

# Infant Holding Preferences in Maternity Hospitals: Testing the Hypothesis of the Lateralized Perception of Emotions

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Infant holding biases of 202 mothers were studied in four French maternity hospitals. The study collected laterality for holding in mother/child dyads as a means of testing the emotional hypothesis (Manning & Chamberlain, 1991). Maternal holding side preferences and handedness were collected through questionnaires. In addition, hemispheric specialization for perceiving visual and auditory emotional cues was examined using a chimeric figure and dichotic listening task. The mothers displayed a significant left holding bias as well as a general perceptual bias in favor of the left side/right hemisphere. However, no significant associations were found between holding biases and emotional perceptual asymmetry. The absence of significant relationships between hemispheric specialization and holding biases does not support directly the emotional hypothesis for infant holding but can be interpreted according to the nature of the holding relationship.

## INFANT HOLDING BIASES

There is a remarkable convergence in the published literature reporting that approximately 2/3rds of humans prefer to hold an infant on the left side of their body (e.g., Erber, Almerigi, Carbary, & Harris, 2002; Vauclair & Donnot, 2005). This left side bias appears to be relatively independent of subject's sex (Bundy, 1979; Bogren, 1984; Harris, Almerigi, & Kirsch, 2000) and age (De Château &

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Andersson, 1976; Manning & Chamberlain, 1991). Vauclair and Donnot (2005) and Bundy (1979) showed that the left-side preference increased with infant care giving experiences.

Several hypotheses have been proposed to explain the left holding bias. The most popular hypothesis is related to the role of the right hemisphere in the perception of emotions. Based on research demonstrating right hemisphere asymmetries in emotional monitoring (e.g., Campbell, 1982; Leventhal & Tomarken, 1986), Manning and Chamberlain (1991) suggested that the mother was better able to monitor her infant's well-being in her left visual field and with her left ear because they project more directly to the right hemisphere. If the control of emotions is implicated in the determination of left-holding side preferences, the most valid procedure would certainly be a real situation of interactions among mother-infant pairs (Sieratzki & Woll, 2002).

To our knowledge, the hypothesis advanced by Manning and Chamberlain (1991) has never been fully demonstrated because auditory and visual advantages have never been simultaneously measured in the same population and because mothers have never been tested. However, this emotional hypothesis has partially been confirmed by several studies. First, Harris, Almerigi, Carbary, and Fogel (2001) found a relation between Chimeric Figures Task (CFT) scores and holding scores in a male population but not in female populations. Bourne and Todd (2004) and Vauclair and Donnot (2005) found in female populations the same relation reported by Harris et al. (2001). Vauclair and Donnot (2005) advanced that the emotional hypothesis was partially confirmed because participants were always students whereas Manning and Chamberlain (1991) suggested that the mother was able to better monitor her infant's well-being while she held on the left side. This proposal is partially confirmed in the study by Donnot (2007) showing that the link between auditory perception of emotion and the newborn's holding bias was observed in left-handed female students but not in left-handed mothers. Thus, the current study was an attempt to confirm Manning and Chamberlain's hypothesis with a population of new mothers. We can formulate the following hypothesis according to the expected results of this confirmation attempt. Infant holding side biases should be related to visual and auditory advantages in emotional perception. Thus, results observed in the population of mothers should confirm those obtained in the students' populations of previous studies and should replicate and validate Manning and Chamberlain's emotional hypothesis (1991).

#### THE CHIMERIC FIGURE AND THE DICHOTIC LISTENING TASKS

A free-viewing Chimeric Figures Task (CFT) was chosen to measure visual asymmetries in new mothers because it was not possible to use a divided-field

tachistoscopic task in maternity hospitals. In addition, this free-viewing task has already been used to study holding biases (Carbary, Almerigi, & Harris, 2001; Vauclair & Donnot, 2005) and is similar to the one devised by Levy, Heller, Banich, and Burton (1983). Concerning the measure of auditory asymmetries, dichotic listening experiments have shown that different sorts of auditory input lead to different ear advantages (e.g., Kimura, 1967; Ley & Bryden, 1982). Participants with left-hemispheric language lateralization were observed to be more accurate in reporting auditory information arriving at the right ear than items arriving at the left ear when the input was verbal (Kimura, 1967). This effect is commonly referred to the right-ear advantage for verbal stimuli. Conversely, the majority of people have a left-ear advantage for tasks involving the recognition of musical or emotional stimuli (e.g., Bryden, 1988; Bryden & McRae, 1988). A specific dichotic listening task (DLT) of auditory information, which is similar to the one used by Turnbull and Bryson (2001), was designed for the present research to assess asymmetry for emotional processing in a French sample. These tasks are well suited for the study of participants in a natural setting as it was the case with our new mothers.

## THE CURRENT STUDY

In summary, the goal of the present study is to test perceptual asymmetries in relation to holding preferences among mothers who had just given birth. Our study represents the first attempt (1) to test the hypothesis of Manning and Chamberlain (1991) in a sample of new mothers while in hospital, (2) to analyze holding biases in conjunction with a visual perception task (CFT) and an auditory perception task (DLT).

## METHOD

### Participants

Participants were 202 mothers who were tested a few days (range 1 to 6 days) after delivery in maternity hospitals. The mean age of the participants was 29.87 years ( $SD = 5.39$ ). Half of the mothers were primiparous (49.5%); for 41% of the mothers, the newborn was their second offspring, and 9.5% of the mothers already had three or more offspring. Fifty one percent of the participants gave birth to a daughter and 49% gave birth to a son. Twenty percent of the participants had a caesarean delivery and 67% of the mothers used breastfeeding. All the infants were born healthy and full term.

## Procedures

*Handedness and holding measures.* An inventory was used to evaluate holding preferences and laterality. Handedness items were extracted from the Edinburgh Handedness Inventory (Oldfield, 1971). The degree of laterality was obtained by calculating a mean score on the ten handedness items, and more precisely by assigning for each item “-1” for a left choice, “+1” for a right choice, and “0” when the participants had no preference. The degree of laterality could range from “-1” to “+1”. Handedness will be evaluated as a continuum of laterality in the analyses of results.

In the current study, holding side preferences (left or right) and holding position preferences (arm-holding vs. shoulder-holding) were assessed by the following question: “When you have to hold an infant, how do you hold him/her?”

For this question, the participant had to specify her preferred position (arm-holding or shoulder-holding). Arm-holding refers to the fact that the newborn was carried in arms on a horizontal plane. Shoulder-holding means that the newborn was held against the chest, the infant’s head being placed on the mother’s shoulder on a vertical plane. These positions were assessed with a Likert type scale (the participant had to choose one of the five responses: always shoulder-holding, often shoulder-holding, no preferred position, often arm-holding, always arm-holding). Then participants had to mention the preferred holding side (left or right) for each of the two positions. A negative score referred to a left-side preference and a positive score to a right-side preference.

*The Dichotic Listening Task (DLT).* A emotional dichotic listening task similar to the one used by Turnbull and Bryson (2001) was especially designed for this study in order to determine which hemisphere is more involved in emotional processing of auditory information (Buchanan et al., 2000). We decided to use an imaginary language with our French speaking participants to limit as much as possible semantic processing of the stimuli (and thus left hemispheric treatment) and, by contrast, to favor the emotional processing most frequently performed by the right hemisphere. For that purpose, five sentences were spoken by a male speaker in three emotional tones (angry, happy, and neutral). For each trial (1) the sound intensity was similar for tones reaching both ears simultaneously, (2) sentences began and finished simultaneously, and (3) the tone peak of the sentence presented to the left ear matched the tone peak of the sentence presented to right ear. All the sentences were composed of four words and the duration of the sentences never exceeded 2 sec.

A pilot study involving 20 university students showed that the sentences had a high reliability with the emotional tones they were supposed to express, as this matching was correct for at least 90% of the trials. Fifteen trials were made by pairing two different emotional tones of a same sentence. Fifteen reversed trials

presented the counterbalanced tones. Each participant had to report the most clearly heard emotion for each of the 30 trials presented via headphones. A value of “-1” was assigned each time the tone presented to the left ear was judged to be the most clearly heard and a value of “+1” each time the tone presented to the right ear was chosen. A mean score was calculated for which a negative value indicates a left auditory field bias and a positive value indicates a right auditory field bias. An error means that the participant answered the only emotional tone that was not presented (e.g., a neutral response while happiness and anger were presented).

*The Chimeric Figures Task (CFT).* On each trial, participants were shown two faces on a computer screen, one above the other for 5 sec. A face resulted from the combination of one smiling hemiface and one neutral hemiface. For each trial, the smile for one happy/neutral chimeric face was displayed in the left visual field, whereas the smile of the other face was displayed in the right visual field. Each mother was individually tested and was requested to indicate orally the face that looked happier. Two presentation programs were prepared to counterbalance the position of the faces. Across the 30 trials, finding that the face was happier when the smile appeared on the left is assumed to reflect a greater right hemisphere role in the task. A value of “-1” was assigned each time the left smiling face was judged to be happier and a value of “+1” each time the right smiling face was chosen. A mean score over all pictures was calculated for which a negative value indicates a left visual field bias and a positive value indicates a right visual field bias.

### Testing Conditions

The order of tasks presentation was as follows. First, the two perceptual tasks were presented to the mother. The order of presentation for these tasks was counterbalanced to avoid a task effect. Then, the participants completed the holding/handedness inventory.

### Data Analyses

Analyses of holding biases are frequently made in the literature in terms of proportions of left-holders versus right-holders. In accord with previous investigators (Harris et al., 2001; Turnbull & Bryson, 2001), we used the holding score as a numerical variable. This choice brings a better precision in the behavioral measure than proportions. However, the main disadvantage of using holding scores is associated with large standard deviations. Consequently, to compensate for this statistical effect, we will also systematically present holding biases and perceptual biases with the distribution of participants.

We used Bravais-Pearson correlational analyses to examine the relations between two numerical variables, Chi-square tests with two nominal variables and

finally Student *T*-tests to compare means between themselves or to compare the means to a value of 0.

## RESULTS

Table 1 summarizes the percentages for basic laterality measures (handedness, holding side preferences, and perceptual tasks advantages).

*Handedness.* This distribution of hand preferences (see Table 1) is similar to the pattern usually observed in the general population (e.g., Annett, 1985).

*Holding side scores and percentages.* The mean infant holding score showed a significant left side preference at the level of the sample ( $M = -.33$ ,  $SD = .83$ ;  $t(201) = -5.61$ ,  $p = .001$ ). The distribution of participants for holding side preferences is presented in Table 1.

*The Dichotic Listening Task.* A significant advantage for the left ear (mean score  $-7.68$ ;  $SD = 12.82$ ;  $t(201) = -8.51$ ,  $p = .001$ ) was observed at the population level. The distribution of participants for ear advantages is presented in Table 1. Furthermore, this left bias was present for all the emotional tones with similar percentages (Happiness = 60%, Anger = 61%, and 63% for neutral).

*The Chimeric Figure Task.* The participants showed a significant left visual field advantage (mean score  $-4.64$ ;  $SD = 13.67$ ;  $t(201) = -4.82$ ,  $p = .001$ ). The distribution of participants for visual field advantages is presented in Table 1.

### Test of The Emotional Hypothesis

Correlational analyses were run between handedness, the DLT scores, the CFT scores, and the holding side scores and are presented in Table 2.

*Handedness, DLT, and CFT.* Handedness was neither correlated with holding side scores nor with DLT scores but a significant relation was observed

TABLE 1  
Basic Laterality Measures in the Sample of Mothers

	<i>Handedness</i>	<i>CFT</i>	<i>DLT</i>	<i>Infant Holding</i>
<i>Left side preferences (%)</i>	13%	62%	72%	64%
<i>Right side preferences (%)</i>	83%	33%	26%	28%
<i>No side preference (%)</i>	4%	5%	2%	8%

*Note.* CFT: Chimeric Figure Task, DLT: Dichotic Listening Task

TABLE 2  
Correlations between Handedness, Holding Scores, DLT Scores  
and CFT Scores (N = 202)

		<i>Holding Scores</i>	<i>DLT Scores</i>	<i>CFT Scores</i>
Handedness	Pearson's Correlation	-.116	-.094	-.144*
	Significance (bilateral)	.101	.182	.040
Holding Scores	Pearson's Correlation	1	.026	.028
	Significance (bilateral)		.712	.697
DLT Scores	Pearson's Correlation		1	.427**
	Significance (bilateral)			.000

\*significant correlation at  $p = .05$  (bilateral), \*\*significant correlation at  $p = .01$  (bilateral)

with the CFT scores (see Table 2). The DLT and CFT scores were found to significantly correlate with each other ( $r(201) = 0.43, p = .001$ ).

*Infant holding scores and perceptual biases.* No significant correlations were found (1) between infant holding scores and DLT scores and (2) between infant holding scores and CFT scores (see Table 1). These correlations were close to zero.

## DISCUSSION

### Infant Holding Preferences

With respect to the holding preferences, a significant left bias was observed in the population of mothers. The present study reinforces the presence of left sided biases in infant holding, on a particularly relevant population, namely new mothers (see for the most recent demonstrations of a left bias, Harris, Spradlin, and Almerigi, 2006 and for a review Donnot and Vauclair, 2005).

### Asymmetries in Auditory and Visual Perception of Emotions

The left auditory biases observed among French mothers was similar to those reported in the literature (e.g., Ley & Bryden, 1982; Turnbull & Bryson, 2001). In accordance with the dichotic listening model (e.g., Kimura, 1967), a left ear advantage led to a greater implication of the right hemisphere compared to the left hemisphere in the processing of emotional stimuli (Buchanan et al., 2000).

Our sample of French mothers displayed a left visual advantage (right hemisphere) for choosing the "happiest" face. This result is very similar to those

reported in the previous studies and it is also in accord with the findings of the literature concerning the perception of facial emotions (e.g., Bourne & Todd, 2004; Mandal & Ambady, 2004, for a review).

Combined measures of emotional perception according to two different sensory modalities demonstrate the existence of a correlation between DLT' and CFT' scores. However, this correlation only concerned 65% of the participants. It can be concluded that the relative implication of the right cerebral hemisphere in the perception of emotions must vary according to the nature of the perceptual task (CFT or DLT). Dagenbach (1986) tested the relationship between auditory and visual language processing asymmetries and concluded that laterality effects may depend on the processing demands of the particular task.

The sensory nature of the perceptual task seems to be related to the handedness of the participants. As handedness is related to the CFT scores (also shown by Harris et al., 2001), no such relation emerged between handedness and the DLT scores (also shown by Bryden, Free, Gagné, & Groff, 1991).

### Absence of Confirmation of the Emotional Hypothesis

The relation between perceptual biases and holding biases revealed by recent studies (Bourne & Todd, 2004; Harris et al., 2001; Vauclair & Donnot, 2005) was not confirmed in our population of new mothers. But, our results confirmed those obtained by Donnot (2007) in a left-handed population of university students but not in a left-handed population of new mothers. We think that the role of hemispheric lateralization on holding biases might depend on the nature of the holding relationship. Thus, we distinguish a basic holding relationship and an advanced holding relationship. We consider that the holding relationship between a student and a doll is basic. The holder has low care giving skills (he or she is not parent) and the doll cannot express a feedback in response to the choice of the holding side or to the holding position (arm- or shoulder-holding). In an advanced relationship, the holder is the mother who has developed a high level of intimacy with the newborn. As the newborn can react to the holding behavior of the holder, she has then later the possibility to adapt her behavior. It is likely that the determination of the infant holding preferences in the advanced relationship depends on a combination of various factors. Affective factors (e.g., attachment) and/or psychological factors (e.g., depression) might play a major role in the determination of holding behaviors (e.g., Bogren, 1984; Vauclair & Scola, in press; Weatherhill et al., 2004). Our results suggest that a significant relation between holding biases and hemispheric specialization cannot be observed in an advanced holding relationship (in mother/child dyads).

Finally, a significant relation between auditory advantages in emotional perception and holding biases has only been demonstrated in a basic holding relationship (Donnot, 2007). Significant relationships between visual advantages in emo-



tional perception and holding biases have only been shown in a basic holding relationship too (Bourne & Todd, 2004; Harris et al., 2001; Vauclair & Donnot, 2005).

Forty-six years have passed since Salk reported for the first time a left holding side preference in new mothers. Each hypothesis advanced for explaining this bias has led to unsatisfactory proposals. For methodological reasons, populations of students were largely tested, but we have to face the facts that infant holding cannot be reduced to a special holding behavior. It must be envisioned above all through mother-infant interactions and therefore must be studied within this framework. This consideration involves a well-balanced coordination of neuropsychological (for hemispheric specialization) and psychological methods (for psychological states of the mothers such as the presence of depressive syndromes) in order to understand and explain the most faithfully possible the origin of holding side preferences. Thus, the consequences of holding side preferences could be efficiently examined.

#### ACKNOWLEDGMENT

The authors would like to thank William D. Hopkins for his comments on the manuscript and for his help with the English.

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