

Does Direction or Consistency of Hand Preference Predict Toddler Stacking Ability?



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Introduction

- ❖ Michel's (1983) Modified Progressive Theory of Handedness suggests that a hand preference results from a history of cascading manual asymmetries for a variety of actions throughout infancy. An infant who consistently uses one hand across multiple action types could gain proficiency using their preferred hand and perform more expertly on challenging manual tasks.
- ❖ However, it is unclear whether a consistent hand preference or the direction of handedness will affect manual skills. This project will test if handedness consistency or direction is related to performance on a challenging manual task: stacking ability.

Prediction 1: Toddlers with a consistent hand preference will be able to stack more objects and increase their stacking ability at a faster rate than toddlers with no consistent hand preference.

Prediction 2: Toddlers with a right or left hand preference will be able to sack more objects and increase their stacking ability at a faster rate, than toddlers with no hand preference.

Methods

Participants

- ❖ 57 participants (25 males)
- ❖ Inclusion criteria: completed all 3 tasks and missing ≤ 3 visits across infancy and toddlerhood

Infant Handedness task (6-14 months; 9 visits) (Michel, Ovrut, & Harkins, 1985)

- ❖ 32 presentations of 20 single toys and 12 double toys.
- ❖ The hand an infant used to pick up a toy was coded from video.

Toddler Handedness task (18-24 months; 7 visits) (Nelson, Campbell, & Michel, 2013)

- ❖ 14 presentations of 7 different toys requiring role-differentiated bimanual manipulation.
- ❖ The acting hand with which a toddler used to manipulate a toy was coded from video.

Toddler Construction Task (18-24 months; 7 visits)

- ❖ 5 toys affording construction: nesting cakes, stacking cakes, 1" blocks, 2" blocks, and wood rings
- ❖ The number of items stacked for each toy was coded and summed for analysis.

Consistency

- ❖ Participants were assigned as having a right, left or no preference for each of the 16 visits.
- ❖ Binomial test – whether participants are significantly consistent in their preference

Table 1. Sample participant data demonstrating how consistency was determined.

Age in Months																Binomial p	Classification	
6	7	8	9	10	11	12	13	14	18	19	20	21	22	23	24			
N	N	L	R	N	N	R	R	R	R	R	R	R	R	R	R	R	0.003	Consistent
N	L	N	L	L	N	R	R	N	R	N	R	N	N	R	R	R	0.189	Inconsistent

Direction (Right, Left, or No preference)

- ❖ One Handedness index (HI) score was achieved by summing all actions across infant and toddler visits.
- ❖ HI: $\frac{\sum(\text{Right hand actions} - \text{Left hand actions})}{\sqrt{\sum(\text{Right hand actions} + \text{Left hand actions})}}$
Right-handed (RH) > 1.96 Left-handed (LH) < -1.96 No preference (NP) -1.96 < x < 1.96

Results

Analytic Plan

- ❖ A multilevel Poisson longitudinal model modeled trajectories of stacking ability
- ❖ Stacking increased quadratically across the 18-24 month ages ($\beta = -0.019$, $p = 0.035$).

Table 2. Group sizes for Direction and Consistency of Handedness

Consistency	Direction			Total
	Left	No	Right	
Consistent	6	3	35	44
Inconsistent	5	3	5	13
Total	11	6	40	57

Direction of handedness (Left-Handed vs. Right-Handed vs. No Preference)

- ❖ Left-handers initially stacked more items ($\beta_0 = -1.06$, $p = 0.01$), increased more quickly ($\beta_1 = 0.49$, $p = 0.01$), and increased at a different rate ($\beta_2 = -0.06$, $p = 0.02$), than right-handers and no preference toddlers.

Consistency of handedness (Consistent vs. Inconsistent)

- ❖ Consistent toddlers initially stacked more items ($\beta_0 = 0.43$, $p = 0.03$) and increased more slowly ($\beta_1 = -0.08$, $p = 0.01$) than inconsistent toddlers; however toddlers did not differ in their quadratic slopes ($\beta_2 = -0.03$, $p = 0.17$).

Figure 1: Handedness Consistency for Stacking Ability.

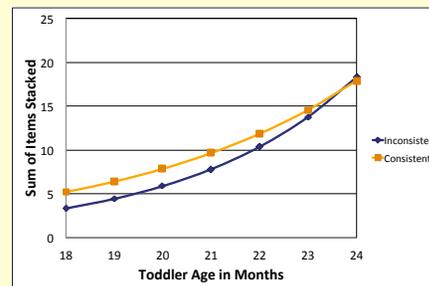
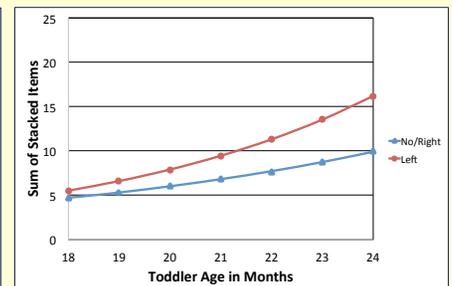


Figure 2: Handedness Direction for Stacking Ability.



Discussion

- ❖ Consistent toddlers initially stacked more items than inconsistent toddlers, suggesting that a consistent preference afford great stacking ability initially. However, both groups increase stacking ability in similar ways.
- ❖ However, the findings for direction were non-intuitive. Left-handers stacked more items initially than right and no preference toddlers, which does suggest that direction of handedness matters.
- ❖ Future study should focus on increasing group sizes to clarify how handedness might affect the development of other manual skills.

References

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