

Linguistic tools for embodied minds

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Abstract In this paper, we outline the embodied perspective of language comprehension indicating some of its limitations. We claim that the notions of language as a tool (CLARK 2006a, 2006b), might be useful to overcome a view focused only on referential aspects of language. Words, in quality of tools, can: a. facilitate communication among speakers; b. influence categorization; c. have a different impact on concrete and abstract words; d. allow us to construct an inner speech. Finally, we discuss how thinking about language as tool can help inform future research on thought, language and body.

Keywords: Embodiment; Language as tool; Vygotskji; Inner speech; Cultural animal.

1. Embodied theories and problems they cannot deal with

In this paper we will deal with one of the most important challenges for an embodied theory of cognition, namely the account of how language comprehension in fact works. According to the standard embodied point of view language is grounded in our sensorimotor system. Much empirical evidence collected in the last years confirms it (For a review, see BARSALOU 2008, FISCHER & ZWAAN 2008, JIRAK, MENZ, BUCCINO, BORCHI & BINKOFSKI 2010). For example, a number of experiments have demonstrated that, during the comprehension of sentences that imply an action, we bodily simulate them (BUCCINO, RIGGIO, MELLI, BINKOFSKI, GALLESE, *et al.* 2005). This is a strong argument against the traditional, amodal, arbitrary and abstract (AAA) theory of representation. Despite the impressive amount of collected evidence, within the embodied approach there are still many outstanding questions. One problem is that the necessity of the activation of the motor system for language comprehension has not been clearly shown yet. Opponents of the embodied view claim that the activation of the motor system can simply be a by-product of the comprehension process (MAHON & CARAMAZZA 2008). However, we believe that recent experimental evidence in favour of the embodied view is quite compelling and it is difficult to reconcile with the idea that the motor system is activated late and that it is not necessary for language

comprehension. In particular, there is clear evidence showing that the activation of the motor system is fast and automatic, as well as evidence on Parkinson patients off dopaminergic treatment (BOULENGER, MECHTOUFF, THOBOIS, BROUSSOLLE, JEANNEROD, *et al.* 2008, BOULENGER, SILBER, ROY, PAULIGNAN, JEANNEROD, *et al.* 2008) and on patients with motor neuron disease showing that they have selective difficulties with action verbs (BAK & HODGES 2004). A more crucial problem embodied theories have to face concerns the way in which meaning of abstract words are represented.

2. Open questions about embodied view of language

In this section we will claim that the embodied view on language comprehension has mostly focused on referential aspects of language, i.e. on the relationships between the words and their referents in the world. Its main limitations, as argued elsewhere in a more thorough way (BORCHI & CIMATTI 2012, TYLEN, WEED, WALLENTIN, ROEPSTORFF & FRITH 2010), is that embodied theories do not fully consider the embodied and social experience provoked by the very fact of being exposed to a specific natural-historical language (English, for example) within a given community, and they do not account for the nature of *social tool* language can assume. This does not mean that the role of social aspects in language has not been addressed. Many studies, in particular in the fields of anthropology and cognitive linguistics, have underlined the importance of social use in language. Tomasello and colleagues (MOLL & TOMASELLO 2007, TOMASELLO, CARPENTER, CALL, BEHNE & MOLL 2005) have proposed the Vygotskian intelligence hypothesis, according to which human infants, differently from other primates, engage in cooperative tasks involving and cooperative rather than competitive behaviours, making communication a central tool (HERRMANN, CALL, HERNANDEZ-LLOREDA, HARE & TOMASELLO 2007, REKERS, HAUN & TOMASELLO 2011, TOMASELLO 2009). Herbert Clark and collaborators have shown that during communication, speakers rely both on self and others monitoring, and work together to find a common ground (e.g. CLARK & KRYCH 2004). Similarly, Pickering and Garrod (2004), in their study of dialogue, proposed that some mechanisms, such as inference, are externalized and interactive rather than internalized in the mind of the speaker/listener. Even though some studies address this topic, the interest for the social aspects involved in language use is still not widespread in the field of cognitive neuroscience. We believe this is an important limitation of embodied theories. So, we will argue that a new challenge for an embodied theory could be to take in account two important dimensions of language: its social and normative nature and its nature of tool, of instrument that allows us to interact with the environment and with ourselves.

2.1 Language from mind to body

According to the classical cognitivist view, public languages are nothing else than manifestations of the “mentalese”, that is just the high-level implementation of a universal, arbitrary, abstract and amodal code (FODOR 1983). However, within the field of philosophy we can find profoundly different views, which emphasize the strict interrelationship between using language and acting. In the pragmatic tradition of the so-called ordinary language philosophy of language, it has been underlined that language doesn't have a mere referential function. Language has mainly a

performative dimension (AUSTIN 1962). Thanks to language we can act (SEARLE 1969), language furnishes us a tool chest (WITTGENSTEIN 1953) to act in the world. Meaning itself is not something that exists beyond its use but it coincides with the social use of the words (WITTGENSTEIN 1953). In the same vein, according to Merleau-Ponty (1945), language is a way to live in the world. Naming an object means to make an action on it, selecting and emphasizing some of its features and de-emphasizing others. Furthermore, through language we can influence others (AUSTIN 1962). Moreover, by speaking we also have a power to change the language itself and the minds of the very language users (DEACON 1997). In fact, during a conversation, thanks of conversational implicature (GRICE 1975, SPERBER & WILSON 1986), we can refer to something in non conventional ways or we can even invent new meanings. This happens, for example, when, in analogy with the shape of a mouse, somebody called "mouse" the computer pointing device. We moved from the assumption that sometimes philosophy can furnish the right questions to experimental sciences. Imagine a situation in which an explorer meets a native whose language is completely unknown for him. A rabbit runs and the native says: "Gavagai!". The first thing that the explorer may think is: "in this language they call 'gavagai' what we call 'rabbit'". But, as Quine (1960) suggests, how can you exclude that the native means other things, such as "look, a rabbit that is running", or "rabbit's ear", or the whiteness of the rabbit? In its semantic olism, Quine assumes that there's no way to have a translation without considering the whole linguistic life-form of the natives. This is surely an assumption which sounds too strong for the research on the relationships between language and categories, but it may suggest that, in order to investigate this relationship, we have to consider different languages as the expressions of different ways of life, as indirectly suggested, among others, by de Saussure (1916), Wittgenstein (1953) and Merleau-Ponty (1945). Among different philosophical proposals, we claim that two notions that can help to reframe problems within the literature on language and embodiment: the idea proposed by Wittgenstein (1953), and later developed by Andy Clark (1998, 2006a, 2006b), that language is like a tool-chest and that words are tools. These two ideas together help to underline two important aspects of language: its social and normative nature on one side, and its capability to augment our cognitive capacities, to extend our mind. In a more radical way we presume that there are some forms of specifically human cognitive activity (arithmetic and logical cognition, self-reflexing thinking, political cognition) that are inseparable by the linguistic means by which they are implemented. At an epistemological level, it is worth of notice that, whereas some notions of Wittgenstein, such as the notion of family resemblance, have widely influenced research on categorization (see seminal work by ROSH 1978, ROSH & MERVIS 1978), this was not the case for the idea proposed by Wittgenstein and further pursued by Clark that words can be tools, and, more radically, that words are specific forms of mental/bodily action. The causes are probably to be searched within the individualistic core of psychological and in particular cognitive research, which focuses on forms of cognition that take place in the mind (or in the brain) of individuals rather than on forms of distributed and extended cognition. An important contribute on reviewing these epistemological assumptions was given, among others, by Gilbert Simondon (1989), who asserted that individuation is just a process and not something which is just given: our bodies are imbued of a trans-individual dimension that can always emerge and influence us. Along the same line, and more recently, Clark (2006a, 2006b) claims that language is not to be confounded with brain

processes, but it can be considered a powerful tool that helps to expand their potentialities. According to Clark (2006a, 2006b), language provides:

a) additional targets for attention and learning. Thanks of its arbitrariness, it allows us to use symbols that don't share with their objects some physical cues that may interfere with our attention (BOYSEN, BERNSTON, HANNAN & CACIOPPO 1996).

b) resources of directing and maintaining attention on complex conjoined cues. Language allows us to reshape our concepts in order to combine them. This is demonstrated by the fact that, whereas pre-linguistic children were not able to solve a task in which different features such as geometric shape and color were to be combined, thanks to their linguistic abilities older children or adults managed to solve it (HERMER-VAZQUEZ, SPELKE & KATSNELSON 1999);

c) some of the proper parts of hybrid thoughts. Studies on mathematical reasoning conducted by Dehaene and colleagues (DEHAENE, SPELKE, PINEL, STANESCU & TSIVKIN 1999) on bilingual participants demonstrated that we resort on non-linguistic biological capacities for approximate reasoning, while precise reasoning on quantities is provided by the language faculty.

In keeping with these philosophical statements, according to a tradition that origins from the soviet developmental Psychology school (CIMATTI 1998, VYGOTSKY 1934), language can be seen as a tool that develops parallel to thought, becoming a powerful means to manipulate the world.

3. Words as tools/actions

Whereas embodiment literature has mostly focused on language grounding, we believe that philosophy could really contribute in helping to consider that treating solely referential aspects of language might be too restrictive. In particular, the idea advanced by Wittgenstein and further pursued by Andy Clark that language is a tool can represent a real theoretical advance that might influence further research. This idea has been recently promoted in a variety of contexts, from robotics (e.g. MIROLI & PARISI 2011) to cognitive science, neuroscience and semiotics (BORGI & CIMATTI 2010, TYLEN, *et al.* 2010). Language is a tool as it accomplishes various functions. One of these functions is to facilitate communication among speakers, finding a common ground. Once we have learned to speak within a given community, this embodied experience results in a second function of language: it contributes in shaping the way we conceptualize objects and entities in our environment, for example changing and constraining boundaries between categories (LUPYAN 2012). In this respect, we are influenced both by the social experience of speaking and by the experience of using a specific language within a specific socio-cultural milieu. From this point of view psychological research should take into account the fact that a Chinese-thinking psychologist might reframe differently what an English-thinking one thinks and mainly *feels* about *consciousness*. Our claim is that the different ways languages categorize the inner mental space influences the way the speakers of such languages feel about their own mental world. From this point of view time is returned to begin a comparative linguistic study of human cognition. A further function of language is to contribute to increase our memory. Finally, language helps us to construct an inner speech that facilitates our interaction with the world and with ourselves: our idea is that the very inner mental conscious world of human beings coincides with their inner speech. We will review some recent experimental evidence on these functions language might play. Unluckily,

evidence is quite scarce, probably due to the fact that within psychological research the social and cultural dimension is often neglected.

3.1 Language helps different speakers to find converging points

Language is a tool because it can be exchanged, like an object or a fact, and it can be a useful public instrument in order to find converging points among speakers. Along this line, in various papers Malt, Sloman and collaborators, criticizing essentialist theories of artefacts (e.g. BLOOM 1996), have addressed the problematic issue of the correspondence between non-linguistic and linguistic categories. They claim that no theory provides a convincing account of non-linguistic categorization, and argue that solving this would mean to assume that there is a fixed category to which the object belongs, whereas such an assumption does not obviously hold, given the instability of conceptual organization and the very fact that the same item can be grouped into different linguistic categories (MALT & SLOMAN 2004). Consider this example, which refers to artefact categorization. In contrast with an essentialist approach, according to which the intention of its creator determines an artefact essence expressed by its name (BLOOM 1996), Malt & Sloman (2007) demonstrate that the intention of a creator might play a role, but it is not crucial for neither of two forms of categorization: the name selected for the artefact and the evaluation of what the artefact “really” is. In their experiments participants read scenarios which described people interacting with artefacts and judged whether different names were suitable for each of them; the crucial manipulation consisted in assigning a different degree of communicative relevance to the creator intention. Results showed that name selection was modulated by the communicative goals of the situation. This reflects the very fact that language has primarily communicative, social goals, and that aspects linked with the assumed identity of entities referred to (such as object properties, knowledge about the creator’s intentions etc.) might be less relevant. In particular, they find that name choice is not totally determined by the characteristics of the object the name refers to; rather it is deeply influenced by linguistic history and by the common pacts adopted by the speaker and the address. Therefore, in this perspective the function of words is not limited to refer to objects and entities, but it is intrinsically social. That is, the meaning of a word can be publicly understood because its semantic value has a social nature. From this point of view the so called grounding-problem assumes quite a different character: the problem is how to reconcile different grounded experiences with the very simple fact that language mediates between individual minds that are quite different. The social nature of meaning is often neglected, while is one of the main problems that an adequate psychological theory of language should face. To claim that language is used to communicate might seem a truism, but it is worth of notice that the way we communicate and name objects does have long term influence on individual cognition. The very problem of the need of communicating something can only be posed as a consequence of the existence of some prior form of social exchange: the problem of communication is an effect, not a cause, of language. These influences are more profound than those obtained through judgements that require evaluating the properties of objects words refer to.

3.2 Language influences the way in which we conceptualize and constrain category boundaries

The very fact of having an additional input, the linguistic one, besides the perceptual stimulus, has clearly an impact on our cognitive activity and on our behavioural responses. In this respect, language is a tool, in that it influences our categorization, for example modifying and constraining the category boundaries. Even though the strong version of the well known Whorfian hypothesis (WHORF 1956), according to which language shapes thought, is not accepted any more in the current literature, a more realist version of this hypothesis might be true, and a number of recent studies have started to recognize the influence of language on cognitive activity (For a review, see BORODITSKY 2003). More specifically, not only language impacts categorization, but different kinds of spoken languages influence categorization (LUPYAN 2012, MALT & WOLFF 2010). We believe that recognizing and studying impact of language of categorization rather than focusing only on grounding of language in the sensorimotor system would help to provide a more complete (and embodied) account of linguistic experience in its complexity. Only recent experimental studies have re-started to focus on the way in which naming reflects conceptual categorization. An interesting line of research shows that using a specific language (and being embedded in a specific culture) might influence the way we represent the world. Here we will not review this literature in an exhaustive way, we simply intend to make some examples. It has been recently shown that different languages influence the way in which spatial relations are represented, the way in which the time line is conceptualized (for example, Mandarin speakers tend to organize time vertically, English speakers horizontally, (BORODITSKY 2001)), the way in which objects are partitioned into objects and substances. Also, there is evidence of influence of the grammatical gender on categorization and of color names on color discrimination (WINAWER, WITTHOFT, FRANK, WU, WADE, *et al.* 2007). Reporting this evidence we do not intend to imply that no universal aspects exist. For example, MALT, GENNARI, IMAI, AMEEL, TSUDA & MAJID (2008) have shown studying motion verbs that many languages distinguish between “walk” and “run”. However, differences emerge while considering finer distinctions, as those between “jump” and “skip”). According to Talmy (1983), language "schematizes" space, selecting "certain aspects of a referent scene...while disregarding the remaining aspects."(p. 225). Indeed, across languages there can be observed closed class grammatical forms (as “at”, “on,” “in,” “above”, “across”), which, in spite of their syntactic status, can convey limited forms of meanings related to domains as time and space. These universal language features can be accounted by an embodied background, since they can emerge from universal properties of our bodily experience with the world. Some studies, however, have shown that linguistic differences in constructing the space in terms of absolute (e.g., north to) vs relative spatial features (e.g., left to) can dramatically affect reasoning (PEDERSON, WILKINS, LEVINSON, KITA & SENFT 1998). The interpretation of these results has nonetheless been challenged by the findings of Li and Gleitman (2002), who showed that similar results can be found within speakers of the same language, when landmark cues are manipulated. Some studies have emphasized that the groupings picked up by names vary consistently depending on the culture, as Saussure (1916) pointed out a century ago, by stressing the basic *difference* between non linguistic concepts and linguistic meanings. For example, the set of objects referred to by the English word “bottle”, the Spanish word “botella”, the French word “bouteille” and the Dutch word “fles” only partially overlap (MALT, SLOMAN, GENNARI, SHI &

WANG 1999). Interestingly, Malt et al. (1999) found that whereas the naming patterns for everyday artefacts such as containers profoundly differed in speakers of different languages, there were almost no differences across different speakers in providing similarity judgements. This suggests that, when the environment provides sufficient information, as it is the case for concrete container objects, universal ways of representing them are maintained. Another interesting way to verify the impact of language on categorization is to study categories of bilinguals. Ameel, Storms, Malt & Sloman (2005) investigated categorization of bottles and dishes in Dutch and French bilinguals and found that it is slightly different from categorization of monolinguals. Namely, the category boundaries of bilinguals are merged in a common naming pattern which is influenced by both languages, thus they diverge from those used by native speakers of both languages. This merging has also advantages for individual cognitive resources, as it is more economical to store one instead of two sets of mappings between objects and names.

3.3 Language shapes the way we use and think to abstract entities

Embodied theories assume that the meaning of abstract words is grounded in our sensorimotor system, exactly as the meaning of concrete words. However, evidence on grounding of abstract concepts is not sufficient, and it is hard to foresee whether evidence can be collected, that goes beyond specific domains. Basically in the framework of embodied views three kinds of evidence have been collected in order to explain the meaning of abstract words (for a recent review, see PECHER, BOOT & VAN DANTZIG 2011). The first kind of evidence, collected mainly within the fields of cognitive linguistics and psychology, is based on demonstrations that, for some abstract concepts, we use a metaphorical mechanisms: for example, we map the concrete experience of a journey into the abstract experience of life (LAKOFF & JOHNSON 1999). Altogether, it is difficult that explanations based on a metaphorical mapping mechanism can be extended to account for all meanings of all abstract words. According to a second approach (BARSALOU & WIEMER-HASTINGS 2005), abstract concepts derive from simulations of internal states rather than of objects or external events: for this reason in feature production tasks they elicit more frequently introspective, situational and contextual information compared to concrete concepts, that elicit more frequently perceptual properties. A third approach has lead to the demonstration that not only comprehension of concrete transfer sentences like “Andy delivered the pizza to you”, but also the comprehension of abstract transfer sentences, such as for example “Liz told you the story”, involves the activation of the motor system (GLENBERG, SATO, CATTANEO, RIGGIO, PALUMBO, *et al.* 2008). Even if this evidence works very well for some kinds of actions, such as transfer ones, it is hard to imagine how far it can be extended. Also, evidence has been found that sentence negation, even if not having a meaning in itself, can modulate the motor simulation process involved in motor content sentence processing (LIUZZA, CANDIDI & AGLIOTI 2011, TETTAMANTI, MANENTI, DELLA ROSA, FALINI, PERANI, *et al.* 2008, TOMASINO, WEISS & FINK 2010), as reviewed more in detail in a special issue of *Rivista Italiana di Filosofia del Linguaggio on Action, Perception and Language* (FASCHILLI 2012, LIUZZA, CANDIDI & S.M. 2012). Anyway, this modulation is at play only when processing motor-related sentences (such as “I squeeze the lemon”), and does not apply to abstract sentences (e.g. “I dream the peace”). Importantly, this evidence shows how syntactic features of language can play a role in embodied

simulation, modulating the focus of attention on the simulated sentence (TAYLOR & ZWAAN 2008, ZWAAN, TAYLOR & DE BOER 2010). This finding is coherent with the theory proposed by Talmy on the role that can be played by closed-class grammatical forms in leading our attention in different parts of space or time (TALMY 1983). In synthesis, we claim that an embodied theory that focuses on language grounding and on referential aspects of language can hardly provide convincing accounts of how meanings of abstract words are represented (for a critique, see DOVE 2009, DOVE 2011). We believe that, in order to provide an adequate account of how abstract concepts are represented, we should consider that the weight played by the linguistic experience differs for concrete and abstract concepts (BORGHI & CIMATTI 2012, BORGHI & CIMATTI 2009, DESAI, BINDER, CONTANT & SEIDENBERG 2010, PECHER & BOOT 2011). Indeed, it has been shown that, given that abstract concepts do not have a concrete referent (an object, an entity), their acquisition mechanism differs from that of concrete concepts (for evidence supporting this, see BORGHI, FLUMINI, CIMATTI, MAROCCO & SCOROLLI 2011). This might be due to the fact that for concrete concepts first we experience objects, then we learn linguistic labels. For abstract concepts the mechanism can work exactly in the opposite way: it can be primarily the linguistic experience that allows us to recognize and put together a variety of bodily and internal states and of events. Some empirical evidence, in this regard, has been provided by Scorolli and colleagues (SCOROLLI, BINKOFSKI, BUCCINO, NICOLETTI, RIGGIO, *et al.* 2011). Other evidence of the possible function of the language as a tool comes from another study, from Gianelli, Scorolli and Borghi (In Press), who have investigated how the kinematics of reach-to-grasp movements can be affected by the perspective conveyed by linguistic pronouns (“I”, “You”). They found that participants reached an object located in front of them more quickly when an interacting other spoke, using the “I” pronoun. Given the aims of this paper, and the increasing recent literature on the topic, we do not intend to treat here extensively or to revise in depth the rich literature on abstract concepts and words. What we intend to underline here is that the influence of language – and of different languages – is more relevant for abstract than for concrete words meanings (for a collection of most recent evidence on abstract concepts and words and on the role of language for their representation see BORGHI & PECHER 2011).

3.4 Language and mental life: the case of inner speech

Language is a tool also because it allows us to speak with ourselves (VYGOTSKY 1934), because it is difficult to imagine how could exist something like our explicit and conscious mental life if it were not formulated and represented by inner speech (CIMATTI 2007). We all know the experience of inner voice, an experience that, if it goes out of control, can be considered a clear pathological symptom of schizophrenia (JONES & FERNYHOUGH 2007). As Luc Steels (2003) points out, inner voice is an “output from the subsystem that produces speech” that, instead of moving out from our body thorough phono-articular movements, feeds back as a further input, as a recurrent network does” (STEELES 2003). Its re-entrance is what allows us to make complex things such as to simulate something that is not present, to prepare ourselves for future situations, to simulate others’ thought process, thus providing the basis for complex social behaviour. But inner speech is socially important in another way: internalizing a public language we interiorize an eminently public fact. In a recent review on the studies on the relationship between inner speech and auditory

verbal hallucinations, Jones and Fernyhough have shown how a model (FERNYHOUGH 2004) based on this process of internalization and condensation of the external expanded dialogue in a condensed inner speech can take into account also the results of neuroimaging and neurophysiological studies. The dialogic nature of the inner speech, for instance, explains why Auditory Verbal Hallucinations (AVHs) have often the form of an order. The difference between healthy and AVHs subjects, in fact, seems to be due to the activation of brain areas involved in representations of acoustic properties of the speech such as the lateral temporal cortex, bilaterally, and to the activation of the parietal cortex that is involved in the alienness experience representation and an activation of Supplementary Motor Area (SMA), that provides information on the self generatedness of an output. More recently, the view that words are tools has been developed within connectionist and robotics models. Within a neural network, we can argue that “inner speech” can be considered as a further input for our cognition that helps us in many tasks (MIROLI & PARISI 2011)

4. Conclusion and directions of research

Whereas the embodied approach to language comprehension, according to which language is grounded in the sensori-motor system, has represented a real advancement compared to propositional views of thought, we believe that there still are some outstanding questions. In particular, we claim that this view is unable to convincingly account for the meaning of abstract words. In addition, probably due to the fact that research has focused on language grounding, it has not sufficiently taken into account the social nature of language, its variability and cultural dependency, and the impact that the experience of being exposed to words in a social context has on individual cognition. We will claim that the notion of language as tool-chest that offers us instruments to act in the world, proposed by Wittgenstein, and the notion of words as tools that complement our cognitive abilities developed by Clark, might be useful to overcome a view that takes into consideration only referential aspects of language (see BORGHI & CIMATTI 2012, and TYLEN, *et al.* 2010). We will argue that these two notions could be fruitfully used to interpret existing (scarce) evidence and to design new experimental paradigms. At a theoretical level, they will help embodied perspective to account for the how abstract words are represented and to avoid an universalistic approach to cognition considering cultural and linguistic diversity. At a methodological level, the emphasis on the impact of social and normative aspects of language and on words as tools could give different suggestions for research. First, in order to test the impact of language on categorization, experiments should be designed, in which novel names are used for new formed categories. Second, more and more studies comparing effects of different languages on cognition should be conducted. Third, in order to study the relationship between meaning of abstract and concrete words, tasks should be used, that differently rely on normative aspects, such as the definition vs. the free association or feature production tasks. An important implication of this view is that it might help to reframe the relationship between categorization and language. Many models of categorization assume that categories are formed, when there is a certain degree of similarity among category members. However, this notion of similarity has been criticized (e.g. MURPHY & MEDIN 1985) with the argument that, without a constraining theory or point of view, everything is potentially similar to anything else. Resemblance seems to be a good concept for a post-hoc description of the way

in which we categorize, but it is poorly predictive and it may drive us in a definition vicious circle. We propose to anchor the notion of resemblance to a goal-oriented frame, thus emphasizing the variable nature of concepts: things might resemble to each other under certain respects in a given context, under other respects in other contexts, depending on the actions we have to perform (PEIRCE 1931 - 1935), and on the different ways different languages categorize things . For example, many studies on the so called "shape bias" (LANDAU, SMITH & JONES 1988) have demonstrated that children from 2 years on, when required to extend a novel name to a new object, do it on the basis of the shape similarity between objects (shape bias) rather than on the basis of similarity on color, texture etc.. This assumption can be explained by rooting categorization in an action-based approach: shape is often particularly salient for action. Imagine a world in which colors are more salient: in this world resemblance will probably be more rooted on colors. In a similar way, we propose that the strategy to take into account the role of action in categorization may even be effective to explain the nature of language as a tool. As we showed, language can be an important tool to empower several cognitive process - included, of course, categorization.

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