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Color

The Neurophysiology of Color

Undoubtedly the most influential and possibly the most robust claims of universal innate constraints on the semantic structure of certain cognitive domains have been made in the area of color terminology, starting with the landmark study of Berlin and Kay (1969) and extended with subsequent work by them and associates (Berlin and Berlin 1975; Kay 1975; Kay, Berlin, and Merrifield 1991; Kay and McDaniel 1978; MacLaury 1987, 1991, 1992). The crosslinguistic study of color terminologies has become something of the paradigm case for demonstrating the effects of universal innate biological constraints on human categorizations of the world. Color has long been a favored semantic domain in which to investigate issues of the relationship between language and thought (Brown and Lenneberg 1954; Lantz and Stefflre 1964; Lenneberg 1953; Lenneberg and Roberts 1956; Stefflre, Castillo Vales, and Morley 1966). This is a tradition that Berlin and Kay (1969) build on, but crucially they are attempting to show universal constraints in this domain, rather than relativistic effects linked to language differences, as is the aim of the earlier work. The whole thrust of work in color terminologies stemming from Berlin and Kay (1969) is to demonstrate that universal design features of the human visual perceptual system strongly constrain the systems of color terminologies found in the world's languages to a very small and largely predictable subset of the very large set of theoretically possible, but actually unattested, types:

> basic color categories can be derived directly from the neural response patterns that underlie the perception of color. (Kay and McDaniel 1978:130)

> predicting the composite color categories of the world's languages from properties of color vision that are independent of culture and of language, biological properties which are in fact independent of human experience *per se* being widespread in genera other than *Homo*. (Kay, Berlin, and Merrifield 1991:18)

Thus, universal constraints in color categorization are directly based in (primate) neurophysiology, and this is reflected in the color-naming systems found in the world's languages. Cultural practices and human interests, according to this view, play no role in the actual sensible experience covered by a given basic color term in a language, as this is informed strictly by biological constraints. This, of course, is a claim already made familiar by the work in ethnobiological classification and kinship already discussed, but it can be made more strongly here and tested more rigorously, given the clearly restricted perceptual basis of the domain and the greater knowledge we have of the human visual system, particularly the physiology of color vision. Ethnobiology, by contrast, is a much more open-ended domain, with probably many more perceptual features relevant to a given classification than just color, and not even the most extreme upholder of the pivotal role of genealogy in the reckoning of kinship relations would argue that this could be reduced to simple perceptual universals. Of these three domains, then, color is quite unique and provides a particularly good arena to study the effect of universal innate constraints, biological ones of human physiology, on human categorization as revealed in linguistic systems of basic color terms.

Before considering the actual linguistic and categorization results of this work, it is best to summarize what is presently known about color and the physiology of human color vision (Davidoff 1991; Thompson, Palacios, and Varela 1992). The physiology of human vision is constant across all races and populations of present-day members of the genus *Homo*, provided, of course, there is no individual pathology. All of the colors that we see are a combination of six basic colors: red, yellow, green, blue, white, and black. For example, turquoise is a combination of blue and green; orange, of yellow and red. Perceivable color varies along three dimensions: hue, saturation, and brightness. Hue is the "coloredness" of a color, its redness, yellowness, greenness, or blueness. These are the fundamental hues, defined as oppositions of red to green and blue to yellow. Combinations are possible across these oppositions, but not within them, as typically within a binary opposition, one pole excludes the other. Thus, turquoise is a combination of green and blue (across the oppositions), but there is no hue that is a combination of yellow and blue. Not all colors have hue; white and black do not, nor do their intermediate shades of grey. Colors with hue are known as chromatic colors; those without hue, achromatic colors. Saturation defines the strength of hue within a given color. Saturated colors have vivid hues, while desaturated colors are like pastels, closer to grey. Finally, brightness indicates the light reflectance of a color, from dazzling to barely visible.

Why is color perceived along these dimensions? Simply because the human visual system is structured in such a way as to reveal these dimensions, according to the now widely accepted opponent-process theory, proposed in modern form by Hurvich and Jameson (1957), but traceable back to nineteenth-century work by Hering. In this theory, the human visual system consists of three subsystems. The first subsystem signals differences in brightness and is achromatic. The other two signal differences in hue; one for the red–green opposition and one for yellow–blue. The relation between these subsystems and actual neuronal connections is not yet settled, but something like the following is generally accepted. The retina contains clusters of cone cells which respond to contrasts in "hue," by differential responses according to the wavelengths of the received light. There are three clusters of cone cells: long wave, middle wave, and short wave. The output of the three cone types is reorganized at neurological levels higher than the retina so that their signals can be additively or subtractively compared. The difference between the signals from the long- and medium-wave receptors constitutes the red–green subsystem, while the difference between the sum of the signals from long- and medium-wave receptors and the signals from the short-wave constitutes the yellow–blue subsystem. The achromatic brightness subsystem is the result of the summed activity of the long- and medium-wave cones. As the two chromatic subsystems are made up of oppositions, one pole always excludes the other; an increase in blue is always at the expense of yellow. This system of oppositions explains in neurophysiological terms the difference between pure hues and secondary "mixed" colors. Pure blue results when the yellow–blue subsystem signals "blue" (i.e. whatever neuronal firing pattern that realizes "blue" is occurring) and the red–green subsystem is neutral, signalling neither "red" nor "green." Turquoise, on the other hand, results when the yellow–blue subsystem again signals "blue," but the red–green subsystem signals "green." Purple, in like manner, is the result of "blue" from the yellow–blue subsystem and "red" from the red–green. Such secondary, "mixed" colors are thus cognitively "computed" from inputs from the two subsystems (this process is modelled formally in Kay and McDaniel (1978)) and are not the responses to neuronal stimulation in only one subsystem, as are the pure, primary opposing hues of the two subsystems. Slight differences in hue of, say, turquoise reflect differences in the relative contributions of "blue" and "green" from the two subsystems. Finally, white, black, and grey result when both the yellow–blue and red–green subsystems are neutral, and the third subsystem of brightness is operative; neurological-firing patterns for high brightness signals "white" and its relative absence, "black," with "grey" in between.

Color Categorization

With this background in the neurophysiology of human color vision in mind, let us return to issues of anthropological linguistics, specifically the constraints this physiology has upon the color categorization reflected in languages. All of this work in universals of color categorization inaugurated by Berlin and Kay (1969) uses the Munsell set of color chips, a set "of 320 color chips of forty equally spaced hues and eight degrees of brightness, all at maximum saturation, and nine chips of neutral hue (white, black and greys)" (Berlin and Kay 1969:5). These represent the controlled stimulus for the required and evaluated responses of color naming. Speakers of languages are asked to provide the basic color term for each stimulus chip, and to date well over 100 languages have been investigated using this methodology, with from two (Dani) to eleven (English) basic color terms. A basic color term is defined on the basis of a number of criteria such as: (1) it is monolexemic, not composed of composite parts, excluding, for example, *bluish* in English; (2) is not included, hyponymically, within another color term, excluding, for example, English *scarlet*, which is *a kind of red*; (3) is attributively not restricted, excluding English *blond* which is restricted to hair and wood; and, perhaps most problematically, (4) is salient psychologically, for example, listed first among terms in the given domain or most widely known. Commonly, these criteria converge, but in individual cases they may conflict, requiring additional criteria or creative decisions on the part of the analyst.

Using these criteria to establish basic color terms and investigating their usage as names for particular stimuli of colored chips, noticeable patterns emerge. First, it is generally the case that regardless of the number of color terms in a language, the focal hue, the best exemplar of a named color, is remarkably consistent across languages. Thus, a speaker of a language with three basic color terms like Watam will identify as the best exemplar of "red" about the same hue as will speakers of English of eleven basic color terms, essentially "fire-engine red." The boundaries, however, of what hues count as "red" is much less stable, but surprisingly, within languages (i.e. variation among speakers of the same language), as much as across them. These prototypical effects are claimed by Kay and McDaniel (1978) to lie in the universal neurophysiology of color vision. Membership in the category labelled by "red," for example, is established by the proportion of "red" response in the neurons of the red–green subsystem. Pure or focal red occurs when the yellow–blue subsystem is neutral. Similar definitions apply to the other focal hues: yellow, green, and blue. Less focal hues have more partial responses in their own subsystem and greater or less contribution from the other subsystem. This neurophysiological description accounts for our perception of primary colors through what Kay and McDaniel call "fundamental neural responses," but is extendable to secondary, "mixed" colors. For example, those hues labelled "purple" by English speakers are the intersection of the neurophysiology underlying "blue" and "red," i.e. a "blue" pattern of neuronal firing in the yellow–blue subsystem and a "red" pattern in the red–green subsystem. In this way, the neuronal and cognitive underpinnings to all the colors subsumed by the eleven basic color terms of English can be modelled. Second, universal patterns of color-naming systems emerge across languages. No language, for example, has a word for "green," unless it also has a word for "red." The maximum number of basic color terms seems fixed at around a dozen, but a language may have much less. If so, a given color term will be a composite category, covering a range of stimulus colors, for example, the native Trobriand color terminology has four terms (Senft 1987); one of these *digadegila* covers the spectrum range of yellow–green–blue, although its prototypical focus seems to be "yellow" (Senft 1987:329). The patterns of such composite categories seems largely, but not completely, predictable on neurophysiological grounds.

Types of Basic Color Terminologies

The simplest system of color naming found in any language consists of two terms (considering the basis of the color domain in oppositions, it is impossible to conceive of a simpler system and still call it "color"). This is exemplified in Papuan languages of New Guinea like Dani (Heider 1972a) and Australian languages, such as Burara (Jones and Meehan 1978). There is some debate as to whether the contrast in such systems is truly one of color (hue), rather than brightness. Dani has been extensively studied by Rosch (Heider 1971, 1972a, b). This has two basic color terms – *mili* and *mola*: *mili* contains black and darker browns and all the cooler colors, greens and blues; *mola* covers white and the warmer colors, reds, yellows, orange, reddish-purple, pink and lighter browns, like European skin colors. The foci of these color terms were highly variable across speakers: for *mili* ranging from black to pure blue or pure green and for *mola*, burgundy, red, pink, brown, or pastel shades. Some speakers chose pure black and pure white as the foci for *mili* and *mola* respectively. On the basis of these findings, Rosch argued that these terms denoted both hue and brightness, glossing them as *mola* DARK/COOL and *mili* LIGHT/WARM, where COOL and WARM described the cool (green, blue) and warm (red, yellow, orange) hues. Interestingly, in spite of Dani's only having two basic color terms, Rosch has been able to demonstrate prototype focal effects for a range of hues lacking unique names in the language. Made-up names for focal hues can be learned more rapidly and recalled more easily than those for more peripheral ones. Thus, made-up names for pure green and pure blue are more accessible than for turquoise (i.e. "mixed" blue–green), in spite of the fact that Dani lacks unique basic color terms for all three of these. This is evidence for Kay and McDaniel's (1978) claim for the universal innate basis for focal colors in the human color vision system.

Jones and Meehan's (1978) evidence suggests that brightness is indeed the basic dimension of contrast for the two Burara basic color terms, *gungaltja* and *gungundja*. *Gungaltja* refers to light, bright colors, like white, pastels, and red. Its focal prototype is reflective aluminum foil, certainly suggesting high brightness as its basic feature. All other colors are covered by *gungundja*. The Burara system, then, is a more transparent brightness-based two-term system than the mixed brightness–hue system of Dani. In fact, MacLaury (1992) suggests two parallel paths of development of basic color terms, one based on hue and one on brightness, with crossover relations between them. Burara is probably the most likely example of a basic color system grounded in brightness contrasts, Dani exemplifying the more common crossover between the two dimensions.

When a language has three basic color terms, the warm colors red–orange–yellow split from LIGHT/WARM to form the following three-way contrast: LIGHT, WARM, and DARK/COOL. A true hue contrast now definitely emerges. The focal hue for LIGHT is white, and for WARM, red but DARK/COOL continues to have variable foci in black, pure blue, or pure green. Watam is a good example of this type of language, with *wawar* LIGHT: white, greyish, *mbukmbuk* DARK/COOL: black, dark brown, green, blue, and *yaup* WARM: red, orange, yellow, red-brown. This early emergence of RED fits well with Sahlin's (1976) claim of its psychological salience and emotional attractiveness.

With four basic color terms, the possibilities now become quite complex, with no less than five-attested systems (Kay, Berlin, and Merrifield 1991). The two most common of these were uncovered as early as Berlin and Kay (1969). In one, the WARM category, previously covering from red through yellow, but focused on red, splits into two distinct terms: RED and YELLOW. This system is found in traditional, pre-Spanish Bisayan of the Philippines (Berlin and Kay 1969:68): *mabosas* LIGHT/WHITE, *maitum* DARK/BLACK, *mapula* RED, and *madurag* YELLOW. In such systems orange is divided between RED and YELLOW.

The other commonly attested four-term system separates the cool colors, green and blue, from the DARK/COOL category, resulting in DARK/BLACK and GRUE, a composite category made up of green and blue. In such systems the focal hue for GRUE is either blue or green or bifocal in both, never turquoise, i.e. the secondary "mixed" hue composed of these two primaries. This again is said to vindicate Kay and McDaniel's (1978) universal neurophysiological account for basic color terminologies. Ibibio of Nigeria is one such four-term system: *àfíá* DARK/BLACK *èbúbìt* LIGHT/WHITE, *ǹdàìdàt* WARM, *àwàwà* GRUE/focus in green (Berlin and Kay 1969:64).

The other three systems are more problematic. In one, GRUE separates from DARK/COOL and RED emerges as a distinct category from WARM, but "yellow" rejoins the LIGHT category. A neurophysiological account for this is not apparent, nor is a diachronic mechanism which would yield this four-term system from the previous three-term one of DARK/COOL, LIGHT, and WARM. Most problematic of all are systems which have as a basic color term a YELLOW/GREEN composite category, in which YELLOW again splits from WARM, but this time merges with GRUE. How can YELLOW be simultaneously LIGHT/WARM and DARK/COOL? Once previously thought to be rare, YELLOW/GREEN is now attested on four continents: Asia (Hanunoo), Australia and Oceania (Gugu-Yalanji, Trobriand), North America (Salish, Wakashan, Creek, Natchez, Karok), and South America (Chacobo). There are two types of such systems. One has a YELLOW–GRUE category and is exemplified by the traditional Trobriand color terminology (Senft 1987): *pupwakau* LIGHT/WHITE, *bwabwau* DARK/BLACK, *bweyani* RED, and *digadegila* YELLOW/GRUE. Other languages with this system include Karok (Bright 1952) and Gugu-Yalanji (Berlin and Kay 1969:70; Rivers 1901). This grouping of YELLOW/GRUE poses formidable problems for Kay and McDaniel's grounding of generalities of basic color terms in innate perceptual properties of the human color vision system, specifically, the subsystems based on opposing colors. Yellow and blue (member of the composite GRUE) are opposing poles of the same subsystem and if these subsystems based on oppositions are the universal grounding for human color categorizations, it is hard to see how yellow and blue could be conflated in a single named category. This serious problem is clearly seen by MacLaury (1992), who tries to solve it by claiming this category is actually informed by a brightness dimension, not one of hue, these colors occupying a range of middle brightness. This is in keeping with his postulation of the pivotal role of a brightness dimension in the sequence of development of basic color terms, but it rather does contravene the strict Kay and McDaniel universalist interpretation in terms of hue, and poses the question what favors the mediation of the brightness dimension in addition to hue in certain color terminologies. Culture?

The other four-term system involving YELLOW/GREEN actually divides GRUE into BLUE and GREEN, merging the former with BLACK and the latter with YELLOW. Hanunoo of the Philippines (Conklin 1964) is one such system: *bi:ru* DARK/BLACK/BLUE, *lagtiq* LIGHT/WHITE, *raraq* RED, *latuy* YELLOW/GREEN. Other languages with this system are Creek (Kay, Berlin and Merrifield 1991) and Shuswap (MacLaury 1987). Given that these languages assign yellow and blue to different named categories, they do not pose the quite same problems for the universal neurophysiological basis of basic color terms in color oppositions like yellow–blue; they do, however, pose problems of their own, such as how would they arise from a previous three-term system of DARK/COOL, LIGHT, and WARM? Again the role of yellow is pivotal; it must migrate out of the WARM category to join with the green focus of GRUE, a composite category already

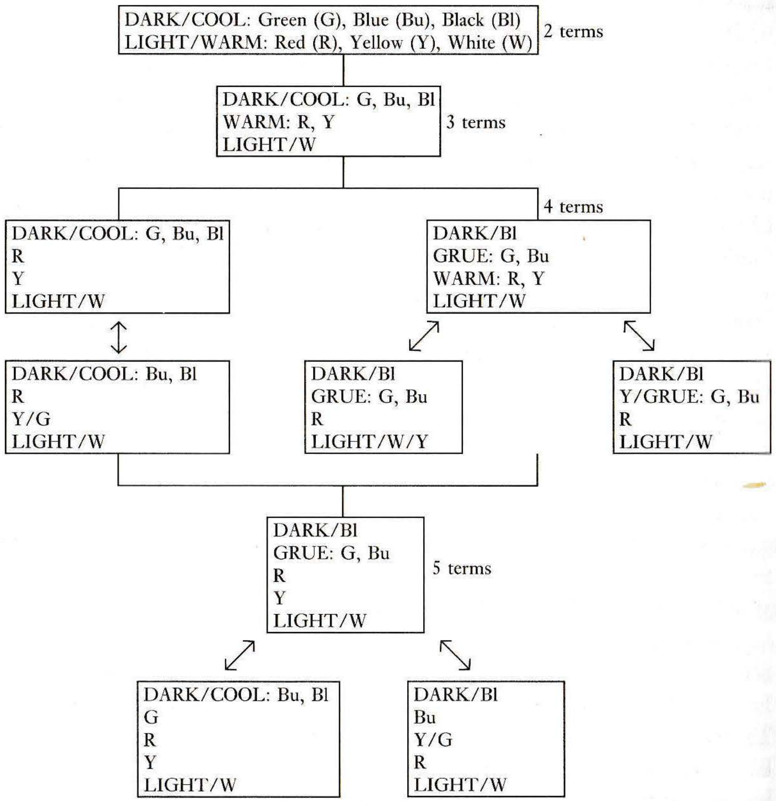
separate from DARK/COOL. Thus, the ancestor of four-term systems with YELLOW/GREEN may be the common type with the four terms LIGHT/WHITE, DARK/BLACK, WARM and GRUE, as in Ibibio. MacLaury (1987) proposes something like this for the history of the color terminology of Shuswap, a Salish language of Canada in which the WARM term extended to the green focus of GRUE (due to an operative brightness dimension?) and simultaneously retracted from red. Blue then merges with DARK/BLACK. Halkomelem, another Salish language (MacLaury and Galloway 1988), shows the opposite trajectory: GRUE is extended to the yellow focus of WARM, isolating red and simultaneously retracting from blue, which again merges with DARK/BLACK. While not ruled out on a neurophysiological account of opposing color hues, yellow–blue and red–green, such an account certainly provides no straightforward explanation of such migrations of yellow or green. MacLaury's (1992) theory of a co-emergent brightness dimension, with YELLOW/GREEN a category of medium brightness, seems to offer the only avenue of explanation here.

Languages with five basic color terms exhibit fewer possibilities than those with four, there being three-attested types. The most common arise from the two most widely attested four-term systems, either by splitting WARM into RED and YELLOW or by dividing DARK/COOL into DARK/BLACK and GRUE, again with variable focus of GRUE in either blue or green, or bifocal in both. All such languages have DARK/BLACK, LIGHT/WHITE, RED, YELLOW, and GRUE and are illustrated by Tzeltal, a Mayan language of Mexico (Berlin and Kay 1969:82); *ʔink'* DARK/BLACK, *salk* LIGHT/WHITE, *cah* RED, *k'an* YELLOW, and *yaʃ* GRUE. Uncommon, but attested, systems include those in which only GREEN is separated from DARK/COOL, leaving blue to remain in the latter along with black: DARK/BLACK/BLUE, LIGHT/WHITE, RED, YELLOW, and GREEN. Chinook Jargon, a pidgin previously spoken in the Pacific north-west of the United States and Canada, is an example of this five-term system (Berlin and Kay 1969:75): *liʔeł* DARK/BLACK/BLUE, *tkʔup* LIGHT/WHITE, *pəl* RED, *ptcəh* GREEN, and *kawakawak* YELLOW (with pale greens). And there is at least one reported language (Kay, Berlin, and Merrifield 1991) in which green migrates from GRUE to merge with yellow to form a YELLOW/GREEN composite category, isolating BLUE as a new uniquely named color category: DARK/BLACK, LIGHT/WHITE, RED, YELLOW/GREEN, and BLUE. Kwak'wala (Saunders 1992), a Wakashan language of Canada, may also illustrate this last system: *zutla* DARK/BLACK, *mela* LIGHT/WHITE, *tlakwa* RED, *lhenza* YELLOW/GREEN, and *zasa* BLUE.

The possibilities for systems of basic color terms from the minimum of two members up to five can be seen in 7.1.

Beyond five basic color terms, there appears to be far less order. Berlin

7.1



and Kay (1969) in their early phase of the theory proposed the strong constraint that GRUE necessarily splits into GREEN and BLUE, followed by the addition of BROWN, and then the emergence of PURPLE, GREY, PINK and ORANGE in any order, but later research has shown this to be false. Evidence above shows that GREEN and BLUE may already emerge as distinct in a five-term system. It is also now well established that, contrary to Berlin and Kay (1969), GREY, BROWN, and PURPLE appear as basic color terms in no fixed order. Indeed, GRUE may persist undissolved into GREEN and BLUE well after GREY, BROWN, or PURPLE have been labelled with their own basic color terms (Kay, Berlin, and Merrifield 1991).

It is important to note that MacLaury (1991, 1992) has found that prior to their emergence as basic color terms both purple and brown show conflicting categorizations in different languages. Thus, in a typical five-term system, purple may be assigned completely to the GRUE category or to the boundary between GRUE and RED. Similarly, brown can be included in the YELLOW or DARK/BLACK category. Variable categorizations like these

may be the source of the largely unpredictable pattern for their emergence as basic color terms. PINK and ORANGE do generally appear to be distinctly late, though see Saunders (1992:151) for a claim that ORANGE is a basic color term in Kwak'wala, otherwise a language with a five-term system, as mentioned above. Finally, some languages may have more than one basic color term corresponding to a single one in English: for example, Russian has two basic color terms for BLUE, *goluboj* for LIGHT-BLUE (i.e. "sky-blue") and *sinij* for DARK-BLUE, and Hungarian has two words for RED, *piros* LIGHT-RED and *vörös* DARK-RED (Wierzbicka 1990).

Universal Constraints on Basic Color Terminologies

Much of the early enthusiasm in the research tradition inspired by Berlin and Kay (1969) lay in a belief that this work uncovered strong universal constraints in one linguistic and cultural domain, contrary to the received wisdom of relativism current in the mid-1960s. However, as sketched above, the current findings in this field represent a significant retreat from the early strong universals proposed in Berlin and Kay (1969), with multiple possibilities now available to languages in their basic color terminologies especially in four- and five-term systems. Still, it is equally apparent that constraints are operative, for not all possibilities are attested: for example, there is no four-term system with ORANGE, LIGHT/WHITE, YELLOW, and GRUE. And for three-term systems only one possibility exists: DARK/COOL, WARM, and LIGHT/WHITE. Why not, COOL/GRUE, DARK/BLACK, and LIGHT/WARM? In other words, why does WARM split from LIGHT before COOL splits from DARK? Phrased in a different way, why does the presence of a distinct COOL/GRUE term always imply the prior emergence of a WARM term, but not vice versa? Such questions demand answers and do argue for universal constraints on the structuring of this linguistic domain. The source of these constraints is quite possibly neurophysiological, to be found in the structure and functioning of the human color vision system, but Kay and McDaniel's (1978) account in terms of Hurvich and Jameson's (1957) opponent-process theory of color vision, with systems of opposing hues, yellow–blue and red–green, is clearly not completely adequate, failing especially in the case of languages with the composite category YELLOW/GREEN/BLUE, like Trobriand (Senft 1987). The neurophysiological account requires opposing colors in the same subsystem, like yellow and blue, to be in separate labelled categories, yet clearly they are not. The future success of the neurophysiological explanation of findings of this research tradition may founder on such cases. As the opposing hue hypothesis is what is contradicted here, MacLaury (1992) tries to account for such systems in terms of brightness, arguing that this represents a second universal, neurophysiologically based, dimension in color terminologies. This move appears necessitated by the data, but if it should turn to be unmotivated, then the findings of this research tradition will no longer be supported by a neurophysiological base. And if this is the case, what is the source of the discovered constraints on basic color terminologies? Culture? This, contrary to the whole intent of this tradition, right back to Berlin and Kay (1969), opens the door to relativism, a point not lost on MacLaury (1992:137):

> Inserting a category of *yellow–green–blue* into the sequence casts doubt upon the presumed connection between panhuman visual physiology and the widely observed regularities of color categorization; it calls into question the very notion of color-category universals.
>
> Since the *yellow–green–blue* category represents the extreme, dropping it into the universal sequence concedes the debate to the relativists.

Relativist Responses to Proposed Universals of Color Terminologies

So what is the relativist response to this imposing body of work and how do they account for the universal constraints on basic color terminologies already mentioned? It is perhaps best articulated in Sahlins (1976), but see also Lucy (1996), Saunders (1992), and Tornay (1978). The basic point, of course, is that cultural practices are a crucial mediating force in color naming and the systems of basic color terms. They argue that culture must be the crucial autonomous intermediary between any innate and hence universal neurological perception of color stimuli and the cognitive understanding of these. This point is echoed linguistically by Wierzbicka (1990) who notes that the meaning of a color term in a language cannot possibly be a neural response to a color chip, but rather the cognitive understanding the Native speaker of the language has of that term: "language reflects what happens in the mind, not what happens in the brain" (Wierzbicka 1990:163).

The basic thrust of the relativist critique of the Berlin and Kay (1969) inspired tradition is to invert its determinism: "it is not, then, that color terms have their meaning imposed by the constraints of human and physical natures; it is that they take on such constraints in so far as they are meaningful" (Sahlins 1976:3), i.e. meaningful in a culturally constructed symbolic system; symbols for practical public action, as in Geertz (1973). Herein lies the rub; Berlin and Kay (1969) and associates regard a particular color as a label given in response to a controlled stimulus, a Munsell color chip, an act of naming an objective sensible difference. The language of color, thus, is reduced to a nomenclature of objective pure color referents in a controlled sensible world. The basic color terms in a language are separated

semantically from other words denoting color on essentially this principle: they denote color and nothing else, whereas secondary color terms have additional denotations and connotations. But to relativists like Sahlins (1976) and Lucy (1996), it is exactly this strict separation which is at issue. And where is the meaning of the color terms in all this? The meaning of a color term is its cognitive understanding, the culturally defined relations it engages in and activates, not its mere recognition and labelling. Color terms in a given culture do not mean Munsell chips. And from this point of view, there is no basis for a *semantic* separation of basic and secondary color terms.

The relativist critique thus rejects the strictly referential/behaviorist theory of meaning, that words are simply labels for perceived stimuli, implicit in the methodology of Berlin and Kay (1969), and subsequent work. This assumes an objective pre-given reality which language simply labels. In the tradition of basic color terminology, this pre-given reality is the separate domain of color, embodied in the contrastive dimensions of the Munsell color chips. Relativism challenges this assumption and claims that any such domain is not a pre-given, easily isolatable piece of reality, but is culturally constructed, seamlessly linked to other parts of that culture's symbolic order and meaningful practices. By isolating color as the only dimension in a pre-given domain of reality, Berlin, Kay, and associates create a completely artificial situation, parallel across cultures and languages, which, *by definition*, should result in their universal findings. Combined with their rejection of secondary color terms and the connotative, non-"color" meanings of basic color terms in languages, Berlin and Kay's (1969) findings are virtually assured (Lucy 1996). Lucy (1996) discusses how different the color terminology of Hanunoo looks from its presentation in Berlin and Kay (1969:64), if the full detail of Conklin's (1964) ethnographic description is systematized. Berlin and Kay (1969) characterize Hanunoo simply as a four-term system, now known to be *bi:ru* DARK/BLACK/BLUE, *lagtiq* LIGHT/WHITE, *raraq* RED and *latuy* YELLOW/GREEN. But Conklin (1964) provides much fuller information. Besides this four-fold contrast in hue/brightness, "this classification appears to have certain correlates beyond what is usually considered the range of chromatic differentiation, and which are associated with nonlinguistic phenomena in the external world" (Conklin 1964:191). Thus, the four terms contrast according to semantic dimensions other than color ascribed to their typical referents. There are three of these (Conklin 1964:191):

> First, there is the opposition between light and dark, obvious in the contrasted ranges of meaning of *lagtiq* and *bi:ru*. Second there is an opposition between dryness or desiccation and wetness or freshness (succulence) in visible components of the natural environment which are reflected in the terms *raraq* and *latuy* respectively. This distinction is of particular significance in terms

> of plant life. Almost all living plant types possess some fresh, succulent, and often "greenish" parts. To eat any kind of raw, uncooked food, particularly fresh fruits or vegetables, is known as *pag-laty-un* (<*latuy*). A shiny, wet, brown-colored section of newly-cut bamboo is *malatuy* (not *mararaq*). Dried-out or matured plant material such as certain kinds of yellowed bamboo or hardened kernels of mature or parched corn are *mararaq*. To become desiccated, to lose all moisture, is known as *mamaraq* (<*paraq* "desiccation" . . .) . . . A third opposition, dividing the two already suggested, is that of deep, unfading, indelible, and hence often more desired material as against pale, weak, faded, bleached or "colorless" substance, a distinction contrasting *mabi:ru* and *mararaq* with *malagtiq* and *malatuy*. This opposition holds for manufactured items and trade goods as well as for some natural products (e.g. red and white trade beads, red being more valuable by Hanunóo standards; indigo-dyed cotton sarongs, the most prized being those dyed most often and hence of the deepest indigo color – sometimes obscuring completely the designs formed originally by *white* warp yarns; etc.).

Conklin concludes by alternatively glossing the four terms as DARKNESS, LIGHTNESS, DRYNESS and WETNESS, respectively, and notes that (Conklin 1964:192):

> what appears to be color "confusion" at first may result from an inadequate knowledge of the internal structure of a color (sic) system and from a failure to distinguish sharply between sensory reception on the one hand and perceptual categorization on the other.

Relativists like Lucy (1996) and Saunders (1992) charge that Berlin and Kay, and subsequent workers, only get the results they do by bracketing out such rich cultural information about the meanings of the basic color terms and by focusing solely on the chromatic information they denote. Lucy notes that adequate Native knowledge (the goal of any truly cognitive anthropology) of the Hanunoo system could never be achieved by codifying labelling responses in the Hanunoo language to color stimuli provided by Munsell chips. The thrust of the relativist critique is to claim that basic color terms stand in meaningful relationships to each other not only according to chromatic contrasts, but many other culturally defined dimensions, and, further, they individually and as a group may enter into relations with many other terms and semantic domains, as part and parcel of the wider meaningful practices which make up the culture. Colors as perceptual structures are merely raw materials of cultural production, the handmaiden of meaningful practices: virginal white versus promiscuous red. Colors, too, are good to think with. Saunders (1992:219) summarizes this view nicely:

bright

> I propose to relocate colour semantics out of the psychophysical domain of nomologically necessary "pure" perception into the domain of *value*, as that which most fully characterises the mental (or psychological). Instead of evolutionarily emerging neuro-based epistemological primitives (fundamental neural responses/basic color terms) I propose to locate a quality like Kwak'wala *lhenxa* [YELLOW/GREEN] . . . in "intentional space" and characterise it in terms wedded to an intentional view of the world, i.e. in purposive, indexical, and interactional terms. Then *lhenxa* . . . have meaning only in the normative setting of the customs, regular beliefs and desires, and appropriate behaviour of a Kwakiutl . . . community [i.e. embodied practices], as components of vistas only discernible from their intentional points of view. Categorisation in terms of "colour" or whatever, would then be inextricably bound up with having states of mind which cannot be understood except by those who enjoy the appropriate kind of intentional liaison with the world [i.e. structural coupling], that is, by people who have the skills to use terms like *lhenxa . . . mauve*, or *Prussian blue* in the appropriate contexts – an intentional liaison only secured when one is part of (or becomes part of) a community for which *it is utterly natural* to identify features of the world with these notions.

Exactly parallel comments are found in relativist critiques (Schneider 1984) of proposed universals of basic kinship term categories discussed in the previous chapter. *Mother* is not just collateral, first-ascending generation female, contrasting to *aunt*, *daughter* and *father*; she is the bearer of semantic dimensions that account for expressions like *necessity is the mother of invention*; *she was like a mother to me*; maybe even *that storm was a real mother*. Similar questions apply to extensions of the Kannada word for "mother," *amma*, to cover "woman," "goddess," "pox," and "help!" (Bean 1981). Only a culturally sensitive reading, in which particular embodied practical engagements with the world are appropriate, can truly account, a relativist would claim, for the semantics of basic kinship terms.

If we concede all this, then, what explanation is available for the universal constraints on basic color terminologies unearthed by Berlin and Kay (1969) and others? Why does WARM always precede COOL/GRUE, for example? If such constraints really are valid (see Lucy (1996) for some serious doubts), then an explanation is required, and simple neurophysiology, for reasons discussed above with regard to the YELLOW/GREEN/BLUE composite category, may not provide a complete answer. Sahlins (1976) does, however, localize the strongest constraints in universals, albeit culturally mediated, of human experience, underlain by biology. WARM precedes COOL/GRUE because "red is to the human eye the most salient of color experiences. At normal light levels, red stands out in relation to all other hues by virtue of a reciprocal, heightening effect between saturation and brightness . . . Red, simply, has the most color; hence its focal position in the contrast of hue to achromaticity (lightness/darkness)" (Sahlins 1976:4–5). Sahlins cautions that the fact that the early emergence of WARM is rooted in biologically based human experience does not imply, however, that WARM *means* this experience. The meaning of WARM is in the oppositions it shares with DARK/COOL and LIGHT/WHITE, and these are culturally constructed. Thus, in a language with a three-term system, WARM is a difference that makes a difference. Like all differences, such as between day and night, WARM versus DARK/COOL must be perceptually discriminable, and WARM emerges early because it scores so highly here on several dimensions. Sahlins (1976:12) summarizes:

> No less than any other code, a system of color meanings must be grounded in a corresponding set of distinctive perceptual properties. Hence, the natural correlates of color words: they comprise the minimal distinctions on the object plane – of lightness/darkness, hue/neutrality, uniqueness/admixture, and the like – by which differences in meaning are signalled.

The members of a culture infuse these distinctions with meaning and employ them in the course of embodied practices in the service of their own symbolic ends, as they do with phonetic distinctions, such as voiced–unvoiced. As mediums of symbolic ends, color categories are cultural notions, enacted in the sense of Varela, Thompson, and Rosch (1991:171): "experiential, consensual and embodied: they depend upon our biological and cultural history of structural coupling."

Summary

The systems of color terminologies among the languages of the world present a promising case for the establishment of universals in human categorization, due to the panhuman neurophysiology of human vision. The thrust of work in the tradition stemming from Berlin and Kay (1969) has been to prove exactly this claim, locating established universals in the systems of basic color terminologies in the mechanisms of human color vision and arguing further that cultural interests and practices play no role. They have determined a typology of basic color terminologies varying from a minimum of two terms up to a maximum of eleven, with the actually attested systems restricted to a very small and mainly predictable subset of the very large set of theoretically possible, but actually unattested, types, a finding strongly in support of universal constraints in this domain. Further, the focal hue of a basic color term like "red," for instance, remains the same across languages, regardless of whether it comes from a three-term system, where the term covers the range from red through yellow, or an eleven-term one, more evidence that universal perceptual biologically based constraints are operative. Relativists respond by claiming that this research tradition gets the results it does almost by definition, by bracketing out all

the cultural information in the meaning of color terms, so that only the non-cultural perceptual components can reveal themselves. They argue that the meaning of a color term is not a labelling response to a color stimulus, but the full culturally defined relations it engages in and activates, its role in the ongoing social coupling of a people.

Further Reading

Color has also been much written about. Davidoff (1991), Hardin (1988), Lamb and Bourriau (1995), and Ottoson and Zeki (1985) are good introductions to the field, but see Thompson (1995) and Thompson, Palacios, and Varela (1992) for an alternative. There is a large amount of literature in the Berlin and Kay tradition, but the basic sources are Berlin and Kay (1969), Kay and McDaniel (1978), Kay, Berlin and Merrifield (1991), and MacLaury (1992). Important relativist responses are Lucy (1996) and Sahlins (1976).