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When language shapes perception

Alessio Plebe
Dipartimento di Scienze Cognitive
Università di Messina
aplebe@unime.it

Vivian M. De La Cruz
Dipartimento di Scienze della Formazione
Università di Catania
vmdelacr@unict.it

Abstract The idea that language molds our thinking has met with varying degrees of favor in the history of philosophy and linguistics. A rather puzzling aspect of this debate is the lack of rigorous demonstration or rebuttal of the language-thought connection. We believe that one obstacle is the intrinsic difficulty in treating "thought" as a measurable dependent variable in empirical, replicable, experiments. We plead the case for a more humble, but more verifiable, aspect of linguistic relativity: by looking at cases where language shapes our perception, instead of "thought" generally.
We target the domain of color terms, a field where the effects of language in shaping perception have been more striking, even if the details are highly debated, and also discuss a different kind of perception, one related to emotion terms. We argue that in this case, there is also a continuum in the proprioceptive determinants of emotions, which is structured into discrete categories by language.

Keywords: Perception, language, linguistic relativity, color terms, emotion.

0. Introduction[1]

The essential idea that language affects the way we think has surfaced in philosophical debates throughout the centuries. Wilhelm von Humboldt (1837), however, was the first to push the idea further, arguing that people who speak different languages end up with different conceptual structures, and that these differences have pervasive effects on their world view. Humboldt's legacy took shape at the beginning of the last century. It can be perceived, albeit vaguely, in Saussure (1916), but it was within the Boasian school of linguistics that linguistic relativity become the dominant project. Among the most significant results was the work on

[1] Although the authors have equally contributed to the ideas and contents of this work, Alessio Plebe was responsible for writing sections 0, and 2, and Vivian M. De La Cruz for sections 1, and 3.

Native American languages, carried out by Sapir (1921) and his student Whorf (1942) whose names were later associated with the "linguistic relativity hypothesis". During the second half of the last century, this hypothesis was fiercely criticized and eventually dismissed by the Chomskian universalist and nativist research enterprise, with a consequent dramatic decline in investigations, with a count that hardly reached a dozen valid studies in over half a century (LUCY 1992). However, in the '90's, when the Chomskian generativist school started losing its dominance and context became an important issue, the relativistic hypothesis gained renewed impetus, marked by the collection of works edited by Gumperz and Levinson (1996), where several basic concepts were revised and refined in the light of progress in anthropology, sociology, and linguistics. The last decades have confirmed the intense interest in linguistic relativism, as is attested by several recent publications (EVERETT 2013; LEAVITT 2011; MALT, WOLFF 2010).

A disappointing realization that has emerged from the body of studies and analyses produced so far is that despite the overall progress, the matter is still far from being convincingly assessed, as pointed out among others, by De Cruz (2009); Pöhls (2013); Reines and Prinz (2009), but none seem to have achieved the status of a compelling demonstration. We believe that one obstacle is in the intrinsic difficulty in treating 'thought' as a measurable dependent variable in empirical, replicable, experiments. For this reason, in this work, we propose a more modest target for linguistic relativity: the analysis of cases where language shapes perception rather than 'thought'.

Before discussing the advantages and limitations of this approach, it is useful to point out that there is important evidence on the influence of culture on perception, independent of language. One of the most striking examples is the response to the Müller-Lyer illusion, made famous by Fodor (1983) as the best representative of an «encapsulated», «cognitively impenetrable», universal feature of our visual system. Fodor was unaware that years before, a team of psychologists and anthropologists systematically investigated this and other perceptual illusions across sixteen societies, finding an astonishing variety of responses. Typically, American and European participants demonstrated an extreme degree of susceptibility to the illusion, while the San foragers of the Kalahari were totally unaffected. Conversely, there are studies that demonstrate the influence of language on perception, within the same language (and culture). Stapel and Semin (2007) show that subjects, in perceptual tests, such as indicating which of two geometric comparisons was more similar to a target figure, focused more on local perceptual features when primed with adjectives, and more on global features when primed with verbs.

Both kinds of evidence described above, offer good grounds for the hypothesis of language's shaping effect on perception, but at the core of the relativism hypothesis there should be evidence of differences in perception deriving from differences in linguistic terms in a certain domain used by various languages, and this is the sort of evidence we are looking for. In the shift from thinking to perceiving there are methodological advantages. Experimental psychology today offers the best equipment, methodologies, and data analysis, for measurement in perceptual tasks. Even more importantly, the distribution of neuroscientific knowledge available on the brain is dramatically uneven and biased towards sensorial areas. Therefore, in looking at perceptual effects it is possible to identify the physiological components involved, and

to some degree, even quantify their contributions. One of the most studied mechanisms in the investigations on linguistic effects on perception is categorical perception, first described by Harnad (1987), and discussed in the next section.

From a theoretical perspective, focusing on the influence of language on perception may seem to contrast with theories that suggest it is the other way around, *i.e.*, our conceptual structure emerges from perceptual experience, like in Barsalou (1999) or in Prinz (2002). It looks like a serious embarrassment that perception might be affected by what it is supposed to build. First, theories like those of Prinz are concerned with pre-linguistic concepts that are not necessarily in direct correspondence with lexical items. Second, linguistic effects on perception do not contradict an empiricist account on concept formation, when we conceive words as 'guiding forces' in the basic perceptual mechanism of concept acquisition. For example, when a child hears the word «red», she is guided to finding perceptual similarities in objects associated with this utterance, and the most regular similarity would be in the color, carved out as «red» in the spectrum by her linguistic community.
The use of this example here is not due to chance, in fact, we will present color terms as the most advanced domain in proving language's effect on perception. Today there is almost unanimous consensus that linguistic relativism affects color perception, even (KAY, REGIER 2007: 290) admit «color-naming differences occur and do correlate with color memory, learning, and discrimination» (similar claim is found in KAY, REGIER 2006: 52) At the same time, however, Kay and Regier defend the plan initially proposed by Berlin and Kay (1969), they admit relativity in the head, claiming for universality from the tail, while searching for a common genealogy of color terms in all languages derived from our visual physiology. The extant differences between languages according to them, are just a function of the level of evolution reached, from primitive languages with two color terms only, up to full-fledged modern languages with ten color terms.
This is a common strategy in the search of relative and universal contributions that can be applied to other perceptions as well, and can be schematized as follows:

1. In perceiving a feature F we are influenced by the lexical term L used to categorize this feature (proximal mechanism);
2. Our perceptual scheme for F is acquired by learning L from caregivers and other speakers of our community (short distal mechanism);
3. The lexical items L are introduced in the language because of our physiology related to the perception of F (remote distal mechanism).

While the step we called "remote distal mechanism" sounds plausible, and has found empirical support in several cross-linguistic surveys (COOK *et al.* 2005), it is a crude simplification indeed of a real history of the formation of any lexical class in a real language. There are historical reconstructions of certain color terms for example, that we will briefly mention below, in which physiology has played a marginal role.
There are many other perceptual domains where language may very well play a shaping effect that we deliberately avoid discussing, such as auditory effects. We instead propose a less obvious domain, that of emotion terms. Emotion research

flourished during the last few decades in linguistics, mainly thanks to the extensive cross-cultural investigations of Wierzbicka (1992, 1999). The prevailing perspective, however, has been in the relation between emotion terms and the expression of emotions, and the recognition of emotions expressed by others, along a tradition proposed by Ekman (1973) and Ekman and Rosenberg (1997). We take a different perspective, that of emotions as basically a kind of perception, more precisely proprioception. We argue that in this case too, there is a continuum in the proprioceptive determinants of emotional feelings, which is partitioned into discrete categories by language. There are clearly important differences between perceiving emotions and colors that will be discussed in the relevant section. For this reason, the arguments on emotion terms will be more speculative, yet we believe there are sufficient grounds to justify our taking it as one more domain, in which language might shape our perceptions.

1. The case of color terms

As previously mentioned, a mechanism proposed to explain how the categories humans make may influence or alter how the perceived world appears, is called categorical perception (CP). Harnad described it as being a phenomenon in which «equal-sized physical differences between stimuli are perceived as larger or smaller depending on whether the stimuli are in the same category or different ones» (HARNARD 1987: 3). As an example, he used how different shades of green look more like one another rather than to a shade of yellow, even though yellow's wavelength may be no more different than that between one of the greens from another green.

Harnad's color example is significant. Color cognition, in fact, has served as an important test bed for hypotheses on CP and for those that link language to cognition, with the domain of color terms being traditionally a privileged terrain. One of the reasons why color categorization has attracted the attention of so many researchers is that while the range of colors visible to humans is rather large (circa 2 million Just Noticeable Differences), the range of color terms humans have available to them in their languages to describe them is very small (between 2 and 22 basic terms) (ROBERSON, HANLEY 2010). In fact, some languages may use just one term to refer to a group of colors a speaker of another language would use three different terms to describe. Even when color vocabulary is very similar across languages, small differences may be found in the range of stimuli a particular term refers to. Thus, the 'potentially' visible wavelength spectrum can be carved up in many different ways according to the color terminology a particular language employs. An example of this can be seen in the different ranges covered by the English Basic Color Term «blue» as opposed to the range covered by the Italian term «blu» or the Greek term «ble». The latter two differentiate between light and dark shades of «blue» with Italian using «blu» for dark blue, «azzurro» for light (and medium) blue (and «celeste» for light blue, a possible contender as a third Basic Color Term for a sub-group of Italian speakers according to PARAMEI, D'ORSI, MENEGAZ 2014), and Greek using «ble» for dark blue and «ghalazio» instead to cover the light blue range. Russian also marks this distinction using the term «siniy» to refer to darker

blues and «goluboy» to refer to lighter blues. We will return to the interesting case presented by the blues below.

Color terms have increasingly been taken as evidence in favor of the linguistic relativity thesis, this is due to the growing amount of results coming from cross-linguistic, behavioral as well as neurocognitive studies that indicate that subjects' categorical perception is influenced by language-specific terminology, or whether they have specific color terms in their language (e.g. ROBERSON *et al.* 2000, 2005, 2008; WINNAWER *et al.* 2007; ATHANASOPOULOS *et al.* 2009, 2011). Participants in these studies have tended to judge two colors as being more similar if they shared the same color name in their respective language rather than on the perceptual distance between them in color space. The cross-linguistic studies of Deb Roberson and her colleagues, for example, on Berinmo spoken in Papua New Guinea, and Himba spoken in Northern Namibia, have played an important role in challenging mainstream universalist views (e.g. ROBERSON, DAVIDOFF, DAVIES 2000; ROBERSON, DAVIDOFF, DAVIES, SHAPIRO 2005). These studies have provided evidence that speakers of both these cultures (whose very different languages possess only five basic color terms), seem to be much better at recognizing prototypical examples of their own linguistic color categories rather than poor examples, regardless of the status of these items in English color categories. This result is difficult to explain according to Berlin and Kay's theory of universals in color terms (1969), which in addition proposes an evolutionary pattern with which basic color terms emerge in languages. A series of recent neurocomputational modeling experiments that include aspects of plausible brain processes have simulated and replicated a number of the results obtained by Roberson and her group, providing additional support to the relativist theoretical perspective on the influence of language on the cognition and categorization of color (e.g. DE LA CRUZ, PLEBE 2013; PLEBE, DE LA CRUZ 2013, 2014).

Several other counter-examples to universal color term organization have also been found, such as the Yélî Dnye group living in Rossel Island, in Papua New Guinea (LEVINSON 2001). Levinson sought to test Berlin & Kay's theory of basic color terms in this culture, and found that color was not salient to them at all. In fact, one interesting result of his investigations, among others, was that while the Yélî Dnye made limited and inventive use of their basic color terms, they used them together with non BCT expressions to divide the color space. Moreover, the evolutionary trajectory of these terms seemed to be quite different to the one proposed by Berlin & Kay. Levinson sees them as being more compatible with alternative evolutionary-philological theoretical views such as the Emergence Hypothesis (LYONS 1999). According to this hypothesis, in some traditional societies a fully systemized lexicon of color is not found, because it is of minor communicative function. In other words, the cultural and technological pressures for color terms to emerge and evolve are not present, thus not making them necessary. In the conclusions of his study, Levinson states that EH recognizes that «for universal perceptual constraints to directly engender semantic universals of color terminology – it takes a culture of color to make a color terminology worthwhile» (LEVINSON 2001).

In recent years, philosophers of language and of science have begun to make fine-grained distinctions of Whorfian effects, proposing taxonomies for them, and

hypothesizing further on the roles language might play in cognition, leaving the traditional universalist/relativist debate behind. This new lense by which to analyze Whorfian effects in the domain of color in particular, categorizes them as deep (*i.e*. effects that establish long-term, stable habits of seeing the world) or shallow (*i.e*. effects that provide short-term online cues during perceptual processing). For a recent brief review and discussion from a philosophy of psychology perspective, see Lalumera (2014), and citations therein (see also REINES, PRINZ 2009).

Evidence coming from bilingual cognition studies has shown how the acquisition of a second language and the increasing proficiency in its use, and in the use of its color terminology in particular, may also influence subjects' ability to perceive particular color categories.

Thierry, Athanasopoulos and collaborators (THIERRY *et al.* 2009) investigated the unconscious effects of language on color perception by measuring the brain waves of a group of monolingual Greek speakers and a group of monolingual English speakers while engaged in a task that required them to watch a sequence of different colored shapes on a computer screen and press a button when the shape presented was a square. As mentioned previously, while both English and Greek have a single word to cover the green color range, Greeks have two. Interestingly, results showed that the brain activity of the Greek subjects was sensitive to differences in the blue range, but not to different shades of green. English speakers on the other hand, attested by their measured brain activity, showed no sensitivity to either blue or green. The conclusion reached in this study is that a relationship exists between a linguistic distinction (Greek division of blue color space) and the *automatic* perception of color, thus adding support to the relativistic notion that language can influence or restructure color cognition without speakers consciously willing it or being aware of it.

Athanasopoulos (2009) instead asked Greek-English bilinguals to make similarity judgements between light and dark blue color stimuli. After other variables characterizing bilinguals were also measured, these researchers observed changes in how subjects perceived within and cross-category stimulus pairs. The primary factors affecting the extent to which the Greek-English bilinguals judged the perceptual difference between the two different shades of blue, hinged on how salient «ble» and «blue» was in semantic memory *and* on the amount of time the subjects had lived in the L2 speaking country.

Athanasopoulos *et al.* (2011) extended the investigation, testing categorical perception of color in late Japanese-English bilinguals with high proficiency in their L2 (English). Like Greek, Russian and Turkish, Japanese also divides the 'blue' color space into a darker shade («ao») and a lighter shade («mizuiro»). Japanese monolinguals, English monolinguals, and Japanese-English bilinguals were tested in the UK, and asked to judge how different or similar two presented blue color pairs were that varied in levels of lightness, using a 10-point scale (10 for maximum dissimilarity and 1 for maximum similarity). The study found that Japanese monolinguals showed categorical perception at the ao/mizuiro boundary. English speakers did not. The degree to which Japanese-English bilinguals instead resembled the English monolingual or Japanese monolingual group respectively, depended on which of their two languages they used more frequently. Athanasopoulos and his colleagues interpret these results as providing support for the principle of linguistic relativity.

The case presented by the variety of terms used to cover the blue color spectrum, often referred to in this section, is particularly interesting. While blue is one of the 11 basic color terms that according to the Berlin-Kay model, is present in languages with a developed color inventory, a number of modern standard languages, as well as dialectal variations of these languages, use several terms to partition the blue color space differently. Possible explanations for this might be the pressure presented by communicative needs to describe the different shades of blue predominant in the ecological environments or landscapes of the places, in which these languages are spoken (e.g. the Mediterranean sea and sky for the Greek and Italian languages, as well as for Maltese, Catalan and Turkish) and experiences linked to living near and by the sea, something that would be in line with the Levinson's (2001) considerations on the Emergence Hypothesis mentioned above.

In the case of the "Italian blues", investigations on the linguistic categorization of blue in Standard Italian (UUSKÜLA 2014) found that the Italian native speakers in her study habitually denoted the blue color space with at least two salient terms, «blu» and «azzurro», but depending on their dialectal background often chose to designate a lighter variety of blue as either «celeste» or «azzurro» (also see PARAMEI, D'ORSI, MENEGAZ 2014). Uusküla interprets the various findings of this study, as suggesting that in Italian

> the cognition of blue is influenced by extra-linguistic phenomena, such as temperature and emotional overtones, which have contributed to the categorization process.

She hypothesizes that the second (or third) blue becomes cognitively salient only when there is

> a need to distinguish between different objects or referents, such as the color of the sky at night, as opposed to during a summer day, or the color of sea water close to, as opposed to farther away from the shore.

According to Uusküla, these conditions based on paleness/darkness, and in part on the emotions the speaker wishes to communicate seem to play an important role in how native Italian speakers categorize the color term «blue». According to her this is compatible with what Biggam (2012: 5-7) has pointed out, namely that the color terms of various languages frequently include features that English speakers would not consider as color-related (e.g. surface texture) or even particularly visible (e.g. dryness). In the Italian cognition of the "Italian blues", Uusküla in fact, thinks temperature dimensions (warm versus cold) might be playing a role, and emphasizes that this should be considered further in future research. Levinson (2001) found something similar in the way the Yélî Dnye linguistically categorized the relatively few colors they use.

The recent studies investigating Italian basic color terms have not only found evidence for the linguistic relativity of Italian blues. They also indicate linguistic, environmental as well as pragmatic communication factors that might have driven the extension of the basic color term «blue» in the Italian language (PAGGETTI, MENEGAZ, PARAMEI 2015).

Furthermore, historical factors, that have nothing or little to do with

psychophysiology may also account for how basic color terms and their variations have evolved and been encoded by the languages of the world, and as a result are cognitively represented by their speakers. This historical genealogy of color terms contrasts with point 3 of the argument (schematized in the Introduction of the present paper), used by Kay and Regier to defend universalism at the "remote distal mechanism" level.

«Blue», in particular, while objectified in modern Mediterranean languages (as the color of the sky and sea), in certain ancient Semitic languages such as Akkadian, Ugaritic and Hebrew, seem to have «emerged as a learned concept, emerging from the realm of precious stones such as lapis lazuli, or dye for fabrics» (see BORG 2014 and citations therein). The semantic field of blue color terms such as «azzurro» may have emerged in Italian due to similar historical circumstances linked to the naming of a finished product, such as a stone, an organic dye, or a mixture of minerals, besides that of referring to a corresponding color percept (FRISON, BRUN 2015). A more recent history of the two main "Italian blues" is briefly reported by Paggetti, Menegaz and Paramei (2015), describing them as possibly emerging in the Italian language as a function of several culture specific practices, such as those in the 17th and 18th centuries linked to the trade of indigo in Northern Italy, as well as due to the cognitive need to differentiate as well as communicate the colors of the ecological environment.

2. The case of emotion terms

In setting the stage for emotion terms as a case where language influences perception, it is first necessary to support the notion that emotion is essentially a kind of perception. A comprehensive defense of this view is beyond the scope of this work, but suffice it to say that it is nothing exotic. In fact, it is in line with the theory of emotions first proposed by William James (1884), who postulated that emotional experience is basically bodily viscero-afferent feedback, something later extended by Damasio (1994), in the somatic marker hypothesis. Emotions can directly derive from viscero-afferent reactions to an external object or event, but similar feelings can be elicited in the brain in response to objects or events that have become associated through experience to the same peripheral reactions. Opposite theories flourish as well, especially the so-called cognitive theory of emotions that essentially defines emotions as beliefs that this is something to avoid or to desire, with little concern for the perceptual side. This Solomon's (1976) perspective according to which emotions are evaluative judgments that provide the structure of our world. A contemporary and refined defense is given by Nussbaum (2001) who describes emotions as judgments assenting some sort of evaluative construal of facts and events, that she calls value-laden appearances. Despite their sophisticated theoretical grounds, these theories fare badly with regard to the huge amount of neurocognitive evidence collected so far on emotions, pointing to specific areas like the amygdala or the periaqueductal gray, and specific neurochemicals, that do not harbor complex propositional attitudes (LEDOUX 2000; PANKSEPP 1998; ROLLS 2014). An attempt to reconcile the perceptual roots of emotions with notions from cognitive theories is given by Jesse Prinz (2004), in saving the appraisal dimension of emotion. As applied by Arnold (1960) in emotion research,

the term means the evaluation of something as affecting oneself in some way that matters. What is saved by Prinz is that appraisal theory entails a sort of mental representation for emotions, but such representations are inextricably bound up with states that are involved in bodily perceptions.

Even if the thesis that emotion is essentially perception is sound, it could be the case that different emotions actually correspond to different sensorial circuits, and a one-to-one mapping between emotion categories and individual physiological correlates is the natural basis for linguistic emotion terms. In this case, no linguistic effect on perception should be expected. This state of affairs would be compatible with Darwin's (1872) early observations of similarities of emotion expressions across species. Its legacy has been influential in the early neurophysiological theories of emotion. Panksepp (1998) identifies seven primary emotional systems, common to several non-human mammals: seeking, rage, fear, lust, care, panic and play, each with its key brain areas and neuromodulators. This view of a number of discrete basic units of emotion has been contrasted by the so-called dimensional theoretical position, like the one found in Russell's proposal (2003). He conceptualizes emotions as arising from combinations of few fundamental dimensions, such as emotional arousal, its intensity, and valence, its degree of pleasantness or unpleasantness. In a review of empirical evidence for discrete or the dimensional theories, Hamann (2012) found substantial agreement with basic emotion accounts, especially in the association of fear with the activation of the amygdala, but also, with a less specific mapping of disgust with activation of the insula, ventral prefrontal cortex, and amygdala; sadness with activation of medial prefrontal cortex; anger with activation of orbitofrontal cortex; and happiness with activation of rostral anterior cingulate cortex. However, no support was found for discriminable neural correlates of basic emotions, in that every region that was activated for a given basic emotion was also activated for at least one other basic emotion. Wilson-Mendenhall, Barrett, and Barsalou (2013) examined responses of subjects to scenarios of fear, happiness, and sadness, finding that activity in orbitofrontal cortex was correlated with the experience of valence across all emotion categories, while activity in the amygdala was correlated with the experience of arousal. Therefore, it seems that the idea of a perceptual continuum along which emotions lay is well supported, even if its neural basis is more complex and distributed than, for example, the neural components of color processing. It is similar to the psychological constructionist model of emotion (LINDQUIST 2013) that conceptualizes emotions as events that are constructed in the mind composing more basic perceptual responses.

Turning now to the interaction between language and emotions, it is so wide-ranging and pervasive, that it can be analyzed under hundreds of possible perspectives. The emotional semantic domain in Western cultures is largely derived from a history that begins with Aristotle's theory of the soul as motion, reappraised later by Christian theologians like Thomas Aquinas, and re-imagined as mechanisms in the Age of Reason, finding its current semantic core with Cartesian dualism (DIXON 2003). A different path has been followed, for example, in Indian cultures, where one of the central words in emotion semantics is «rasa», that translates sometimes as «taste», «flavor», but also «juice», «essence», it is rooted in embodied, gustatory experience, but gradually shifted in denoting spiritual states (LYNCH 1990). Several theories

posit that expressing emotion vocally may even have played a crucial role in the origin of language (LIEBERMAN 2002; TURNER 2000). In a sociological and ethnographic perspective, Wilce (2009, 2014) investigates the relationship between language and emotion as fundamental in the identification process of humans with their society. For him, specific linguistic concepts of emotion are closely linked with political economy and thus can be usefully described as ideologies.

An early cognitive linguistic analysis of emotions was given by Lakoff and Kövecses (1987), who identified a bodily metaphor for «anger», as 'hot fluid in body as container'. There is no doubt that metaphors are a fruitful locus in exploring how body and emotions are linked in language, however, the study of Lakoff and Kövecses suffers the weakness of attributing some universality to «anger», neglecting the wide cultural variation of this emotion. Since the influential work of Paul Ekman (1973) on facial expressions, for decades many scholars have applied the same faulty assumption that the emotions to be studied should be the six English words held as «basic» and «universal»: happiness, sadness, anger, fear, disgust, and surprise. Even if principle emotion terms were known not to match across languages (BRIGGS 1970), it was only two decades later that the accurate work of Anna Wierzbicka (1992, 1999) and her collaborators revealed how profound this diversity is. An exemplary case is the German word «Angst», that roughly covers a semantic field between anxiety and fear in English, with some special features that can be found in Danish, and other Lutheran countries. For Wierzbicka a common influence can derive from the popularization of Luther's writings, filled with the constant anxiety induced by the lifelong expectation of the imminent end of the world. Inside the great body of Wierzbicka's works, a controversial contribution is her Natural Semantic Metalanguage (NSM) scripting, the attempt to set a number of cognitive scripts, that describe all possible emotions in a language using only 'primitive' affective concepts, avoiding terms that are language-specific. We can see it as an equivalent of the Munsell color chips used to compare colors across languages, for comparing emotions. Unfortunately the two cases are very different, and, as noted by Wilce (2009: 76-77), NSM are actually written in English, making use of concepts that are far from being universal.

We argue that a real equivalent of Munsell color chips should associate perceived emotions with emotion terms, instead of lexical emotion elements with their linguistic descriptions. To our knowledge, nothing similar has been conceived so far, not surprisingly, given the intrinsic difficulties in exposing subjects to a range of emotion stimuli. On the other hand, the traditional method of presenting subjects with faces (EKMAN 1973b), has continued and evolved thanks to digital imaging. Perceiving the emotions of others is certainly related with genuine interoceptions of one's own body sensations, but it is only an indirect and vague correlate, however, it has allowed interesting recent empirical research that seems to support our hypothesis. Lindquist, Satpute, and Gendron (2015) review evidence, collected mainly by their group, on linguistic influences in this kind of indirect visual perception of someone else's emotions. Using the semantic satiation method, in which repeating a word out loud many times makes it temporarily lose its meaning, they show that without access to the word «anger» subjects were slower and less accurate in perceptually classifying relevant facial expressions. Similarly, toddlers

seem unable to discriminate unpleasant faces into categories like «sad», «angry», or «afraid», before being acquainted with the use of these words. Himba speakers, from Northwest Namibia, are not able to distinguish faces into English lexical categories of anger, disgust, fear, sadness, happiness, even when prepared in advance with translations of English emotion words (GENDRON, ROBERSON, VAN DER VYVER, BARRETT 2014b). In addition to faces, non-word vocalizations have also been used as stimuli to indirectly evaluate emotion perception. Gendron, Roberson, van der Vyver, and Barrett (2014a) found that Himba speakers do not recognize intended emotions in Western vocal utterances used to express amusement, anger, disgust, fear, sensual pleasure, relief, sadness, surprise and triumph.

To summarize, we reviewed arguments for conceptualizing emotion as a kind of perception, and we found fertile ground to support the treatment of the perceptual space of emotion as a continuum, even if composed by a network of several brain circuits. We examined evidence on the large cross-cultural diversity of emotion terms, and empirical findings on the influence of emotion words in perceiving, at least, the emotions of others. We believe that there are sufficient grounds to support the speculation that the way languages categorize emotion in words, affects how the perceptual continuum of emotion reaction is carved up by speakers.

Let us conclude with a final example. The Huaorani people, living in Ecuador, use the word «pïï» to mean a kind of anger that drives men to make spears and to use them to kill others (RIVAL 2002). Victims are often unrelated to them, but occasionally, are their own kin. Can «pïï» be translated just with intense rage? It looks much more like a specific category, specific to their culture. For Huaorani the «pïï» emotion is represented as something natural, that slides inescapably towards killing, it does not matter who the victims are, for the goal is to bring on death, therefore, there is no moral disapprobation for it. It seems very likely that the Huaorani people experience this emotion not because their perceptual emotional system is different from Western people, but simply because the knowledge of the «pïï» category has sharply carved out in their perceptual continuum, this extreme emotion as a «natural» one.

3. Conclusions

While the idea that language molds our thinking is not new, new evidence has been found to confirm its influence in a variety of domains. We have focused on how language might influence perception, in an attempt to bypass the intrinsic difficulty in treating ‘thought’ as a measurable dependent variable in empirical, replicable, experiments. We have opted for a more verifiable approach to linguistic relativity, by concentrating in particular, on the case presented by color terms, and the more speculative case of emotion terms.

In the case of color, as we have discussed above, differences in color naming are not only sensitive to the predominant colors found in the natural environment, it also sensitive to historical changes in the pressures and needs to communicate color related information. In particular languages, such as in Standard Modern Italian (and in other much more ancient languages), the emergence of new technologies and/or cultural practices together with the predominance and the variety in the hues of particular

colors, such as blue, in the 'visual diet' of its speakers, might have led to a more fine-grained use of blue color terms as opposed to those used in English, modulating also how they are perceived. Thus, both the cultural history as well as the environment might have played a role in shaping this language, but in turn, the color terms for blue in Italian, have modified how these colors are perceived its speakers. In the case of emotion we reviewed the wide-ranging and pervasive interaction between language and emotion, and the available evidence for conceptualizing emotion as a kind of perception, whose categories are shaped by the linguistic set of related terms.
Cross-linguistic and cross-cultural studies in the domains of color and emotion, in fact, while not balanced in the results they have made available, strongly suggest that while as humans we share a common biologically endowed visual system, how we see the world, ourselves and others, as well as how we experience and express emotion, is subject to the attention 'grabbing' and often dominating influence of language, as the medium of our culture.

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