Linguistic relativity

The principle of **linguistic relativity** holds that the structure of a language affects the ways in which its speakers are able to conceptualize their world, i.e. their world view. Popularly known as the **Sapir–Whorf hypothesis**, or **Whorfianism**, the principle is generally understood as having two different versions: (i) the *strong* version that language determines thought and that linguistic categories limit and determine cognitive categories and (ii) the *weak* version that linguistic categories and usage influence thought and certain kinds of non-linguistic behavior.

The idea was first clearly expressed by 19th century thinkers, such as Wilhelm von Humboldt, who saw language as the expression of the spirit of a nation. The early 20th century school of American Anthropology headed by Franz Boas and Edward Sapir also embraced the idea. Sapir's student Benjamin Lee Whorf came to be seen as the primary proponent as a result of his published observations of how he perceived linguistic differences to have consequences in human cognition and behavior. Harry Hoijer, one of Sapir's students, introduced the term "Sapir–Whorf hypothesis",[1] albeit infelicitously due to Sapir's non-involvement with the idea and the term's misleading use of *hypothesis* in a colloquial (i.e. non-scientific) sense.[2] Whorf's ideas were widely criticized, and Roger Brown and Eric Lenneberg decided to put them to the test. They reformulated Whorf's principle of linguistic relativity as a testable hypothesis and conducted experiments designed to find out whether color perception varies between speakers of languages that classified colors differently. As the study of the universal nature of human language and cognition came into focus in the 1960s the idea of linguistic relativity fell out of favor. A 1969 study by Brent Berlin and Paul Kay claimed to demonstrate that color terminology is subject to universal semantic constraints, and hence to discredit the Sapir–Whorf hypothesis.

From the late 1980s a new school of linguistic relativity scholars have examined the effects of differences in linguistic categorization on cognition, finding broad support for weak versions of the hypothesis in experimental contexts.[3] Effects of linguistic relativity have been shown particularly in the domain of spatial cognition and in the social use of language, but also in the field of color perception. Recent studies have shown that color perception is particularly prone to linguistic relativity effects when processed in the left brain hemisphere, suggesting that this brain half relies more on language than the right one.[4] Currently a balanced view of linguistic relativity is espoused by most linguists holding that language influences certain kinds of cognitive processes in non-trivial ways but that other processes are better seen as subject to universal factors. Current research is focused on exploring the ways in which language influences thought and determining to what extent.[3] The principle of linguistic relativity and the relation between language and thought has also received attention in varying academic fields from philosophy to psychology and anthropology, and it has also inspired and colored works of fiction and the invention of constructed languages.

History

The idea that language and thought are intertwined goes back to the classical civilizations, but in the history of European philosophy the relation was not seen as fundamental. St. Augustine, for example, held the view that language was merely labels applied to already existing concepts.[5] Others held the opinion that language was but a veil covering up the eternal truths hiding them from real human experience. For Immanuel Kant, language was but one of several tools used by humans to experience the world. In the late 18th and early 19th century the idea of the existence of different national characters, or "*Volksgeister*", of different ethnic groups was the moving force behind the German school of national romanticism and the beginning ideologies of ethnic nationalism.

In 1820, Wilhelm von Humboldt connected the study of language to the national romanticist program by proposing the view that language is the very fabric of thought. That is, thoughts are produced as a kind of inner dialog using the same grammar as the thinker's native language.[6] This view was part of a larger picture in which the world view of an ethnic nation, their "Weltanschauung", was seen as being faithfully reflected in the grammar of their language. Von Humboldt argued that languages with an inflectional morphological type, such as German, English and the

other Indo-European languages were the most perfect languages and that accordingly this explained the dominance of their speakers over the speakers of less perfect languages.

Wilhelm von Humboldt declared in 1820:

> The diversity of languages is not a diversity of signs and sounds but a diversity of views of the world.[6]

The idea that some languages were naturally superior to others and that the use of primitive languages maintained their speakers in intellectual poverty was widespread in the early 20th century. The American linguist William Dwight Whitney, for example, actively strove to eradicate the Native American languages arguing that their speakers were savages and would be better off abandoning their languages and learning English and adopting a civilized way of life.[7] The first anthropologist and linguist to challenge this view was Franz Boas who was educated in Germany in the late 19th century where he received his doctorate in physics.[8] While undertaking geographical research in northern Canada he became fascinated with the Inuit people and decided to become an ethnographer. In contrast to von Humboldt, Boas always stressed the equal worth of all cultures and languages, and argued that there was no such thing as primitive languages, but that all languages were capable of expressing the same content albeit by widely differing means. Boas saw language as an inseparable part of culture and he was among the first to require of ethnographers to learn the native language of the culture being studied, and to document verbal culture such as myths and legends in the original language.

According to Franz Boas:

> It does not seem likely [...] that there is any direct relation between the culture of a tribe and the language they speak, except in so far as the form of the language will be moulded by the state of the culture, but not in so far as a certain state of the culture is conditioned by the morphological traits of the language."[9]

Boas' student Edward Sapir reached back to the Humboldtian idea that languages contained the key to understanding the differing world views of peoples. In his writings he espoused the viewpoint that because of the staggering differences in the grammatical systems of languages no two languages were ever similar enough to allow for perfect translation between them. Sapir also thought because language represented reality differently, it followed that the speakers of different languages would perceive reality differently. According to Edward Sapir:

> No two languages are ever sufficiently similar to be considered as representing the same social reality. The worlds in which different societies live are distinct worlds, not merely the same world with different labels attached.[10]

On the other hand, Sapir explicitly rejected pure linguistic determinism by stating, "It would be naïve to imagine that any analysis of experience is dependent on pattern expressed in language."[11]

While Sapir never made a point of studying how languages affected the thought processes of their speakers, the notion of linguistic relativity lay inherent in his basic understanding of language, and it would be taken up by his student Benjamin Lee Whorf.

Benjamin Lee Whorf

More than any other linguist, Benjamin Lee Whorf has become associated with what he himself called "the principle of linguistic relativity". Instead of merely assuming that language influences the thought and behavior of its speakers (after Humboldt and Sapir) he looked at Native American languages and attempted to account for the ways in which differences in grammatical systems and language use affected the way their speakers perceived the world. Whorf has been criticized by many, often pointing to his 'amateur' status, thereby insinuating that he was unqualified and could thereby be dismissed. However, his not having a degree in linguistics cannot be taken to mean that he was linguistically incompetent. Indeed, John Lucy writes "despite his 'amateur' status, Whorf's work in linguistics was and still is recognized as being of superb professional quality by linguists".[12] Still, detractors such as Eric Lenneberg, Noam Chomsky and Steven Pinker have criticized him for not being sufficiently clear in his formulation of how he meant languages influences thought, and for not providing actual proof of his assumptions. Most of his

arguments were in the form of examples that were anecdotal or speculative in nature, and functioned as attempts to show how "exotic" grammatical traits were connected to what were apparently equally exotic worlds of thought. In Whorf's words:

> We dissect nature along lines laid down by our native language. The categories and types that we isolate from the world of phenomena we do not find there because they stare every observer in the face; on the contrary, the world is presented in a kaleidoscope flux of impressions which has to be organized by our minds—and this means largely by the linguistic systems of our minds. We cut nature up, organize it into concepts, and ascribe significances as we do, largely because we are parties to an agreement to organize it in this way—an agreement that holds throughout our speech community and is codified in the patterns of our language [...] all observers are not led by the same physical evidence to the same picture of the universe, unless their linguistic backgrounds are similar, or can in some way be calibrated.[13]

Among Whorf's well known examples of linguistic relativity are examples of instances where an indigenous language has several terms for a concept that is only described with one word in English and other European languages (Whorf used the acronym SAE "Standard Average European" to allude to the rather similar grammatical structures of the well-studied European languages in contrast to the greater diversity of the less-studied languages). One of Whorf's examples of this was the supposedly many words for 'snow' in the Inuit language, which has later been shown to be a misrepresentation[14] but also for example how the Hopi language describes water with two different words for drinking water in a container versus a natural body of water. These examples of polysemy served the double purpose of showing that indigenous languages sometimes made more fine grained semantic distinctions than European languages and that direct translation between two languages, even of seemingly basic concepts like snow or water, is not always possible.

Another example in which Whorf attempted to show that language use affects behavior came from his experience in his day job as a chemical engineer working for an insurance company as a fire inspector.[14] On inspecting a chemical plant he once observed that the plant had two storage rooms for gasoline barrels, one for the full barrels and one for the empty ones. He further noticed that while no employees smoked cigarettes in the room for full barrels no-one minded smoking in the room with empty barrels, although this was potentially much more dangerous due to the highly flammable vapors that still existed in the barrels. He concluded that the use of the word *empty* in connection to the barrels had led the workers to unconsciously regarding them as harmless, although consciously they were probably aware of the risk of explosion from the vapors. This example was later criticized by Lenneberg[15] as not actually demonstrating the causality between the use of the word *empty* and the action of smoking, but instead being an example of circular reasoning. Steven Pinker in *The Language Instinct* ridiculed this example, claiming that this was a failing of human insight rather than language.

Whorf's most elaborate argument for the existence of linguistic relativity regarded what he believed to be a fundamental difference in the understanding of time as a conceptual category among the Hopi.[16] He argued that in contrast to English and other SAE languages, the Hopi language does not treat the flow of time as a sequence of distinct, countable instances, like "three days" or "five years" but rather as a single process and consequentially it does not have nouns referring to units of time. He proposed that this view of time was fundamental in all aspects of Hopi culture and explained certain Hopi behavioral patterns.

Whorf died in 1941 at age 44 and left behind him a number of unpublished papers. His line of thought was continued by linguists and anthropologists such as Harry Hoijer and Dorothy D. Lee who both continued investigations into the effect of language on habitual thought, and George L. Trager who prepared a number of Whorf's left-behind papers for publishing. The most important event for the dissemination of Whorf's ideas to a larger public was the publication in 1956 of his major writings on the topic of linguistic relativity in a single volume titled "Language, Thought and Reality" edited by J. B. Carroll.

Eric Lenneberg

In 1953 psychologist Eric Lenneberg published a detailed criticism of the line of thought that had been fundamental for Sapir and Whorf. He criticized Whorf's examples from an objectivist view of language holding that languages are principally meant to represent events in the real world and that even though different languages express these ideas in different ways, the meanings of such expressions and therefore the thoughts of the speaker are equivalent. He argued that when Whorf was describing in English how a Hopi speaker's view of time was different, he was in fact translating the Hopi concept into English and therefore disproving the existence of linguistic relativity. He did not address the fact that Whorf was not principally concerned with translatability, but rather with how the habitual *use* of language influences habitual behavior. Whorf's point was that while English speakers may be able to *understand* how a Hopi speaker thinks, they are not actually able to *think* in that way.[17]

Lenneberg's main criticism of Whorf's works was that he had never actually shown the causality between a linguistic phenomenon and a phenomenon in the realm of thought or behavior, but merely assumed it to be there. Together with his colleague, Roger Brown, Lenneberg proposed that in order to prove such a causality one would have to be able to directly correlate linguistic phenomena with behavior. They took up the task of proving or disproving the existence of linguistic relativity experimentally and published their findings in 1954.

Since neither Sapir nor Whorf had ever stated an actual hypothesis, Brown & Lenneberg formulated one based on a condensation of the different expressions of the notion of linguistic relativity in their works. They identified the two tenets of the Whorf thesis as (i) "the world is differently experienced and conceived in different linguistic communities" and (ii) "language causes a particular cognitive structure".[18] These two tenets were later developed by Roger Brown into the so-called "weak" and "strong" formulation respectively:

> 1. Structural differences between language systems will, in general, be paralleled by nonlinguistic cognitive differences, of an unspecified sort, in the native speakers of the language.
> 2. The structure of anyone's native language strongly influences or fully determines the worldview he will acquire as he learns the language.[19]

It is these two formulations of Roger Brown's which have become widely known and attributed to Whorf and Sapir while in fact the second formulation, verging on linguistic determinism, was never advanced by either of them.

Since Brown & Lenneberg believed that the objective reality denoted by language was the same for speakers of all languages, they decided to test how different languages codified the same message differently and whether differences in codification could be proven to affect behavior.

They designed a number of experiments involving the codification of colors. In their first experiment, they investigated whether it was easier for speakers of English to remember color shades for which they had a specific name than to remember colors that were not as easily definable by words. This allowed them to correlate the linguistic categorization directly to a non-linguistic task, that of recognizing and remembering colors. In a later experiment, speakers of two languages that categorize colors differently (English and Zuni) were asked to perform tasks of color recognition. In this way, it could be determined whether the differing color categories of the two speakers would determine their ability to recognize nuances within color categories. Brown & Lenneberg in fact found that Zuñi speakers who classify green and blue together as a single category did have trouble recognizing and remembering nuances within the green/blue category.[20] Brown & Lenneberg's study became the beginning of a tradition of investigation of the linguistic relativity through color terminology (see below).

The universalist period

Lenneberg was also one of the first cognitive scientists to begin development of the Universalist theory of language which was finally formulated by Noam Chomsky in the form of Universal Grammar, effectively arguing that all languages share the same underlying structure. The Chomskyan school also holds the belief that linguistic structures are largely innate and that what are perceived as differences between specific languages – the knowledge acquired by learning a language – are merely surface phenomena and do not affect cognitive processes that are universal to all human beings. This theory became the dominant paradigm in American linguistics from the 1960s through the 1980s and the notion of linguistic relativity fell out of favor and became even the object of ridicule.[21]

An example of the influence of universalist theory in the 1960s is the studies by Brent Berlin and Paul Kay who continued Lenneberg's research in color terminology. Berlin and Kay studied color terminology formation in languages and showed clear universal trends in color naming. For example, they found that even though languages have different color terminologies, they generally recognize certain hues as more focal than others. They showed that in languages with few color terms, it is predictable from the number of terms which hues are chosen as focal colors, for example, languages with only three color terms always have the focal colors black, white and red.[22] The fact that what had been believed to be random differences between color naming in different languages could be shown to follow universal patterns was seen as a powerful argument against linguistic relativity.[23] Berlin and Kay's research has since been criticized by relativists such as John A. Lucy, who has argued that Berlin and Kay's conclusions were skewed by their insistence that color terms should encode only color information.[24] This, Lucy argues, made them blind to the instances in which color terms provided other information that might be considered examples of linguistic relativity. For more information regarding the universalism and relativism of color terms, see Universalism and relativism of color terminology.

Other universalist researchers dedicated themselves to dispelling other notions of linguistic relativity, often attacking specific points and examples given by Whorf. For example, Ekkehart Malotki's monumental study of time expressions in Hopi presented many examples that challenged Whorf's interpretation of Hopi language and culture as being "timeless".[25]

Today many followers of the universalist school of thought still oppose the idea of linguistic relativity. For example, Steven Pinker argues in his book *The Language Instinct* that thought is independent of language, that language is itself meaningless in any fundamental way to human thought, and that human beings do not even think in "natural" language, i.e. any language that we actually communicate in; rather, we think in a meta-language, preceding any natural language, called "mentalese." Pinker attacks what he calls "Whorf's radical position," declaring, "the more you examine Whorf's arguments, the less sense they make."[26]

Pinker and other universalist opponents of the linguistic relativity hypothesis have been accused by relativists of misrepresenting Whorf's views and arguing against strawmen put up by themselves.[27]

Fishman's 'Whorfianism of the third kind'

Joshua Fishman argued that Whorf's true position was for a long time largely overlooked by most linguists. In 1978, he suggested that Whorf was a 'neo-Herderian champion'[28] and in 1982, he proposed his 'Whorfianism of the third kind' in an attempt to refocus linguists' attention on what he claimed was Whorf's real interest, namely the intrinsic value of 'little peoples' and 'little languages'.[29] Whorf himself had expressed the sentiment thus:

> But to restrict thinking to the patterns merely of English […] is to lose a power of thought which, once lost, can never be regained. It is the 'plainest' English which contains the greatest number of unconscious assumptions about nature. […] We handle even our plain English with much greater effect if we direct it from the vantage point of a multilingual awareness.[30]

Where Brown's weak version of the linguistic relativity hypothesis proposes that language *influences* thought and the strong version that language *determines* thought, Fishman's 'Whorfianism of the third kind' proposes that language *is*

a key to culture.

Cognitive linguistics

In the late 1980s and early 1990s, advances in cognitive psychology and cognitive linguistics renewed interest in the Sapir–Whorf hypothesis.[31] One of those who adopted a more Whorfian approach was George Lakoff. He argued that language is often used metaphorically and that different languages use different cultural metaphors that reveal something about how speakers of that language think. For example, English employs metaphors likening time with money, whereas other languages may not talk about time in that fashion. Other linguistic metaphors may be common to most languages because they are based on general human experience, for example, metaphors likening *up* with *good* and *bad* with *down*. Lakoff also argues that metaphor plays an important part in political debates where it matters whether one is arguing in favor of the "right to life" or against the "right to choose"; whether one is discussing "illegal aliens" or "undocumented workers".

In his book *Women, Fire and Dangerous things: What categories reveal about the mind,*[17] Lakoff reappraised the hypothesis of linguistic relativity and especially Whorf's views about how linguistic categorization reflects and/or influences mental categories. He concluded that the debate on linguistic relativity had been confused and resultingly fruitless. He identified four parameters on which researchers differed in their opinions about what constitutes linguistic relativity. One parameter is the degree and depth of linguistic relativity. Some scholars believe that a few examples of superficial differences in language and associated behavior are enough to demonstrate the existence of linguistic relativity, while others contend that only deep differences that permeate the linguistic and cultural system suffice as proof. A second parameter is whether conceptual systems are to be seen as absolute or whether they can be expanded or exchanged during the lifetime of a human being. A third parameter is whether translatability is accepted as a proof of similarity or difference between concept systems or whether it is rather the actual habitual use of linguistic expressions that is to be examined. A fourth parameter is whether to view the locus of linguistic relativity as being in the language or in the mind. Lakoff concluded that since many of Whorf's critics had criticized him using definitions of linguistic relativity that Whorf did not himself use, their criticisms were often ineffective.

The publication of the 1996 anthology *Rethinking linguistic relativity* edited by sociolinguist John J. Gumperz and psycholinguist Stephen C. Levinson marked the entrance to a new period of linguistic relativity studies and a new way of defining the concept that focused on cognitive as well as social aspects of linguistic relativity. The book included studies by cognitive linguists sympathetic to the hypothesis as well as some working in the opposing universalist tradition. In this volume, cognitive and social scientists laid out a new paradigm for investigations in linguistic relativity. Levinson presented research results documenting rather significant linguistic relativity effects in the linguistic conceptualization of spatial categories between different languages. Two separate studies by Melissa Bowerman and Dan I. Slobin treated the role of language in cognitive processes. Bowerman showed that certain cognitive processes did not use language to any significant extent and therefore could not be subject to effects of linguistic relativity. Slobin on the other hand, described another kind of cognitive process that he named "thinking for speaking" – the kind of processes in which perceptional data and other kinds of prelinguistic cognition are translated into linguistic terms for the purpose of communicating them to others. These, Slobin argues, are the kinds of cognitive process that are at the root of linguistic relativity.

Present status

Current researchers such as Lera Boroditsky or Debi Roberson believe that language influences thought, but in more limited ways than the broadest early claims. Exploring these parameters has sparked novel research that increases both scope and precision of prior examinations. Current studies of linguistic relativity are neither marked by the naive approach to exotic linguistic structures and their often merely presumed effect on thought that marked the early period, nor are they ridiculed and discouraged as in the universalist period. Instead of proving or disproving a theory, researchers in linguistic relativity now examine the interface between thought (or cognition), language and culture,

and describe the degree and kind of interrelatedness or influence. Following the tradition of Lenneberg, they use experimental data to back up their conclusions. These psycholinguistic studies have since gone far beyond color perception (although that is still studied), having explored motion perception, emotion perception, object representation, and memory. The gold standard of psycholinguistic studies on linguistic relativity is now finding cognitive differences in speakers of different language when no language is involved in an experimental task (thus rendering inapplicable Pinker's claim that linguistic relativity is absurd because it is "circular").

Recent work with bilingual speakers attempts to tease apart the effects of language from the effects of culture on various aspects of bilingual cognition including perceptions of time, space, motion, colors, and emotion.[32] Researchers have described differences between bilinguals and monolinguals in perception of color,[33] representations of time,[34] or other elements of cognition.

Empirical research

John Lucy has identified three main strands of research into linguistic relativity.[35] The first is what he calls the "structure centered" approach. This approach starts with observing a structural peculiarity in a language and goes on to examine its possible ramifications for thought and behavior. The first example of this kind of research is Whorf's observation of discrepancies between the grammar of time expressions in Hopi and English. More recent research in this vein is the research made by John Lucy describing how usage of the categories of grammatical number and of numeral classifiers in the Mayan language Yucatec result in Mayan speakers classifying objects according to material rather than to shape as preferred by speakers of English.[36]

The second strand of research is the "domain centered" approach, in which a semantic domain is chosen and compared across linguistic and cultural groups for correlations between linguistic encoding and behavior. The main strand of domain centered research has been the research on color terminology, although this domain according to Lucy and admitted by color terminology researchers such as Paul Kay, is not optimal for studying linguistic relativity, because color perception, unlike other semantic domains, is known to be hard wired into the neural system and as such subject to more universal restrictions than other semantic domains. Since the tradition of research on color terminology is by far the largest area of research into linguistic relativity it is described below in its own section. Another semantic domain which has proven fruitful for studies of linguistic relativity is the domain of space.[37] Spatial categories vary greatly between languages and recent research has shown that speakers rely on the linguistic conceptualization of space in performing many quotidian tasks. Research carried out by Stephen C Levinson and other cognitive scientists from the Max Planck Institute for Psycholinguistics has reported three basic kinds of spatial categorization and while many languages use combinations of them some languages exhibit only one kind of spatial categorization and corresponding differences in behavior. For example the Australian language Guugu Yimithirr only uses absolute directions when describing spatial relations — the position of everything is described by using the cardinal directions. A speaker of Guugu yimithirr will define a person as being "north of the house", while a speaker of English may say that he is "in front of the house" or "to the left of the house" depending on the speaker's point of view. This difference makes Guugu yimithirr speakers better at performing some kinds of tasks, such as finding and describing locations in open terrain, whereas English speakers perform better in tasks regarding the positioning of objects relative to the speaker (for example telling someone to set a round table putting forks to the right of the plate and knives to the left would be extremely difficult in Guugu yimithirr).[38]

The third strand of research is the "behavior centered" approach which starts by observing different behavior between linguistic groups and then proceeds to search for possible causes for that behavior in the linguistic system. This kind of approach was used by Whorf when he attributed the occurrence of fires at a chemical plant to the workers' use of the word 'empty' to describe the barrels containing only explosive vapors. One study in this line of research has been conducted by Bloom who noticed that speakers of Chinese had unexpected difficulties answering counter-factual questions posed to them in a questionnaire. After a study he concluded that this was related to the way in which counter-factuality is marked grammatically in the Chinese language. Another line of study by Frode

Strømnes examined why Finnish factories had a higher occurrence of work related accidents than similar Swedish ones. He concluded that cognitive differences between the grammatical usage of Swedish prepositions and Finnish cases could have caused Swedish factories to pay more attention to the work process where Finnish factory organizers paid more attention to the individual worker.[39]

Other research of importance to the study of linguistic relativity has been Daniel Everett's studies of the Pirahã people of the Brazilian Amazon. Everett observed several peculiarities in Pirahã culture that corresponded with linguistically rare features. The Pirahã for example have neither numbers nor color terms in the way those are normally defined, and correspondingly they don't count or classify colors in the way other cultures do. Furthermore when Everett tried to instruct them in basic mathematics they proved unresponsive. Everett did not draw the conclusion that it was the lack of numbers in their language that prevented them from grasping mathematics, but instead concluded that the Pirahã had a cultural ideology that made them extremely reluctant to adopt new cultural traits, and that this cultural ideology was also the reason that certain linguistic features that were otherwise believed to be universal did not exist in their language. Critics have argued that if the test subjects are unable to count for some other reason (perhaps because they are nomadic hunter/gatherers with nothing to count and hence no need to practise doing so) then one should not expect their language to have words for such numbers.[40] That is, it is the lack of need which explains both the lack of counting ability and the lack of corresponding vocabulary.

Color terminology research

The tradition of using the semantic domain of color names as an object for investigation of linguistic relativity began with Lenneberg and Roberts' 1953 study of Zuni color terms and color memory, and Brown and Lenneberg's 1954 study of English color terms and color memory. The studies showed a correlation between the availability of color terms for specific colors and the ease with which those colors were remembered in both speakers of Zuni and English. Researchers concluded that this had to do with properties of the focal colors having higher codability than less focal colors, and not with linguistic relativity effects. Berlin and Kay's 1969 study of color terms across languages concluded that there are universal typological principles of color naming that are determined by biological factors with little or no room for relativity related effects.[41] This study sparked a long tradition of studies in to the typological universals of color terminology. Some researchers such as John A Lucy,[42] Barbara Saunders[43] and Stephen C Levinson[44] have argued that Berlin and Kay's study does not in fact show that linguistic relativity in color naming is impossible, because of a number of basic unsupported assumptions in their study (such as whether all cultures in fact have a category of "color" that can be unproblematically defined and equated with the one found in Indo-European languages) and because of problems with their data stemming from those basic assumptions. Other researchers such as Robert E. Maclaury have continued investigation into the evolution of color names in specific languages, refining the possibilities of basic color term inventories. Like Berlin and Kay, Maclaury found no significant room for linguistic relativity in this domain, but rather concluded as did Berlin and Kay that the domain is governed mostly by physical-biological universals of human color perception.[45] [46]

Linguistic relativity and artificial languages

The Sapir–Whorf hypothesis influenced the development and standardization of Interlingua during the first half of the 20th Century, but this was largely due to Sapir's direct involvement.

Programming languages

Kenneth E. Iverson, the originator of the APL programming language, believed that the Sapir–Whorf hypothesis applied to computer languages (without actually mentioning the hypothesis by name). His Turing award lecture, "Notation as a tool of thought", was devoted to this theme, arguing that more powerful notations aided thinking about computer algorithms.[47]

The essays of Paul Graham explore similar themes, such as a conceptual hierarchy of computer languages, with more expressive and succinct languages at the top. Thus, the so-called blub paradox (after a hypothetical programming language of average complexity called 'Blub') says that anyone preferentially using some particular programming language will 'know' that it is more powerful than some, but not that it is less powerful than others. The reason is that *writing* in some language means *thinking* in that language. Hence the paradox, because typically programmers are "satisfied with whatever language they happen to use, because it dictates the way they think about programs".[48]

In a 2003 presentation at an open source convention, Yukihiro Matsumoto, creator of the programming language Ruby, said that one of his inspirations for developing the language was the science fiction novel *Babel-17*, based on the Sapir–Whorf Hypothesis [49]

Experimental languages

An experimental language is a constructed language designed for the purpose of exploring some element in the theory of linguistics. Many experimental languages are concerned with the relation between language and thought. In particular, much work has been done in science fiction.

Notes

[1] "The Sapir–Whorf hypothesis", in Hoijer 1954:92–105
[2] This usage is now generally seen as a misnomer. As Jane Hill and Bruce Mannheim write: Yet, just as the Holy Roman Empire was neither holy, nor Roman, nor an Empire the "Sapir–Whorf Hypothesis" is neither consistent with the writings of Sapir and Whorf, nor a hypothesis (Hill & Mannheim 1992)
[3] Koerner, E.F.K."Towards a full pedigree of the Sapir–Whorf Hypothesis:from Locke to Lucy" Chapter in Pütz & Verspoor 2000:17"
[4] Drivonikou et al. 2007, Gilbert et al. 2008
[5] Gumperz & Levinson 1997:2
[6] Trabant, Jürgen."How relativistic are Humboldts "Weltansichten"?" chapter in Pütz & Verspoor 2000
[7] Seuren 1998:180
[8] Seuren 1998:181
[9] Boas, Franz (1911), *Handbook of American Indian languages* (Bureau of American Ethnology, Bulletin 40. Washington: Government Print Office (Smithsonian Institution, Bureau of American Ethnology).) **1**
[10] Sapir, Edward (1929), "The status of linguistics as a science", *Language* **5**
[11] Edward Sapir & Morris Swadesh (1946) American Indian Grammatical Categories. Word 2:103–112. Reedited for Dell Hymes in Language in Culture and Society, Harper and Row, 1964:100–107.
[12] Lucy (1982b:25)
[13] Whorf (Carroll; Ed.); 1956: pp. 212–214
[14] Pullum 1991
[15] Lenneberg 1953
[16] Whorf, B. L. "The relation of habitual thought and behavior to language" in Carrol (ed.) 1956
[17] Lakoff 1987
[18] Brown & Lenneberg, 1954:455,457
[19] Brown 1976:128
[20] D'Andrade, Roy G. *The Development of Cognitive Anthropology* 1995: 185
[21] Gumperz & Levinson 1997:3 & 6
[22] Berlin & Kay 1969
[23] Gumperz & Levinson 1997:6
[24] Lucy 1992a
[25] Malotki 1983
[26] Pinker 1994:60
[27] Casasanto 2008, Lucy 1992a, Lakoff 1987
[28] Fishman, 1978
[29] Fishman, 1982, p. 5
[30] Whorf, 1956, p. 244 (criticizing Ogden's Basic English).
[31] Seidner, Stanley S., *Ethnicity, Language, and Power from a Psycholinguistic Perspective.* Bruxelles: Centre de recherche sur le pluralinguisme, 1982.
[32] E.g. Pavlenko 1999, Cook and Bassetti 2010, Athanasopoulos 2009, Phillips & Boroditsky 2003 inter alia
[33] Andrews 1994

[34] Boroditsky, Ham & Ramscar 2002
[35] Lucy 1997
[36] Lucy 1992b
[37] Lucy 1997:301
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- Babies think before they speak says Harvard professor (http://www.news.harvard.edu/gazette/2004/07.22/21-think.html)
- The Great Whorf Hypothesis Hoax by Dan Moonhawk Alford (http://www.enformy.com/dma-Chap7.htm).
- Language and Thought (http://www.unc.edu/~jdumas/projects/languagethought.htm)
- How Does Our Language Shape The Way We Think? (http://edge.org/3rd_culture/boroditsky09/boroditsky09_index.html)
- Effects of grammatical gender on human thought (http://www-psych.stanford.edu/~lera/papers/gender.pdf)

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