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The Leftward Cradling Bias and Prosody: An Investigation of Cradling Preferences in the Deaf Community

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ABSTRACT. Popular theory on the tendency to cradle an infant to the left side points to the specialization of the right hemisphere for the perception and expression of emotion. J. S. Sieratzki and B. Woll (1996) recently suggested that more emphasis be placed on the auditory modality, specifically focusing on the role of prosodic information. In this study, the direction of the lateral cradling bias in a group of profoundly deaf children, a group of deaf adults, and a control group of adults with no hearing impairment was investigated. The authors found a strong leftward cradling bias in all groups, a bias that was, if anything, stronger in the deaf participants. Given that people who are profoundly deaf, especially those who have been deaf from birth, have not been exposed to auditory prosody, the data do not support the suggestion that such prosodic information is the basis for the leftward cradling bias.

Key words: cradling, deaf, laterality, prosody

ONE OF THE MOST STRIKING aspects of the manner in which women prefer to cradle an infant is the asymmetry of the behavior: Most prefer to cradle to the left side of their body's midline, an effect that has been shown in girls as young as 5 years old, in a variety of cultures, and even in great apes (De Château & Andersson, 1976; Manning & Chamberlain, 1990; Saling & Bonert, 1983; Saling & Cooke, 1984).

There has been a variety of attempts to explain the lateral cradling bias, though it does not appear to be related to the obvious variable of handedness (Bruser, 1981; De Château, Holmberg, & Winberg, 1978; Saling & Tyson, 1981; Salk, 1960). No explanation has produced convincing evidence of the reasons for the phenomenon. The most widely accepted theory (Kaplan-Solms, 1985; Man-

ning & Chamberlain, 1990, 1991) suggests that the leftward bias could be due to the specialization of the right hemisphere for the perception and expression of emotion. Thus, an infant cradled to the left will be preferentially seen by the right hemisphere, which allows the mother to show her more expressive side of face (the left) to the infant. In principle, this idea seems quite plausible.

Several attempts have been made to test the hypothesis that lateral biases in vision are important in determining the lateral cradling preference, with respect to both the visual perception and expression of emotion (Lucas, Turnbull, & Kaplan-Solms, 1993) and lateral biases in visual attention (Turnbull & Lucas, 1996). Neither investigation successfully showed a link between the two lateralized phenomena. However, a recent article suggested that more emphasis should be placed on the auditory, rather than the visual, modality (Sieratzki & Woll, 1996). The rationale for this argument related to the cerebral lateralization of various aspects of speech and language. In those with normal hemispheric asymmetry, the left hemisphere is preferentially involved in the control of word content, grammar, and syntax; that is, the formal aspects of language. In contrast, the right hemisphere is primarily involved in the control of prosody, the intonation and affective aspects of verbal communication that form the music of speech and so dominate the vocal interactions of mothers and babies (e.g., Fifer & Moon, 1994; Glanville, Levenson, & Best, 1977).

Sieratzki and Woll (1996) suggested that leftward cradling would have advantages for both mother and baby in terms of affective prosody. They noted that, with her baby to her left side, the mother's left ear (and hence right hemisphere) would preferentially receive auditory signals from her infant. Sieratzki and Woll concluded, on this basis, that left-sided cradling would enhance auditory communication between the mother and the infant. They presented no empirical data to support their theory. However, the cradling behavior of people who are deaf might provide data that bear on this issue. Profoundly deaf people are unable to detect any form of auditory prosody. In the extreme case of those who have been deaf from birth, they have never been exposed to auditory prosody. Thus, if prosodic information is crucial in determining the side to which infants are cradled, then people who are profoundly deaf should show no lateral cradling preference.

To investigate the existence of a lateral cradling bias in deaf people, we collected data from three groups. In Study 1, we collected data from a sample of 41 prelingually deaf children. Investigating the cradling bias in this group presented certain problems; for example, there is some question about the extent to which children show a lateral cradling bias. In addition, we were unable to collect satisfactory data on handedness or the age at onset of deafness. In Study 2, we were

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able to overcome these methodological difficulties by collecting data from 70 profoundly deaf adults, gathering more suitable data on handedness, and controlling for the age at onset of deafness. In Study 3, we collected cradling bias and handedness data from a control group of hearing adults, matched for number and gender with the participants of Study 2.

STUDY 1: Cradling in Deaf Children

Method

Participants

We assessed 51 participants as part of a more general investigation of theory of mind tasks. All were prelingually deaf, and all attended schools for deaf children or a hearing-impaired unit within a mainstream school. All used British Sign Language as their preferred communication medium. Seven participants were excluded from the analysis because they had cochlear implants, on the grounds that they would have acquired some experience of auditory prosody. Three participants were excluded because they had never learned sign language, which might have affected the issue of hemispheric specialization. This left 41 participants, ranging in age from 3.4 to 16.9 years old (M = 10.2 years, SD = 4.1). Twenty of the participants were boys, and 21 were girls.

Procedure

All participants were tested by a hearing experimenter qualified to British Sign Language Stage II level (the minimum required for teachers in most British schools for deaf children). Participants were presented (while seated) with a newborn-sized doll to their midline. The doll was filled with 6 lbs. of artist's clay to approximate the weight of a real newborn. The children were instructed (in British Sign Language) to "imagine that this doll is a real infant who is familiar to you. I would like you to cradle it, as if to rock it to sleep." The side to which the child placed the infant's head was noted. Participants were asked which hand they used for writing. Of the 41 participants, 37 (90%) reported that they were right handed and 4 (10%) that they were left handed. In addition, participants were asked which hand they preferred to use for signing. Thirty-five (85%) of the participants regarded their right hand as preferred for signing, of which 34 (97%) had been classified as right handed. Six (15%) regarded their left hand as preferred for signing, of which 3 (50%) had been classified as right handed.

Results

Of the 41 participants, 29 (71%) spontaneously cradled leftward, which was significantly different from chance, $\chi^2(1, N = 41) = 7.05$, $p < .01$. This fig-

ure represented 16 (76%) of the girls and 13 (65%) of the boys, $\chi^2(1, N = 41) = 0.62$, $p > .05$. It also represented 28 (76%) of the right handers and 1 (25%) of the left handers. Finally, it represented 26 (74%) of those whose signed dominantly with their right hand and 3 (50%) of those who signed dominantly with their left hand.

Discussion

These data suggested that profoundly deaf individuals show a clear leftward cradling bias. Indeed, the extent of the lateral bias for girls (76%) was of the same magnitude (70–80%) as that generally reported in the cradling bias literature. However, several artifacts may open these data to criticism. For example, although a 79% leftward cradling bias has been reported in 6-year-old girls (De Château & Andersson, 1976), some of our participants were younger than 6 years old. Also, almost half of our sample were boys, for whom a clear lateral cradling bias has not been reported (De Château & Andersson). In addition, we were unable to collect satisfactory data on handedness in the present sample, largely because it is difficult to administer a standard handedness inventory to young children. Furthermore, the cradling bias judgment in this task was based on a single episode of cradling in each participant, and a more detailed investigation of cradling preference would be more appropriate. Finally, we were unable to establish the age at onset of deafness in this sample, opening the possibility that participants had been exposed to auditory prosody before they became deaf and potentially invalidating the argument that profoundly deaf people do not use auditory prosody as the basis for their cradling bias. We were able to avoid these methodological difficulties in a second study, involving a more detailed investigation of cradling in deaf adults.

STUDY 2: Cradling in Deaf Adults

Method

Participants

We assessed 82 participants while completing an experiment investigating regional differences in British Sign Language. Nine participants were excluded from the analysis because they were not profoundly deaf. One participant was excluded because of not knowing sign language, which might have affected the issue of hemispheric specialization. Another 2 participants were excluded because age at onset of deafness could not be determined. This left 70 participants, of which 44 were women and 26 were men. Forty-nine had been deaf from birth, of which 37 (76%) were dextrals. Another 21 had become deaf between 7 weeks and 19 years after birth ($M = 4.3$ years, $SD = 3.2$), of which 15 (71%) were dextrals.

Procedure

All participants were tested by a profoundly deaf experimenter qualified to British Sign Language Stage II level. Participants answered questions about the history and nature of their deafness. They were then presented (while seated) with a doll as in Study 1. Again, participants were instructed (in British Sign Language) to "imagine that this doll is a real infant who is familiar to you. I would like you to cradle it, as if to rock it to sleep." The side to which the individual placed the infant's head was noted and considered to be the spontaneous cradling side. Participants were then requested to try cradling to both the left and right sides and to rate (on a scale of 1–10) the degree of comfort that they felt with each position. They were encouraged to test out both sides on as many occasions as they felt necessary before making their decision.

A measure of hand preference (the Edinburgh Handedness Inventory; Oldfield, 1971) was then completed. Participants were classified as dextral (52 participants, or 74% of the sample) if they responded "right" to all items on the inventory and adextral (18 participants, or 26% of the sample) if they responded "left" to one or more items. In addition, they were asked which hand they preferred for signing. Fifty-nine (84%) regarded the right hand as preferred for signing (of which 51, or 86%, had been classified as dextral on the handedness questionnaire) and 8 (11%) regarded the left hand as preferred for signing (of which 7, or 88%, had been classified as adextral on the handedness questionnaire). The final 3 participants reported no preference in terms of the hand they preferred in signing (all 3 had been classified as adextral on the handedness questionnaire).

Results

Spontaneous Cradling Direction

Fifty-eight of the 70 participants (83%) spontaneously cradled leftward, which was significantly different from chance, $\chi^2(1, N = 70) = 30.2$, $p < .001$. This figure was unrelated to variables that might be important in the context of lateral asymmetry and cradling. For example, the figure of an 83% leftward preference represented 35 (80%) of the women and 23 (88%) of the men, $\chi^2(1, N = 70) = 0.91$, $p > .05$. It also represented 41 (82%) of dextrals and 17 (85%) of adextrals, $\chi^2(1, N = 70) = 0.90$, $p > .05$. Finally, it represented 49 (83%) of those whose signed dominantly with their right hand and 100% of those who signed dominantly with their left hand (Fisher's Exact Test $N = 67$, $p = .25$).

We also considered the influence of early childhood exposure to auditory stimulation and thus recast the data to compare those who had been deaf from birth with those who became deaf after birth (at an average age of 4.3 years). The leftward bias was present in 43 (88%) of those who had been deaf from birth and 15 (71%) of those who became deaf after birth. Both results were significantly different from chance: from birth, $\chi^2(1, N = 49) = 27.7$, $p < .001$; after birth, $\chi^2(1,$

$N = 21) = 3.85$, $p < .05$. However, the leftward cradling bias was significantly lower in those who had become deaf after birth, $\chi^2(1, N = 70) = 30.2$, $p < .001$.

Cradling Direction Rated for Comfort

When the participants were offered the opportunity to systematically compare the left and right sides for their comfort in cradling, the incidence of leftward cradling increased. Typically, participants who had cradled to the right in the spontaneous condition rated the left side as the more comfortable, with 3 participants having no comfort preference. Indeed, a remarkable 62 (89%) of the participants reported the left side to be the more comfortable position for cradling, with only 5 (7%) preferring the right side. Three participants showed no preference.

Of the leftward comfort cradlers, 52 (78%) were dextrals, and 3 (60%) of the rightward comfort cradlers were adextrals. Of the 3 participants who showed no preference, 2 were dextrals. For 55 left cradlers and 4 right cradlers, the direction of preference was the same on both the spontaneous and comfort measures. One participant who spontaneously cradled leftward subsequently reported the right side to be more comfortable, whereas 7 participants who spontaneously cradled rightward subsequently reported the left side to be more comfortable.

STUDY 3: Cradling in Hearing Adults

Method

Participants and Procedure

A sample of 70 adults without hearing impairment, of which 44 were women and 26 were men, were chosen to involve the same absolute number and the same gender ratio as the 70 participants in Study 2. All were presented with the same cradling (i.e., spontaneous and comfort ratings) and handedness (i.e., Oldfield, 1971) investigations used in Study 2, and the data were scored in the same manner. Based on the strong criterion that participants were classified as adextrals if they responded "left" to one or more items on the Oldfield inventory, 61 (87%) of the participants were classified as dextrals. This was not significantly different from the percentage of dextrals (74%) in Study 2, $\chi^2(1, N = 140) = 3.72$, $p > .05$.

Results and Discussion

Spontaneous Cradling Direction

Fifty-three of the 70 participants (76%) spontaneously cradled leftward. This figure represented 37 (84%) of the women and 16 (62%) of the men, $\chi^2(1, N = 70) = 4.52$, $p < .05$. It also represented 48 (79%) of dextrals and 6 (67%) of adextrals, $\chi^2(1, N = 70) = 0.64$, $p < .05$.

Cradling Direction Rated for Comfort

When the participants were offered the opportunity to compare the left and right sides for comfort in cradling, the incidence of leftward cradling increased slightly. Here, 56 (80%) participants reported the left side to be the more comfortable position for cradling, with 13 (19%) preferring the right side. One participant showed an equal preference for both left and right sides. Of the leftward comfort cradlers, 50 (89%) were dextrals, and 10 (77%) of the rightward comfort cradlers were dextrals, $\chi^2(1, N = 69) = 1.42, p > .05$.

GENERAL DISCUSSION

Before we consider the question of the cradling bias in the present study, it seems appropriate to examine the more general question of lateral asymmetries in the deaf participants, in particular to establish whether those samples represent a group of individuals with conventional cerebral dominance. There has been some question of the nature of hemispheric asymmetry of function in people who are deaf, with the suggestion that the incidence of right-handedness is lower in deaf persons than it is in hearing individuals. It appears that these arguments do not hold for those who have acquired sign language in the course of early development (see Bonvillian, Richards, & Dooley, 1997, for review). Consistent with this literature, it does not appear that the deaf participants in this study are anomalous in terms of hemispheric asymmetry. For example, the vast majority of the participants in Study 1 (92%) reported themselves to be right-handed. In Study 2, we used the especially severe handedness inventory criterion of classifying as adextral anyone who rated that they preferred to use their left hand on any item. Even here, 76% were classified as dextral (71% of those who became deaf after birth), which was not significantly different from the proportion of the hearing participants who were classified as dextral. This finding is consistent with the literature on lateral asymmetry in deaf persons, with slightly larger proportions of left-handedness being reported among deaf participants, presumably because this group was less likely to have been exposed to appropriate sign language from birth, and given that early exposure to sign language—indeed, any language—is important to the development of conventional cerebral dominance (Bonvillian et al., 1997). In addition, Studies 1 and 2 revealed that 83% of the participants rated their right hand as preferred for signing, a figure that is also consistent with previous findings (Bonvillian et al.). Taken together, the data suggest that the sample of deaf participants in the present study had relatively conventional cerebral dominance, at least to the extent that handedness serves as a marker.

We now turn to the question of the cradling preference in people who are deaf. Previous studies have shown a clear leftward lateral cradling bias among hearing women, and the results of the Study 3 are consistent with this: a leftward cradling bias among hearing participants of 76%. The findings for the deaf par-

ticipants were comparable: a spontaneous leftward cradling preference in 71% of those in Study 1 and 83% of those in Study 2. When asked to rate the two sides in terms of comfort, the proportion of leftward cradlers in Study 2 increased to 89%, a figure higher than the 80% finding for hearing participants in Study 3. As in previous studies (Bruser, 1981; De Château et al., 1978; Saling & Tyson, 1981; Salk, 1960), there was no clear relation between the participants' handedness and direction of cradling in people who are deaf. Indeed, there also appeared to have been no significant relation between cradling direction, preferred signing hand, or gender among the deaf participants.

The present study was carried out because of the claim of Sieratzki and Woll (1996) that the leftward cradling bias was a result of the right hemisphere specialization for the detection of prosody in infant sounds and/or the production of prosodic information by the mother. We argue that, were this prosody argument correct, people who are profoundly deaf would show no clear cradling bias. This would be especially true of those who have been deaf from birth, who would have had no exposure to prosody. Thus, it is of interest that there was a clear leftward cradling preference among deaf participants: in Study 1, 71%; in Study 2, 88% of those who had been deaf from birth and 71% of those who had become deaf after birth. This is not consistent with the claim of Sieratzki and Woll (1996).

This finding also should be viewed in the context of another test of the Sieratzki and Woll (1996) prosody proposal. Turnbull and Bryson (2001) recently used a dichotic listening procedure in hearing participants to investigate whether ear preference for prosody in speech was related to the lateral cradling bias. The findings of both a leftward lateral cradling bias and a left ear emotion perception advantage were replicated in that study. However, we found no correlation between the two variables. Taken together with the findings of the present study, these data are not consistent with Sieratzki and Woll's (1996) suggestion that women cradle to the left to enhance auditory communication between themselves and the infant. Viewed in the more general context of other failures to find evidence that accords with the hemispheric asymmetry account (Lucas et al., 1993; Matheson & Turnbull, 1998; Turnbull & Lucas, 2000; Turnbull & Matheson, 1996; Turnbull, Stein, & Lucas, 1995), there appears to be little support for the claim that humans cradle leftward because of the right hemisphere's specialization for the perception and expression of emotion.

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