

*Infant Color Categories and
Categorical Perception*

Reinhard Blutner

UvA

Outline

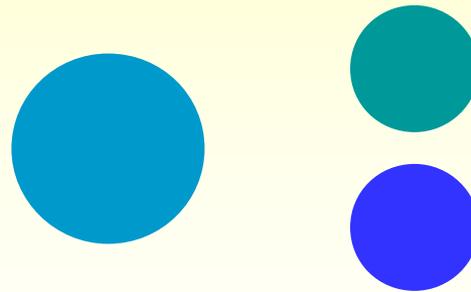
- Categorical perception
- Bornstein, Kessen & Weisskopf study
- The Franklin/Davies study
- Universalist and relativist positions
- Conclusions

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. blue₁) four-month old infants looked longer at a test color from a different adult category (green) than one from the same category (blue₂) even though the differences in wavelength of the test stimuli from the standard were equal.

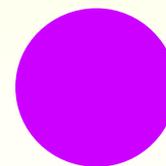
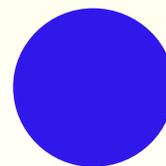


- Their results suggest that pre-linguistic infants have perceptual color categories, and show categorical perception by at least four-months of age.

Habituated stimulus		Test stimulus		Distance		Looking time
λ nm	category	λ nm	category	λ	(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.

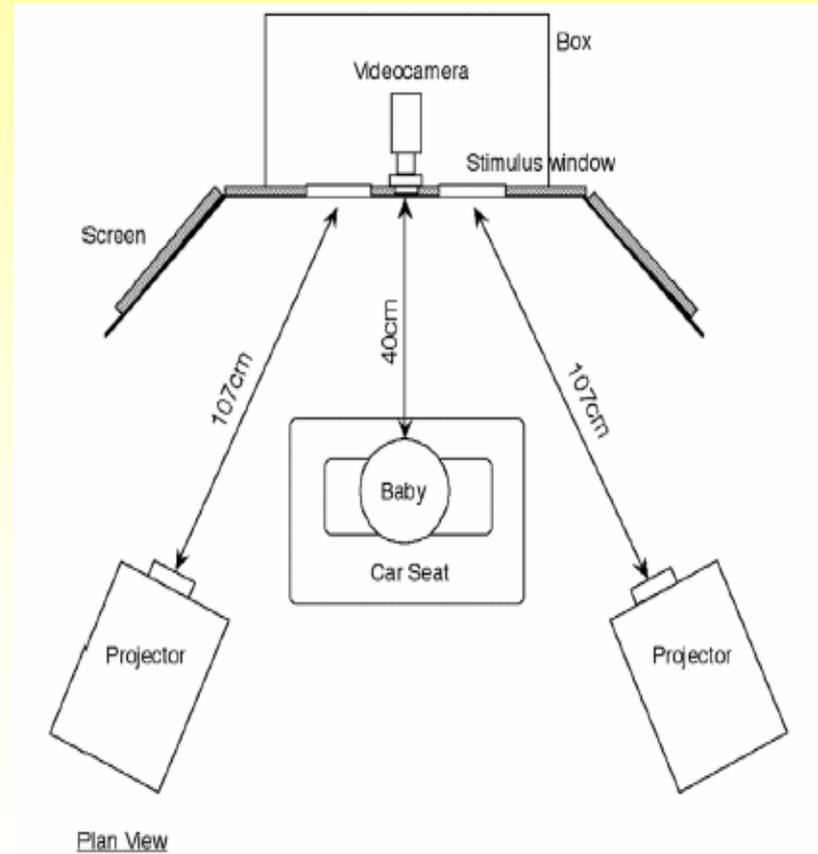
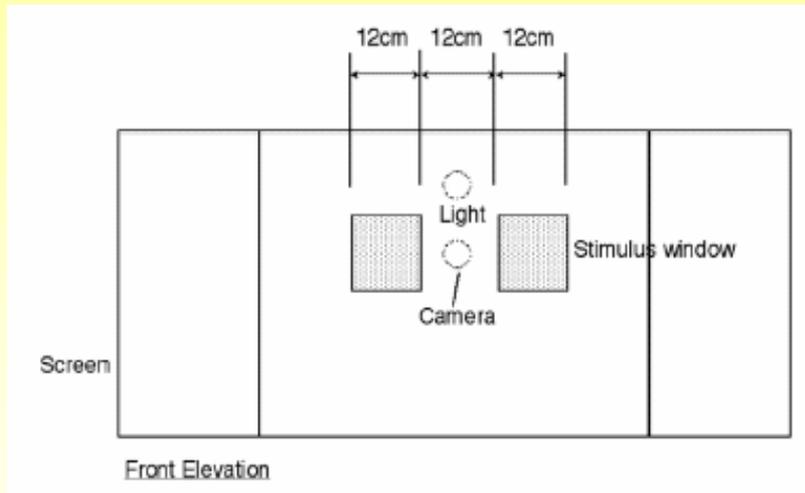
Hypothesis

- 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.

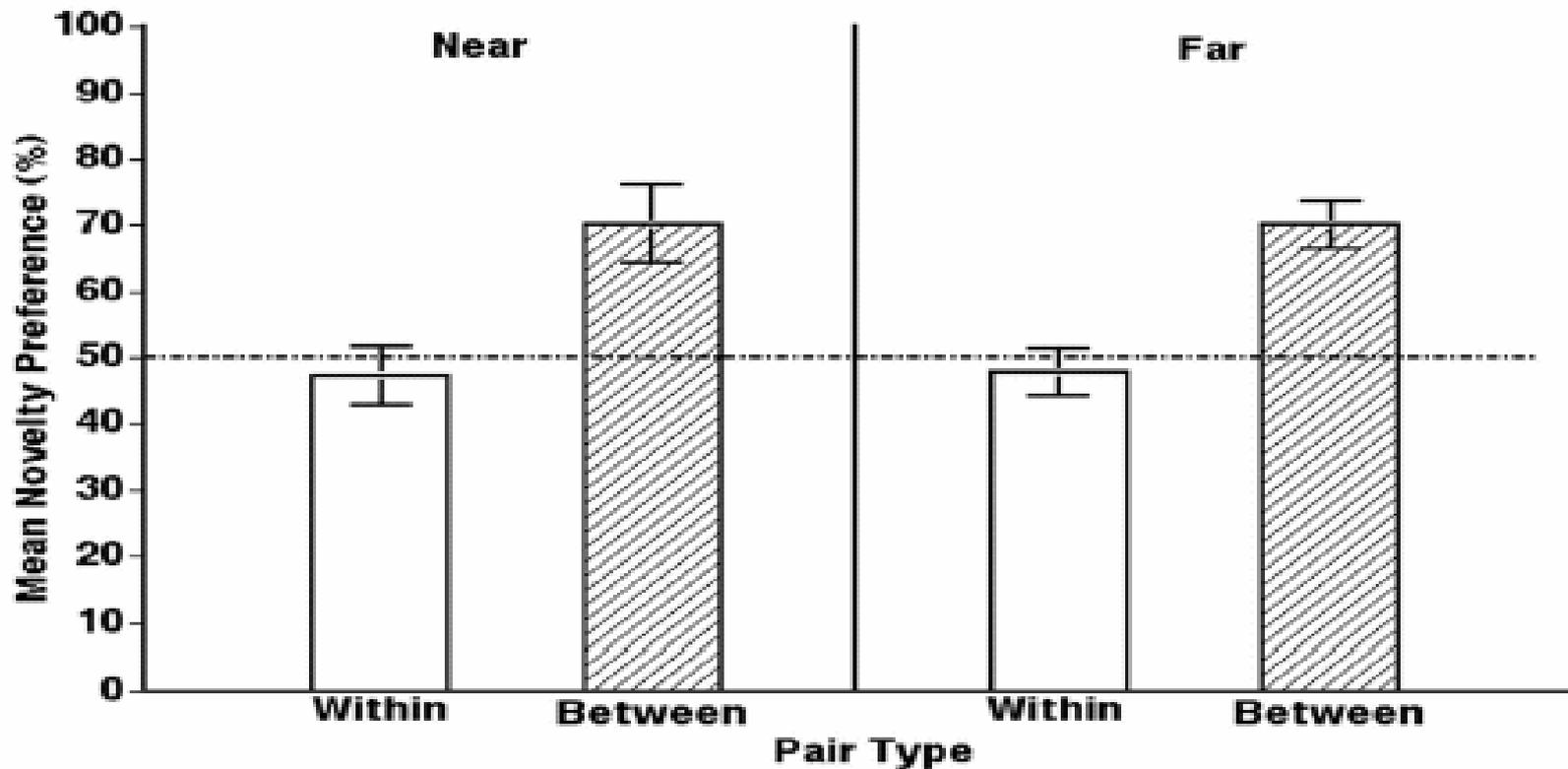
Experimental set up



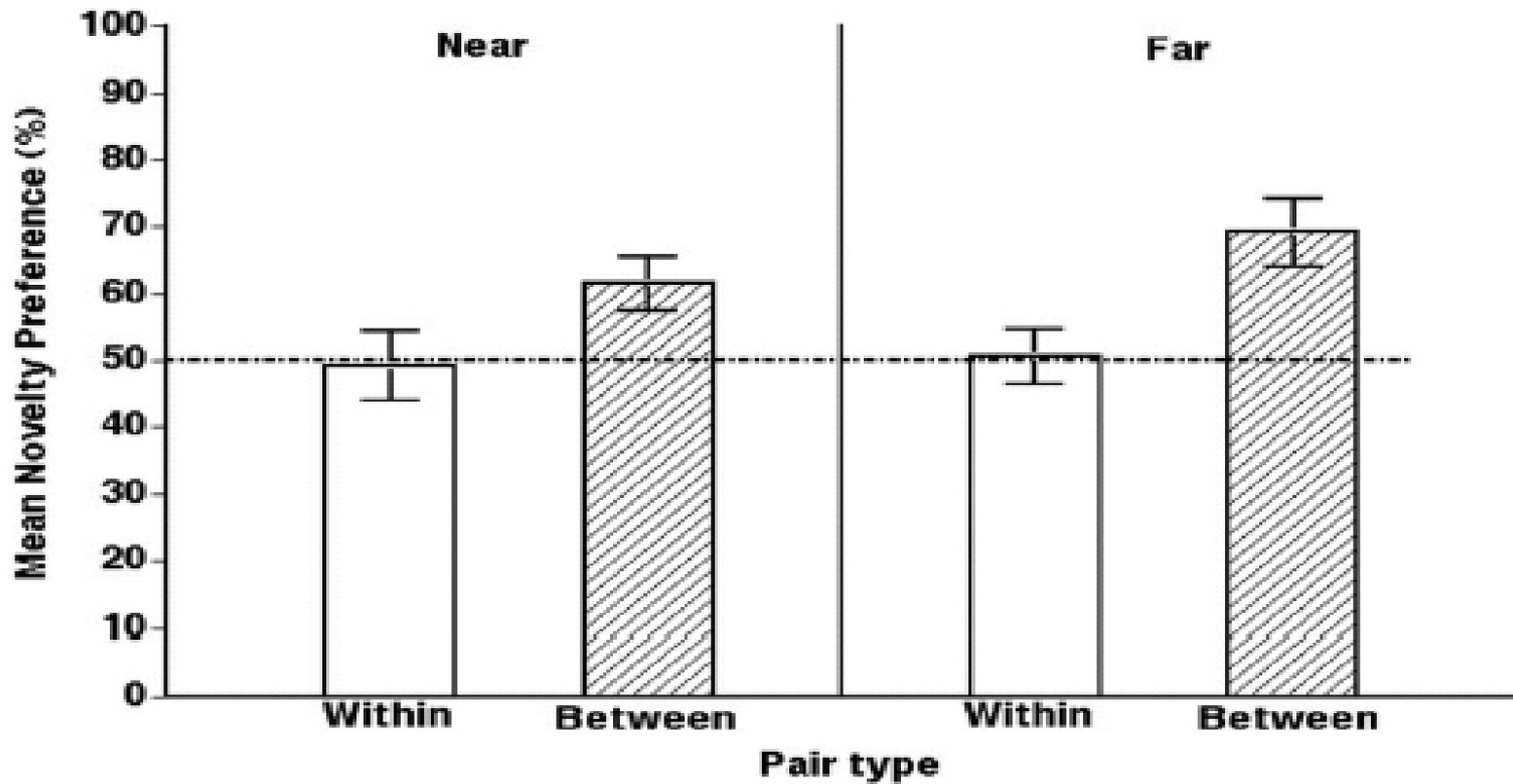
Infant procedure

- 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.