Commentary

Color Naming and Sunlight

Commentary on Lindsey and Brown (2002)

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Lindsey and Brown (2002) proposed an intriguing explanation for the existence and geographical distribution of languages that lack a distinct word for the color blue. Many such languages include blue in a color term that also encompasses green, yielding a green-or-blue ("grue") term. Others include blue in a color term that also encompasses dark colors such as black, yielding a black-or-blue ("dark") term.[1] Lindsey and Brown proposed that "grue" and "dark" terms result from exposure to high levels of ultraviolet-B (UV-B) radiation from sunlight; this UV-B radiation leads to accelerated yellowing of the ocular lens, and a resultant distortion of perceptual color space, so that blue stimuli appear greenish (or dark, in the extreme case), and are thus named by the word for "green" (or "dark"). This is Lindsey and Brown's "lens-brunescence hypothesis" (LBH). In support of the LBH, Lindsey and Brown demonstrated that the proportion of languages having a term for "grue" or "dark," as opposed to a distinct "blue" term, is well predicted by the amount of UV-B radiation from sunlight that strikes the earth's surface where these languages are spoken. They also demonstrated that English-speaking subjects exposed to stimuli that simulate the result of accelerated lens yellowing in a high-UV-B environment extend the term "green" to include the color blue.

The LBH is potentially controversial for at least two reasons. First, there is evidence for perceptual processes that at least partially compensate for increases in ocular media density (Delahunt, Webster, Ma, & Werner, 2002; Kraft & Werner, 1999); thus, lens yellowing may not substantially affect color perception in the long term. Second, there is evidence that languages lacking a term for "blue" tend to be spoken in societies with a low level of technological development—and these societies are often located in the tropics, where UV-B is strongest (Berlin & Kay, 1969; Hays, Margolis, Naroll, & Perkins, 1972; Kay & Maffi, 1999; Naroll, 1970). Hence, Lindsey and Brown's correlation between UV-B and no "blue" term could be an artifact of the link between low technology and no "blue" term. Consequently, a further test of the LBH seems to be in order.

The LBH makes a prediction concerning which colors should be chosen as the *best examples* of "grue" terms cross-linguistically. If "grue" terms are simply terms for green that extend to blue because of a distortion of perceptual color space, there should be a single peak in the distribution of choices of best examples of "grue," and it should fall somewhere between green and blue. If, in contrast, "grue" terms do not result from a perceptual distortion, but rather are genuine abstractions over green and blue in an undistorted perceptual color space, the best examples of "grue" terms should lie at either green or blue or both.

Lindsey and Brown acknowledged these issues (p. 510), and also acknowledged impressionistic findings suggesting that best examples of "grue" may in fact cluster near focal green and blue. However, they did not seem to acknowledge that such findings, if more firmly empirically established, would constitute a direct challenge to their theory—not just a limitation. MacLaury (1997, pp. 234–235) demonstrated that in Mesoamerican languages, the best examples of "grue" terms tend to fall near green and blue. We were interested in determining whether this pattern held in a broader language sample.

The World Color Survey (WCS; Kay, Berlin, Maffi, & Merrifield, 1997; data now available on-line at http://www.icsi.berkeley.edu/wcs/data.html) contains color-naming data from 110 unwritten languages worldwide, from an average of 24 native speakers per language (mode: 25 speakers). Each speaker named each of the color chips shown in the stimulus array at the top of Figure 1; these chips were presented in a fixed random order. Each speaker then also viewed the entire array and selected the best example (or examples) of each of his or her major color terms.

We focused on those speakers in the WCS who provided the same name (effectively, "grue") for central green, central blue, and all chips in between. Central green and central blue were taken to be the centroids of naming responses for the English terms "green" and "blue," respectively, obtained from Sturges and Whitfield (1995). We then examined these speakers' best-example choices for "grue" and counted how many such choices ("hits") fell in each cell of the stimulus array in the top panel of Figure 1.

The single highest peak of the resulting distribution is at J0, the blackest chip in the array (87 hits). The bottom panel of Figure 1 shows the distribution of hits across the chromatic (colored) cells of the array. There are peaks at English "green" ("green" and peak both at F17, 79 hits) and near English "blue" ("blue" at F27, peak at F29, 45 hits). This distribution suggests that "grue" terms tend not to be perceptual distortions of green, but rather genuine abstractions over green and blue—and black. Thus, these findings are evidence against the LBH.

Some investigations have suggested a Whorfian effect of color language on color cognition (Davidoff, Davies, & Roberson, 1999;

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[1]There are also languages, not explicitly noted by Lindsey and Brown, that include green, blue, and black in a single term (see, e.g., Kay & Maffi, 1999).

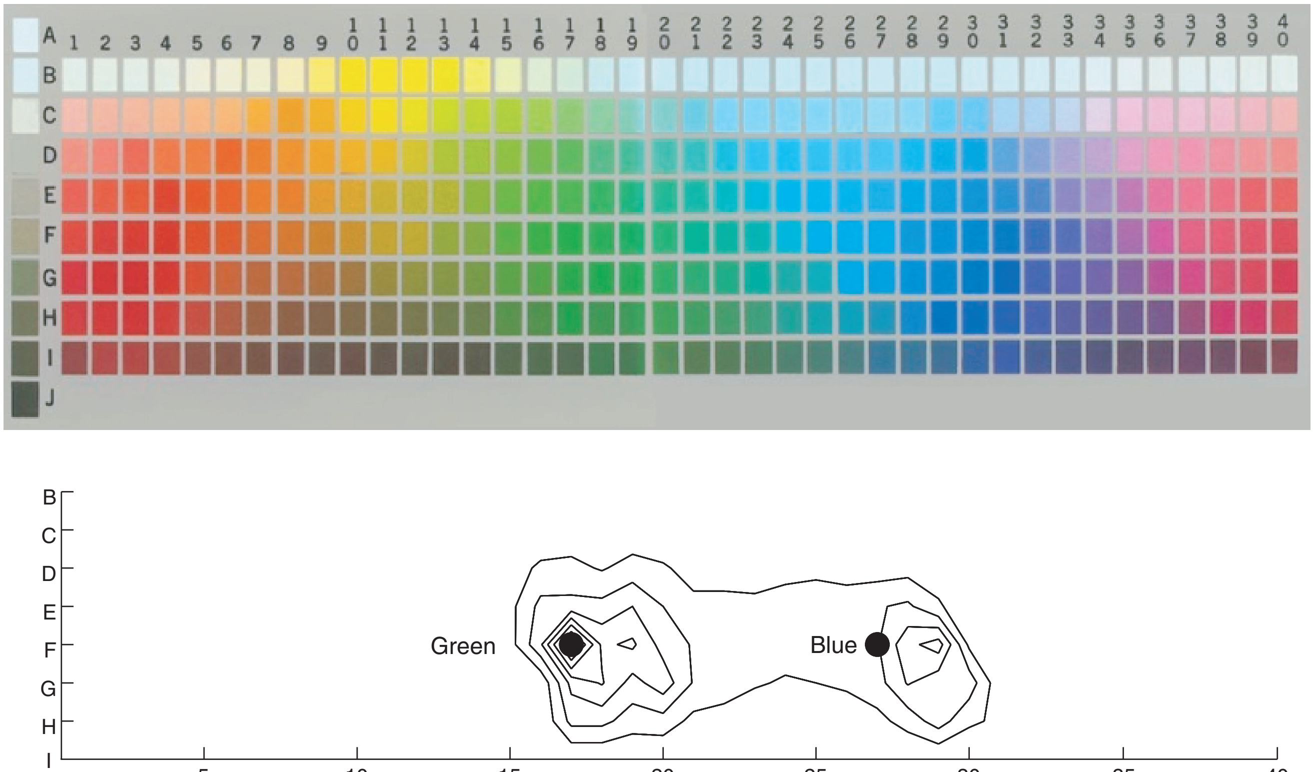

Fig. 1. World Color Survey (WCS) stimulus array (top panel) and contour plot (bottom panel) showing the distribution, over chromatic stimuli in the array, of best examples of ''grue'' terms in the WCS. The outermost contour represents a height of 10 hits; each subsequent inner contour represents a height increment of 10.

Kay & Kempton, 1984). Lindsey and Brown argued that the LBH may provide an alternative explanation for such results (see p. 509 for details of this argument). Yet the LBH—and thus the alternative explanation—is challenged by our current findings. Therefore, if we were to follow the current practice of characterizing research findings in the area of color categorization as either "universalist" or "relativist," we would be obliged to say that one universalist result (ours) has undermined another (the antirelativist LBH)—and in so doing, has indirectly supported relativism. The resulting rhetorical irony, or confusion, suggests that the universalist-relativist dichotomy may be invidious and that the field might benefit from its abandonment.

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