Abstract

During the last decade, a renewed interest in linguistic relativism has given rise to an exponentially growing body of literature concerning the influence of language on cognition. The current concern is not whether language influences cognition, but rather how much, and to what extent. After briefly characterizing Whorf's linguistic relativism, the current neo-Whorfian hypothesis is introduced, and a selection of the most relevant and influential studies is reviewed. The conclusion contends that the influence of language on cognition is not homogeneous, but depends on how much recoding is brought about during linguistic development.

Keywords:

Whorf, linguistic relativism, basic color terms, categorical perception, linguistic diversity, spatial frames of reference, numerals, time conceptions, conceptual metaphor, relational thinking, grouping effect
Linguistic relativism finds its roots in Romanticism: in the reaction to the supremacist attitudes of the Enlightenment thinkers, who were in the business of establishing hierarchies of languages in order to find the “perfect” one (generally, French). Romantic thinkers, such as Herder, viewed peoples (“Volks”) as incommensurable historical entities, whose worldviews are somehow condensed in their respective languages. In other words, language was viewed as the accumulated wisdom and repository of experience of a particular People.

This Romantic attitude found its proper place in the development of Anthropology as a science in the late nineteenth century. A privileged area of research in this regard was the documentation of the Amerindian languages as their speakers were being exterminated. This work naturally gave rise to the linguistic relativism hypothesis: what one can think is constrained or molded by the language one speaks. Whorf’s originality (1956), in this regard, lies in his particular way of arguing for this view and in his effort to provide evidence for it, instead of taking it as an obvious postulate.

Whorf’s reasoning sides with the functionalist American tradition. Following William James’ views, Whorf describes the infant development as the process of making sense of the “booming, buzzing” confusion of early sensory experience. Language provides a set of “ready-made” categories. By learning a language, then, we acquire a categorical system that allows us to make sense of our experience. If different languages “carve nature at different joints”, speakers of different languages will come to experience the world differently. To put the point in anti-realist terms, as sometimes Whorf did, they will come to experience different worlds. Language, from this point of view, is not just a communicative tool but also a representational one.

This simplistic argument is not coherent, though: it doesn’t apply to language the general point about sensory confusion. Language is thought to provide a way to structure one’s experience, as if it were a salient part of one’s experience in the first place, as if the sounds of language were not part of that initial confusion. In addition, there could be categories common to all languages. In other words, Whorf’s relativistic hypothesis is grounded in taken-for-granted assumptions.

It is also true that Whorf suggests in some passages that thought is carried out in the particular language one speaks: “Thought takes place in a language, be it English, Sanskrit or Chinese” (Whorf, 1956, p. 283). But this is not a core aspect of linguistic relativism as such. The latter just requires that what can be thought is configured by the categories of one’s language, that one’s global conceptualization of experience derives exclusively from one’s linguistic experience: the doctrine of linguistic determinism.

The contemporary Neo-Whorfian versions of linguistic relativism (Lucy, 1992; Gumperz & Levinson, 1996; Levinson, 2003; Boroditsky & Casasanto, 2008) avoid the epistemological and
metaphysical assumptions of Whorf, and are not committed to the contention that thinking takes place in a natural language. The focus is on the central argument for linguistic relativism, which can be summarized this way:

*Premise 1: Linguistic diversity:* languages differ in their lexical and morphosyntactic rules and categories.

*Premise 2: Linguistic determinism:* the linguistic ways of categorizing human experience determine the cognitive ways of categorizing it.

*Conclusion:* The categorical structure of thought varies according to the language of the thinker.

Notice that this is more a deductive schema than a well-specified hypothesis. All sentences in this reasoning admit of different degrees of modal strength, while for any of them some sort of linguistic relativism follows. Thus, linguistic diversity may be underlined (Levinson, 2003) or downplayed, for instance as parametric variation of linguistic universals (Chomsky, 2007). In the same vein, the second premise affords a strong reading (all cognitive categories are linguistic), or a weak one (at least some cognitive categories depend upon the language acquired) (Kay & Kempton, 1984).

Understood this way, Whorf provides a concrete program of empirical research, to find out whether, and to what extent, it is true that linguistic structure influences cognition: select a way in which languages differ, and see whether speakers of those languages differ in some non-specifically linguistic cognitive task (perception, memory); then, pay attention to how such cognitive abilities appear in ontogeny, to confirm whether differences appear only due to language mastering. Such a program has given rise in the last decade to a lively neo-Whorfian programme in contemporary cognitive science, whose main contributions are novel paradigms, rigourous experimental control, and piecemeal examination.

In what follows, I'll select the most outstanding recent contributions in this area. Then, I'll discuss which conclusion is best supported by the evidence - the influence of language on cognition not being into question, but rather how much influence it has, in which areas, and by which mechanism. The conclusion will turn out to be that relativist influences do not happen across the whole cognitive system, but just in late-developing, more abstract, cognitive domains. They might also show up, though, in early-learned perceptual categories, as long as they involve recoding of sensory experience. There is no need for radical constructivist assumptions (“no perception without language”) to accept Whorfian effects: they may just involve overcoming initial implicit preferences, which are not linguistically coded, and making some perceptual aspects more salient because of the way language drives attention to them, as cognitive development benefits from the abstract recoding fostered by lexical development (Gomila, 2012).
1. Color terms influence color perception and memory

Berlin & Kay (1969)'s Basic Color Terms made a long-lasting impact by challenging the relativistic hypothesis. They claimed that color perception is independent of the color terms of one's language, and also, they downplayed linguistic diversity, claiming that languages differ in their color vocabularies in a systematic way. The outcome of the debate that followed was not a rejection of the notion of basic color terms, but rather a heightened awareness of the need to be more careful in experimental research in two directions: in introducing greater experimental control when looking for non-verbal cognitive effects of such different vocabularies; and in carrying out an ambitious world survey of color vocabularies, in order to assess the claim of a universal pattern of increasing differentiation of colors, the World Color Survey (Kay & Regier, 2003), which is made available through the online World Atlas of Language Structures (Kay & Maffi, 2011). It was realized, though, that linguistic diversity is an independent issue: linguistic differences may have a cognitive effect, even if these differences are not arbitrary or purely conventional.

A great deal of effort focused on color discrimination tasks to assess whether the categorical effect—the fact that discrimination is easier between category than within category—in color perception is sensitive to linguistic differences in establishing categorical borders. Thus, Kay and Kempton (1984) supported the role of linguistic categorization in perception through different categorical perception effects across languages. In Tarahumara, a Mexican indigenous language, there is just one term for the part of the spectrum that we divide between blue and green. Kay and Kempton reasoned that if language influences cognition, speakers of English would distinguish more strongly between color samples that they call “green” and “blue” than between color samples that fall into the same color category. They posited that this would be true, even if the differences in physical terms were the same in all instances, while for speakers of Tarahumara that would not be the case. The experimental paradigm consisted in three color samples, and the participants had to decide which one was the most different. As hypothesized, the Tarahumara speakers—lacking a verbal distinction—discriminated among the examples in relation to their physical differences, while the English speakers saw the similarities and differences along their lexical categories. Kay and Kempton reasoned that this could be due to the fact that the strategy of the participants could be that of labeling the samples in the first place, calling each sample “blue” or “green”—a strategy not available to the Tarahumara speakers. The sample that was categorized differently from the other two would be the one chosen as most different, even if the physical differences among the different samples were the same.

To test this explanation, they devised a second experiment. To block that strategy, this time, the three color instances were not presented simultaneously, but through a moving window that allowed the participants to see two of the three samples at the same time: the one on the left and the one in
the center, or the one in the center and the one on the right. In each trial, the participant had to
determine whether the left example was “greener” than the one in the middle and whether the right
example was more “bluish” than the one in the middle. In order to answer which difference was the
greatest: the one between the two “greens” or the one between the two “blues.” In so doing, the
center instance was labeled both “green” and “blue” in the same trial, so that the discrimination
could not be due to its categorization as one of the two. In this setting, the effect found in the first
experiment disappeared, and speakers of English performed as the speakers of Tarahumara.
Language, then, can be said to be influential in how we perceive similarities and differences.

This comparison also makes it clear that we do not perceive colors only when we have a term to
denote them; it is not that without language we would not have color experiences. It is rather that
language plays a role in structuring our perceptual space, particularly in memory tasks. Thus,
Berinmo speakers from Papua New Guinea exhibit enhanced color discrimination from memory
across Berinmo category boundaries, but not across English boundaries, while English speakers
show the reverse pattern (Robertson et al., 2000). In general, if two colors are the extension of the
same term in a particular language, speakers of that language will judge the two colors to be more
similar and will be more likely to confuse them in memory than speakers of a language with a term
for each color. These differences develop early in infants and coincide with the acquisition of color
terms (Robertson et al., 2004).

Further studies also confirmed the Kay and Kempton’s verbal interference effect: crosslinguistic
differences in similarity judgments and recognition memory can be affected by direct verbal
interference. This suggests that it is language, itself, that is involved “online” during these tasks.
Verbal interference has also been shown to affect speeded color discrimination and visual search
tasks across the English blue/green boundary (Drivonikou et al., 2007; Gilbert et al., 2006).
But such linguistic effects have been found not just on non-verbal memory tasks, but also in
discriminative tasks. Winnaver and his colleagues have recently compared Russian and English
speakers on a simple similarity judgment task, focused on the blue part of the spectrum. It turns out
that in Russian two “basic” terms (according to the Berlin & Kay definition) correspond to the
English “blue”: “golubóy” and “siniy.” The former is typically applied to the sky, the latter to the
sea. Winower and his colleagues (2007) showed their participants three chips of the blue spectrum:
one being the sample, and two options from which to choose the one that’s more similar to the
sample. They reasoned that if linguistic representations are used to deal with ambiguous color
samples—as claimed by critics of relativistic effects—then no language effects should appear in this
task, given that it is an objective one that participants can solve with high accuracy. Reaction times
were measured as an indication of the relative easiness of the task. Finally, the task had to be carried
out under two conditions: with and without verbal interference. The main hypothesis concerns the
effect of the categorical boundary on Russian speakers. If color vocabulary has cognitive effects, performance of Russian speakers should differ from English speakers with regard to perceptual discrimination performance across the boundary. Additionally, verbal interference should affect only Russian speakers. Therefore, it is the cross-category trials—when the participants had to choose between a “goluboy” item and a “siniy” item—in which critical differences were to be expected. Russian speakers should be faster at cross category trials than within-category trials, whereas no difference is expected by English speakers. The results nicely confirmed the predictions: Russian speakers were faster at judging similarity cross-categorically than within-categorically, and verbal interference affected more Russian cross-category than within-category judgments.

2. Spatial terms influence non-verbal spatial tasks

Languages offer different kinds of terms to talk about space. Levinson (2003) has distinguished between three main areas of spatial cognition which can also be found in language: deixis, topology, and frames of reference. Deixis concerns distance from ego (“this” versus “that”) and direction (“coming” versus “going”), and involves radial rather than vector characterizations (it is possible to “come here” from any direction). Topological distinctions concern relations of contact, containment, or propinquity between a “figure” object and a “ground” landmark. Finally, frame of reference provides a way to specify directions—taking ego as polar coordinates—and it is thus most relevant for orientation and navigation.

Bowerman studied some crosslinguistic differences in topological terms (Bowerman & Choi, 2003). Thus, for instance, Choi and Bowerman compared how English and Korean speakers differ in which spatial relationships they pay attention to. In English, the prepositions “on,” “in,” and “under” specify the possible relations between an object and a container. Korean, though, lacks a similar specification, but it marks morphologically whether an object is tightly or loosely limited by another (for instance, a finger by a ring versus a picture and the wall), an aspect of the situation which English doesn’t specify. Their comparative studies revealed that English and Korean pay different attention to these spatial relations, concluding that acquisition of spatial semantics of the terms of one’s language influences children’s categorization of spatial relations. This does not mean that babies learning English are blind to the tight fit versus loose fit containment relations: all babies are sensitive to this difference by 9 months of age (McDonough et al., 2003). It is rather that—given that the language they learn does not pay attention to such differences—those differences lose cognitive saliency later on. A study with deaf children, though, suggest that without linguistic input, some spatial relationships take much longer to be understood (Gentner et al., 2013).
As regards frames of reference, three different lexical systems have been distinguished (Levinson, 2003).

a) Object-centric or intrinsic framework terms are terms that specify intrinsic positions of landmark objects to extract a direction (often by metaphorical projection of body parts). In English, such terms as “heads” and “tails” (mostly for coins, but extensible to other objects), “front” and “back,” or “top” and “bottom” specify a particular part of a landmark that can be used for orientation.

b) Egocentric or relative framework terms are indexical terms whose meanings require attention be paid to the position of the speaker. In English, some of the previous terms can be so used, if they specify a part of the speaker (whose corresponding direction, though, moves with the moving subject). Such terms as “in front of,” “to the right of,” or “behind” are of this kind (as in “it’s in front of you,” “the seat to my right,” or “put it behind the table”).

c) Allocentric or absolute framework terms are terms that specify absolute positions in space. In English, terms such as north or south are of this kind (as in “travel North” or “it’s more to the South”).

Most languages combine two or more of these systems. While in English allocentric spatial terms seem to be exceptional, they seem to be the rule in languages such as Tzeltal (a Mayan language); some Australian aboriginal languages, such as Guugu Yimithirr and Kuuk Thaayorre; and some Asian languages, such as rural Tamil, Longgu, and Arrernte (Levinson & Wilkins, 2006, which is a survey of linguistic diversity in space and movement description). Notice that such absolute directions are more arbitrary and abstract than intrinsic or relative terms, since they cannot be directly perceived; they do not depend upon endpoints or milestones, and orientation requires constant tracking of one’s position in a fixed spatial map.

Levinson and Brown (Brown & Levinson, 2009) have studied the Tzeltal linguistic community of Tenejapa. The Tzeltal spatial vocabulary lacks terms corresponding to “left” and “right,” but has words corresponding to absolute positions, formed by abstracting from the slope of their land. In this case, absolute position terms correspond to “uphill” (which is South) and “downhill” (which is North), so that they say things like: “Give me the uphill glass,” or “the rope is downhillwards the bottle,” regardless of current position of the speaker. For orientations corresponding to East and West, the term is the same, corresponding to “across.” Tenejapan people are oriented by reference to this framework at all times, while they can also use an intrinsic system of reference, with terms that refer to body parts. The question is whether this preference for an independent frame of reference plays a cognitive influence beyond language.

According to Levinson and Brown, the answer is yes: speakers of “allocentric” languages differ from speakers of “egocentric” languages in nonverbal tasks of spatial reasoning, of visual memory,
and of gesture. The differences occur in forms related to their different lexical systems, thus providing evidence for a role of language in cognition. Levinson and Brown set several different nonverbal spatial tasks for speakers of these languages, and compared their performance to that of speakers of “intrinsic” and “egocentric” languages (such as Dutch). Tasks required memory of spatial configuration, motion, and path direction. Thus, in a spatial reversal task, Tzeltal speakers saw the spatial ordering of four items on a table, for instance, and were asked to remember the spatial ordering of three of them. They had to reconstruct that “same” ordering on another table, which they approached from the opposite side (a 180° turn). The Mayan put the objects in the same allocentric ordering as the original set (what was to the left was again to the left, despite the subject reversal), while Dutch control participants would go for the same egocentric ordering (what was to the left was now to the right). Similarly, in a spatial-reasoning task, participants were observed to find out whether they preferred a transitive ordering of objects in terms of a left to right (egocentric) or a north to south (allocentric) frame of reference. Again, the Dutch used the egocentric and the Tenejapans used the allocentric framework.

Notice that the strategy consists in presenting an ambiguous task, which is why it was described as the “same,” as opposed to the same. The instructions could be understood both ways. Therefore, the evidence does not show that any of the participants could not solve the task the other way. In fact, further research showed that both groups could solve the task both ways (Li et al., 2005). The results, though, do show a different preferential understanding of the task, related to the dominant spatial vocabulary.

3. Numerals are required for counting

Numbers, or rather, numerals, have been another outstanding area of research. Numbers are abstract entities, which cannot be grasped directly, but through a symbolic means of representation. Numerals are the terms language offers to denote numbers; for arithmetics, other, more specific symbols may be required (functions, operations), in addition to a graphical numerical representation. Languages also differ in their numeral systems, so the question arises: to what extent do these differences matter for arithmetic competence? There is a broad consensus that some numerical concepts are independent of language. There is evidence that we share some basic notions with animals, such as “more or less” and “numerosity”, given that prelinguistic infants and some nonhuman animals can discriminate the numerosity of small groups of objects and can recognize that one is larger or smaller than another (Starkey et al., 1990).

However, when it comes to exact numerical concepts larger than four, it is clear that they are
acquired through language. It is a prominent example of the concepts that depend on language, at least at two levels: developmentally, in that the term comes first and then the child has to somehow come to understand its meaning; and processually, given the evidence that their linguistic representation is involved in calculations and arithmetic tasks (Spelke & Tsivkin, 2001). The authors of this study found that bilingual subjects trained on new number facts in one language, recalled those facts faster and more reliably when tested in that language, than when tested in their other language.

As with color, though, languages may vary a lot in their numbering systems. Some languages may have a very short numeral repertoire, as in “one-two-many”, while others avail themselves a generative system that guarantees a numeral for each possible number, such as that found in Western languages. Peter Gordon has focused on one of the “one-two-many” languages: the Pirahä, an Amazonian language spoken by a tribe of hunter-gatherers (Gordon, 2004). The question is whether Pirahä speakers—having terms just for one, two, and many—are somehow impaired in arithmetic functions, such as counting, addition, or subtraction. According to Gordon, they are unable reliably to tell the difference between four and five objects placed in a row. In other words, Pirahä speakers perform like nonverbal infants and nonenculturated primates, lacking a symbolic means for counting. The procedure Gordon used was a sort of imitation game: he laid out a random number of familiar objects, like sticks and nuts, in a row, and the participant (there were seven of them), was supposed to do the same. For one, two, and three objects, the Pirahäs’ row matched Gordon’s sample. But when the number of objects was from 4 to 10, Pirahäs just approximated the number, with increasing deviation as the row grew longer. In another task, participants were shown several boxes, with different quantities of fishes depicted on top. Seconds later, they failed to take this difference into account in order to remember which box kept a hidden object. Similarly for rhymic tapping: they could imitate tapping on the floor of up to three taps, they failed to mimic strings of four or five taps. Gordon observes that the Pirahä do not need to count in daily life, and concludes that this evidence demonstrates that numerical concepts beyond three are acquired through the acquisition of the corresponding numerals.

Similar results were obtained by Pierre Pica with speakers of Mundurukú (Pica et al., 2004), another Amazonian language which lacks numerals beyond five, even though Pica and collaborators avoid a relativistic conclusion. While speakers of Mundurukú are able to compare and add large approximate numbers beyond five, they fail exact arithmetic with numbers over 4 or 5. Again, this evidence is interpreted in terms of a dual system of numerical competence: a basic nonverbal system of number approximation, and a language-based counting system of exact number and arithmetic. However, it again remains to be established what the precise role language is in the understanding of numbers. This must be determined in order to know if the language-based system
is not a real improvement on numerical cognition (as Pica thinks), or if abstract understanding of
corcepts as language-dependent is a relativist effect (as Gordon affirms). The question is: which
relationship holds between the two systems, once the recursive number system made possible by
numerals is in place? Is it a complementary one? Or is it rather a transformative one, given that
exact number understanding opens up a whole new world of cognitive possibilities? At least part of
the answer to this latter question will depend on how number understanding is developed. In other
words, what does it take to grasp a recursive, potentially infinite system, like the number one?
A way to address this question can be found in Pica’s observation that numeral expressions in
Mundurukú are long, often having as many syllables as their corresponding quantity. The words for
3 and 4 are polymorphemic: “ebapüg” means “your two arms plus one”, and “eba-dipdip” means
“your two arms plus one plus one”. This suggests the rudiment of a way to name quantities in a
systematic way, by establishing a correspondence between quantity and syllabic structure. Whereas
it is not a feasible procedure in general, it makes clear that counting is the required ability to master.
Pica suggests that other languages of the Mundurukú family use a base-2 system of numerals—in
which the corresponding terms of “eba” get repeated—but even in that case, the most revelatory
aspect is that it suggests a basic form of counting that is related to body parts. Similarly, the
expression for five corresponds to “a hand” or a “handful.”

This required emphasis on counting as the key ability to go from numerosity and approximate
quantity to exact number prompts us to refer in this context to Saxe’s (1982) study of Oksapmin, as
a sort of middle, transitional case. Oksapmin is a Papua New Guinea linguistic community, which at
the time of study was undergoing a cultural change related to the introduction of money. This made
counting practices more relevant, an required an amplification of the numeric system to deal with
the new arithmetic operations involved in the use of money. According to Saxe, the traditional
Oksapmin number system for counting is also finite and based on the body, but this time 27
consecutive numerals are available. As a matter of fact, the terms constitute an order sequence of
body parts, starting with the thumb on one hand, and proceeding through the upper periphery of the
body and then down to the other side. No other symbolic representation is available: number 14
corresponds to the nose, and the forearm is 7. This numeric system was used for counting and
measuring. However, it was not put to traditional arithmetic use, and no term exists for math-
ematical concepts of division, or for rational and irrational numbers.

During the seventies, money was introduced to the Oksapmin community, through paid work and
commerce. This created a denomination problem, given the shortness of the numerical system. The
adaptation that took place to deal with the new social need for referring to currency was a base-20
system, that recursively uses the basic terms in successive cycles, as required. Such a change went
hand in hand with a reorganization of arithmetic thought: beginning with the new coin counting
practices in commerce, for instance, arithmetic functions—such as addition and subtraction—later emerged. The culmination was the emergence of mental calculus—the ability to count without physical support (fingers in our case; upper body parts in the Oksapmin’s case). Saxe (1982) found evidence of this cognitive transformation in the making, by comparing four groups of subjects with respect to addition and subtraction problems. The groups included: men who had owned a trade store for at least 2 years; men who had returned from a period of work at a plantation but did not own a trade store; young adults who had not been to a plantation, and, therefore, had no money experience; and older adults who had only a cursory level of experience with the money economy. He could witness the process by which practice with money pushes for a recursive open-ended numerical system that is increasingly used for mental calculation. Addition problems were solved in that way by the most experienced subjects. A procedure of starting with the first figure and then following the bodily series for the other figure was used by less experienced subjects. This followed more simple strategies—like the double enumeration one—in which each figure, which corresponds to a numeral-body part, is mapped onto the corresponding body part to begin with, and then a procedure for establishing correspondence is tried. In general, while all groups could do addition with coins, subtraction with coins was difficult for the groups not habituated to money. Without coins, performance of all groups differed in proficiency, in a rank that went from nonceiling competence for experienced traders, to null for nonexperienced older adults. Nonexperienced adults, though, performed at a higher than chance level, an indication of a greater facility for learning.

In summary, Oksapmin exemplifies the central idea of the “conceptual metaphor” theory: that understanding of abstract concepts is achieved in terms of more concrete ones. Most importantly, these concrete ones are “image-schemas” and spatial egocentric concepts based on the body (Núñez, 2008). While these basic schemas are thought to be primitive, there are many of them. Languages freely choose from this pool of conceptual resources in a rather arbitrary manner, which, however, has strong cognitive effects. In other words, numerals do not create number understanding out of nothing. When numerals are encountered by children in their process of language acquisition, they make sense of them in terms of one of the basic body schemas available that the group is already using to make sense of numbers. In this way, such schemas scaffold the individual cognitive development. Numerical problems can only be dealt with to a certain extent in such a system. Purely mental processes result from interiorization of such practices, which also limits the scope of tractable arithmetic problems. Change in these systems is also possible by standard processes of cultural innovation, but what is kept constant is the bodily grounding of conceptual understanding.

4. Linguistic differences in temporal concepts
As observed by Whorf, languages differ in terms of the time units they distinguish. As important as that is, languages also differ in the different aspects of time they require a speaker to morphologically mark (e.g., tense, aspect, and mode), and in terms of the means for temporal deixis they make available (e.g., now, tomorrow, and later). Moreover, most temporal concepts—just like abstract mathematical notions—are grounded in spatial metaphors (which entail different frames of reference), and languages also differ in which conceptual metaphors they use (Casasanto & Boroditsky, 2008).

For example, Boroditsky studied whether the preference for absolute spatial orientation also influenced these other cognitive areas (Boroditsky & Gaby, 2010). She gave participants a set of pictures showing some kind of temporal process (like an aging man or a growing crocodile) and asked them to arrange the pictures according to temporal order. They tested the participants in two separate places, differently positioned according to cardinal orientation. Previous studies had shown that time direction in English and Hebrew speakers is conceived in terms of writing direction: left to right for English, right to left for Hebrews (Fuhrman & Boroditsky, 2010). Given that speakers of Kuuk-Thaayorre lack terms for left and right, they did not arrange cards from left to right, more often than from right to left. The pattern of their responses was rather east to west orientation (metaphorically grounded in the daily process of the sun): if they were placed facing South, they placed the cards left to right, but if they were placed facing North, they placed the cards right to left. Thus, speakers of Kuuk Thaayorre exhibit a greater navigational ability and spatial knowledge than speakers of languages with relative frames of reference. They keep track of where they are, even in unfamiliar landscapes or inside unfamiliar buildings, because otherwise they could not talk about space.

Many other metaphors are used in different languages: speakers of English tend to use a horizontal spatial metaphor (past is behind, future is ahead), whereas speakers of Chinese use a vertical metaphor (future is down, past is up) (Boroditsky, 2001). The demonstration that this is not just a façon a parler, but that it reveals how events in time are conceived is found in the example that, given a spot in space directly in front of the subject to stand for today, when asked to place a spot for yesterday and tomorrow, English speakers use a horizontal axis, while Chinese speakers use a vertical one (Boroditsky, 2007). A similar metaphorical understanding was found by Whorf in the Hopi language, which revealed a circular understanding of time.

Núñez’s work on the Ayamaras’ conceptual metaphors for time also deserves mention (Núñez & Sweetser, 2006). The Ayamara linguistic community is over two million people; they live in the Andes highlands of Bolivia, Peru, and northern Chile. They reverse the central Western spatial metaphor time: instead of the projection “front of ego: future / back of ego: past,” they use exactly the converse one. The basic word for front, “nayra,” is also a basic expression meaning past,
whereas “qhipa,” which is the basic word for back, also means future. Thus, for example, “nayra mara,” which translates literally as “front year” refers to the previous year. Again, this is not a purely linguistic difference (a sort of frozen metaphor), but it affects how Aymaras understand temporal relations. In this case, Núñez found the evidence in the deictic gestures that accompany Aymaras talk of past and future: deictic temporal reference involved pointing to one’s back to refer to future events and to one’s front to refer to past ones, with distance from one’s self-indicating temporal distance.

Conclusion
We have just sampled the recent Neo-Whorfian literature. But it is enough to find a common pattern in the evidence: language has a deep impact on cognitive development. It is not that all cognitive development is driven by language -that's too strong a position-; but when linguistic coding plays a role on categorization, linguistic differences give rise to cognitive difference. These are not absolute differences, but rather force fields, that make some differences more salient and relevant.

Language exerts its influence on cognition through linguistic development. It changes the initial, sensorimotor, and imagistic medium of the mental representation of a restricted implicit system into a more powerful explicit system. Or it facilitates attention to dimensions of experience for which no initial preference is set. Lexical labeling is not just a matter of tagging a previously and independently constituted symbolic concept, but the way symbolic concepts are grasped (Lupyan, 2008). It has to be kept in mind, though, that the greater impact of language on cognition is made evident, not in comparing speakers of two languages, but in comparing verbal minds to non-verbal ones (Gomila, 2012).

Relevant webpages

References


