

## Infant-holding side biases: Comparison of laterality patterns in childcare professionals and mothers or students

Julien Donnot and Jacques Vauclair

*University of Provence, Aix-en-Provence, France*

Among the various interactions between an adult and an infant, postural behaviours and their lateral biases expressed by adults for holding an infant represent a growing field of investigation. To better understand the building up of mother/child relationships, the current study reports data concerning infant-holding biases collected in a new population, namely childcare professionals, where experience with and emotional relationships with infants could be classified as intermediate between basic and advanced. Two sub-populations of childcare professionals were studied: women who work in maternity hospitals and women who work in day-care centres. Their infant-holding side preferences were correlated with emotional perceptive biases to ascertain whether hemispheric specialisation influences holding side biases as well as in *basic holding relationships*. Results showed that childcare professionals behaved like mothers, which means like participants with advanced holding relationships. The discussion emphasises the complexity of infant-holding behaviours and the importance of considering the nature of holding relationships in the study of side-of-hold biases.

**Keywords:** Cradling; Infant holding; Childcare; Laterality; Maternity hospitals.

Since Salk's (1960) report of a left-side preference for holding a newborn in arms, infant-holding behaviour has become an active topic of investigation in the field of mother/child interactions. In the last 50 years psychologists have attempted to explain not only the origin of the well-established left-side bias but also the consequences of this lateral preference on mothers, on infants, and on the quality of their relationships. First this left-side bias has been observed in all kinds of populations (see Donnot & Vauclair, 2005, for a review). Female and male participants (Bogren, 1984; Harris, Almerigi, &

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Address correspondence to: Dr Julien Donnot, Centre PsyCLE, University of Provence, 29 Avenue Robert Schuman, 13621 Aix en Provence, France. E-mail: Julien.Donnot@univ-provence.fr

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Kirsch, 2000), adults and children (De Chateau & Anderson, 1976; Manning & Chamberlain, 1991), as well as parents (Salk, 1960; Scola & Vauclair, 2010) and non-parents (Donnot, 2007) showed a significant left-side bias.

Second, some factors have been examined in order to study their implication in the lateralisation processes of infant holding. Several of these factors—the holder's handedness (e.g., Van der Meer & Husby, 2006), the holder's hemispheric lateralisation of emotions (e.g., Bourne & Todd, 2004), and the presence of mother's depressive symptoms (e.g., Vauclair & Scola, 2008, 2009)—have received some support with respect to their role in the lateralisation of infant holding. Among the several hypotheses tested in the literature, it has been shown that factors supposedly responsible for the left-side bias may change according to the nature of the relationships between the holder and the infant. In fact, Donnot and Vauclair (2007) have distinguished two kinds of holding relationships: in basic holding relationships the holder has low care-giving skills and thus has little opportunity to experience infant-holding behaviours. This situation happens with university students who have to hold a doll. By contrast, in advanced holding relationships the holder has high care-giving skills and takes care of an infant frequently (almost every day), as in the case of a mother with her infant. Thus hemispheric specialisation of emotions was shown to influence holding side preference in populations with basic holding relationships but not with advanced holding relationships: for example, such an effect was recorded in samples of university students (Donnot, 2007; Vauclair & Donnot, 2005). Currently, no study has shown a link between lateralisation of emotions and holding side preferences in advanced holding relationships such as develop in mother/child dyads. But one confusing phenomenon is that left-side preference for holding an infant is observed both in parents and non-parents, whatever the role of hemispheric specialisation. That means that other factors than hemispheric specialisations are likely to be responsible for left-side biases in parents' populations. The holder's as well as infant's contributions have to be considered in evaluating holding biases. In other words, do adults hold on the left side because they prefer this side, or do they adapt their behaviour to the infant's initial side preferences? For example, Ginsburg, Fling, Hope, Musgrove, and Andrews (1979) demonstrated a link between the mother's preferred holding side and the head-turning side preference of the newborn. As dolls cannot express head-turning side preferences, it was suggested that in basic holding relationships the holder chose her/his side preference according to his/her own characteristics such as visual and auditory field preferences for perceiving emotions (Vauclair & Donnot, 2005). To put it differently, the holder might prefer to hold an infant on the left side because he/she better perceives emotions in the left auditory and visual field (e.g., Bourne & Todd, 2004; Donnot, 2007).

Nevertheless, Bundy (1979) controlled head turning of dolls and showed that it has a left-side reinforcer effect in participants.

However, in advanced holding relationships additional aspects such as the frequency of holding behaviours or the development of affective relationships between the mother and her infant need to be considered. In fact several studies showed left-side bias variations according to the experience and care-giving skills (e.g., Harris et al., 2000; Turnbull & Lucas, 1991), and even differences between mothers of their first newborn compared to mothers with other children (Harris, Spradlin, & Almerigi, 2007). Taken into account, these aspects can help explain why the effect of hemispheric specialisation of emotions on holding side biases is limited. In the present study we tested a novel population with interesting characteristics. Professionals in day-care centres and maternity hospitals can be considered as having *intermediate holding relationships* with infants and newborns. Indeed, they are highly skilled and have a vast experience in child caring, like parents in advanced holding relationships. However, they do not develop an intimate relationship with the infant and, in this respect, they compare to students who expressed basic holding relationships. Both professional populations take care of infants; this means that they hold to soothe, to put to sleep, and to carry. In the present study both populations of childcare professionals were highly skilled but, because of their profession, they interacted with infants of different ages. Maternity hospital professionals care for newborns (on average from 1 day to 6 days of age), whereas day-care centre professionals care for children from 3 months to 2.5 years of age. This difference is thus likely to influence holding biases. The objective of the current study was to find out whether infant-holding behaviours of day-care professionals is more like mothers' behaviours or students' behaviours. Therefore we first assessed the lateralisation of infant-holding biases for specific holding contexts, and then measured the influence of lateralised perception of emotions on these biases by testing our participants with an emotional dichotic listening task (EDLT).

## METHOD

### Participants

Day-care centre participants were 41 women (mean age = 36.0 years,  $SD = 12.4$ ) working in four different day-care centres. Ages ranged from 18 to 66 years, and 14.6% were left-handed (measured with the Edinburgh Inventory questionnaire; Oldfield, 1971). Maternity hospital participants were 100 women (mean age = 36.1 years,  $SD = 11.0$ ) working in three maternity hospitals. Ages ranged from 18 to 58 years, and 14% were left-handed. All the participants volunteered to fill out the questionnaire.

## Holding side biases measures

We used an original questionnaire presenting 10 infant-holding positions (see Figure 1) to allow participants to choose their preferred type and side-of-hold. This questionnaire was designed to be used in other studies in our laboratory; we used it in the current study only to gather information about the holding side preferences.

Because the participants were highly skilled, we assessed holding side preferences by averaging the holding preferences in three specific infant-holding contexts. Thus we proposed three questions about the preferred position (1) for putting an infant to sleep, because both day-care centre and maternity hospital professionals have to do it principally when they interact with infants, and (2) and (3) for soothing a crying infant. We used two soothing contexts. Participants were asked to soothe the infant because it was crying, but the cause of crying differed according to the context. For the first soothing context (*external cause of crying*), the infant cried because of some environmental disturbances such as noises and various activities around her/him. For the second soothing context (*internal cause of crying*), the infant cried because of somatic troubles like stomach ache or fever. The main difference between these two holding contexts comes from the holder's understanding of infant's state. Logically, if the holding behaviour is fully decided by the holder, no holding side changes (right or left) should

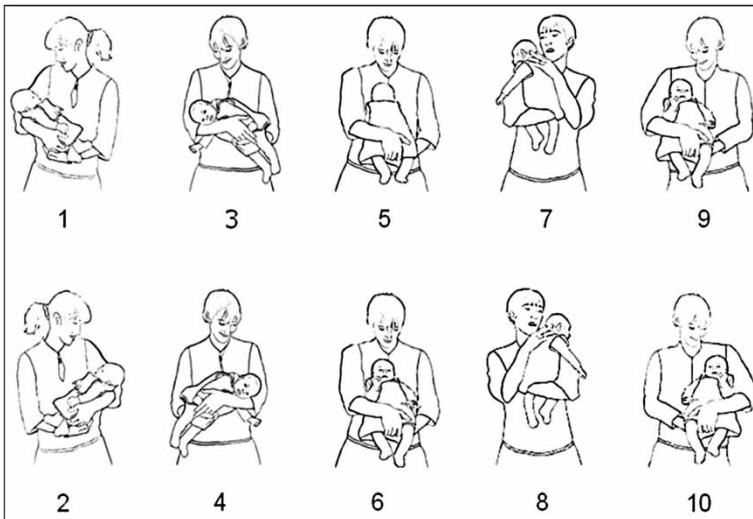


Figure 1. The holding side questionnaire.

be observed between the two contexts. Although the difference between these two holding contexts will be exploited in another study, we kept the three contexts to get a consistent mean measure of side preferences. Participants had to choose their preferred holding position among the 10 that were presented with the following instructions: "Choose your preferred position to hold a newborn". For each of the three holding contexts, a value of  $-1$  was attributed for a left side position,  $+1$  for a right side position, and  $0$  for a middle position. We averaged the three values to get a mean holding score ranging from  $-1$  (strong left holding) to  $+1$  (strong right holding).

### Lateralised perception of emotions

We used the Emotional Dichotic Listening Task (EDLT) designed by Donnot (2007) to assess the preference for an auditory field in emotional perception. For each trial the same sentence (in an imaginary language to avoid specific stimulation of the hemisphere, the left, responsible for language processing) was pronounced in each ear but in different emotional tones (two of three options: angry, happy, and neutral tone). For example, the sentence "Sim vobona surat ogarin" was simultaneously pronounced with an angry tone in the left ear and with a happy tone in the right ear. Participants had to choose orally which emotional tone was the clearest. A value of  $-1$  was assigned each time the preferred tone was presented in the left ear and a value of  $+1$  each time it was presented in the right ear. Errors mean that participants chose a tone not presented. After 30 trials including five different sentences, participants obtained a score ranging from  $-30$  (strong preference for the left ear) to  $+30$  (strong preference for the right ear). For practical reasons, some participants who answered the questionnaire had no time to spare for the dichotic listening task.

We expected an overall preference for the left ear/auditory field, but above all we expect a significant link between holding side preferences and ear/auditory field preferences as shown in student populations, namely that left-holders had a left ear preference via the EDLT and vice versa. As already noted, day-care centre and maternity hospital professionals do not develop intimate relationships with infants. One reason is the short time spent with them in comparison with mothers, and because of the large number of infants to care for. The perceptual field advantages of an adult (left or right auditory and/or visual field advantage) thus might influence the preference for side of holding when the holder has no affective relationship with the infant.

## RESULTS

### Holding side biases

The maternity hospitals workers did not express a significant left-side bias, as their mean holding side score ( $M = -.11$ ;  $SD = .72$ ) was not different from 0,  $t(101) = 1.539$ ;  $p = .13$ . The mean holding side score in day-care centre workers ( $M = -.28$ ;  $SD = .79$ ) was significantly different from 0,  $t(40) = -2.308$ ;  $p = .026$ : this result indicates that this population expressed a left side preference for holding infants. In terms of proportions (see Table 1) the holding side preferences reported via the questionnaire were weaker than most of those reported in literature (e.g., Almerigi, Carbary, & Harris, 2002; Harris, Almerigi, Carbary & Fogel, 2001), whatever the assessment method used (e.g., Donnot & Vauclair, 2005, Scola, Arciszewski, & Vauclair, 2010; Vauclair & Scola, 2009).

### Emotional perceptive biases

The Emotional Dichotic Listening Task (EDLT) showed a mean score of  $-11.03$  ( $SD = 13.22$ ) among maternity hospital professionals, which corresponds to a significant left ear/auditory field preference,  $t(90) = -7.96$ ;  $p < .001$ . In terms of proportions, 78% of maternity hospital professionals obtained a negative EDLT score, namely a left ear preference. Among day-care centre professionals the mean EDLT score was  $-3.27$  ( $SD = 15.76$ ) but we noted no significant auditory field preference,  $t(40) = -1.33$ ;  $p = .19$ , although 59% of participants had a negative score, namely a left ear preference.

### Relationships between EDLT and holding side scores

We ran Pearson's correlations between EDLT scores and holding side scores to test the matching of the preferred auditory field for perceiving an emotion and the preferred side of holding. Despite an overall left side preference both

TABLE 1  
Mean side preferences

	<i>Left side</i>	<i>Right side</i>	<i>Middle</i>
Maternity hospitals	53 (-0.69; 0.29)	34 (0.75; 0.30)	13 (0; 0)
Day-care centres	63 (-0.83; 0.24)	32 (0.77; 0.32)	5 (0; 0)

Percentages of mean side preferences in specific holding contexts among maternity hospital and day-care centre professionals. Average holding scores and standard deviations are in parentheses.

for the auditory field and for the holding side, our correlations were close to 0. No significant link was found either in maternity hospital,  $r(91) = .034$ ;  $p = .75$ , or in day-care centre professionals,  $r(41) = .092$ ;  $p = .57$ .

## DISCUSSION

### Holding side biases

We decided to assess infant-holding biases of professionals (in day-care centres and maternity hospitals) because these populations can be considered to have intermediate holding relationships with infant compared to the basic holding relationships of students and advanced holding relationships of mothers. Recent studies (Donnot & Vauclair, 2005; Reissland, Hopkins, Helms, & Williams, 2009) showed significant left-side biases in both populations (students and mothers). It is interesting to note that day-care centre professionals showed an expected significant left-side bias, but that maternity hospital professionals did not. The proportion of middle-holding participants could be responsible for the weaker and non-significant left-side bias of maternity hospital professionals compared to other studies (see Table 1). The first obvious factor that can be involved is the age of the infants. Maternity hospital professionals held newborns, whereas the infants held by day-care centre professionals were at least 3 months old. It seems logical that the small size of a newborn is adapted for middle holding, and that the older the child becomes the more adapted is a lateralised holding behaviour.

### Was the left-side bias overestimated?

Most studies of the bias have not reported figures for middle-holds. Generally, middle-holds are either not possible in the experimental protocol or are not taken into account because of their negligible number. One of the innovations of our study is our use of a panel of 10 holding positions (see Figure 1), giving participants a large range of choices for selecting the most faithful holding position when requested to do so in a precise holding situation.

We showed that 13% of maternity hospital professionals answered “in the middle”. These results raise concerns about the most appropriate method for assessing infant-holding preferences. The main question is if participants systematically give a middle response to describe their usual holding behaviour, would we observe the same proportions of left-side preferences as reported in the literature? The effect of including this middle category for holding side biases must be checked by investigating other populations

(e.g., students, mothers), especially for holding newborns. By comparing our results with an imagined situation test (Harris et al., 2001) submitted to our participants in which they were forced to choose between left and right holding side, we noticed that about 90% of participants who could not answer middle-holding chose the left side for holding an infant. Thus, the left-side bias may be overestimated in populations of held newborns, and one consequence should be the emergence of specific studies on middle-holding behaviours.

### Emotional perceptive biases

Results on the EDLT showed an expected left ear/auditory field bias in maternity hospital professionals but, surprisingly, no significant bias in day-care centre professionals (59% of day-care centre professionals showed a negative score, namely a left ear preference). No influence of handedness can be involved because the percentage of left-handers was the same (14.6% vs 14%) in the two samples. We suppose that a larger sample will help to reach the level of significance. Another limit of our experimental protocol can be raised. An auditory test like the EDLT may not be well adapted to participants who are used to working in a noisy environment.

### Relationships between lateralised emotional perception and infant-holding side preference

Harris et al. (2001), Bourne and Todd (2004), and Vauclair and Donnot (2005) demonstrated that hemispheric specialisation of the holder was correlated with infant-holding side preferences in participants without experience in child-caring (*basic holding relationships*, according to Donnot & Vauclair, 2007). Moreover, Donnot (2007) reinforced these results by showing that this link was present in left-handed female students but not in populations of left-handed mothers. Finally, Donnot and Vauclair (2007) confirmed the absence of this link among right-handed mothers (*advanced holding relationships*, according to Donnot & Vauclair, 2007). Thus, the question is whether participants in *intermediate holding relationships* (day-care centre and maternity hospital professionals) behave like students or mothers according to the role of lateralised emotional perception on holding biases. We hypothesised that if results for child-care professionals were similar to those of students, namely that EDLT and holding side scores were related, then only affective factors linked to the intimate relationship between the infant and its mother may be responsible for the reduction of effect of the lateralised emotional perception's influence on holding side preferences. Clearly, holding side preferences are determined by the



development of an affective and intimate relationship between the mother and her child, whatever may be her visual and auditory field advantages for perceiving an emotion. But if, on the contrary, our results were similar to those of mothers (absence of link between EDLT scores and holding side scores), we hypothesised that experience in child-caring, whatever the relationship with the infant, would be responsible for the reduction of the effect of lateralised emotional perception on infant-holding biases. Our results showed that side preferences of day-care centre and maternity hospital professionals are probably determined by factors linked to the experience acquired in contact with infants and not by some characteristics of the holder, such as advantages for a visual/auditory field in emotional perception. Given these results, it seems that Manning and Chamberlain's hypothesis (1991) was only confirmed in population of non-experimented participants as students. The main consequence of the findings is that holding side preferences in advanced holding relationships are likely determined by an adaptation of the holder to the child and not unilaterally decided by the holder (as seems to be the case in basic holding relationships). In any case, future studies will need to go beyond the left–right dichotomy to focus on deeper analyses of left and right side holding separately.

Several studies reported the existence of relationships between infant right holding and the presence of affective symptoms such as depression and/or stress (e.g., Donnot, Vauclair & Bréjard, 2008; Reissland et al., 2009; Vauclair & Scola, 2008, 2009; Weatherill et al., 2004). The present paper aims not to challenge the factors affecting left and right holding, but rather to draw attention to the distribution of left side preferences. If, initially, curiosity pushed scientists to ask why mothers held on the left side, we now have to enquire about the factors that are related to each side preference. Are there cases in which right holding is more advantageous than left holding? Vauclair and Donnot (2007) tried to show that right holding could be advantageous for mothers who perceive emotions better in the right auditory and right visual field, but this demonstration failed. Reissland (2000) showed that mothers adapted the pitch of their voice according to their holding side by speaking louder and with a higher pitch when cradling on the right side. She suggested that mothers can vary the holding side according to whether they want to arouse or soothe the infant. It thus appears that future investigations should focus on the infant-holding behaviour and interactions between the infant and the holder more than on the proportions of side preferences.

The main issue with the usual method of measuring preference for side-of-hold is that it considers only the favourite holding behaviours and not other behaviours. For example, an in-depth study of mother/child relationships of a mother who prefers to hold on the left side is inadequate without taking her right-holding behaviours into account. The same is true for a

mother preferring arm holding without considering her shoulder-holding behaviours. Moreover, in a majority of studies, the record of holding side preferences implies that no consideration is given to someone who always holds on the left compared with someone who holds slightly more often on the left side. Recently, Donnot (2007) and Donnot and Vauclair (2007) did a frequency analysis of left and right holds. It showed some intra-individual variability, namely that adults never held systematically on the same side. One crucial point is to identify which factors are likely to induce these variations. The use of holding side preferences as a measure is consistent when applied to non-experienced populations such as students. The reason is that such participants rarely hold infants. Their holding behaviour therefore is mainly determined by individual factors such as the advantage for a visual or an auditory field in emotional perception. In contrast, when participants (professionals or parents) frequently hold infants, the sole evaluation of side preference seems meaningless because these experienced participants necessarily hold on both sides. Proportions of left versus right and even middle holding can vary from one person to another. That is why holding behaviours must now be studied as a complex pattern and not just as a study of the preferred holding behaviour (left, right, or middle).

## CONCLUSION

What are the implications of infant-holding side preferences? It has been showed that holding side preferences are not a simple expression of motor laterality and must be related to several factors. Considering this growing field of investigation, we observed a large variability in side preferences according to the population studied, and more precisely according to the holding relationships between infant and holder (basic vs advanced). The results on intermediate holding relationships suggest that the development of holding relationships is complex, and emphasise the need for investigating a complete range of holding behaviours. Because the study of holding side preferences does not allow assessment of the affective relationships between a mother and her child, we will need further researches using new methods to describe holding behaviours. For example, longitudinal studies will certainly shed a new light on the phenomenon of infant holding by proposing a dynamic rather than static view of its development. Only two have been conducted so far (Dagenbach, Harris, & Fitzgerald, 1988; Vauclair & Scola, 2009).

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