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AUTHOR Bonvillian, John D.; And Others
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ABSTRACT

This study examined young children's hand usage when they produced American Sign Language signs and while they played, in order to determine their hand preference in early signing and to compare their hand use in signing with their hand preference in other, nonlinguistic, motor actions. Subjects were 24 young children (from the age of 12 months or younger to the age of 18 months or older) of deaf parents, living in homes in which sign language was the principal means of communication. Of those signs made with one hand or with a clearly dominant signing hand, 83 percent of the signs were right-handed and 17 percent were left-handed. The evidence for a distinct hand preference in nonsign gestures and motor actions was not as clear as it was for sign production. Of the motor actions made with a single hand, 60 percent were right-handed and 40 percent were left-handed. In a later questionnaire survey of 23 of the 24 sets of deaf parents, parents revealed that 20 of the children indicated a mature right-hand preference for nonsign actions, while 19 showed a right-hand preference in their signing. The children were slightly accelerated in their manual mode acquisition of several early language milestones. Findings indicate an earlier onset of a distinct hand preference than has been previously reported. (Contains 12 references.) (JDD)

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# Hand Preference in Young Children's Early Signing

John D. Bonvillian, Herbert C Richards, and Tracy T. Dooley

with Samantha Kinzler, Laura E. Mayer, Ashley E. Maynard,

Mazen I. Saah, and Georgina R. Slavoff

University of Virginia

Address for Correspondence;

John D. Bonvillian
Department of Psychology
Gilmer Hall
University of Virginia
Charlottesville, VA 22903-2477
E-mail: jdb5b@virginia.edu
Tel.: 804-924-0646



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## Introduction

Hand preference is viewed by most researchers as a manifestation of cerebral hemispheric asymmetry, with hemispheric dominance for language closely related to hand preference. Right-handers are predominantly left hemisphere dominant for language, whereas left-handers exhibit a range of dominance patters. This cerebral lateralization of language has been interpreted by Kimura (1973, 1976) as an evolutionary outgrowth of early humans' sequential motor actions or manipulative activities. According to this view, human handedness emerged first in the form of a dominant hand and the use of a gestural language; spoken language emerged much later and was based on this manual or gestural framework.

Investigations of the onset of handedness in young children typically have reported small asymmetries in hand preference during infancy. Infants, moreover, often change which hand they use more frequently as well as alternating their preference for unimanual or bimanual actions. For those individuals who become right-handed, Gesell and Ames (1947) reported that the right hand usually dominates at 52-56 weeks, only to be followed by a period of considerable use of both hands; not until about 4 years of age does right hand dominance become permanently established. Some of these changes in early hand preference have been tied to the child's mastery of new language milestones. Hand preference has been shown to vary or become unstable when infants start emitting duplicated syllables at 5-7 months, first words at 12-14 months, and first word combinations at around 20 months (Gesell & Ames, 1947; Ramsay, 1984, 1985). One

explanation for this phenomenon has been that verbal activity can either facilitate or inhibit manual activity (Kinsbourne & Hiscock, 1983).

Studies of the interrelationships between language acquisition and human handedness in the past have focused on children's spoken language development. In the present investigation, however, we examined young children's hand usage when they produced American Sign Language (ASL) signs and while they played. (ASL is the predominant means of communication among most prelingually deaf persons in the United States.) This procedure enabled us to determine the children's hand preference in their early signing and to compare their hand use in signing with their hand preference in other, nonlinguistic, motor actions.

## Method

The subjects were 24 young children (9 boys, 15 girls) of deaf parents who participated in one of two studies of sign language acquisition (Bonvillian, Orlansky, Novack, & Folven, 1973; Folven & Bonvillian, 1991). Two of the children were reported as congenitally deaf and a third child lost his hearing during the course of the study. For 19 of the children, both their parents were deaf; the remaining 5 children had one deaf and one hearing parent. In all the families, the parents reported that a sign language, typically ASL, was the principal means of communication within their home. The children and their parents were visited in their homes about once every 4 to 6 weeks for periods ranging from several months to over 2 years. For most of the children, these regular home visits commenced prior to their first birthday. During each visit, the experimenters made written and videotape records of the children's motor skills and

expressive sign vocabularies. The children also were videotaped playing with a wide range of toys. At least several years after the last home visit, the parents were asked to complete a questionnaire on their child's eventual hand preference.

The children's signs on the videotapes were coded as made either by the right hand (RH), left hand (LH), or both (B). Signs were classified as RH if they were made with the right hand alone or if the right hand was the active or dominant hand and the left hand the base in two-handed asymmetrical signs. Signs were classified as LH if they were made with the left hand alone or if the left hand was the active or dominant hand and the right hand the base. Signs were classified as B if they were two-handed symmetrical signs (i.e., signs with the same handshape, movement, and location for each hand). In addition to the signing records, a brief segment (typically 2 1/2 minutes) of object play from each monthly videotape session was coded for each child. Each segment was coded for object actions (e.g., throws, rolls), self-touching movements (e.g., sucks thumb/finger, rubs self), nonsign communicative gestures (e.g., shows, gives), and noncommunicative gestures (e.g., pointing for self). Percentage agreement across independent coders for classification of the children's signs and actions consistently exceeded 85 percent.

## Results

An overall preference for the right hand in the young children's sign formation was evident throughout the study (see Figure 1). Altogether, the subjects on videotape produced 1406 signs with their right hand as the sole or dominant hand, 290 signs with their left hand, and 451 signs with both hands performing symmetrical actions.

Comparing only those signs made with one hand or made with a clearly active or dominant signing hand, 83% of the children's signs were right-handed and 17% were left-handed. The evidence for a distinct hand preference in nonsign gestures and motor actions was not nearly as clearcut as it was for the subjects' sign production. For the coded videotape segments over the duration of the project, the children produced 3941 nonsign actions (i.e., object actions, self touches, communicative and noncommunicative gestures). Of these actions, 2360 were made with the right hand, 1581 were made with the left hand, and 626 were made with both hands. Examining only those actions made with a single hand, 60% were right handed and 40% were left handed.

To quantify more precisely the observed patterns of hand usage, we devised a "Hand Preference Index" HPI to measure the degree to which individuals favored one hand or the other. In this index, an HPI score could range from -1.00 (all observed actions with LH) to +1.00 (all actions performed with the RH). HPI scores were computed as follows:

$$HPI = (RH\ sum - LH\ sum)/activity$$

with "activity" level determined by counting all coded instances of RH, LH, and B signs or nonsign actions. For each subject, two HPI scores were computed: one for signing and the other for nonsign actions (see Table 1). HPI means, standard deviations, and t-ratios of differences between sign and nonsigns actions were then calculated for each age level and are shown in Table 2. It can be seen that, at every age level, the children collectively expressed a stronger right-handed preference for signing than nonsigning actions.

Twenty-three of the 24 sets of deaf parents responded to our questionnaire about their children's eventual hand preference. Of these responses, 20 (87%) indicated a mature right-hand preference in the children for a range of nonsign actions (e.g., writing, throwing). This proportion is close to the expected 90% value for the population as a whole (Corballis, 1980, 1991). Nineteen of the children also showed a strong right-hand preference in their mature signing. One parent, however, reported that her daughter signed with her left hand and performed all other actions with her right.

In addition, the young subjects were slightly accelerated in their acquisition of several early language milestones in comparison with young children learning to speak (Nelson, 1973). The parents reported that their children produced their first recognizable signs at a mean age of 8.6 months, attained a 10-sign lexicon at 13.4 months on average, had a mean vocabulary size of 48.2 signs at 18 months, and first combined signs at a mean age of 16.7 months. In contrast with their slightly accelerated language development in the manual mode, the children's acquisition of a range of motor milestones was very close to previously published norms.

## Discussion

The present findings indicate that an earlier onset of a distinct hand preference may occur in children than has been previously reported. Beginning with their initial signs, most of the subjects demonstrated in their signing a clear preference for the use of the hand that subsequently would be identified as their dominant hand. The present findings also are in accord with those of a case study account of a signing deaf child who was followed from age 1 to 3 years (Bellugi, Klima, Lillo-Martin, O'Grady, & Vaid,

1986). This child, like the right-handed subjects in the present investigation, showed an overall right-hand preference for nonlinguistic movements and a much stronger right-hand preference for sign production.

Some of the children's high incidence of right-handed signing might be attributable to the sign training they received from their parents during infancy. The parents occasionally molded their child's right hand into the correct sign handshape and then guided the child's hand through the appropriate sign movement. We do not, however, think that the children's distinct hand preference was primarily the product of their imitation of their parents' signing because the children's perspective of their parents' signing was quite variable, whereas the children's hand preference in their signing was quite stable. Rather, we feel that the distinct right hand preference may reflect cerebral hemispheric specialization for sign language processing at a very early age. Finally, the concordance between right-handed manual activity and signing may facilitate children's early onset of recognizable sign production.

## Conclusions

This study established that there is a very strong, relatively consistent, and early emerging hand preference in young children's signing. This hand preference also was more clearly evident in the children's signing than in their nonsign actions. For most of the children, their preferred hand for signing and for nonsign actions was their right hand. These findings were interpreted as indicating left hemispheric involvement for sign language at a very early age.

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Table 1

Mature Handedness, HPI Scores, Total Signs, Total Actions, and Number of Sessions by Subject

| Subject | Handedness | HPI (Sign) | # Signs | HPI (n-sign) | # Actions | # Sessions |
|---|---|---|---|---|---|---|
| 1 | Left/Right | .11 | 47 | .20 | 182 | 7 |
| 2 | Right | .74 | 58 | .33 | 187 | 9 |
| 3 | Right | .51 | 67 | .15 | 312 | 12 |
| 4 | Right | .49 | 41 | .10 | 251 | 11 |
| 5 | Right | .57 | 141 | .24 | 374 | 12 |
| 6 | Right | .40 | 45 | .01 | 213 | 8 |
| 7 | Left | -.14 | 21 | -.19 | 320 | 12 |
| 8 | Right | .42 | 207 | .09 | 192 | 6 |
| 9 | Right | .71 | 230 | .06 | 192 | 5 |
| 10 | Right | .16 | 67 | -.25 | 127 | 5 |
| 11 | Right | .84 | 25 | .34 | 213 | 7 |
| 12 | Right | .79 | 220 | .38 | 136 | 7 |
| 13 | Left | .80 | 5 | .12 | 164 | 6 |
| 14 | Left | .18 | 62 | .26 | 242 | 10 |
| 15 | Right | .54 | 39 | .55 | 273 | 9 |
| 16 | Right | .50 | 4 | .14 | 7 | 1 |
| 17 | Right | .41 | 206 | -.03 | 317 | 12 |
| 18 | Right | .72 | 244 | .15 | 135 | 6 |
| 19 | Right | .06 | 123 | -.27 | 152 | 6 |
| 20 | N.A. | .64 | 120 | .51 | 124 | 7 |
| 21 | Right | .38 | 52 | .52 | 83 | 4 |
| 22 | Right | .64 | 11 | .25 | 24 | 2 |
| 23 | Right | .50 | 109 | .46 | 297 | 13 |
| 24 | Right | .33 | 3 | .12 | 50 | 4 |

Table 2

Means, Standard Deviations, and t-ratios of HPI Scores as a Function of Signs or Nonsigns for Each Age Group

| Age Range | n | Signs | Nonsigns | Difference | t-ratio |
|---|---|---|---|---|---|
| 12 months or younger | 11 | .57 (.40) | .16 (.12) | .41 | 3.66* |
| 13 to 17 months | 17 | .43 (.27) | .15 (.24) | .28 | 3.27* |
| 18 months or older | 17 | .51 (.26) | .19 (.35) | .32 | 3.64* |
| Total Observations | 24 | .47 (.26) | .18 (.23) | .29 | 6.23* |

* $p < .01$

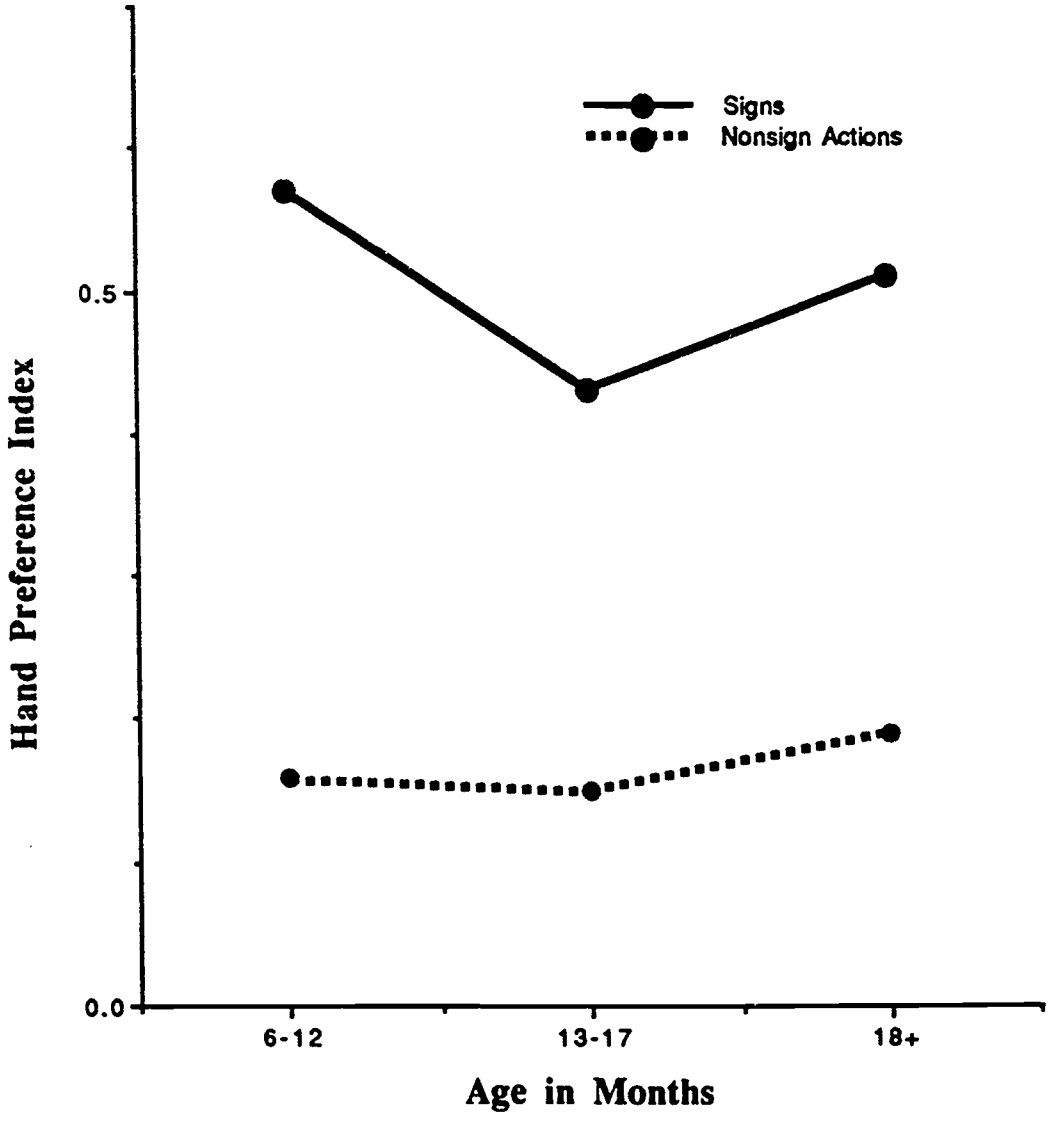


**Figure 1. Hand Preference Index of signs and nonsign actions over age.**