Language & Mind
HONR 218L

Color Terms and Color Categories

Final reading & homework


There will be a homework on this, due May 11th (last day of class)
3 Dimensions of Color

<table>
<thead>
<tr>
<th>hue</th>
<th>wavelength</th>
<th>Oscillation frequency of light radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>brightness</td>
<td>intensity</td>
<td>Amplitude of light radiation</td>
</tr>
<tr>
<td>saturation</td>
<td>purity</td>
<td>Intensity of dominant wavelength, relative to entire light signal</td>
</tr>
</tbody>
</table>

Maunsell color chips
Cross-cultural Studies

Berlin & Kay (1969)

• Historical backdrop
  “The prevailing doctrine of American linguists and anthropologists has, in this century, been that of extreme linguistic relativity. Briefly, the doctrine...holds that each language performs the coding of experience into sound in a unique manner. Hence, each language is semantically arbitrary relative to every other language. According to this view, the search for semantic universals is fruitless in principle. The doctrine is chiefly associated in America with the names of Edward Sapir and B. L. Whorf. Proponents of this view frequently offer as a paradigm example the alleged total semantic arbitrariness of the lexical coding of color. We suspect that this allegation of total arbitrariness in the way languages segment the color space is a gross overstatement.”

• Relativistic position
  “Our partitioning of the spectrum consists of the arbitrary imposition of a category system upon a continuous physical domain... The Shona speaker from a color category from what we call orange, red, and purple, giving them all the same utterly unpronounceable name. But he also makes a distinction within the band we term green. Here we have a clear case of speakers of different languages slicing up perceptual world differently. And, of course, it is also the case that the kinds of slices one makes are related to the names for the slices available in his language.”

Table 2. Languages studied by Iik (1)

<table>
<thead>
<tr>
<th>Index</th>
<th>Language</th>
<th>Where spoken</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arabic (Lebanese colloquial)</td>
<td>Lebanon</td>
</tr>
<tr>
<td>2</td>
<td>Bahasa Indonesia</td>
<td>Indonesia</td>
</tr>
<tr>
<td>3</td>
<td>Bulgarian</td>
<td>Bulgaria</td>
</tr>
<tr>
<td>4</td>
<td>Cantonesan</td>
<td>Chile</td>
</tr>
<tr>
<td>5</td>
<td>Catalan</td>
<td>Spain</td>
</tr>
<tr>
<td>6</td>
<td>(American) English</td>
<td>United States</td>
</tr>
<tr>
<td>7</td>
<td>Hebrew</td>
<td>Israel</td>
</tr>
<tr>
<td>8</td>
<td>Hungarian</td>
<td>Hungary</td>
</tr>
<tr>
<td>9</td>
<td>Igbo</td>
<td>Nigeria</td>
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<tr>
<td>10</td>
<td>Japanese</td>
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<tr>
<td>11</td>
<td>Korean</td>
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</tr>
<tr>
<td>12</td>
<td>Mandarin</td>
<td>China</td>
</tr>
<tr>
<td>13</td>
<td>(Mexican) Spanish</td>
<td>Mexico</td>
</tr>
<tr>
<td>14</td>
<td>Pomo</td>
<td>United States</td>
</tr>
<tr>
<td>15</td>
<td>Swahili</td>
<td>Tanzania</td>
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<tr>
<td>16</td>
<td>Tagalog</td>
<td>Philippines</td>
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<td>17</td>
<td>Thai</td>
<td>Thailand</td>
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<td>18</td>
<td>Tzeltal</td>
<td>Mexico</td>
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<tr>
<td>19</td>
<td>Urdu</td>
<td>Pakistan</td>
</tr>
<tr>
<td>20</td>
<td>Vietnamese</td>
<td>Vietnam</td>
</tr>
</tbody>
</table>

Data reported from one subject per language. (Berlin & Kay, 1969)
Berlin & Kay Findings
Support the Universality Hypothesis

“although different languages encode in their vocabularies different numbers of basic color categories, a total universal inventory of exactly 11 basic color categories exists from which the 11 or fewer basic color terms of any given language are always drawn.”

Berlin & Kay’s
Implicational Hierarchy

white < red < green < blue < brown < purple
pink < orange < grey

There are 2,048 possible combinations of these 11 colors
Of these, only 22 combinations (1%) are found to occur in fact

Cross-cultural Studies

• 1972 - Eleanor Rosch - ‘Dugum’ Dani community, Papua New Guinea
  - 2 color terms (‘dark’, ‘light’)
  - Color perception similar to English speakers
    • Better recognition of 8 ‘focal’ colors
    • Verbal paired-associate learning for focal/non-focal colors

Eleanor Rosch
UC Berkeley

Cross-cultural Studies

• Criticisms of Berlin & Kay conclusions
  - Small samples of speakers
  - Over-reliance on Western, literate societies
  - Almost all speakers lived in San Francisco & spoke English too
Kay & Rieger (2003)

- Analyzed data from the Word Color Survey (WCS)
  - Data collected in situ from 110 unwritten languages
  - Languages spoken in small-scale, nonindustrialized societies
  - Average of 24 native speakers per language
  - Monolingual speakers, insofar as possible
  - 330 color chips named, 1 at a time (random presentation)
  - Tell which is the best example of each of their basic color terms

Kay & Rieger (2003)

- Questions
  - Do color terms from different languages cluster together in color space to a degree greater than chance?
  - Do color terms, all from unwritten languages of nonindustrialized societies, fall near color terms of written languages from industrialized societies (from Berlin & Kay sample)?

Results
“Certain privileged points in color space appear to anchor the color naming systems of the world’s languages, viewed as a statistical aggregate.”

White: MacLaury (1997), *Elemental Chromatic Colors*

Black: Kay (2005), Berinmo color centroids

Berlin & Kay’s Implicational Hierarchy

- white
- black
- red
- green
- yellow
- blue
- brown
- purple
- pink
- orange
- grey

More

- These privileged points in perceptual color space are similar for the unwritten languages of nonindustrialized communities and the written languages of industrialized societies.
Questioning Universality

- Tests involving memory for colors
- Tests of categorical perception

- Roberson, Davies & Davidoff (2000)

Recognition Memory

- First just name all color chips
- Then look at 1 chip at a time, then taken away for 30 secs, then point to the color you saw in the whole array
- Berinmo patterns of naming and memory for color chips were more closely matched than Berinmo memory and English memory patterns
Paired Associate Learning

• Speakers learn arbitrary associations between (non-)focal colors and objects (e.g. palm nuts—\textit{nol})

• Berinmo participants did not find it easier to form associations to the (English) focal set of stimuli than to the non-focal set

Categorical Perception

• If categorical effects are restricted to linguistic boundaries, the 2 populations should show markedly different responses across the 2 category boundaries (green-blue and nol-wor)

• If categorical effects are determined by the universal properties of the visual system, then both populations should show the same response patterns

Similarity Judgments

• Choose the odd-man-out in a set of 3 color chips

• Perceptual distances were the same for each pair in the set

• Observers judged colors from the same linguistic category (for their language) to be more similar; they were at chance for decisions relating to the other language’s color categories.

(Davidoff, 2001)
Category Learning

• Taught to divide the color space at 4 places:
  - blue/green (English only boundary)
  - yellow/green (English only boundary)
  - nol/wor (Berinmo only boundary)
  - green1/green2 (boundary in neither language)

• Shown 6 chips, and told these 3 are category A, and these 3 are category B
• Subsequently asked to sort new chips into A & B
• Given feedback and continue until they reach criterion

Recognition across/within categories

English speakers showed significantly superior recognition for targets from cross-category pairs than for those from within-category pairs for the green-blue boundary, but not for the nol-wor boundary. Berinmo speakers showed the opposite pattern. \([X - A,B\) paradigm]
• “At the very least, our results would indicate that cultural and linguistic training can affect low-level perception.”

• “Our data show that the possession of color terms affects the way colors are organized into categories. Hence, we argue against an account of color categorization that is based on an innately determined neurophysiology. Instead, we propose that color categories are formed from boundary demarcation based predominantly on language. Thus, in a substantial way we present evidence for linguistic relativity.”

• So what do we conclude about linguistic relativity and color…?