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Berlin and Kay Theory

C.L. Hardin*
Department of Philosophy, Syracuse University, Syracuse, NY, USA

Definition

The Berlin-Kay theory of basic color terms maintains that the world's languages share all or part of a common stock of color concepts and that terms for these concepts evolve in a constrained order.

Basic Color Terms

In 1969 Brent Berlin and Paul Kay advanced a theory of cross-cultural color concepts centered on the notion of a *basic color term* [1]. A basic color term (BCT) is a color word that is applicable to a wide class of objects (unlike *blonde*), is monolexemic (unlike *light blue*), and is reliably used by most native speakers (unlike *chartreuse*). The languages of modern industrial societies have thousands of color words, but only a very slender stock of basic color terms. English has 11: *red*, *yellow*, *green*, *blue*, *black*, *white*, *gray*, *orange*, *brown*, *pink*, *and purple*. Slavic languages have 12, with separate basic terms for light blue and dark blue.

In unwritten and tribal languages the number of BCTs can be substantially smaller, perhaps as few as two or three, with denotations that span much larger regions of color space than the BCT denotations of major modern languages. Furthermore, reconstructions of the earlier vocabularies of modern languages show that they gain BCTs over time. These typically begin as terms referring to a narrow range of objects and properties, many of them noncolor properties, such as succulence, and gradually take on a more general and abstract meaning, with a pure color sense.

The development of English BCTs is typical [2]. The terms *red*, *black*, *white*, *gray*, *red*, *green*, *yellow, and brown* have roots that go back to Old English and before. All of them except for *red* had a variety of non-hue senses, taking on predominately hue sense during the Middle English period. *Purple* and *orange* were borrowed from Latin and Arabic with a hue sense from the beginning, and *pink* emerged sometime in the sixteenth century.

The Original Berlin-Kay Theory

These considerations invite two questions. Are there similarities in the ways that different languages with the same number of BCTs carve up color space? Is the order in which languages acquire BCTs constrained? In their influential 1969 *Basic Color Terms* [1], Berlin and Kay answered both questions in the affirmative and proposed a sequence in which the number of BCTs in a language predicts what those terms would be. According to the scheme, a Stage I language will contain terms for black and white. In Stage II, these are joined by a word for red. In Stages III and IV, either a word for green appears, followed by a word for yellow, or else a word for yellow appears first, followed by

*Email: chardin1@twcny.rr.com

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a word for yellow. A word for blue arises in Stage V, followed by a word for brown in Stage VI. Thereafter, in Stage VII, words for pink, purple, orange, and gray appear in no particular order.

The World Color Survey and the Revised Berlin-Kay Theory

The 1969 sequence has been enshrined in many textbooks, but it has since been significantly modified and conceptually refined. The authors and their collaborators improved their methodology and greatly extended the scope of their samples with the 1976 *World Color Survey* (WCS) [3] published with analysis and interpretation in 2009, along with work by others, notably MacLaury's 1997 *Color and Cognition in Mesoamerica* [4]. For the WCS, Protestant missionaries from the Summer Institute of Linguistics collected data from 25 monolingual speakers of each of 110 unwritten minor and tribal languages from 45 different language families. Respondents were asked to name 320 Munsell color chips of maximum chroma and 8 value levels in addition to 10 achromatic chips, presented in random order. After two such naming sessions, they were presented with a miniature version of all 330 samples arrayed in standard order and asked to pick out focal (best) examples of each of the named colors. The resulting dataset [5] permitted much more sophisticated statistical analysis, which broadly – but not completely – confirmed Berlin and Kay's original conclusions. However, in the years between the appearance of *Basic Color Terms* and the publication of the World Color Survey, the original sequence was replaced by a substantially more complex developmental scheme, as well as a reconceptualization of what that development consisted in.

The original sequence was understood as a succession of encodings of basic colors in which a language would acquire a term for red, and a bit later yellow or green, then blue and so on. It soon became clear that this wouldn't do, since in languages with fewer BCTs, the reference for each color term would encompass a correspondingly larger region of color space – a megacategory – so the addition of each new BCT should be understood as breaking up a megacategory into smaller categories. For instance, in a Stage I language with just two color categories, referring to one category as "white" and to the other as "black" is misleading, since the native category names extend across a broad range of hue samples. The more accurate gloss would be "warm/light" for the "white" category and "dark/cool" for the "black" category. In WCS notation, Stage I is represented as [W/R/Y, Bk/G/Bu]. In Stage II, the first megacategory breaks up, yielding [W, R/Y, Bk/G/Bu], and so on, culminating in Stage V, consisting of [W, R, Y, G, Bu, Bk]. The remaining BCTs appear in no fixed order.

A well-established basic megacategory in many North American and Mesoamerican Indian as well as some African languages is a "grue" term that covers the region that English speakers would separate into a blue and a green category. English, in turn, has its own megacategory. Modern Russian speakers break up our blue category with two BCTs: *goluboi*, light blue, and *sinji,* dark blue.

Constraints on Color-Category Formation

A fundamental question now arises. If the development of basic color categories is constrained in various ways, what are the bases of these constraints? One striking feature of the sequence is that as megacategories break up, categories whose foci lie close to the six elementary Hering colors get named before categories focused near the binary colors such as orange. Furthermore, the focal choices for each of these categories tend to cluster around average unique hue choices. Studies have found the variability of focal choices among the speakers of a given language to be substantially

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greater than the variability of average focal choices across languages with a comparable number of BCTs. This suggests that the elementary colors are perceptually salient for all language users, making them more likely to be named [6].

Alternative Explanations

An alternative view, first advanced by Jameson and D'Andrade [7], starts with the observation that the outer surface of the Munsell solid that was used in the collection of the WCS data is lumpy. Regions of high chroma are "mountains" of greater perceptual prominence than "valleys" of lower chroma in which the samples are less readily discriminable from their neighbors. This salience makes them more readily nameable.

Kay and Regier [8] constructed a CIELAB representation of the WCS Munsell samples and used them to define a dispersion metric. This enabled them to determine individual and group centroids for every category of each WCS language. They found a strong tendency of category centroids to cluster across languages. Subsequently, they used the same CIELAB representation to formalize and test the ideas of Jameson and D'Andrade [9]. Defining similarity and dissimilarity measures, they derived a measure of the "well formedness" of a language. By this they mean the extent to which the language maximizes the perceptual similarity of colors within a category and minimizes it across categories. Rotating the data for each of the WCS languages around the lightness axis showed that in most cases the well formedness of the language was maximized at or very near 0° of rotation. They concluded that the irregularities in perceptual color space along with general principles of category formation could account for the organization of the WCS languages. Well formedness is not overly sensitive to the placement of category boundaries, according to this account, and permits adjustment by linguistic convention.

Other explanations for the Berlin-Kay structure take different approaches. Vantage Theory, offered by Robert MacLaury, is psychological, giving a role to individual perceptual-cognitive differences. By contrast, a theory advanced by Sergej Yendrikhovskij [10] maintains that the structure of color-category systems originates in the statistics of the natural environment. He developed a clustering model that predicted the location, number and order of color categories and tested the model with a database of 630 natural images. The clustering was consistent with the 11 basic color categories of Berlin and Kay. These theories of universal constraints are not necessarily incompatible, since they focus on different aspects of color categorization.

Further Questions

Many questions concerning the evolution and structure of color categories remain to be answered. Why do red terms seem to be the first hue words to appear in color lexicons? Why do grue categories persist for so long in color-category evolution? How are we to understand the appearance of categories in languages from lands as far apart as New Guinea and North America that lump yellow with green instead of with red?

It is very likely that social factors such as trade and conquest drive the evolution of color vocabularies. It seems clear that culture plays a significant role in both the origins and the boundaries of color categories. Exactly what is that role? Can culture override perceptually based constraints? It appears that a proper understanding of even the denotations – let alone the connotations – of a

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language's color terms requires a proper grasp of the relative contributions of biological, cultural, and environmental factors [11].

Cross-References

▶ Ancient Color Categories
▶ Centroid and Boundary Colors
▶ Color Categorical Perception
▶ Cultural Relativism and Color Categories
▶ Dynamics of Color Category Formation and Boundaries
▶ Effect of Color Terms on Color Perception
▶ Infant Color Categories
▶ Unique Hues
▶ Vantage Theory of Color
▶ World Color Survey

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