

*Infant Color Categories and  
Categorical Perception*

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# Outline

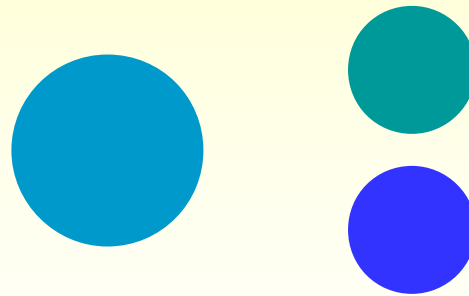
- Categorical perception
- Bornstein, Kessen & Weisskopf study
- The Franklin/Davies study
- Universalist and relativist positions
- Conclusions

# Color perception is categorial

- Although the color spectrum is continuous, it appears to be segmented into qualitatively different perceptual categories.
- Discrimination of pairs of colors from adjacent categories is easier than discrimination of equivalently spaced colors in the same category. This is the hallmark of “categorical perception” (Harnad, 1987).

# Bornstein, Kessen & Weisskopf study

- Following habituation to a standard color (e.g. blue<sub>1</sub>) four-month old infants looked longer at a test color from a different adult category (green) than one from the same category (blue<sub>2</sub>) even though the differences in wavelength of the test stimuli from the standard were equal.

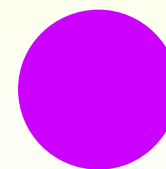
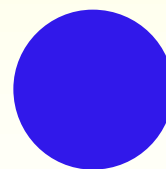
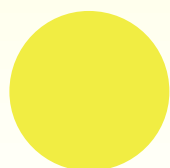
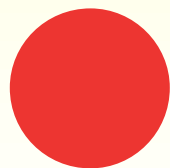


- Their results suggest that pre-linguistic infants have perceptual color categories, and show categorical perception by at least four-months of age.

Habituated stimulus		Test stimulus		Distance		Looking time
$\lambda$ nm	category	$\lambda$ nm	category	$\lambda$	(CIE)	(secs)
480	blue	480	blue	0	0.0	5.7
		450	blue	30	203.5	5.8
		510	green	30	243.3	7.3
510	green	510	green	0	0.0	5.0
		540	green	30	252.5	4.0
		480	blue	30	243.3	7.0
560	green	560	green	0	0.0	3.8
		550	green	10	32.7	3.8
		570	yellow	10	40.1	6.4
570	yellow	570	yellow	0	0.0	4.3
		580	yellow	10	48.6	3.3
		560	green	10	40.1	6.2
600	yellow	600	yellow	0	0.0	4.4
		580	yellow	20	114.5	4.1
		620	red	20	94.7	6.0

# Questions and problems

- What are the relevant perceptual categories for very young children?
- Methodological problem: Differences in wave length don't necessarily reflect the corresponding perceptual differences



# Universalist and relativist positions

- Universalists
  - perceptual categories are “hardwired” into the visual system, and language exploits these discontinuities in perceptual color space.
- Relativists
  - perceptual categories are constructed through language, and color perception varies as language varies.

# Hypothesis

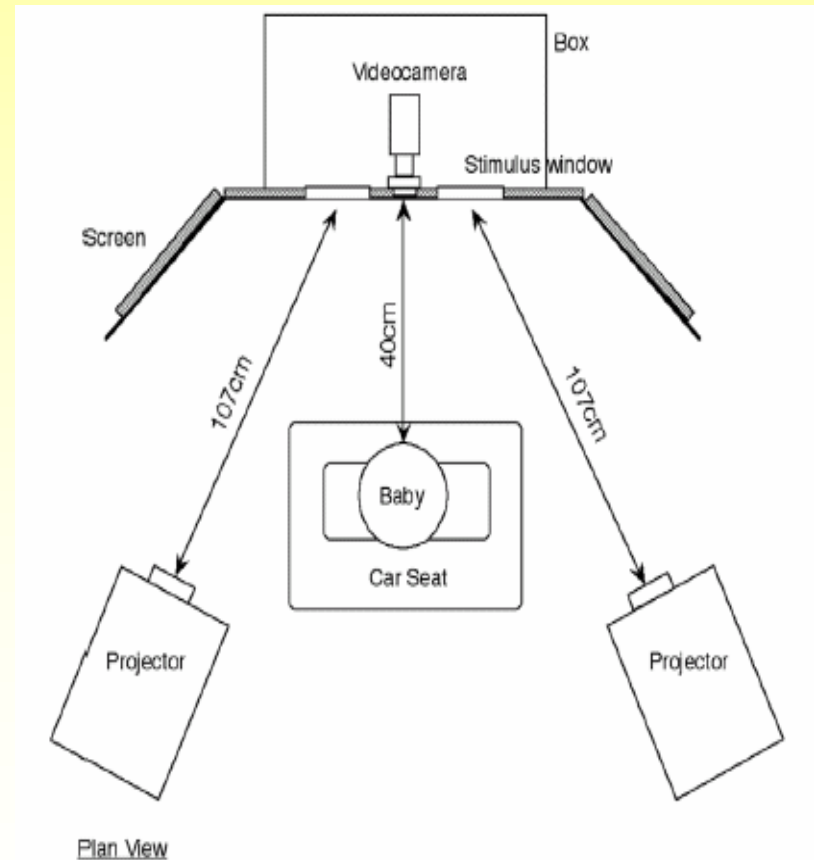
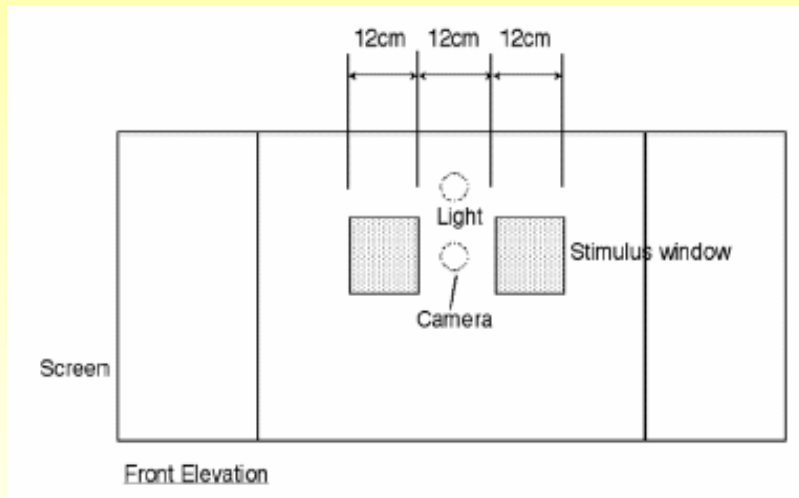
- If linguistic categories are determined by universal perceptual categories, why should they vary so?
- Primary category boundaries (red, green, yellow and blue) are hardwired, but secondary categories (brown, orange, pink and purple) are not.



# Material of the Franklin/Davies study

- Two boundaries were investigated only: blue-green, and blue-purple
- Munsell stimuli equated in value (lightness)
  - Remember: the Munsell color order system is standardized so that stimuli separated by the same number of hue steps have the same perceptual distance throughout the color space.
- Four experimental pairs for each case (boundary): category (within/between) and distance (near/far).
  - Near pairs were separated by two steps of Munsell hue, far pairs by three steps.

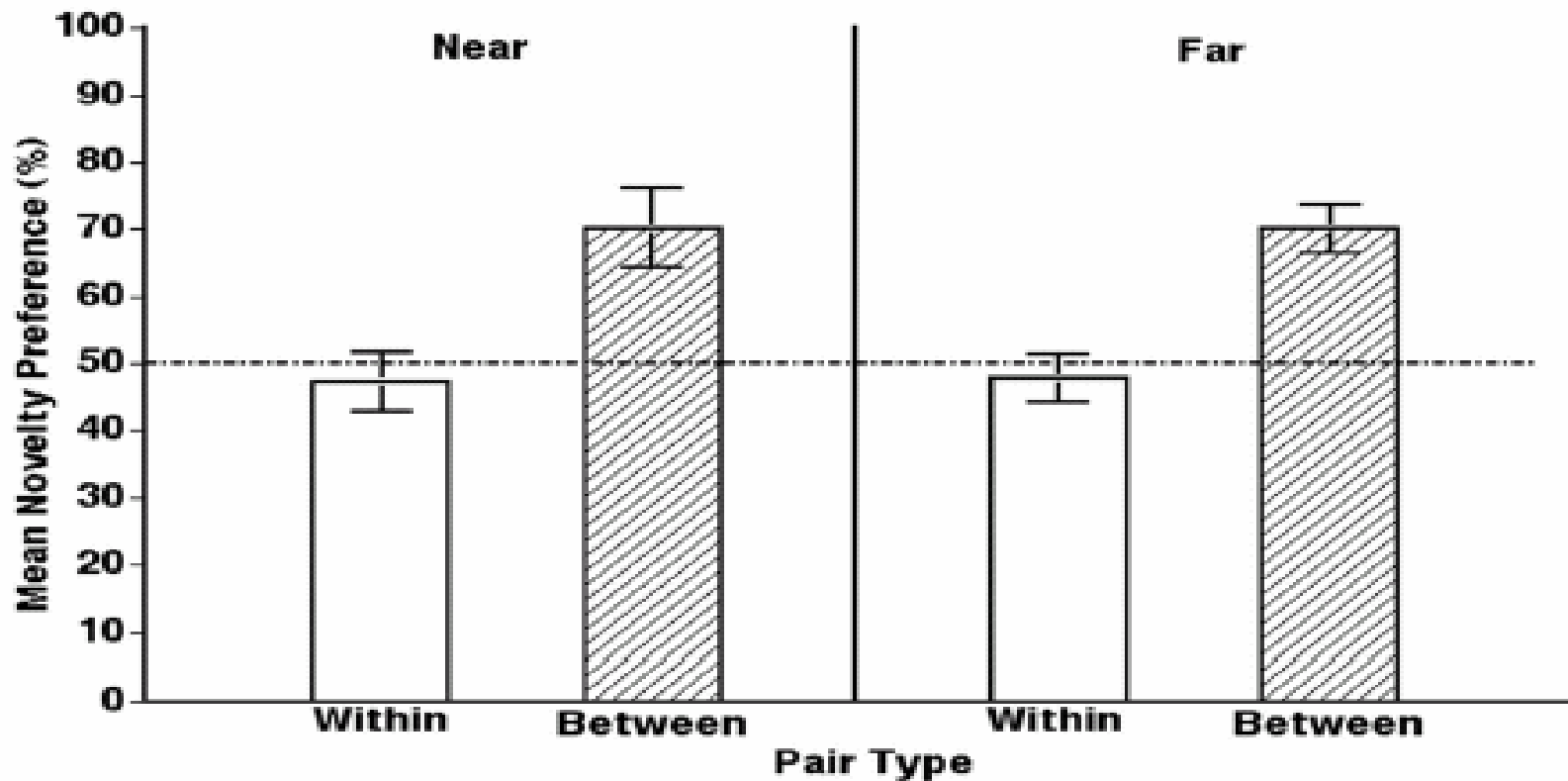
# Experimental set up



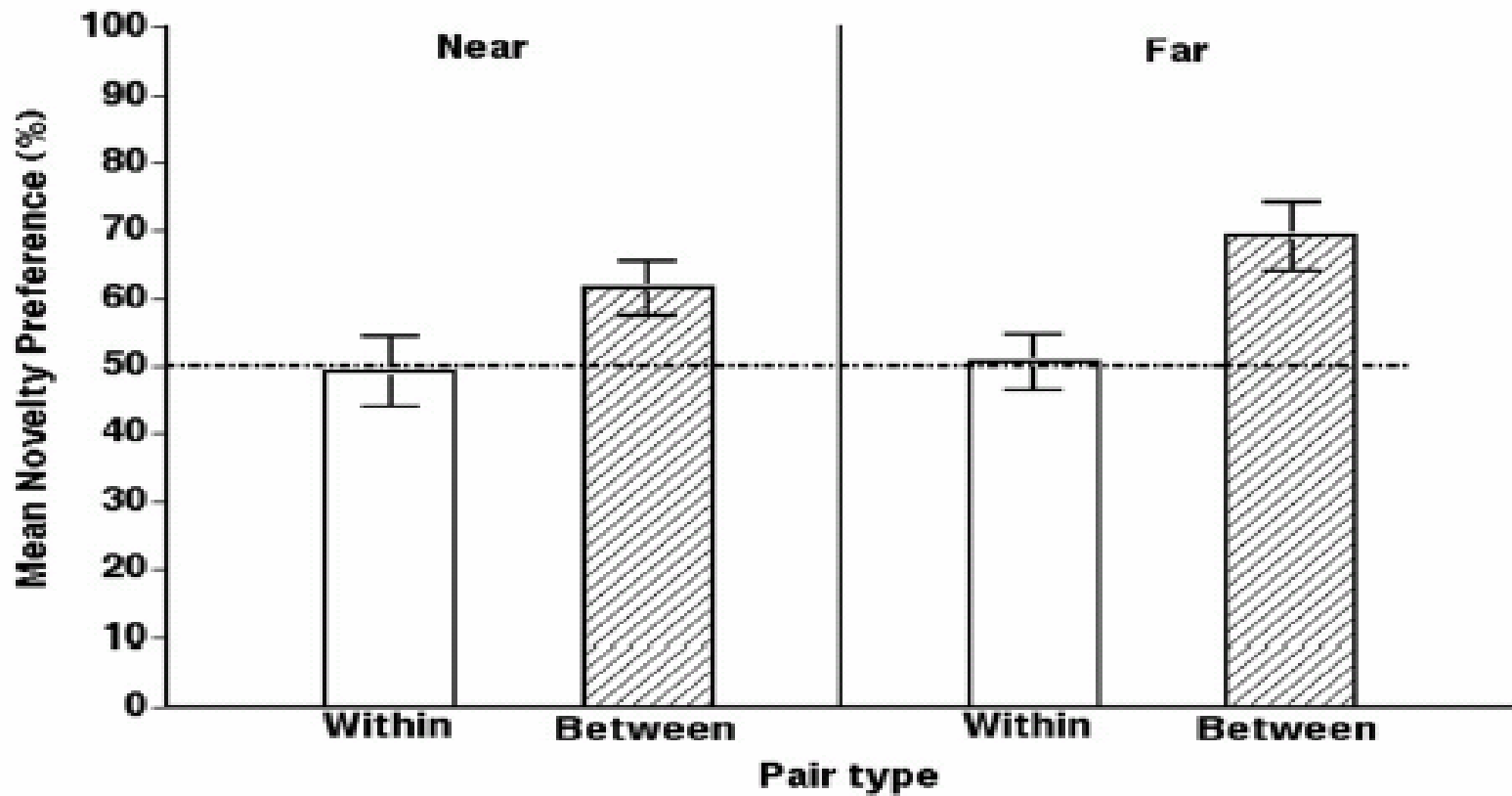
# Infant procedure

- 36 infants were in the final sample
- Mean age: 17 weeks (range: 16 – 20 weeks).
- 21 infants were female and 15 were male.
- Familiarization phase: one stimulus from a pair (familiarized stimulus) was presented in both stimulus windows for 8 seconds
- Test phase: the remaining, novel stimulus from the pair was presented alongside the familiarized stimulus for 8 seconds
- Novelty preference =  $(\text{novel fixation} / (\text{novel fixation} + \text{familiar fixation})) * 100$ .
  - A score of above 50% indicates a novelty preference.

# Results for the *blue-green set*



# Results for the *blue-purple* set



# Results

- The results are consistent with Bornstein et al.'s, and show that pre-linguistic infants can detect the categorical difference among color stimuli by four-months of age.
- Infant categorical perception occurs for stimulus separations equated in a perceptually uniform metric.
- The size of the novelty preference effect did not differ between the two stimulus sets (blue-green and blue-purple).
- Nor did the perceptual distance among pairs (near or far) have any effect.

# Conclusions

- The data offer no support to the conjecture that primary categories are hardwired whereas secondary categories are learned.
- Both boundaries appear to elicit categorical perception, and the strength of these effects did not differ between boundaries.
- If the blue-purple boundary is as strongly hardwired as the blue-green boundary, this cannot explain the greater pre-valence of languages marking the latter distinction than the former. Perhaps this suggests that the influence of percept-ual categories on linguistic categories may be relatively weak (contrary to what Berlin & Kay assert).

# References

- Bornstein, M.H., Kessen, W. & Weisskopf, S. (1976). Color vision and hue categorization in young infants. *Journal of Experimental Psychology: Human Perception and Performance*, 1, 115-129.
- Franklin, A. & Davis, I. (2002): New evidence for infant color categories. Manuscript University of Surrey.
- Harnad, S. (1987). Psychophysical and cognitive aspects of categorical perception: A critical overview. In S. Harnad (Ed.), *Categorical Perception: The groundwork of cognition* ( 535-565), New York: Cambridge University Press.