Color naming and sunlight:
Commentary on Lindsey and Brown (2002)

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Lindsey and Brown (2002) (L&B) propose 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 may include blue in a color term that also encompasses dark colors such as black, yielding a black-or-blue ("dark") term.[1] L&B propose 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 L&B's "lens brunescence hypothesis" (LBH). In support of the LBH, L&B demonstrate 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 demonstrate 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 et al., 2002; Kraft & Werner, 1999); thus, lens-yellowing may not substantially affect color perception in the long term. Second, there is evidence that

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[1] There are also languages, not explicitly noted by L&B, which include green, blue and black in a single term (See, e.g., Kay & Maffi 1999).

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 et al., 1972; Kay & Maffi, 1999; Naroll, 1970). Hence L&B's UV-B/no-blue-term correlation could be an artifact of the low-technology/no-blue-term link. Consequently, a further test of the LBH would seem 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 grue best example choices and it should fall somewhere between green and blue. If, in contrast, grue terms do not result from a perceptual distortion, but are rather 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.

L&B acknowledge these issues (p. 510), and also acknowledge impressionistic findings suggesting that best examples of grue may in fact cluster near focal green and blue. However, they do 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: 234-5) demonstrates 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 (Kay et al., 1997) (WCS) 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 in Figure 1; these chips were presented in a fixed random order. Each speaker then also viewed the entire array and selected the best example(s) of each of his/her major color terms.

Insert Figure 1 here.

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 the best example choices for grue made by these speakers, and counted how many such choices (“hits”) fell in each cell of the stimulus array in Figure 1.

The single highest peak of the resulting distribution is at J0, the blackest chip in the array (87 hits). Figure 2 shows the distribution of hits across the chromatic (colored) cells of the array. There are peaks at English “green” (“green” at F17; peak 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 argue against the LBH.

Insert Figure 2 here.

Some investigations have suggested a Whorfian effect of color language on color cognition (Davidoff et al., 1999; Kay & Kempton, 1984). L&B argue that the LBH may provide an alternative explanation for such results (see L&B, 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 anti-relativist 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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Figure 1. WCS stimulus array.

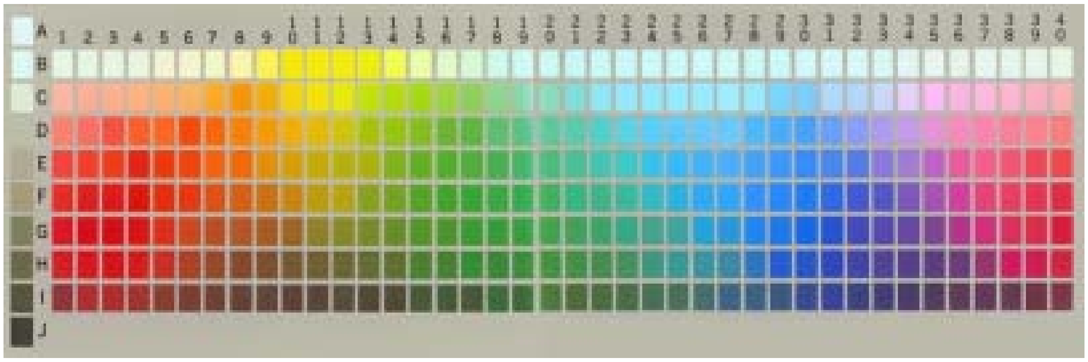

Figure 2. Contour plot showing the distribution, over chromatic stimuli, of best examples of grue terms in the WCS. Outermost contour represents a height of 10 hits; each subsequent inner contour represents a height increment of 10.