Chapter 6
Language, Languages, and Abstract Concepts

> *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

6.1 Introduction

Aim of the present chapter is to present additional evidence favouring the WAT proposal. While in the previous chapter, the focus was on language acquisition, here the focus is on the role linguistic information plays for abstract concepts representation, independently from acquisition. We will present rather sparse evidence, obtained in different domains and research areas, with no pretense of exhaustivity. We will start with the description of a computational linguistic study showing that a rich linguistic context is more relevant for abstract than for concrete concepts; then, we will turn to analysis of sign language indicating that for signs referring to abstract concepts, strategies based on the exploitation of language are used. Larger part of the chapter, however, is dedicated to the review of cross-linguistic studies. The aim of this review is to provide support to the hypothesis that abstract concepts are more influenced by linguistic variability, i.e., that the differences between different languages are more marked for abstract than for concrete concepts.

6.2 Abstract Concepts and Rich Linguistic Context: Computational Linguistics Evidence

One possible way to investigate how abstract and concrete concepts are represented is to ask participants to produce the characteristics of a given concept and then to analyze the relationships between the features produced and the concept itself. We have briefly mentioned some examples of feature generation tasks in Chap. 1 (e.g., Barsalou and Wiemer-Hastings 2005; Roversi et al. 2013). It is generally assumed that this task allows accessing information on how concepts are represented (Wu and Barsalou, 2009; Mcrae et al. 2005). Recent further evidence obtained with a

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free association task reveals that language associations characterize more abstract than concrete concepts, while sensorimotor information characterizes both concrete and abstract concepts (Marques and Nunes 2012). Here, we will briefly focus on a study in which the generated features were analyzed in order to determine the influence of physical and linguistic context in concrete and abstract concepts representation. We will illustrate in detail this study, which was recently conducted by Recchia and Jones (2012) at Indiana University, since we think that its results provide support to the WAT proposal. The authors designed a novel online game to collect norms for more than 500 concepts, both concrete and abstract ones. Participants were required to perform a feature generation task, that is to produce 10 properties to describe a concept; they were told that another participant would have to guess the target-words from their description. Their analysis focused on 3 measures, i.e., number of features (NFs), contextual dispersion (CD), and number of semantic neighbors (NSN). They found that for abstract words, NSN and CD were significant predictors of the performance in lexical decision (a task requiring to distinguish between words and non-words in a given language), but NFs was not. As to concrete words, NFs and CD were significant predictors of latency in lexical decision, but NSN was not. CD was the only measure of semantic richness that significantly predicted the performance on another task, naming, and in this case, there was no difference between abstract and concrete words. As to the features produced, abstract concepts elicited more communicative acts, more evaluations, more social artifacts/actions, and more cognitive states/operations/affects features than concrete words. Concrete concepts, instead, evoked mostly perceptual features, locations (e.g., "helicopter air"), and associated objects. The high frequency of communicative acts characterizing abstract concepts is fully in line with the predictions advanced by WAT, and also the high number of mental states and emotions are compatible with it, for the reasons discussed in Chaps. 1 and 3. However, while the NFs predicted lexical decision times with concrete words, it did not predict them with abstract words.

More crucial for WAT is the finding that NSN is a predictor of lexical decision times of abstract concepts, while NFs is a predictor for concrete ones: In other words, abstract concepts benefit of rich linguistic contexts, while concrete words of rich physical contexts. NSN represents the richness of linguistic contexts in which a given word appears: the relevance of this measure for abstract concepts is predicted by WAT and, more generally, by theories according to which abstract concepts rely more on language than concrete words. Obviously, this might depend on different factors: on the peculiar acquisition modality of abstract words, as hypothesized by WAT, or on the fact that abstract words do not have concrete referents, thus, participants need to rely on linguistic elements to represent them (e.g., Paivio 1986). As the authors themselves recognize, this result is not in conflict with the idea that abstract concepts are grounded in sensorimotor states, but theories according to which both concrete and abstract concepts are grounded in non-linguistic content should be extended to explain this finding. Similarly, theories of abstract concepts that do not consider the importance of linguistic information, as the conceptual

metaphor view or other embodied views, are not necessarily disconfirmed by these results but they should be extended to account for this finding.

6.3 Abstract Concepts and Sign Language: Some Examples from Italian Sign Language

Sign languages provide an important source of evidence in support of the WAT view. Here, we will refer more specifically to Italian Sign Language (LIS, Lingua dei Segni Italiana) (Volterra 1987; Capirci et al. 1998), even though the same considerations can be extended to other sign languages (for a more thorough analysis of how examples extracted from LIS can be used to support theories of abstract concepts and words, see Borghi et al., in submission; an important source of information is the Ph.D. dissertation by Gianfreda (2011; see also Gianfreda et al. in press). Evidence favoring the conceptual metaphor theory is easy to find within LIS (for a recent analysis of American Sign Language in which the domain of politeness is analyzed in terms of the conceptual metaphor theory, see Roush 2011): for example, signs such as "to know," "to think," "to understand," and "to remember" refer to the same metaphor, that is to the idea that the head is the container of knowledge, that comprehension consists in grasping something and putting it in the head container and that recall consists in retrieving information from it. The fact that signs the aim of which is to represent through a concrete action an abstract notion make an extensive use of metaphors referring to concrete objects and domains is relatively obvious. Similarly, it is quite intuitive that signs refer to events or situations. The presence of such signs can be used as support of Barsalou and Wiemer-Hasting's view of abstract concepts. For example, the sign used to indicate "December" refers to Christmas, that is to a salient event occurring during that month.

Finding in sign languages supports to the idea that linguistic representations play a major role for abstract concepts and words is, instead, all but straightforward and might seem counterintuitive. Crucially, however, LIS is full of examples of initializations, i.e., of cases in which the hand configuration reproducing the initial letter of the word is used to convey meaning, and other sign languages share this characteristics with it. In particular, American Sign Language is particularly prone to initializations (Olga Capirci, personal communication). Let us start with an example of a polymorphic sign, the sign referring to "communicate," which is similar in LIS and ASL. This sign is polymorphic as it combines a strategy based on initialization with a strategy based on metaphor use (Russo 2005). This sign combines indeed the hand configuration representing the capital letter C with a reciprocal movement of the two hands, possibly due to the underlying metaphor that "interaction is exchanging objects" (Roush 2011). Miscommunication implies a combination of the sign for communicate, followed by a hand drop with a change in orientation, indicating the failure of communication. In LIS, these two signs underwent interesting changes: at first, the sign was made in front of the mouth,

and then a bit lower, probably due to the acquired concept that communication cannot be limited to spoken communication, but that it implies also gestural, signed, and more generally bodily communication. What is relevant for the WAT proposal is the use of a linguistic strategy, initialization, even for a sign that can be represented through metaphor use.

More crucial for the WAT view, however, are signs referring to rather "pure" abstract concepts, such as "truth" and "philosophy." In the signs indicating "true" and "truth," a strategy based on initialization is used: speakers form the initial V with the index and middle fingers and move it in front of their face, sometimes reinforcing the affirmative meaning with a forward head movement (see Fig. 6.1).

While LIS does not distinguish between "true" and "truth," in ASL the two notions are represented differently. "True" is represented by using an iconic gesture grounded on the straight-path image schema (Roush 2011): The meaning of "true" is represented through the image of an object sent from the mouth along a straight line. In order to represent "truth," a slight variation is introduced which is relevant for us. The gesture is given by a movement of the index and middle fingers in a straight line on the hand. It is therefore possible that the iconic gesture referring to the straight-path image schema is complemented by a lexicalization—the two fingers probably depict an H, i.e., the H present in the noun "truth."

Other interesting examples of initialization or of language exploitation in LIS are words referring to disciplines. A striking example is given by the sign for "philosophy" (filosofia), which is made using a part of the word that has a semantic meaning. Even if etymologically the word derives from Greek and means "love for knowledge," in Italian the first part of the word "filosofia," namely "filo," means "wire." This is exploited by the sign, which is represented by reproducing a wire moving away from the head of the speaker with a twirling movement. Further examples relevant to our aims are represented by two other nouns referring to scientific disciplines, as linguistics and literature. In the sign for "linguistica" (linguistics), the initial L is mimicked and the hand is moved as if it moved away from the mouth, while in the sign referring to "letteratura" (literature), the initial L again is mimicked, this time as if it moved away from the hand, probably to convey the meaning of (writing) a letter. These two cases are interesting because they combine a strategy based on initialization with a strategy in which a specific body part (mouth, hand) is involved to constrain and delimit the meaning.

Other cases in which initialization is used concern proper or arbitrary names: For example, all days of the week are initialized, that is the first letter of the name is used to refer to the day: L M M G V S D. In contrast, initialization occurs only in one case for the names of the month: to say "ottobre" (October), the letter O is used. For the other months, it is more immediate the reference to a situation or a salient event occurring in that period (e.g., the meaning of December is signed referring to Christmas days, July is represented referring to the harvest). Alternatively, some months are represented using symbols: For example, May is represented as the month of the Madonna; thus, the position of hands which is typical of certain pictorial styles representing Madonna is used. The wide use of initialization for the signs referring to the days of the week but not to the months

Fig. 6.1 An example of initialization in LIS (Lingua dei Segni Italiana): the sign for "truth/true" (verita'/vero). The signer forms the initial V with the index and middle fingers and moves it in front of his face. In some occasions, the affirmative meaning is reinforced with a forward head movement. From Volterra (1987, p. 73). The sign exemplifies how language can be exploited to represent abstract concepts

suggests that it is a strategy mainly used when other strategies, such as the anchoring of a name to a specific object, event or situation, fail. It is also possible that initialization is widely used for names as those of the days since these words are mostly taught at school; indeed, initialization is a phenomenon linked more to the written than to the spoken language.

We believe that these few examples from Italian Sign Language are very relevant to WAT, as they suggest that in order to represent some abstract concepts language is exploited to better ground the signs. This clearly appears in the wide use of initialization for proper and arbitrary names and for names of disciplines, and for pure abstract names such as "truth," and in the example of the sign for philosophy, in which part of the word, i.e., filo (wire) is used and mimicked to convey the meaning of the overall term.

6.4 Abstract Concepts and Differences Between Languages

One of the tenets of the WAT proposal and one of the stronger hypothesis deriving from it claims that, given that abstract concepts activate more linguistic information compared to concrete concepts, they should be more affected by linguistic variability. In his label feedback hypothesis, Lupyan (e.g., Lupyan 2012) clarifies that it should be important to classify behavior on different tasks as (a) influenced by language; (b) influenced by the different spoken languages; (c) not influenced by language. We will try to show that, compared to concrete concepts, abstract concepts are both more influenced by language and by the different spoken languages.

In support of our claim, we will report examples of cross-linguistic studies on the impact of language on categorization, which indicate that, when the stimulus space is more structured, as in the case of concrete concepts, the influence of linguistic diversity is less marked. For abstract concepts, instead, there is more room for the influence of language, as demonstrated by the fact that different languages differently partition the stimulus space. A similar view was proposed by Gentner and Boroditsky (2001), according to whom the influence of language is more marked in the conceptualization of relations, expressed through verbs and spatial prepositions, than of objects. As demonstrated by Gillette et al. (1999), indeed, objects can be easily identified through observation. As anticipated, Gillette et al. (1999) had adult participants observing videos of mother–child interaction and trying to guess the content of "mystery words" during their talk. While they were able to guess the nouns 45 % of the times, their ability to guess the verbs dropped to only 15 % correct guesses. In addition, they were more able to guess concrete verbs as "push" than abstract ones: mental states verbs such as "think" and "see" were never identified when subjects could rely only on the visual context; rather, their meaning was typically inferred from the syntactic construction used.

To support our claim, we will start with concrete concepts and then refer to progressively more abstract concepts: We will describe studies on concepts of concrete objects, such as containers, then on motion and locomotion verbs, on spatial relations, and then we will turn to studies on abstract entities such as "time" and "number," and finally on abstract verbs such as mental states. One influent study on the relationship between language and categorization in concrete objects was conducted by Malt et al. (1999) who asked Chinese, Spanish, and English speakers to perform two different tasks: a naming and a sorting one. Participants were presented with black and white pictures of 60 containers and were required to label them, as well as to group them into piles on the basis of their physical characteristics, of their function, or of their overall qualities. Results showed a high variability in the naming pattern, indicating that the boundaries of linguistic categories differ substantially across languages. In contrast, the sorting results revealed that the different speakers perceived the categories in a very similar way, as the high correlations between the sorts suggested. These results

open the possibility that named categories differ from similarity-based categories. The first need to be more similar within a given language, and have more rigid and fixed boundaries, since speakers have to converge during communication; similarity-based categories instead are not used for communication; thus, they do not need to have explicit boundaries (Sloman et al. 2001). Importantly for us, these results show that the impact of linguistic diversity on a non-linguistic task with a kind of concrete objects, i.e., containers, is limited. This suggests that the representation of containers is not strongly influenced by linguistic diversity, even if these results do not exclude that there is some room for influence of language on categorization. Examples of a dissociation between the naming pattern and the conceptual representation can be found also with verbs referring to motion and locomotion (for a review, see Malt et al. 2010). In general, verbs can be considered to a certain extent as more abstract than concrete objects (Gentner and Boroditsky 2001), but motion and locomotion verbs are clearly grounded in the sensorimotor system and are constrained by biomechanic aspects. English and Spanish motion verbs such as "walk" and "run" differ: English verbs typically encode the manner of movement (e.g., "walk," "run," "stroll"), and the path is encoded through an adverb while Spanish verbs usually encode path or direction of movement (e.g., "entrar," "salir": Mary enters the shop vs. Mary enters into the shop). Participants observed video-clip of events and encoded them either using language or not, and then they performed a recognition memory task and a similarity judgment task. Even if Spanish and English speakers differently encoded the manner and the path of motion, linguistic differences did not influence recognition memory neither in the linguistic nor in the non-linguistic encoding condition (Gennari et al. 2002); however, language influenced the similarity task, even if only in the linguistic condition. The study reveals that conceptual and linguistic categories differ and suggest that the influence of language is present but limited. In a more recent cross-linguistic study, Malt et al. (2008) compared motion and locomotion verbs in English, Japanese, Spanish, and Dutch. They found that two broad categories formed on the basis of biomechanical constraints, "to walk" and "to run," characterize all languages; beyond this distinction, the different languages differently partition the stimulus space (e.g., the English words "jog," "run," and "sprint" correspond to a single Japanese word).

The studies we have briefly overviewed suggest that the influence of language on categorization in concrete domains is limited, as revealed by the dissociation between naming pattern and similarity judgments for objects (containers), and by the fact that different characteristics of motion verbs did not impact memory; however, the results of these studies do not exclude that language impacts categorization, particularly when fine-grained distinctions between motion verbs are considered.

Consider now relations which are typically expressed by spatial preposition. In a variety of studies, Melissa Bowerman and collaborators have demonstrated the effect of language on categorization of spatial categories. For sake of brevity, we will refer here just to one example. While English only distinguishes between containment and support, Korean distinguishes as well between tight containment

(e.g., ring on a finger) and loose containment (e.g., apple in a bowl). In a variety of studies, Choi and Bowerman and collaborators (e.g., Choi and Bowerman 1991; Choi et al. 1999; for a review, see Bowerman and Choi 2003) demonstrated that these differences already appear in children's spontaneous speech at 17–20 months and influence the perception of spatial relations later. In addition, habituation and preferential looking paradigms revealed the early sensitivity of English and Korean children to spatial relations such as containment and adherence in comprehension tasks, already during the first year of life, and showed that already at 18–23 months Korean children paid attention to adherence, while English speaker children did not. These results suggest how the developmental pattern of the acquisition of spatial relations might take place: Sensitivities that are not relevant to the spoken language are dropped with time, similarly to what happens in infants for sensitivity to phonetic distinctions. Importantly for us, they suggest an important role played by language in categories referring to relations rather than to concrete objects.

Consider now abstract concepts, such as "time" and "number." The example of time is paradigmatic. A growing number of studies have been conducted to investigate the notion of time, in particular in its relation with the more concrete domain of space. Even if spatial metaphors are used in most languages to refer to time, the specific mapping between space and time differs depending on the language. A growing amount of experiments have demonstrated how tight the relationships between space and time are (for reviews, Bonato et al. 2012; Santiago et al. 2011). We will describe here only some studies, in which the influence of language on the concept of time emerges more clearly. Boroditsky (2001) started from the observation that in English, people typically use front/back terms to talk about time (e.g., the talk of the good times ahead or behind them, they move meetings forward, etc.), while in Mandarin Chinese, people use horizontal but also vertical metaphors to speak about time: earlier times are up, and later times are down. The fact that Chinese speakers use different spatial metaphors for time leads to a different representation of time for Chinese and English speakers, as she demonstrated with a clever priming paradigm. Chinese speakers were faster to confirm that March comes earlier than April if they had just seen vertically displayed pairs of objects or entities (e.g., a black and a white worm/ball); the opposite was true for English speakers. A further experiment with Mandarin–English bilinguals revealed that the advantage of the vertical dimension over the horizontal one was more pronounced if they had learned English late. In addition, Boroditsky demonstrated that if English speakers learn to talk about time as Chinese do, they start to change the way they represent time. This study raised some controversy since in a different study a Chinese researcher, Chen (2007), showed that in Chinese, horizontal metaphors prevail over vertical metaphors. He found it estimating the frequency of usage, focusing on news selected through Google and Yahoo search. Furthermore, in four experiments, the author failed to replicate the priming results obtained by Boroditsky (2001). Even if its results were not replicated, in our view, the study by Boroditsky (2001) is important because to our knowledge, it was one of the first to suggest that in an abstract

domain such as that of time, language influences and shapes thought. The future, for example, is represented differently: in English and other languages, such as Italian, the future is represented as ahead from us and the past as behind us, but its representation differs in other languages: for example, in Mandarin Chinese, it is up. In Aymara, an Amerindian language spoken in the Andean of western Bolivia, southeastern Peru, and northern Chile, the mapping is completely reversed: the word for front means also past, and the word back means future. Núñez and Sweetser (2006) conducted an analysis of gestures performed by Spanish and Aymara speakers as well as by Spanish–Aymara bilinguals and found that the different metaphors used in the two languages influence time conceptualization. Casasanto (2008) started from the consideration that in English, the distance metaphor is more frequent than the amount metaphor to refer to time, while the opposite is true for Greek (e.g., a long meeting vs. a large meeting). He reports a study aimed at verifying to what extent people estimations of time were influenced by the ability to evaluate the length of a growing line or the growing quantity of water in a container (for a similar method see also Casasanto and Boroditsky 2008). In keeping with the metaphors adopted in their own languages, time estimates provided by English speakers were influenced by length and not by quantity, while the opposite was true for Greek speakers. An increasing amount of studies we are not going to review here, but which can be relevant for the WAT proposal, suggest that the notion of time is grounded both in language and in the body. Time progression is perceived as going from left to right in certain cultures, from right to left in other cultures, due to conventions linked to the reading/writing direction. We will report just a few examples. Santiago et al. (2007) found that Spanish participants respond faster to words referring to the future on the right and to the past on the left (see also Flumini and Santiago 2013), and Ouellet et al. (2010) demonstrated that Hebrew speakers show a reversed right-to-left mapping (see also Fuhrman and Boroditsky 2007; Sell and Kaschak 2011).

Consider now a further example: abstract verbs. Goddard (2003) demonstrated how the meaning of "thinking" varies consistently across languages. More recently, Goddard (2010) has shown that the majority of words referring to emotions and mental states are language specific, beyond a small set of meanings which are shared by many languages, such as think, feel, want, and know. For example, words such as "sad" and "unhappy" in English do not have a Chinese counterpart, since Chinese does not distinguish between "fatalistic sadness," "confused sadness/malincholy," and "ethical and altruistic grief."

A final example concerns numbers and the ability to use them during counting. As anticipated in Chap. 1, the concept of number is rather idiosyncratic among abstract concepts. Many authors have provided compelling evidence that numbers are grounded and that finger counting represents the basis for number acquisition (for a review, see Fischer and Brugger 2011; Fischer et al. 2012). The literature on numerical cognition is vast and complex, and we are not going to review it here, also due to the specificity of this abstract concept. Here, we focus only on the issue of whether counting is affected by linguistic differences or not (Gelman and Gallistel 2004; Gordon 2004). Gordon (2004) investigated the Piraha culture in the

Brasilian part of Amazonia, characterized by a one-two-many counting system. The absence of a linguistic-based counting system limits the ability of the Piraha people to enumerate exact quantities when exceeding two or three items. While subjects possessing a linguistically based numerical system have an exact sense of numerical quantity, non-numerate participants possess an imprecise and vague notion of number, as revealed by their performance on a variety of tasks, as naming the number of items in a stimulus, constructing sets of equivalent numbers, judging the more numerous among more sets, mentally performing additions and subtractions. Across different tasks, however, Gordon found that the ability to use an analog estimation process was present. Overall, these studies suggest that language might play an important role for the abstract concept of number and for numerical processing abilities. We will not discuss here whether this implies the existence of two different numerical systems: one rather universal on number approximation and another for counting and arithmetic, which is language based, as some authors propose (e.g., Pica et al. 2004). What is relevant for us is only the importance of language for the concept of number. As clearly argued by Gelman and Gallistel (2004, p. 442), "reports of subjects who appear indifferent to exact numerical equality even for small numbers, and who also do not count verbally, add weight to the idea that learning a communicable number notation with exact numerical reference may play a role in the emergence of a fully formed conception of number."

Due to space reasons, we will not discuss the implications of the results we reviewed for the proposal of linguistic determinism, according to which language shapes thought (Whorf 2000/1939, 1956), neither will we review the debate that followed. It is sufficient to say that in the last years, there has been a renaissance of the Whorfian point of view, supported by evidence in a variety of domains. The results we have briefly illustrated, even if they do not support linguistic determinism in its stronger version, can at least be framed within the idea proposed by Slobin (1987, 1996) that thinking and thinking for speaking might differ. According to Slobin, during language processing, attention is directed to the aspects of experience which are encoded in the grammar of a specific language. The review we made suggests at a minimum that language differences affect thinking for speaking. More importantly for the WAT proposal, our review indicates that the impact of language on thinking for speaking is more pronounced for certain domains, as the abstract domain when compared with the concrete one (Boroditsky 2001; Boroditsky and Prinz 2008). Further research is necessary, in order to investigate this important issue.

6.5 Conclusion: Influence of Language on Abstract Concepts

We started the present chapter with a question of Benjamin Lee Whorf: "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)." The aim of this chapter was not to review the hot debate on whether thought is determined or influenced by language—we start indeed from the assumption that the influence of language is pervasive (Malt and Wolff 2010), and we do not think this represents a departure from an embodied view since language is a form of experience. The aim of this chapter was to verify to what extent the influence of language differently affects the representation of concrete (e.g., bottle) versus abstract words (e.g., time). From the evidence we reviewed, we believe we can come to two conclusions. First, language plays an important role in the representation of abstract concepts, as suggested by the computational model and by the analysis on sign language. The influence of language on conceptual representation is not in contrast with an embodied approach: according to WAT, all concepts are grounded in the sensorimotor system. But this is not the whole story. We also reviewed evidence showing not only that language influences abstract concepts more than concrete ones, but that different languages differently impact abstract concepts, and that the influence of linguistic diversity is higher in the case of abstract than of concrete words.

In "The Analytical Language of John Wilkins," Borges describes "a certain Chinese Encyclopedia," the Celestial Emporium of Benevolent Knowledge, in which it is written that animals are divided into:

> those that belong to the Emperor, embalmed ones, those that are trained, suckling pigs, mermaids, fabulous ones, stray dogs, those included in the present classification, those that tremble as if they were mad, innumerable ones, those drawn with a very fine camelhair brush, others, those that have just broken a flower vase, those that from a long way off look like flies.

Our review indicates that cultural and linguistic aspects do indeed influence concepts. However, the version we adopt is less extreme than that proposed by Borges: The influence of language on cognition is high for abstract concepts, while it is less important (even if present) for concrete concepts, such as that of animal, since the environment and the body provide a better-defined structure that needs to be shaped by linguistic input to a much lesser extent.

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