

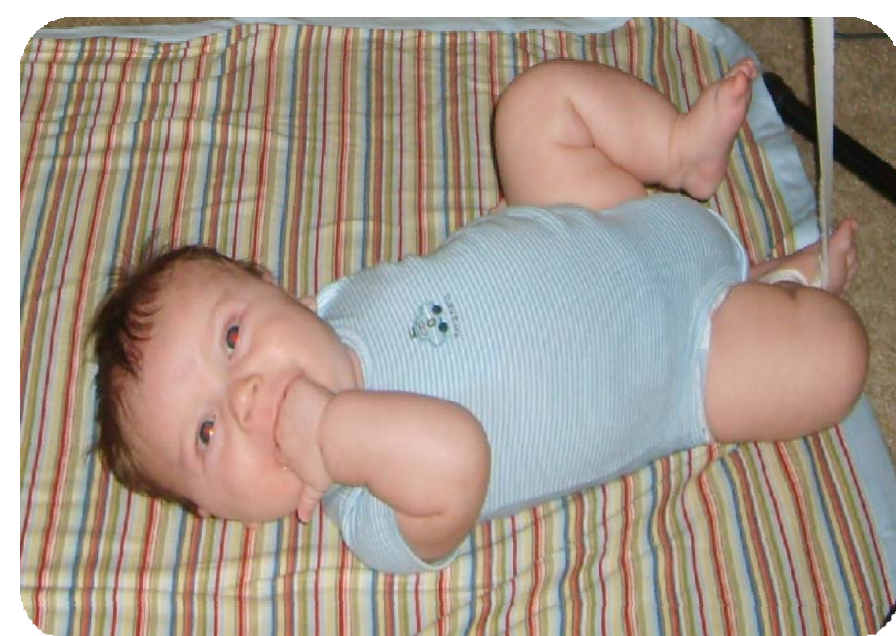
# Examining the Role of Amodal Cues (shape, size) and Their Contribution to Facilitated Operant Learning in 3-Month-Old Infants

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## Abstract/Background

The current study examined human infants' ability to utilize cross-modal information in a learning context (specifically, in Rovee-Collier's conjugate learning procedure; Rovee & Rovee, 1969). Studies have shown that human infants can detect equivalences across modalities and that this detection is facilitated by multimodal presentation (Bahrick & Lickliter, 2004). Bahrick and Lickliter (2000) found that 5-month-old infants were able to discriminate between two rhythms when the rhythms were presented in two modalities but not when they were presented in only one modality, suggesting that amodal cues may facilitate learning. The current study examined the influence of amodal dimensions in a more complex learning paradigm, operant learning. Three-month-old infants learned to make an operant response (leg kicks) for reinforcement (movement of a toy mobile). Two amodal stimulus dimensions, size and shape, were manipulated within the context of the learning procedure. That is, infants held an object during acquisition that either matched or mismatched in size and/or shape of the mobile's objects. Preliminary results suggest that when shape and size matched, this amodal congruency facilitated learning of the operant response. When shape matched but size did not, however, facilitated learning was not observed. These results support Bahrick and Lickliter's (2004) Intersensory Redundancy Hypothesis but also suggest limitations to such facilitated learning.

## Participants/Apparatus



Participants were 3-month-old infants ( $M$  age in days = 97.4,  $SE = 2.13$ ). Sample sizes ranged from  $n = 9$  to  $n = 14$ ,  $MSES = 53.93$ ,  $SE = 2.03$ .



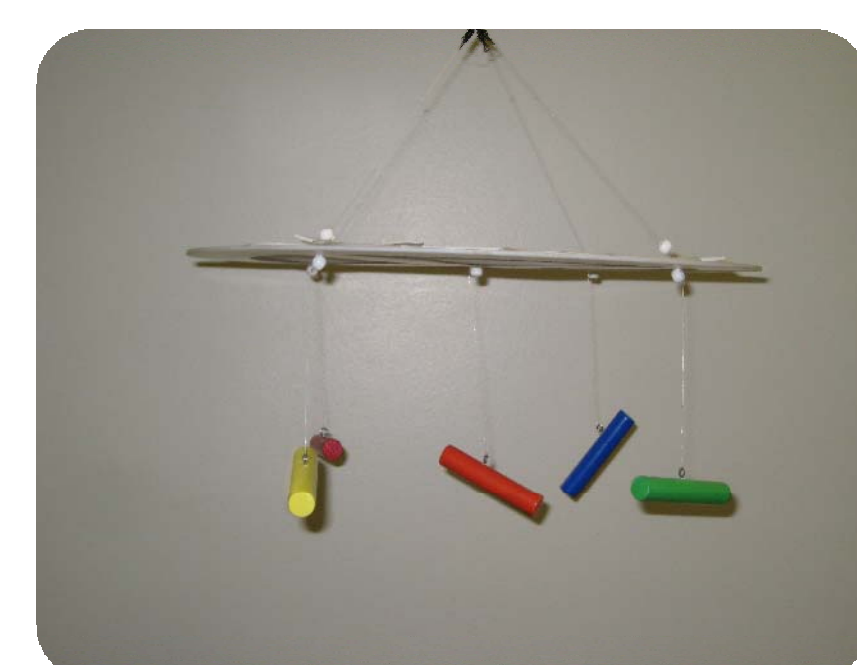
A computerized apparatus, analogous to Rovee-Collier's (1969) mobile procedure, measured kicks and controlled presentation of reinforcement (movement of the mobile).



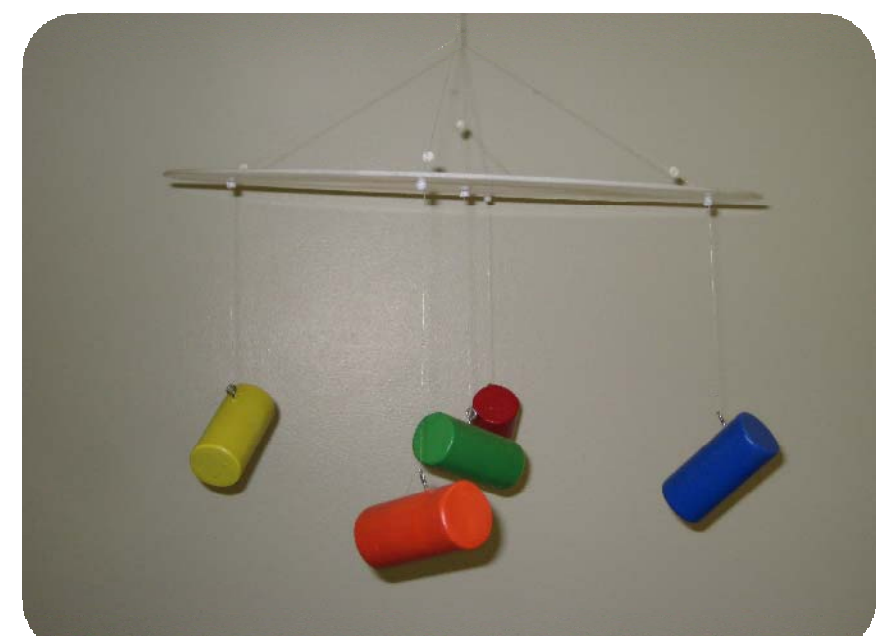
A padded arm shield prevented visual and oral processing of the held object. The shield is 63 cm in length and 19.5 cm in height. The aperture measures 10 x 8 cm.



The objects measure 8 x 1.5 cm. A 1-way ANOVA on  $M$  holding time was not statistically significant,  $F(3,33) = 2.1, p = .11$ . All groups held the objects greater than 90 s – the minimum time required to process shape haptically (Streri, 1993).

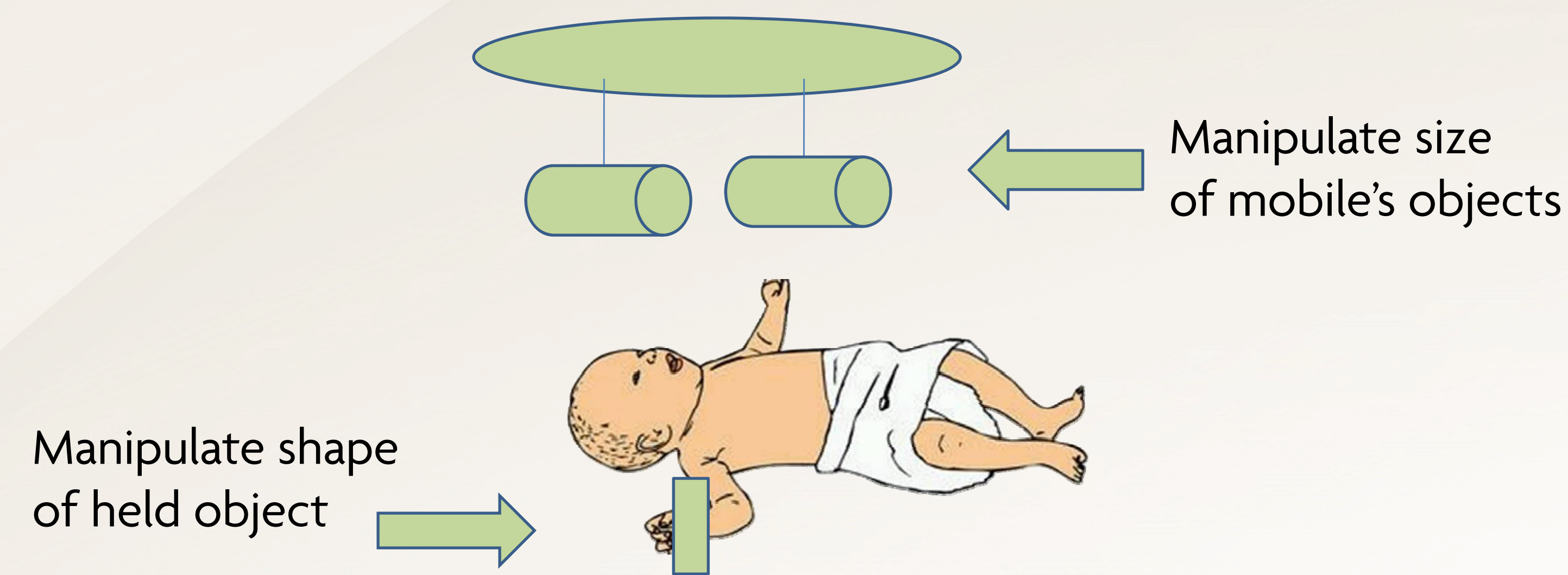


The small mobile. The cylinders measure 8 x 1.5 cm.

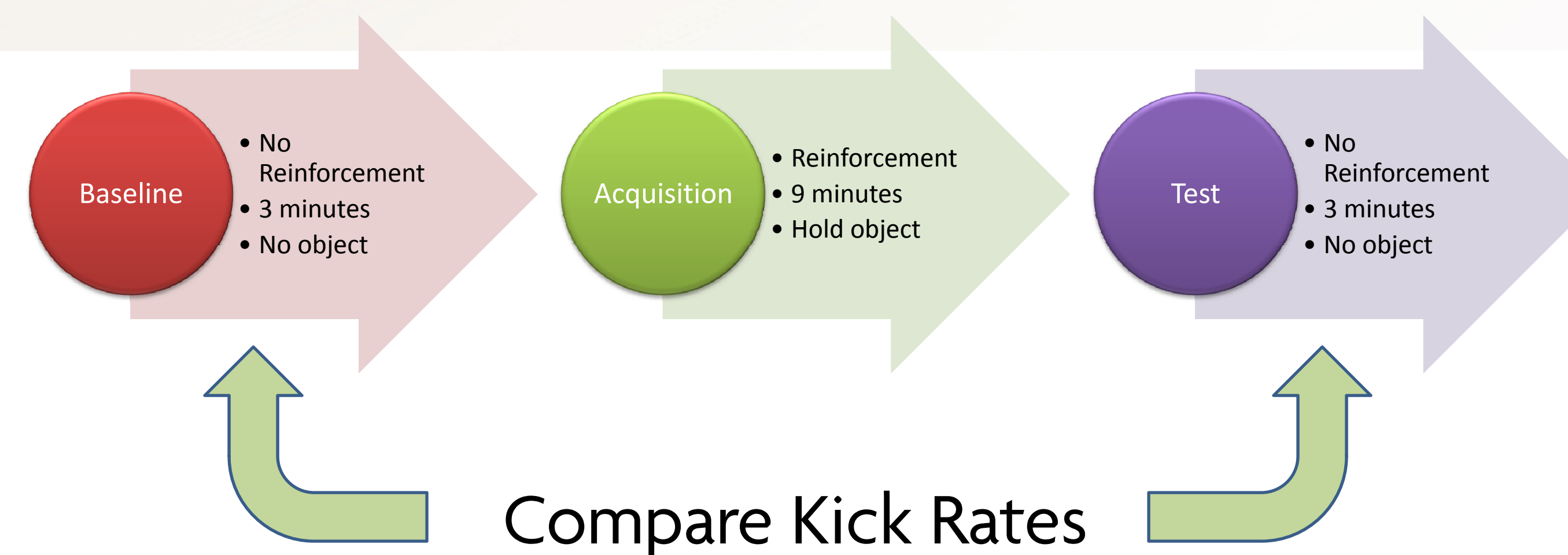


The large mobile. The cylinders measure 8 x 3.5 cm.

## Procedure



## Standard Learning Session



## Design/Predictions

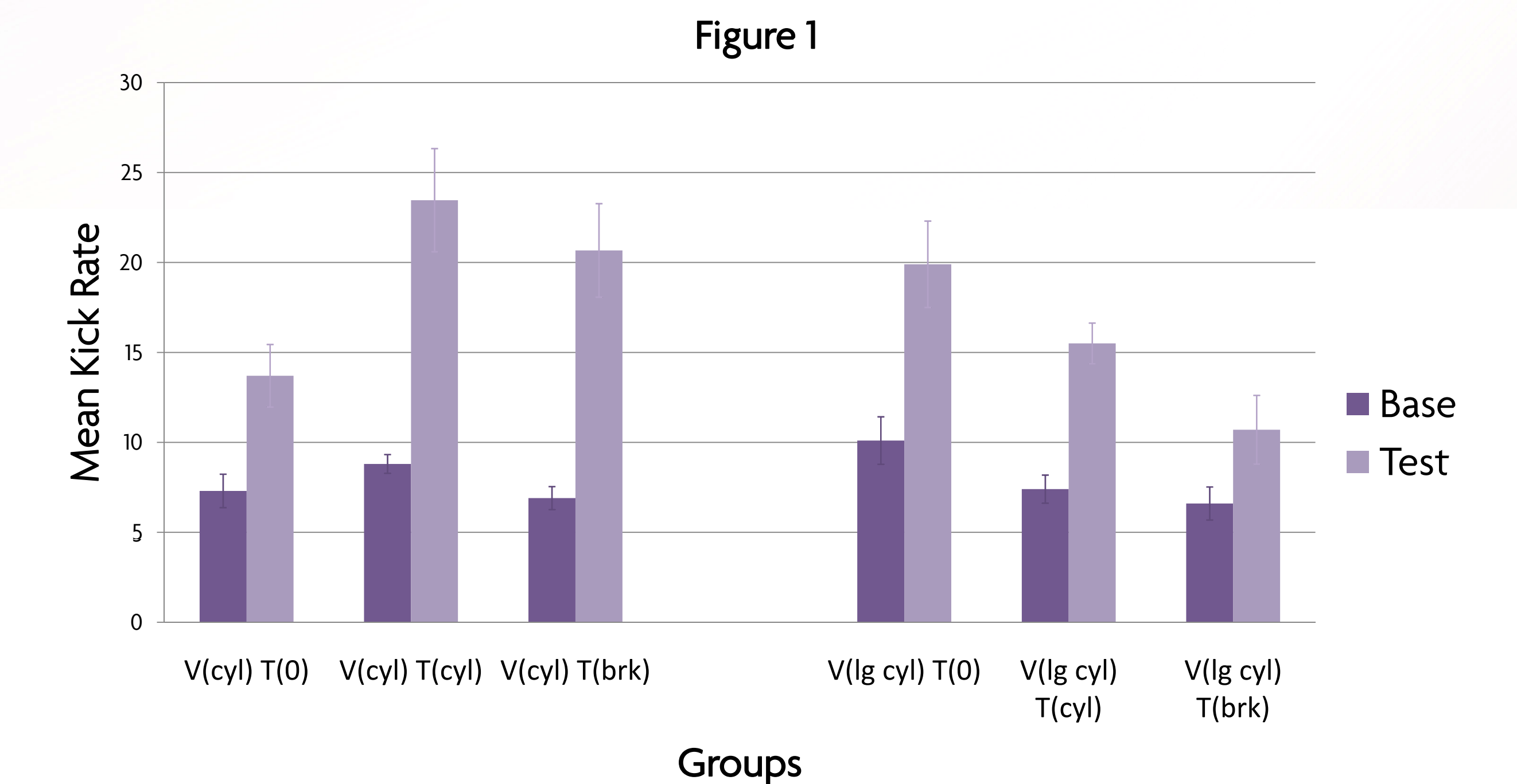
Group	Visual	Tactile	Prediction
V(cyl) T(0)	Sm. Cylinders	None	Ave
V(cyl) T(cyl)	Sm. Cylinders	Sm. Cylinder	Facilitation
V(cyl)T(brk)	Sm. Cylinders	Sm. Brick	Inhibition
V(lg cyl) T(0)	Lg. Cylinders	None	Ave
V(lg cyl) T(cyl)	Lg. Cylinders	Sm. Cylinder	Facilitation
V(lg cyl) T(brk)	Lg. Cylinders	Sm. Brick	Inhibition

## Results

A 6 (Group) x 2 (Phase) ANOVA revealed a significant Group x Phase interaction,  $F(5, 54) = 3.63, p = .006$ . See Figure 1. LSD tests revealed the following:

- No significant differences in baseline kicking among any of the groups.
- All groups, except V(lg cyl) T(brk) ( $p = .07$ ), showed a significant increase in kicking from Baseline to Test.
- Kick rates in V(lg cyl) T(brk) were significantly lower in comparison to all other groups.
- During test, V(lg cyl) T(cyl) did not differ from V(lg cyl) T(0) ( $p = .10$ ) or V(lg cyl) T(brk) ( $p = .07$ ).

One-way ANOVAs showed no significant differences among groups during acquisition or in trials to meet criterion ( $M = 5.7$  trials,  $SE = .34$ ). There were also no significant differences in holding times or number of drops between the two objects.



## Conclusions

- The results of the current study suggest that infants, in an ambiguous situation (unsure of the exact shape of the visual mobile) will show facilitated learning when the size of the held object matches the size of the visual objects.
- This facilitation effect is diminished when size of the held object does not match the size of the visual objects.
- Additional control groups are needed to verify that in an unambiguous situation (clear detection of the shape of the visual objects), facilitation is observed when shape (and size) matches and inhibition occurs when shape does not match (but size does).
- The results suggest that the congruent amodal information need not be directly perceived (the object was not held during test) for the facilitated or inhibited learning to be observed.
- The current results are in agreement with Bahrick and Lickliter's (2002) Intersensory Redundancy hypothesis, suggesting improved attention to amodal cues in a multimodal context.

