; we think that in order to develop such a theory we need: a. an embodied theory of human *individual* experience; b. an embodied theory of human *collective* action modulated by mirror neurons system and the like; c. an embodied theory of language as a *social fact* (Saussure, 2006), which allows us entering in contact with other people on the basis of social norms; d. a theory of how experiencing language as a social fact impacts individual cognition.

Our Proposal and the Problem of Abstract Words Meanings

In light of the proposal we have presented, the notion of meaning of abstract words (MAWs) can be reframed. Being able to provide a compelling explanation of abstract word meanings is a major challenge for embodied theories. However, we believe that in order to account for MAWs, an extension of embodied theories is necessary. Namely, MAWs cannot be fully explained by simply assuming that they are grounded in sensorimotor systems. Rather, we propose to consider the forms of cognitive activity usually defined as abstract thinking as particular forms of bodily activity mediated by linguistic social tools, i.e. words or gestures. In this framework, the very distinction between the meaning of concrete and abstract words could be rephrased as a distinction between a more individually grounded form of cognition versus a more socially grounded form of cognition. In both cases there is a necessary normative/social component in the constitution of the lexical meaning. In our proposal the distinction between concrete and abstract words is not based on two different mental processes, but it is a consequence of their different context of acquisition. A word like "bottle" is grounded in the individual/social sensorimotor experience, while a word like "fantasy" is grounded in the social/individual sensorimotor experience. In both cases the meaning of the words have a sensorimotor grounding, and both kinds of words are actions, that is, they are things we do with words.

Overall, the evidence pertaining the grounding of abstract word meanings is still not sufficient. However, the main problem is not only the scarcity of evidence collected until now, but the fact that it is hard to imagine how far this evidence can be extended.

Embodied accounts assume that abstract word meanings, such as concrete ones, are grounded in sensorimotor system. Within this general framework, three different explanations of abstraction have been proposed (see a review in Glenberg, Sato, Cattaneo, Riggio, Palumbo & Buccino, 2008). The most classical explanation is based on metaphors (e.g., Lakoff & Johnson, 1999; Gibbs, 2003). The theory describes that image-schemas derived from sensorimotor experience can be transferred to experience which is not truly sensorimotor in nature. Evidence in favour of this view, though compelling, is confined to domains that are quite specific (e.g., Boroditsky & Ramscar, 2002), and it is difficult to imagine how far a mechanism based on metaphorical mapping can be extended. A second view is more radically action-based. The idea is that during comprehension of abstract words the motor system is recruited. Evidence in favour of this view is mainly based on compatibility effects. In a number of studies, Glenberg and collaborators found evidence in favour of the ACE (action sentence compatibility effects) with both concrete and abstract transfer sentences, utilising both behavioural and TMS methods (Glenberg & Kaschak, 2002; Glenberg et al., 2008; Glenberg, Sato & Cattaneo, 2008). According to a third view, proposed by Barsalou et al. (Barsalou, 2003; Barsalou & Wiemer-Hastings, 2005), abstract concepts differ from concrete ones as they derive from simulations of internal states rather than of external ones. Feature listing tasks demonstrate that abstract concepts rely on introspective and on situational and contextual information more than concrete ones. Overall, we believe that current evidence on abstract concepts, though compelling, risks to refer only to a subset of phenomena without being able to account for the whole phenomenon of abstraction.

To clarify: by saying this we do not intend at all to adopt an anti-empirical attitude. Rather, we believe many behavioural and brain imaging data should be collected, but we propose to adopt a different theoretical framework, which should be tested through a variety of experiments. In this paper we simply present a theoretical proposal which should be tested empirically, further developed and, where evidence makes it necessary, revised.

The present proposal, though in keeping with Barsalou's view, is somewhat more radical, because it extends embodied views assuming *two* simultaneous cognitive sources for developing a thorough theory of word meanings; an individual one, the embodied individual experience, and a socially embodied one. This second source is located *outside* the individual mind, in the particular language everyone uses in formulating his/her internal "verbal thoughts" (Vygotskij, 1934). And the presence of this second source is crucial in particular for MAWs (but it is still necessary for MCWs). While we could construe the

embodied concept BOTTLE without any help from language (as many other non human animals can do), the same situation does not hold in the case of "God". In the case of "God" the cognitive source is still embodied, but not only in the individual experience, but primarily in the *use* of the social word/tool "God". (Consider, however, that even in the case of "bottle" the fact of being exposed to and using a certain label influences our way of conceiving of bottles.) The existence of words like "God", that do not presuppose any pre-existing concepts, possibly lays down our ancient prejudice that each word has to be grounded in some physical referent. Thus we probably can give up the necessity to consider words as mere signals of something different, i.e. referents of objects or entities in the world. According to our proposal the so called "grounding problem" should not only be considered as the problem of how to attach words to things, but also as the problem of what we do with words, because words are actions.

Two interesting consequences follow from this view, that might lead to new research lines:

a. the proposal helps to highlight the variable and cultural dependency of our word use rather than its universal aspects (e.g. Davidoff, Davies & Robertson, 1999; Gentner & Goldin-Meadow, 2001; Gilbert, Regier, Kay, & Ivry, 2008; Malt, Sloman, Gennari, Shi, & Wang, 1999). Namely, a word like "God" is part of a particular semantic/action network, while the Italian word "Dio" is part of a different semantic/action network of words. The two semantic/action networks will obviously have many similarities and overlapping areas, but they will also have idiosyncratic aspects and differences that reflect the differences between the specific communities that have used those words. In keeping with this view, few recent studies, from an embodied perspective have demonstrated that languages influence the way in which we organize categories. For example, Boroditsky and collaborators have shown that the different spoken languages influence not only abstract concepts but even perceptual categories, such as colour ones (Winawer, Witthoft, Frank, Wu, Wade, & Boroditsky, 2007; for further evidence on colour and animals see also Gilbert, Regier, Kay, & Ivry, 2006; Gilbert et al., 2008).,

b. different mechanisms might underline the construction of meanings of concrete and of abstract words (MCWs and MAWs). 1. In the case of MCWs, sensorimotor experience can precede the linguistic experience, and linguistic labels contribute in constraining the boundaries of grounded categories. Therefore, when we hear or read a linguistic label, we "ground" it by activating the multimodal experience related to the object or entity it refers to (the conceptual referent). This grounding mechanism is obviously not sufficient to explain the richness of language, and to explain in particular its social aspects. However, in keeping with embodied theories we claim that the process of building concrete concepts might start from the sensorimotor rather that from the linguistic experience, even if the linguistic experience might play a role in shaping it. 2. As to MAWs (e.g., "freedom", "truth"), the mechanism

could be the opposite. It is primarily the linguistic experience that helps us in collecting a variety of bodily states, internal and external experiences, etc. These bodily states and introspective experiences emerge and are recognized once they are named. This *naming* typically takes place in a social context. It is possible that such a mechanism extends to emotions as well (Cimatti, in press a), even if more research is required and a more fine grained analysis of the differences between MAWs would be necessary.

This view can explain a number of empirical findings. Firstly, it is able to account for the longer response times typically necessary for processing abstract rather than for concrete words. This can reflect the "construction" necessary to build online abstract word meanings. Secondly, it can help to explain why, even if in feature listing tasks MAWs elicit properties that greatly differ across speakers, in quality of speakers we do converge on common definitions of abstract terms. Thirdly, it can help to explain why MAWs are acquired by children much later than concrete ones. For example, it has been demonstrated that concrete and abstract concept nouns definitions displayed a shift in their developmental trend (see for example McGhee-Bidlack, 1991). One could object that this depends on the higher complexity of abstract compared to concrete word meanings. But this objection would leave the question open, of why abstract word meanings are more complex than concrete ones. Fourth, our proposal can help to account recent results on Mode of Acquisition (Wauters, Tellings, Van Bon & Van Haaften, 2003), which demonstrate that in the first grades acquisition is mainly perceptual, later it is mainly linguistic. Consider that the hypothesis of different acquisition mechanisms does not imply the existence of a dichotomy between meanings of abstract and concrete words. The existence of definitional or nominal terms, such as "aunt" or "bachelor", as well as the fact that many concrete words, such as "ring", are rich in abstract associations, clearly highlight how slippery, complex, and unclear this distinction is. To clarify: along with the embodied cognition view, we claim that abstract word meanings are grounded exactly as concrete ones. However, departing from embodied views and extending them, we believe that the kind of grounding might differ, because the role of social/linguistic experience is more crucial for the acquisition of the meaning of words like "truth" than of the meaning of words such as "pencil" and "dog".

Conclusion

We endorse a fully embodied theory of cognition and language. The basic tenet of any embodied theory is to assume that every form of human cognition has an embodied basis. More specifically, according to the radical embodied theory we endorse, all forms of cognition are grounded in our sensorimotor system and are constrained by the kind of body we have and by its relationship with the particular environment in which our species has evolved and

in which we currently inhabit. Such a theory presents an obvious and well known problem: the existence of the so called abstract word meanings, as those articulated in English by words like "freedom", "God", and the like. We feel that in order to try to solve this problem an extension of classical embodied theory is necessary. In this paper we have proposed how such an extension could take place without assuming any non embodied source of cognition.

Along with many others we suppose that in any language there are words, like the English word "bottle", that express a pre-existing non linguistic individual and embodied concept. The story can not be so simple, however. Namely, the very fact of using the word "bottle" certainly influences the way individuals conceive bottles. Thus, children's pre-verbal concept of bottles changes once they have learned the word "bottle" – for example, it might become easier for them to categorize bottles and to distinguish between objects which are bottles and objects which are not. In fact we believe that the formation of the concept BOTTLE is influenced by the social world "bottle", even if the influence of language is less strong for BOTTLE than in the formation of the concept FREEDOM. In other words, the distinction between pre-verbal concept and linguistic concept (i.e. the linguistic meaning) is probably not sufficient to correctly describe the way human cognitive system develops, and it is certainly not adequate for meanings of abstract words. Namely, compared to words like "bottle", things are even more complicated with words like "freedom" and "God" which do not have a concrete referent, and therefore it is more difficult to think of their embodied basis. What is the problem here? How can we have experiences corresponding to non existing entities? We propose this solution: we can have experience of the apparently abstract entity GOD (that actually does not exist and there is no need of postulating its existence) only through the use of that particular modal *thing* that is the English word "God". If I am able to use such a word in the appropriate contexts my mind is later able to make internal experience of God. The trick all lies in the double nature of particular things that are words: at one side they are normal things we make experience of with our senses: we hear them, we see them on a printed page or in the gestures of someone else, we feel them when we articulate them through our tongue and lips or hands. On the other side they are social entities, whose value is external to us, as it lies in the social set of rules that regulates them. In this way we can explain why mutual comprehension is possible, because we do not communicate to each other our private concepts, on the contrary we all use the same things, i.e. words, as a public and objective means of relationship. Think of a word as a tool, for example a hammer. My hand is different from yours, maybe I have a prosthesis, but if I want to hammer a nail in the wall I only have to follow the *same* rule: that is, the *use* of the hammer is the same between us despite the individual differences in the form of our hands. In the very same way a social word does standardize the different concepts of our own minds.

In our proposal we also suggest that this social nature of words might have an impact on individual cognition, and that this impact might have a different weight for meanings of abstract and for concrete words. For word meanings having a concrete referent labels are "attached" to concepts formed on the basis of sensorimotor experience. Whereas for meanings of abstract words the experience of language might represent a powerful means to collect a variety of sparse bodily and situational experiences. According to the present proposal the uneasiness that any embodied theory of cognition feels when explaining meanings of abstract words can be mitigated (and perhaps solved) by stressing the social nature of language and its impact on cognitive activity.

Our proposal is still an embodied theory of cognition, that is, a theory of human cognitive activity based on body experience; our point is that we have to consider social experience too as a typical human embodied experience. Embodied experience is not closed inside the boundaries of our body. The social linguistic experience is an embodied experience too.

Acknowledgments

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