Journal PARADIGMI – accepted June 21, 2019

Pre-print

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Linguistic relativity and abstract words

Abstract

Abstract words (e.g. freedom, truth) differ from concrete ones (e.g. table) because linguistic experience is more crucial for their acquisition and representation. In previous work we proposed that the linguistic input is more pivotal to learn abstract than concrete concepts, because the members of the first are less perceptually similar and more heterogeneous. During abstract concepts processing we would therefore activate language, either because we re-enact previous acquisition modality or because we use inner speech to master their complexity. Here I propose that, because abstract words evoke previous linguistic experience to a larger extent than concrete ones, they are more affected by linguistic relativity and by the differences between spoken languages. To substantiate this proposal, recent studies with words of different abstractness level are taken into account and reviewed, showing that the weaker the environmental constraints and the more abstract the words are, the more their meaning differs across languages.

Keywords: Abstract Words, Concrete Words, Linguistic Relativity, Whorf, Language and Thought, Words As Tools.

‘‘Are our own concepts of ‘‘time,’’ ‘‘space,’’ and ‘‘matter’’ given in substantially the same form by experience to all men, or are they in part conditioned by the structure of particular languages?”
(Whorf 1939/2000, p. 138).

“Whereas the individuals of all nonhuman species can communicate effectively with all of their conspecifics, human beings can communicate effectively only with other persons who have grown up in the same linguistic community—typically, in the same geographic region.”
(Tomasello, 2003, p. 1)

1. Introduction

Language is one of the most complex and sophisticated human abilities. Whether, to what extent and how language influences thought has been one of the most debated issues in the history of psychology, philosophy and linguistics. The issue is complicated, because it does not revolve only on whether our linguistic capability influences thought, but also on whether the different languages that we speak influence our way to think. The focus here will be linguistic relativity, i.e. to what extent using different spoken languages differently shapes our cognition (Whorf, 2012; Lucy, 1997), and not semiotic relativity, i.e. to what extent possessing the language ability influences thought (Majid, 2018), although the two issues as clearly interrelated. In this contribution I will reject a universalistic assumption, according to which the same – or similar - cognitive processes characterize humans independently both of the culture to which they belong and of the language they speak. At the same time, I will propose that linguistic relativity is modulated by the conceptual domain, arguing that it is more pronounced in the domain of abstract concepts (e.g. freedom) than of concrete ones (e.g. bottle). I will start defining abstract concepts and word meanings and I will then outline the main claims of a recently proposed theory on abstract concepts, named Words As social Tools (WAT). I will then explain the relationship between this theoretical proposal and the issue of linguistic relativity.

1.1 Abstract words and the role of language

This contribution focuses on whether different languages differently influence abstract and concrete word meanings (from now on abstract words and concrete words) and the (abstract and concrete) concepts they vehicle. I will use the terms “abstract words” rather than “abstract concepts” because the focus of the present work is the relationship between spoken languages and thought, hence it will not deal with concepts that are not linguistically expressed. Even though no clear and dichotomous opposition exists between concrete and abstract concepts (e.g. chair vs. justice), I define the latter as more detached from sensorial modalities, more variable in meaning and lacking a physical, concrete, single referent when compared to the former (Borghi et. al, 2014). Compared to concrete concepts, they activate less exteroceptive and more interoception modalities (Connell et al., 2018) they are less imageable (Paivio, 1990) and they are learned more through language than through perception (Wauters et al., 2003).

The Words As social Tools (WAT) theory (Borghi et al., 2018a, 2018b) proposes that words can be considered as tools useful to operate in the social and physical environment, aimed at modifying and changing it; importantly, words can also be used as mental tools, helpful to support and refine our perception, categorization, thought processes (Lupyan & Winter, 2018; Dove, 2018). The notion of words as tools is all but new and has famous antecedents in Wittgenstein (1953) and Vygotsky (1986), and in philosophy it has been recently used by Andy Clark and other authors (e.g. Clark, 1998; Tylen et al., 2010). While Wittgenstein and Vygostky clearly inspire WAT, the relevance of the WAT proposal in the present context is that it declines this notion in relation to abstract words, providing specific predictions. Indeed, according to WAT the idea that words are social tools is particularly effective in the case of abstract words (Borghi, 2019).

Specifically, the WAT proposal on abstract words (Borghi et. al, 2009; Borghi et al., 2017; 2018b) has four main tenets:

1. The acquisition of concrete and abstract words differ. Because the members of the latter are more heterogeneous and sparse (Hampton, 1981), linguistic labels and more generally the linguistic and social input given by others (e.g. explanations of the word meaning) are more crucial for their acquisition;
2. The neural representation of concrete and abstract words differ. While both are grounded in the sensorimotor experience (Pulvermueller, 2018), for concrete words the sensorimotor networks are more crucial, while for abstract ones linguistic, social and interoceptive networks play a major role.
3. Because abstract words re-enact and evoke linguistic experiences to a larger extent than

concrete words, the mouth motor system is more activated during their processing than during the processing of concrete words (e.g. Dreyer & Pulvermueller, 2018). The facilitation of mouth responses with abstract concepts found across a variety of studies (e.g. Borghi & Zarcone, 2016) suggests that, in order to process them, we need to activate inner speech, either because we re-explain to ourselves their meaning or because we prepare ourselves to ask information to others (Borghi et al., 2018a, 2018b);
4. Because abstract words re-evoke linguistic experiences, their representation is more influenced by linguistic variation across languages variation than the representation of concrete ones.

Claims 1 to 3 have been proposed and supported by a variety of evidence, collected in different labs, as discussed elsewhere (Borghi et al., 2018a, 2018b). This contribution will focus on claim n. 4, which is quite difficult to address. The difficulty is due not only to theoretical but also to practical and methodological reasons, because cross-linguistic comparisons are all but easy. In the following I will review current literature on linguistic relativity, illustrating evidence in support of this claim.

2. Abstract words and linguistic relativity

The linguistic relativity hypothesis proposes that linguistic habits influence thinking habits (Casasanto, 2016; Majid, 2018). The issue I indend to address, is whether the different degree of words abstractness influences the supposed universality or linguistic variation of word meanings.

According to recent views, linguistic variation is ubiquitous, and is not specific to one domain, but it contaminates many areas (Wolff & Malt, 2010). However, influ-

ent proposals have been advanced, claiming that words might be characterized by different degrees of universality/variation, and that whether a word meaning is universal or not might depend on its grammatical class. From a cross-linguistic perspective, one could even question the legitimacy of the category "word" (e.g. Haspelmath, 2011). In this work we will however use the category "word", using it in line with the psychological literature. According to a first distinction, open-class items (e.g., nouns, verbs, adjectives) would be variable across languages, while closed-class items (e.g., prepositions, conjunctions, articles) would be more universal, because more constrained by the linguistic structure (e.g., Slobin, 1985; Talmy, 1988). Another proposal differentiates between verbs and nouns: according to many authors the meaning of the first would be more variable across languages than the second, because the second are more heavily constrained by the environment (e.g., Gentner & Boroditsky, 2001; Morris & Murphy, 1990). Adopting this perspective, Gentner and Boroditsky (2001) have for example proposed that languages might influence more strongly the conceptualization of relations, expressed by verbs (e.g. eat) and prepositions (e.g. on, in), than by objects expressed by nouns (e.g. father, bottle).

While I am convinced that linguistic variation is present across all kinds of words, as evidence related to a variety of domains demonstrates (Wolff & Malt, 2010), here I will argue that the degree and extent of linguistic variation differs depending on the kind of words. However, I will propose that the distinction does not pertain only grammatical class but that it is modulated by the degree of abstractness of the underlying concepts. Specifically, I will contend that the influence of language varies depending on the considered domain, and that it is more marked with abstract than with concrete words. The reason is quite simple: with words with concrete referents the environment plays a strong scaffolding role, supporting categorization and simplifying language acquisition; with abstract words, where the environmental support is weaker, the different languages have more space in shaping categories and in shifting the boundaries across categories.

One could say that names referring to objects (e.g. "hammer) are typically more concrete than corresponding verbs (e.g. "to hammer"). This is generally true. However, there is evidence showing that verbs referring to actions might be perceived as more concrete than more abstract nouns (Gillette et al., 1999). The higher variation of verbs per se compared to nouns is also partially disconfirmed by studies on concrete events/actions, such as those on cutting/breaking ones, that I will briefly describe later. The evidence found suggests indeed that the categorization of events that refer to concrete actions, follows a pattern more universal than predicted. In sum: I propose that both grammatical class and abstractness level count, but that the abstractness level might render grammatical items like prepositions, cases, etc. irrelevant. For example, when comparing verbs and nouns, verbs would be more influenced by linguistic variation than nouns, but only when both verbs and nouns refer to concrete objects and situations.

In the following pages I will try to substantiate the hypothesis that linguistic relativity is markedly influenced by the degree of abstractness of the considered words. To support this thesis, I will review recent evidence, with no pretense to be exhaustive; I will select papers that in my opinion report paradigmatic examples of words differing in degree of concreteness/abstractness. I will start with object concepts, continue investigating action verbs, and then review studies on more abstract concepts, such as

emotions, number and time. While doing this, I will consider first words that can be considered at the extreme of the concreteness/abstractness continuum.

2.1 Evidence on concrete words.

Concrete nouns: the case of containers. How do we categorize everyday objects, and specifically containers? An influential paper written by Malt et al. (1999) some years ago deals with containers of different sorts – bottles, cans, etc. The authors used 60 containers, from common containers to containers that are strange in shape and configuration. They asked Spanish-speaking, English speaking and Chinese-speaking participants to name the containers, and then to sort them into different groups. They then computed the correlations between groups in the two tasks. While the correlations in naming were quite low, indicating a low level of agreement between the three groups, the correlations in the sorting task were much higher in overall similarity, functional similarity and physical similarity among the items. This pattern of data suggests that, even if the languages differed in labeling the object, the way participants mentally grouped these objects did not substantially differ. In Slobin's terms (Slobin, 1996) these results could indicate a dissociation between two processes, i.e. "thinking for speaking" and "thinking for thinking". Importantly, this dissociation occurs with concrete objects, such as containers: despite the cultural differences, the environment poses some constraints on the categories to form that the difference in languages does not overcome.

Concrete verbs: breaking/cutting verbs. Let us consider now actions instead of objects, and verbs instead of nouns. Verbs should be more abstract than nouns (Gentner & Borodisky, 2001), but here we consider action verbs related to everyday actions. A recent study aimed to verify whether there are distinctions expressed by the verbs of cutting and breaking, and whether this distinction is the same or differs across different languages and cultures (Majid, Boster and Bowerman, 2008). For example, does language express the differences between forms of material destruction as slicing bread with a knife vs. cutting papers with scissors, and to what extent there is agreement within languages in reflecting possible perceptual distinctions?

Majid, Boster and Bowerman (2008) took into account cutting and breaking verbs of 28 different languages, from 23 countries, 13 language families and a range of cultures, from rural to urban ones. Participants were presented with video-clips of different actions and had to describe what the agent did. Results reveal an impressive number of convergence between speakers, highlighted by a correspondence analyses identifying a multidimensional space defined by 4 dimensions. The dimensions according to which the semantic space is organized are surprisingly similar across cultures; hence the organization of cutting and breaking events is highly constrainedA major distinction is present across languages, that between cutting events, where the locus of separation is highly predictable, and breaking events, where the locus of separation is not (Dimension 1 of the correspondence analysis). This distinction is present irrespective of the considered culture, even among the speakers of Yélî Dnye in who live on an archipelago in Papua New Guinea, a culture where steel tools like knives were introduced only in the early 20th century, and where no other sharp tools were present. A further distinction that intervenes is that between "tearing" and other events (Dimension 2), then between "snapping" and "smashing" events (Dimension 3). Finally, poking a hole in a cloth with a twig was defined with a unique verb (Dimension 4). The production pattern of all languages highly correlate with the common solution including the 4 di-

mensions. Despite the similarity of the dimensions, the categories recognized by the different language substantially vary: for example, the number of verb used vary from 50 (Tzeltal speakers, Mexico) to 3 (Yélî Dnye speakers); a subset of languages (e.g. Dutch, Swedish, Mandarin) use different verbs to convey the meaning of cutting with one or more blades (e.g. with scissors); chopping events are assimilated to cutting events in some languages (e.g. speakers of Chontal), to unpredictable breaking events with others (e.g. Hindi speakers). Hence, these concrete action verbs have subtle differences in the way in which they are used across different languages, but also many similarities. Similarly to what happens with objects, this can be due to the fact that the perceptual input constrains and provides boundaries to the linguistic expressions.

Concrete verbs: motion verbs. Gennari et al (2002) compare English and Spanish motion verbs, such as "walk" and "run". In order to address the impact of the spoken language, they use two non-linguistic tasks, a recognition memory and similarity evaluation task. English and Spanish verbs are namely characterized by a fundamental difference: English verbs include both the manner of motion (e.g. run, stroll) and the path of motion, while Spanish verbs encode the path (e.g. "entrar", "salir") while the manner of movement is expressed through the adverb. This is exemplified by the different sentences "Mary enters the shop (English) vs. into the shop (Spanish)". In the study participants observed videos of events, while being assigned to different conditions. In the Naming First condition they had to describe events, in the Free Encoding condition they simply watched the events on a computer screen, in the Shadow condition they were required to repeat nonsense syllables while watching the videos. While in the Naming condition emphasis was put on linguistic encoding, in the last the role of linguistic information was minimized and verbal working memory was overloaded during encoding. After encoding, participants were provided with triads of events; each triad contained the target and two alternate events in which the manner or path of the target event had been changed. Examples of the triad were: 1) target: run in / entra (corriendo), 2) same manner alternate: run out /sale (corriendo); 3) same path alternate: entra (caminando). Participants had first to perform a recognition task, then to evaluate the similarity between the target videos and the other videos. At the end participants were asked to verbally describe the target and alternate events (for the Naming condition only the alternate events). According to the strong linguistic hypothesis, the spoken language should have an influence always, both in the recognition and in the similarity task and both with linguistic and non-linguistic encoding; according to the contrasting universal hypothesis, it should never have an influence. The weak language-based hypothesis predicts instead that the spoken language influences the two tasks only in the linguistic encoding condition. Finally, what the authors call the language as strategy hypothesis predicts that language would have an influence limited to the linguistic encoding cases, but only for tasks that do require conscious processes rather than automatic retrieval ones, such as the similarity task.

Results reveals differences across the languages: Spanish speakers tended to produce more path verbs and to use the same verbs with actions with the same path, English speakers verbs with the same manner. Across language the performance was better in the Naming only condition and worse in the Shadow condition. More crucially, the interaction between the conditions reveal a pattern of data that supports what the the authors call the language as strategy hypothesis. No effect of language was found in the recognition task, neither after non-linguistic nor linguistic encoding. However,

the spoken language influenced also non-verbal tasks, but only explicit ones such as the similarity judgments. The dissociation between naming and perception of similarity is in keeping with what found by Malt (1999) in the previously described study on containers and extends this dissociation to concrete events.

Malt, Gennari, Imai, Ameel, Tsuda and Majid (2008) investigated how speakers of English, Japanese, Spanish and Dutch named and evaluated the similarity between clips showing a student locomoting on a treadmill, at different slopes and speeds. If between walking and running we perceive a biomechanical discontinuity rather than a gradual transaction, this discontinuity should be perceived universally, and reflected in the different languages. Naming data reflect the distinction between the human gaits of walking and running, confirming this hypothesis. Importantly, these results indicate that languages reflect correlations among dynamic properties, not only static and lasting ones. In a second experiment participants were shown clips and were asked to evaluate how typical they were of walking/of running. Languages might differ in the way they extend walking and running to less frequent actions, as marching, and in how they distinguish other kinds of motions (e.g. jumping, hopping, skipping). The data on typicality judgments demonstrate, further, that the best examples of the gait terms are quite convergent across languages. Overall, this convergence in naming and typicality ratings is likely due to the presence of a strong structure in the world/environment, that constrain the categories; more cultural and linguistic influence is possible in domains, such as the more abstract ones, where the structure in the world is not as strong.

These studies are clearly only a subset of the existent ones on the topic. As argued at the beginning, the aim of this work is not to provide a full review of the literature. However, they show that both concrete nouns and concrete verbs are characterized by variationvariation across languages, but that this variationvariation does not necessarily extend to sorting tasks, i.e. to tasks where "thinking for thinking" is involved.

2.2 Evidence on abstract words

Abstract words: numbers and counting. The domain of numbers is very interesting (Fischer & Shaki, 2018), since the numerical system linked to subitizing, i.e. the quick and accurate judgment of low numbers (1-4, 1-5), is rather universal, and the distinction between the system linked to subitizing and the system of large numbers, is quite uncontroversial. Many studies have focused on the approximate number system (ANS), that allows the rough calculation of quantities without symbols, and is not related to language. The role of the approximate number system to acquire mathematical competences is hotly debated. Prominent scholars like Butterworth (2005) think that such number system, which is not linguistically based, is at the core of the development of mathematical abilities. However, much evidence shows the importance of possessing a linguistic system for numerical abilities. Some studies on children show that possessing words for numbers facilitates the comprehension and recall of numbers also in non verbal tasks (Negen & Sarnecka, 2010). At a crosslinguistic level, there is clear evidence showing that the numerical ability of people who have only an approximate number system is clearly different from that of populations who possess specific words for numbers. Pica, Lemer, Izard and Dehaene (2004) tested speakers on Munduruku, Brasil, who possess exact numbers only until 5. For approximate quantities, their performance does not differ from that of French participants; their perfor-

mance is however drastically reduced at the increase of the numerical quantities, when language comes into play. Hence they have difficulties in performing exact calculations with numbers that go above 4-5. In the same vein, Gordon (2004) tested speakers of Pirahã (Brasil), a population of hunter-gatherer who possess words only for the numbers "one/due" and "many". In the tasks that do not involve counting (e.g. judging the larger group, build groups composed by the same number of elements), their performance is not different from that of Western participants; the performance decreases when computing equivalence vs. differences relations (Gelman & Gallistel, 2004). In the same line Spaepen, Coppola, Spelke, Carey, and Goldin-Meadow (2011) found that home-signers from Nicaragua, i.e. individuals who do not possess sign to designate exact numbers living in a culture that possesses numerical terms, had difficulties with precise numbers. Whether these difficulties depend on the absence of linguistic terms for numbers or whether the absence of numerals reflects cultural practices where having high numbers is not necessary (e.g. Everett, 2005). In sum: the role played by language for numerical knowledge has been object of many investigations and extended debates. According to one of the most prominent views, language seems to play a major role for numbers, especially when larger numbers, i.e. the most abstract ones, are concerned. Variation across languages in the numerical domain is quite massive, but it concerns primarily large numbers and not small numbers, for which we use a likely universal mechanism, that of subitizing. Again, the stronger is the effect of the surrounding environment is large, the more variations across languages exist.

Aside single numbers, effects of linguistic variation on arithmetic are clearly documented (review by Brysbaent 2018). Brysbaert, Fias, and Noël (1998) reported that Dutch speakers name faster the solution of problem 4 + 21 than of the problem 21 + 4, while French participants do the opposite, because of the linguistic difference between Dutch and French, where two-digit numbers are pronounced in the reverse way; the effect however disappeared while typing the solution. However, a different study (Colomé, Laka, & Sebastián-Gallés 2010) found that Basque speakers solve problems such as 20 + 15 faster than Italian or Catalan speakers, since the Basque number naming system combines multiples of 20 (e.g., 35 is said as "twenty and fifteen"), both in naming and in typing (see also Salillas & Carreiras, 2014). Pixner, Moeller, Hermanova, Nuerk, and Kaufmann (2011) showed that it is more difficult to decide that 47 is smaller than 62 than that 42 is smaller than 57 because in the first case the response required (47 < 62) and the response elicited by the units (7 > 2) are incongruent, since 7 is larger than 2; the effect was replicated by Moeller, Shaki, Göbel, and Nuerk (2015). Such an effect is larger in German, which names the units before the tens (seven and forty), than in Italian or Czech, which name the tens before the units (forty-seven).

Abstract words: emotions terms and epistemic verbs. Goddard (2010) analyses cross-linguistic variations of emotion terms, epistemic verbs, and ethnopsychological constructs. His analysis of emotion terms highlights a substantial variation: for example, he compares emotion terms related to sadness in English and Chinese. English distinguishes between being sad and being unhappy, while Chinese uses the two terms "bei" (tragic fatalistic sadness, e.g. contemplating the inevitability of death) and "chou" (confused sadness/ worry/melancholy); but there is no close correspondence in meaning across the two languages. Examples like this push the author to claim that emotional terms are culture specific "Research in cross-linguistic semantics shows definitively that emotion terms are semantically complex, and that the meanings of emotion

terms in the world's languages are culture specific. They represent local interpretations, local construals, of how people can feel in response to particular cognitive and social scenarios" (Goddard, 2010, p. 80). The same is true for epistemic verbs, such as those referring to knowing, believing, doubting, assuming, supposing. Goddard analyses a verb which is apparently basic, i.e. believe, and shows that the English word believe has not an equivalent in Russian, and that, conversely, sc˘itat' has not a close English correspondence: sc˘itat' implies a long process leading to form an opinion, and cannot be modulated through intensifiers, differently from the English believe (e.g. I strongly/firmly believe). His analysis of nominal expressions designating nonphysical parts of a person, such as the English mind, heart, soul, and spirit, leads to similar conclusion. First, mind is an English notion, lacking precise correspondent terms even in languages such as French, German, and Russian. Second, he analyses the distinction between the term mind/body in English and the Korean construct of maum (Yoon, 2006), often translated with the English "mind" or "heart". In conclusion, emotion, epistemic and ethnopsychological terms are strongly dependent on the spoken language. Whether it is a matter of relativity or simply of culture-specificity of verbs in these domains is unclear, and should be object of further research. We are however inclined to think that there is a high linkage between cultural and linguistic variations.

Abstract words: time. There is plently of demonstration of the high variation across languages of the abstract notion of time. Many studies have investigated whether time is represented mapping it with different metaphors. For example, time can be represented in terms of length, or in terms of quantity. Casasanto et al. (2008) report a study in which English, Indonesian, Greek and Spanish participants evaluate the length of a growing line or the growing quantity of water in a container, estimating how much they would grow and for how long they would remain on the screen. These non-linguistic evaluations are influenced by their language-dependent representation of time: for English and Indonesian time is represented in terms of length (long meeting, long time), whereas for Greek and Spanish speakers in terms of quantity (largo tiempo). Hence the language spoken has an impact also in non linguistic tasks, in line with a strong Whorfian view. However, such representation can be flexibly modified: Bylund and Athanasopoulos (2017) demonstrate that Swedish and Spanish participant represent time repectlively in terms of length and of quantity, but also that in bilingual speakers this representation can shift depending on the language in which they are tested.

A variety of evidence has been provided, showing that time is mapped onto the more concrete concept of space (Boroditsky, 2018). While across many languages the representation of time is grounded in that of space, the time-space mapping differs across languages. For example, English (and Italian) speakers use the front/back axis to represent the relationship between past and future, as testified by expressions like "I am looking forward to my vacation," "Let's put the past behind us". This time-space mapping is however not universal. Núñez & Sweetser (2006) recorded gestures that accompany temporal expression of Aymara mothertongue, and reported that they tend to use metaphors that place the past in front of them, the future behind them. For example, to talk about an ancestral generation they point the index finger on the forehead.

Aside the front/back axis, English speakers use primarily horizontal metaphors to think about time (past/future, left/right) (e.g. Sell & Kaschack, 2011), while Chinese

Mandarin speakers use vertical metaphors (past/future, up/down). This leads Mandarin speakers to arrange pictures vertically when indicating progression in time, to make spontaneous gestures on the vertical axis when talking about time. A variety of experimental studies, since the seminal work by Boroditsky et al. (2001), have demonstrated this with implicit tasks, and have shown that the effect is more marked in monolinguals and can shift in bilinguals depending on the spoken language. Importantly, the left-right representation of time in English speakers is not necessarily induced by linguistic metaphors but it is modulated by the writing direction, in line with an embodied view: for example, Yiddish and English speakers present an opposite pattern in locating early and later events along a horizontal line: for Yiddish speaker right is early, consistently with their right-left writing direction (Fuhrman & Boroditsky, 2007). When asked to decide whether words are related to time (e.g. tomorrow), Spanish and German speakers are faster to respond when the words related to the future are presented on the left, while Yiddish people are faster with the opposite mapping (Santiago, Lupiáñez, Pérez & Funes, 2007; Ulrich & Maienborn, 2010; Ouellet, Santiago, Israeli and Gabay (2010). Hendricks and Boroditsky (2017) investigated whether learning new linguistic relations can shape thought. English speakers were taught to talk about time using vertical linguistic metaphors, that are not present in English language (e.g. breakfast is above vs. below dinner), and they were tested with the task used by Fuhrman and Boroditsky whether their consolidated left-right representation and their newly acquired up/down representation were susceptible to linguistic interference. Strikingly, they found that neither representations can be linguistically interfered, suggesting that language is a tool that can play a causal role in expanding new representation of abstract concepts.

Strikingly, neither the time-space mapping is universal, irrespective of the left-right vs. right-left direction. Levinson & Majid (2013) investigated what they called “the Island of time”, the Yélî Dnye, an isolated language spoken in New Guinea where no calendar time is present. Time is indicated through gestures, indicating the sun. The authors compare Yélî Dnye speakers with Dutch speakers in a task in which participants have to locate temporal sequences in space (yesterday, today, tomorrow): they find that Dutch people tend to use a left-to-right mapping, while in Yélî Dnye speakers no clear tendency is present.

Overall, we can conclude that research on representation of time, i.e. of a very abstract concepts, reveals its high variation across languages and cultures; importantly, this variation holds also in non linguistic tasks.

2.3. Evidence on words at the boundary between concrete and abstract ones

Only a tiny subset of words is either very abstract or very concrete; instead, in reality the boundaries between concrete and abstract words are often nuanced, fuzzy and unclear. For example, how about sensory modalities? Are they concrete or abstract concept? They are anchored to perception, but do not have a physically bounded object referent. It is therefore possible that they are less variable than abstract words, but more variable that concrete ones.

I will make only two examples. The first example is represented by musical pitch. Pitch is directly available to auditory perception, but it does not refer to a specific clearly bounded object as referent. Dolscheid et al. (2013) show that the representation of musical pitch also varies across languages. Speakers of Dutch represent pitches

as “high” vs. “low”, Farsi speakers as thin or thick. This different representation leads to a different performance in a pitch reproduction task. However, after training the performance of Dutch speakers changes resembling that of Farsi speakers. This shows that that these linguistic based representations are malleable and flexible.

The second example concerns smell. Odors do not have a concrete, spatially bounded object as referent. They cannot be seen, touched, heard, even if the source from which they originate can be eventually seen and touched. As written by Thomas Reid (1764), “It is evidently ridiculous, to ascribe to it [the smell] figure, colour, extension, or any other quality of bodies.“ Majid and Burenhult (2014) collected data from English speakers and Jahai speakers, a hunter-gatherer community living in the rainforests of the Malay Peninsula. Speakers of both languages performed free naming of smells and color chips were used, in order to compare production of odor and color words. The researchers found that, differently from English speakers who have a few words of odor, Jahai speakers name odors easily, with the same conciseness and level of agreement as colors; these results clearly cast doubts on the universality of difficulty of naming odor wordsodors. Another analysis performed by Majid et al. (2018) is informative as to the specificity of odor. Majid et al. (2018) analyzed 20 different languages, including 3 sign languages, and found that information related to the 5 sensory modalities is elaborated and expressed differently depending on the language. The pattern of codability consisting in: agreement of speakers; length of the produced speech; specificity of the response, in no language was compatible with the classic Aristotelian hierarchy of the senses, i.e. sight, audition, touch, taste, and smell; the language closest to this order is the English language. Hence, the authors conclude that “the mapping of language onto senses is culturally relative”, and each language seems to concentrate more on a given sensory domain. The only exception is odor, which is poorly coded in the majority of languages. Not surprisingly, odor has been called “the muted sense” (Olofsson & Gottfried, 2015), characterized by a weak link with language. How do we explain this strange pattern elicited by smell? Its consistency across many languages could be given by the fact that olfaction is represented mainly by referring to its (concrete) source. Across the languages, speakers tended to use less specific terms for olfaction (e.g. musty) and to rely heavily on its sources (e.g. mint). At the same time, there is a huge difference between English and Jahai speakers in using odor words, in keeping with the more abstract character of the concepts they refer to.

2.4. Evidence on words belonging to domains that differ in abstractness

Strong evidence favouring the hypothesis that there is more variations in meaning for abstract than for concrete words can be found in a paper by Majid, Jordan, and Dunn (2015), in which the authors collect naming data from participants of 20 Germanic languages (e.g. Danish, English, Dutch, Frisian, German, etc). Participants are required to name elements of 4 domains: color (e.g. blue), body parts (e.g. forearm), containers (e.g. bowl) and spatial relations (e.g. in, on). The results indicate that color, body parts and also containers are similar across languages, while spatial relations show the most variation in meaning. The authors interpret the results arguing that grammaticised meanings are more variable than meanings in open class lexical items. In our view, the result can be interpreted not only in terms of grammatical class, but they can clearly support our hypothesis. So far we have seen that the distinction between concrete and abstract words can be quite blurred. However, spatial relationship

are generally considered more abstract than words referring to colors, body parts and containers. Consistently, spatial relations show more variation across languages compared to the other words.

3. Conclusion

The data we reviewed allow us to draw some initial conclusions.

1. Language contributes in shaping thought. In keeping with neo-whorfian approaches, the
   evidence that language influences the way we think is, in my opinion, quite compelling, even though the debate is still open. Language plays an important role in regulating thought, in boosting working memory and in rendering our thought processes sharper and more compelling. Such an influence of language in categorizing and segmenting the world and in helping our cognitive processes is particularly marked in some domains. For example, language influences our ability to compute and count, rendering it more precise. It is also possible that, because of the lack of environmental support, abstract words lead to larger effects on cognition than concrete words. Some evidence we illustrated seem to be in keeping with this hypothesis, but further research is needed to better substantiate it.

2. Different languages differently influence our thinking abilities. Studies on linguistic variation provide a lot of examples of how the spoken language influences thought.

3. The influence of (inner and outer) language on thought is universal, the influence of languages on thought is ubiquituous but its weight widely depends on the considered domain – when the environmental input is less strong, the effect of linguistic variation is more marked.

If we consider studies on very abstract concepts, like time and numbers, we can see that language influences categorization also in non linguistic tasks, in a pretty consistent way. Hence the two systems, language and thought, are not independent, but integrated. If we consider more concrete domains, such as those of objects and actions, then we can notice that the effects of languages are more confined and do not extend to non linguistic tasks. In these cases, categorization seems to be more immune to the influence of language and of languages. For example, Malt et al. (1999) demonstrated that the spoken language influences verbal tasks, but not sorting tasks; in a similar fashion, Gennari et al. (2002) and Majiid et al. (2008) demonstrated with motion verbs that the influence of languages is confined to linguistic tasks. Clearly this does not mean that the domain of concrete objects and actions is not influenced by the spoken (and signed) languages: linguistic variation has an impact here too, but not such a large one when compared with more abstract domains. A more complex case is represented by words referring to sensory modalities. They have an intermediate status, being neither concrete nor abstract; there is evidence of their variation, as demonstrated by the examples of odor and musical pitch, but it is unclear whether this evidence is so strong as that related to more abstract concepts like time, emotions, numbers.

In sum, this contribution identifies one domain – that of abstract words – where the influence of the spoken language on thought is high, contrasting it with one domain - that of concrete words – where I hypothesize that, even if language plays a role, it is mostly confined to linguistic tasks, because the structure of the environment has an important influence and puts many constraints on how categories are formed. This hypothesis is clearly not in keeping with universalistic views, but it is neither in line with views according to variations across languages affect any domain. Languages influence our thinking habits in every domain, but at a different level and to a different extent.

This work has clearly a number of limitations. First, this review is clearly not complete. I have excluded some domains that have been extensively investigated, such as those of body parts (e.g. Enfield, Majid & Van Staden), of color (e.g. Regier & Kay, 2009), of space (e.g. Bowerman & Choi, 2001), and even the review on the considered domains is far from exhaustive. Furthermore, I have taken into account mainly behavioral studies, and have not considered studies on bilingualism, where the neoWhorfian approaches are raising in consensus (Athanasopoulos, Bylund, & Casasanto, 2016). Finally, I have not considered an important research direction, that investigates whether the different languages shape our brain representation (Kemmerer, 2016; 2019). The second, more crucial limitation is that, even if I reviewed the current literature and reported evidence that supports my proposal, this review does not and cannot lead to conclusive and definitive results. Its main aim is to offer some insights and a point of view in the debate on linguistic relativity that takes into account the different level of abstractness of words. A clearer picture, especially for what concerns words that are neither concrete nor abstract, can only be obtained with further experimental studies comparing many different languages in a systematic way. Novel experimental methods and new instruments that allow collaborations among scientists are now available, that might allow us to better understand the power and the limits of the variety of languages we use.

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