

Methodological Issues in Assessing Infant Handedness

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Introduction

Handedness is usually defined as a preference to use one hand more than the other, or an ability of one hand to perform faster or more skillfully certain manual tasks that are not likely to have been practiced.

Researchers may use different techniques to describe infant handedness. For example, Corbetta used the initial reach for objects (Corbetta & Thelen, 1996); Michel used object acquisition (Ferre, Babik, & Michel, 2010), while Fagard used object apprehension (picking up a toy) (Fagard & Lockman, 2005).

In addition, Michel used only right- and left-hand actions (Ferre, Babik, & Michel, 2010), while Corbetta and Fagard incorporated also bimanual ones (Corbetta & Bojczyk, 2002; Fagard & Lockman, 2005).

Because the presence of infant handedness is controversial, it is important to determine how different the results might be for the same infants using these different techniques for identifying a hand-use preference.

Method

Participants:

- 171 infants (98 males, 73 females)

Apparatus:

- 34 common infant toys

Procedure:

- Validated and reliable handedness assessment (Michel, Ovrut, & Harkins, 1986). The hand used for three actions (initial reach and contact with a toy, initial acquisition, and pick-up) were coded separately.
- Contact was coded when the infant's hand/hands first touched a toy. Acquisition was coded when the infant's hands closed around the edge of a toy. Pick-up (apprehension) was coded when a toy was completely separated from a table.
- Handedness Index – the ratio of number of right-hand actions divided by the sum of right- and left-hand acquisitions ($R/(R+L)$).
- 95% confidence interval (CI) on the proportion of right-hand actions across 9 visits.
- If this confidence interval for a particular infant crossed the 0.5 baseline of no preference, the subject was assigned to the "no preference" group; completely above 0.5 – the subject was assigned to the "right-hand preference" group; completely below 0.5 – "left-hand preference" group.

Contacts, Acquisitions, and Pick-ups

Figure 1. Observed Average Trajectories of Handedness for Contacts, Acquisitions, and Pick-ups

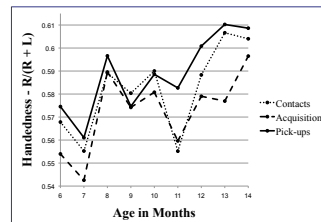


Figure 3. Distributions of Handedness Groups for Contacts, Acquisitions, and Pick-ups

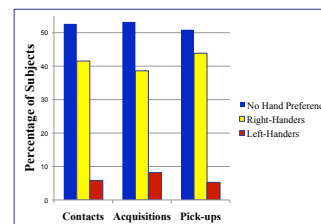


Figure 2. Estimated Average Trajectories of Handedness for Contacts, Acquisitions, and Pick-ups

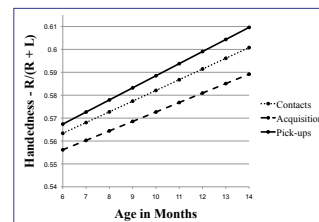


Table 1. Correlations Between Handedness Measures Estimated Using Contacts, Acquisitions, and Pick-ups

	Handedness		
	Contacts	Acquisitions	Pick-ups
Contacts	1.00		
Acquisitions	0.86**	1.00	
Pick-ups	0.69**	0.77**	1.00

** $p < 0.01$

Results

The observed trajectories of handedness for contacts, acquisitions and apprehensions (pick-ups) differ significantly, particularly beginning at age 11 months (Figure 1). Infants do more toy acquisitions with their left hands, but more pick-ups with their right hands (Figure 2).

The choice of coded action shifts the handedness distribution (Figure 3). Contact handedness is distributed as 41.5% right-handed, 52.6% no preference, and 5.9% left-handed infants. For acquisition, these proportions are 38.6%, 53.2%, and 8.2%, respectively. For apprehension (pick-up), handedness is distributed as 43.9%, 50.9%, and 5.3%. About 70% of infants had the same handedness status for all three measures. However, 83% showed concordance between contacts and acquisitions, 75% - concordance between contacts and pick-ups, and 81% - concordance between acquisitions and pick-ups. Contacts, acquisitions, and apprehensions represent a highly probable sequence of actions in the infants manual engagement with toys.

Examination of Table 1 reveals highly significant correlations between handedness estimated with different measures.

Figure 4 illustrates the trajectory of handedness estimated with the inclusion of bimanual movements. Notice that the trajectory has a cubic shape, while the trajectory of handedness estimated without bimanual movements has a linear shape.

When bimanual actions were included in the estimated handedness index (Figure 5), trajectories of all 3 handedness groups are located predominantly below the 0.5 midline. As a result, the 95% CI for 5.3% of infants was greater than 0.5; the CI overlapped 0.5 for 49.7% of infants, and the CI was less than 0.5 for 45% of infants. Thus, using the confidence interval (a reasonable method for reliably estimating the infant's handedness status) to determine the handedness is influenced greatly by including bimanual actions.

Handedness with Bimanual Movements

Figure 4. Handedness Estimated Including Bimanual Reaching

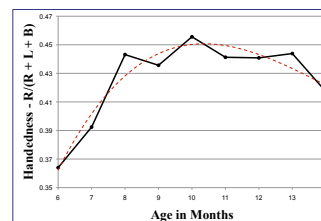
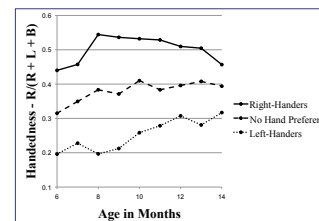


Figure 5. Handedness with Bimanual Movements in 3 Hand-use Groups



Discussion

The current analysis demonstrated that the trajectory of handedness, as well as handedness distribution in a sample highly depends on the measure of handedness that is used by a researcher. The highest correlation was found between handedness estimated with contacts and acquisitions. Interestingly, contacts seem to provide more balanced picture, whereas acquisitions shift the handedness distribution towards left-handedness and no hand-use preference, and pick-ups shift the distribution towards right-handedness.

Moreover, the inclusion of bimanual movements in the estimation of handedness brings the problem of choosing a normative baseline for categorizing infants into handedness groups. Thus, bimanual movements can inform a researcher about the degree of symmetry in the infant's motor system, but they dilute the capability of identifying a lateralized preference.