The Development of Color Categories in Two Languages: a longitudinal study

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Purpose of study
- Put universalist hypothesis to the test
- To investigate the origin and development of color term knowledge and cognitive color categories in two very different languages and cultures

Abstract
- Color naming and comprehension and children’s ability to remember colors tracked over 3 yr period
- One group: semi-nomadic African culture
- Second group: English
- Saw noticeable similarities in pattern of color term acquisition: slow with great individual variation
- No evidence for universalist 11 categories

Background
- Diversity in way different languages split up table of visible colors
- Some empirical data supports universal cognitive color categories
- Universalist hypothesis: universal categories based on same focal colors regardless of # of terms
- No proof from visual system
Background con’t

- Some cross-cultural studies found no increased salience for proposed universal focal colors
- Tests the developmental predictions of these opposing views

The study: Brings together two researched fields of investigation into color categorization

- 1. Identifying Whorfian questions: effects of language on cognitive tasks
- 2. Children acquire color terms surprisingly late

Inadequacies of color term acquisition research

- Past studies examined only single measure or acquisition of only small subset terms over short pd.
- This one had strict controls on response measures and examined naming and comprehension systematically over 3 yrs = more reliable measure of acquisition

New Question

- How does color term acquisition differ in speakers of different languages?
- Harder for children learning new language where universal set must be over-written by new set (Bornstein Prediction)
- Or put old categories into new ones based on another dimension ex lightness
Predictions of Universalist hypothesis

- Children yet to learn any labels for their language should show similar patterns of memory errors that reflect the 11 basic categories
- Within category confusions should be more common than across

Predictions con’t

- English should learn the universal set before Himba learn their linguistic set (Himba have to override universal set)
- English need only map a set of labels on their existing color categories

Predictions of Relativist

- Expect reflection of different adult patterns of naming in cognitive organization of color
- Without predetermined organization, initial errors must depend on perceptual similarity
  confusions would be made to nearest perceptual neighbors

Previous studies findings in acquisition of color terms

- English: naming is harder task (# responses infinite)
- found asynchronous pattern of knowledge development (verbal and manual responding contrasted, pointed right, said wrong)
- This study uses more stringent (combined) criteria for determining whether a child has acquired a color term
Aims of study

1. compare universal and relativist hypotheses of color categorization by comparing acquisition over time to see whether the pattern of acquisition relates to appropriate set of adult categories
2. find empirical data facts about color development (learning patterns)

The subjects

- English: tested 3 and 4 yrs before entering pre-school and then through 3 years formal education
- Himba: 3 and 4 yrs, few received education during, have five BCTs
- Different environments

Himba BCTs

- Serandu: broadly red with orange and pink
- Dumbu: broadly beige with yellow and some light green
- Zoozu: broadly all dark colors and black
- Vapa: broadly all light colors and white
- Burou: broadly green with blue and purple
The stimulus

- Two identical sets of 22 Color Aid matt surface colored squares
- 11 were best examples (focal colors) of English basic categories: black, white, gray, red, green, blue, yellow, pink, orange, purple, and brown
- 11 others were intermediates

Tasks at each time period

- First task: listing, tell me all the colors you know
- Second task: productive, shown each tile one at a time
- Third task: comprehension, all 22, which is red?
- Fourth task: memory, see all 22, then shown single tile, find “hidden” one
- Tested every 6 months for 3 years

How many children knew no color terms at time 1?

- 19% English & 38% Himba failed to pass the combined naming and comprehension criteria for any of their color terms (didn’t know any)
- This is the critical group (all of next findings focuses just on them)
Recall Predictions of Universalist
- If color categories are universal, innate, independent of language, all children with no color terms would share the same set of cognitive categories
- Colors in same category should appear more alike than different category
- Items in same are closer in perceptual terms

Prediction of Relativist
- Memory confusions should be based solely on perceptual distance (irrespective of where boundaries are between 11 "universal" color categories).

So what did they do?
- They examined memory confusions with respect to perceptual distance and predetermined categories to see how far each would explain the data

Findings
- Regardless of language environment, very similar errors made that appear to be closely associated with perceptual distance
- Error patterns not influenced by 11 basic color categories of English
- So based on perceptual distance not predetermined categories
Memory for focal colors

- Universal hypothesis would be supported if focal items were found to have a natural salience regardless
- Stimuli central to the 11 English categories should be remembered better than other items, even by people who cannot name them

Focal status of stimuli

- Tiles focal to English only: gray, brown, orange, purple, green, and pink (UF)
- Tiles focal for Himba only: dark navy blue, dark orange, orangey-pinky-red, greeny-blue
- Tiles focal for both: black, white, red, yellow, blue
- Tiles focal for neither: 7 remaining

Results

- Only those targets focal in neither language were recognized significantly less than those focal in both
- But even this difference was an artifact (because perceptual diff turned out to be smaller for this group of stimuli)
- Was no specific advantage for colors that were focal to either language

List task Results

- No consistency
- Of 9 English who knew none, 4 listed none, 2 listed three, 1 listed five, and 2 listed six
- Of the 26 Himba who knew none, 23 listed none, 1 listed two, 1 listed three, and 1 listed four
Kids who knew 1 or more color terms at time 1
- Some believe Universalist theories predicted primary (RYGB) learned before secondary
- Findings regarding primary vs. secondary in this study
- Children knew more primary
- However, was little consistency in which terms learnt first
- Little evidence for predictable order of acquisition

Memory for Focal Results
- Overall recognition was better for English kids
- Himba recognized more targets focal in both

By the sixth testing...
- All English had completed 2.5 years of education
- 29 Himba had never attended, while 34 did to one of the mobile schools (6-12)
Results

- In period between each testing, children had acquired more than one color term.
- Children consistently recognized items focal to their own language over time.
- Overall, English children recognition was better across all tests. (Himba have broader categories)

<table>
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<th>Time of test</th>
<th>Serendu</th>
<th>Vega</th>
<th>Zooni</th>
<th>Dumbu</th>
<th>Buron</th>
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<td>30</td>
<td>11 (13)</td>
<td>17</td>
<td>4 (10)</td>
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<tr>
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<td>43</td>
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</table>

Overall Findings

- Pattern of term acquisition is slow for both.
- Children gained advantage in memory for colors focal to their language.
- As errors in memory task decreased over time, so did the perceptual distance of the errors from the target.

Universalist vs Relativist

- Children do not have a universal set of predetermined categories.
- There is not a predictable order of term acquisition in either language.
- Cognitive color categories are learned and not innate.
- Children continue to refine these for some yrs after knowing terms for focals.
In Summary

- The universal thing about acquiring color vocabs is that it is a gradual progression from uncategorized organization based on perceptual similarity to structured
- Without intensive adult input, color category acquisition is universally slow and effortful