Impact of Toy Characteristics and Posture on Bimanual Object Interactions in Infancy

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INTRODUCTION

Role differentiated bimanual manipulation (RDBM) is a complex skill where each hand plays a specific role (e.g., Babik et al., 2016; Gonzalez et al., 2015; Kimmerle et al., 1995; 2010; Nelson et al., 2013). One-object RDBM occurs when one hand stabilizes an object while one hand manipulates it. The development of RDBM provides insight into how infants learn to coordinate movements.

In prior research, seated infants were given a series of toys (similar size and weight) in a structured task designed to elicit RDBM. This methodology misses how RDBM emerges in naturalistic settings, where other factors (e.g., toy preferences, postures) may impact behavior.

In contrast, we observed RDBM in a free-play setting to investigate how infants incorporate RDBM into their everyday lives when infants can move about freely in their environment.

QUESTIONS OF INTEREST

1. How do infants adapt their posture (sitting or standing) when engaged in RDBM?
2. How do toy characteristics (e.g., size, weight) impact how infants engage in RDBM?

METHODS

Participants:
39 13-month-olds and 39 24-month-olds
Procedures:
Infants played for up to 20-minutes in a playroom with 18 toys of varying sizes and weights (Figure 1).
Measures:
Using Datavyu, trained coders identified instances of one-object RDBM.
For each instance of RDBM, coders recorded the toy characteristics and the child's posture.

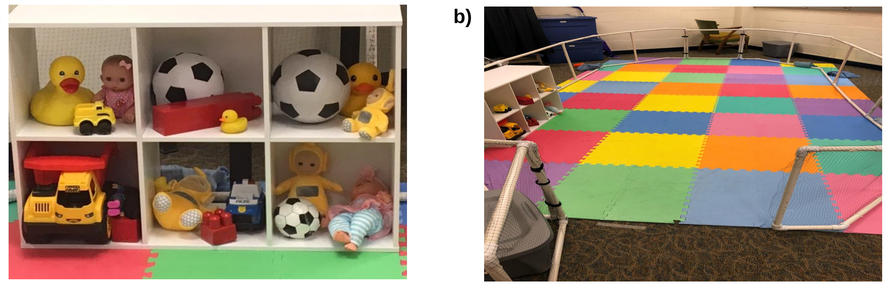

Figure 1a) Examples of the 18 toys available, size (small, medium, large) and weight (light, moderate, heavy) were decoupled, **b)** Picture of the free-play area.

RESULTS

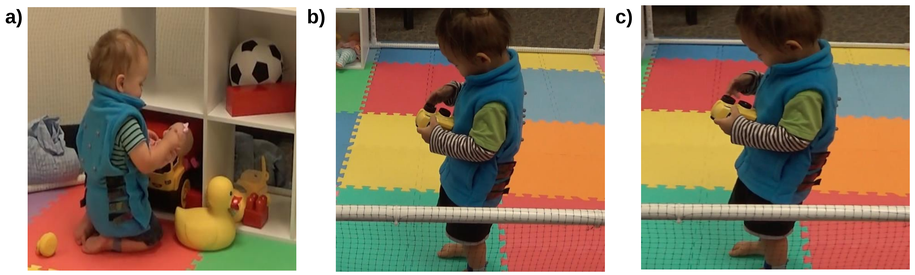

Figure 2a) An example of one-object RDBM in a 13-month-old infant while sitting, **b)-c)** An example of one-object RDBM in a 24-month-old infant while standing.

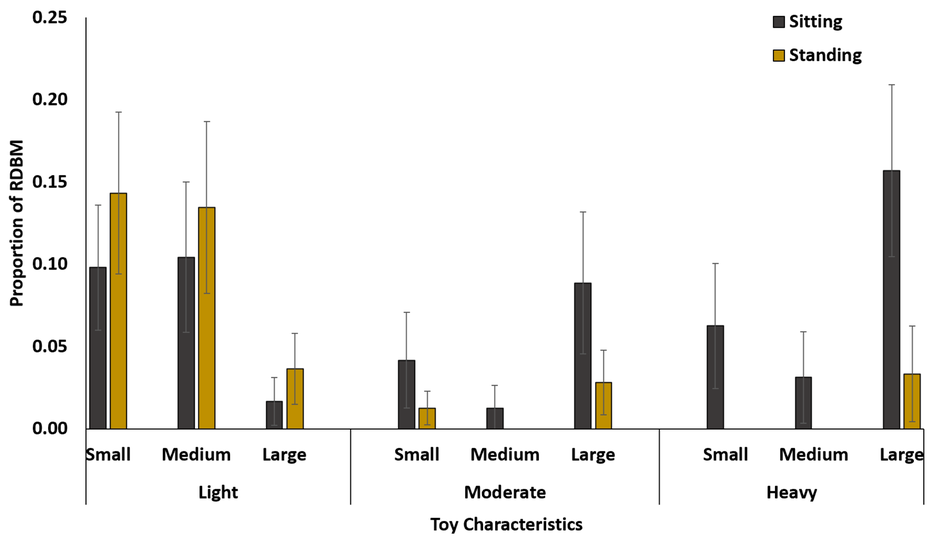

Figure 3. Proportion of RDBM by toy characteristic (±SEs). An Age (2) x Posture (2) x Size (3) x Weight (3) repeated-measures ANOVA with Bonferroni corrections was conducted.

Sixteen 13-month-olds (8 girls, M_{age}=13m, 20d, range=13, 2-13,29) and twenty 24-month-olds (9 girls, M_{age}=23m, 15d, range=23,0-24,29) performed one-object RDBM (Figure 2a,b,c).
There were no age differences. There was a significant Posture x Weight interaction ($F(2,68)$= 3.99, p=0.02). While standing, RDBM occurred more frequently with light toys (p=0.004), but while sitting, RDBM occurred more frequently with heavy toys (p=0.004).
There was a significant Size x Weight interaction ($F(2.96,101.40)$=5.16, p=0.002, with Greenhouse -Geiser correction). Regardless of posture, for toy weight, compared to light large toys, RDBM occurred more frequently with light small toys (p= 0.02) and with light medium toys (p=0.04). For the size comparisons, medium light toys were used more than medium moderate (p=0.004) and medium heavy toys (p=0.016).

DISCUSSION

Specific toy properties (size/weight) impacted the frequency that infants engaged in RDBM when in sitting or standing postures.
Weight was a key factor. Infants choose light over heavy toys while standing, possibly because they were easier to integrate with this more challenging posture.
Our results highlight the importance of exploring infant behaviors in a free-play setting to observe how variations in posture and toy properties impact manual behaviors.

REFERENCES

Babik et al. 2016. *Developmental Psychobiology, 58(2)*, 243-256.
Kimmerle et al. 1995. *Infant Behavior and Development, 18(3)*, 299-307.
Kimmerle et al. 2010. *Developmental Psychobiology 52(2),* 168-180.
Gonzalez et al. 2015. *Frontiers in Psychology* 6, 560.
Nelson et al. 2013. *Infant Behavior and Development,* 36(2), 181-188.

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