# Exploring Nulliparous Female Students' Expectations of Motherhood: Are Right Cradlers More Anxious About Becoming Mothers?

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## Abstract

**Background:** Approximately 65-85% of women and girls share a tendency to cradle infants on the left side of their body. Many hypotheses have been put forward to explain this bias. This study aimed to identify differential beliefs around expectations of motherhood between left and right cradling participants.

**Methods:** Cradling preference was determined through systematic observations, whilst expectations of motherhood were measured through two self-report questionnaires, namely the Importance of Motherhood and Perceived Ability to Relate to Children. An equal number of left and right cradling nulliparous female students ($n$ = 35) completed the two questionnaires and performed the cradling task. A one-way ANOVA was run for both dependent variables.

**Results:** Results yielded significant differences for both the Importance of Motherhood and Perceived Ability to Relate to Children between the left and right cradling nulliparous female students.

**Conclusions:** Findings supported our hypotheses that right and left cradlers perceived themselves differently with regards to their expected mothering competence. Right cradlers, on average, seem to be more anxious and less willing to become mothers than the left-cradler group.


*Keywords:* leftward cradling bias, nulliparous females, expectations of motherhood, ability to relate to children.

## Introduction

A large body of evidence has shown that between 65% and 85% of all women and girls share a tendency to cradle infants on the left side of their bodies, similarly to non-human primates (i.e. gorillas and chimpanzees; Dagenbach, Harris, & Fitzgerald, 1988; Manning & Chamberlain, 1991; Sieratzki & Woll, 1996; Weatherill et al., 2004). By contrast, cradling bias is inconsistent in males, whose leftward bias seems to only emerge once they themselves become fathers (Harris, Almerigi, Carbary, & Fogel, 2001). Subsequently, the largest part of the literature on this topic focuses on female cradling bias. No real consensus has emerged in explaining the observed bias (Reissland, 2000; Suter, Huggenberger, Blumenthal, & Schachinger, 2011; Suter, Huggenberger, & Schachinger, 2007).

### Handedness, heartbeat and head position & left-cradling bias.

Many theories have been advanced to explain the leftward cradling bias, including the role of handedness, the role of the mother's heartbeat as a soothing effect for the infant, and the baby's preferred head-turning direction evoking the mother's cradling preference (Dagenbach et al., 1988; Manning & Chamberlain, 1991; Sieratzki & Woll, 2002; Suter et al., 2007; Suter, Huggenberger, Richter, Blumenthal, & Schachinger, 2009; Todd & Butterworth, 1998; van der Meer & Husby, 2006). The first explanation reflects a rather logical approach, according to which one would prefer to keep one's dominant hand free in order to perform other tasks while cradling a baby (van der Meer & Husby, 2006). Handedness would therefore play a pivotal role in the left-cradling bias, considering that the largest proportion of human beings are right handed (van der Meer & Husby, 2006). An alternative theory emphasises the role of the heartbeat and its soothing effects on the infant, due to a possible "imprint" that would have occurred *in utero*; subsequently, women would cradle their babies on the left side, closer to their hearts (Salk, 1960). Lastly, another argument suggests that infants prefer turning their head towards the right side, which would elicit left-cradling from mothers in order to increase "face-to-face" interaction with their babies (Dagenbach et al., 1988). Yet, all these hypotheses have yielded negative results. Studies have found no significant relation between leftward cradling and handedness, lateralized heartbeat or head turning preferences (Donnot, Vauclair, & Brejard, 2008; Todd & Butterworth, 1998; Vauclair & Scola, 2008).

### Brain hemispheric lateralization & left-cradling bias.

Subsequently, the causal narrative in the literature shifted towards an analysis of the asymmetric functions of the brain and the predominance of the right hemisphere in processing 'emotional' information (Bourne & Todd, 2004; Sieratzki, Roy, & Woll, 2002;

Sieratzki & Woll, 1996; Vauclair & Donnot, 2005). In typically structured brains, the left visual and auditory fields are directly connected to the right hemisphere, which is believed to be specialised for emotional information; as a result, left cradling would allow mothers to decipher their infants' somato-affective state more accurately and therefore react more effectively to them (see, e.g. Manning & Chamberlain, 1991; Manning et al., 1997; Sieratzki et al., 2002; Turnbull & Bryson, 2001). More specifically, whilst both left and right hemispheres are involved in interpreting various categories of information, the right hemisphere is considered to be dominant for the perception and processing of emotions (Bourne & Todd, 2004). For instance, Huggenberger, Suter, Reijnen and Schachinger (2009) have shown that females cradling on the left, who therefore have the infant's face in their left visual field, are more accurate in distinguishing emotional from neutral facial expressions in their babies. In addition, studies have argued that left-cradling woman share a left ear preference in detecting auditory inputs from their babies (Turnbull & Bryson, 2001; Sieratzki et al., 2002; Manning et al., 1997). Consequently, being able to accurately process their infants' emotional needs enables mothers to respond optimally to them, and build a channel of somato-affective communication (Sieratzki & Woll, 1996). This channel of communication would subsequently provide the foundation for secure bonding and attachment between the mother and her infant, which are seen as the necessary steps towards healthy interpersonal development in children (De Carli, Tagini, Sarracino, Santona, & Parolin, 2015; Huggenberger et al., 2009).

There have been surprisingly few studies focusing on women and girls who display a rightward cradling preference. Bourne and Todd (2004) found a slight leftward hemispheric lateralization of emotional processing in right-cradling females, which could explain the atypical bias in these cases. In other words, whilst left-cradlers tend to share a right hemisphere specialization in emotional processing, an inverse left hemisphere specialization in emotional decoding could explain right-cradling. Nevertheless, Bourne and Todd (2004) emphasized that their findings were not significant enough (they showed only a very slight tendency to left hemispheric lateralization in right cradlers), and therefore suggested that other psychological factors could play a role in rightward cradling bias.

**Depression, stress, anxiety & reduced left-cradling bias.**

In order to understand the mechanism of reduced left-cradling bias, studies have focused on behavioural characteristics of right-cradling mothers (De Château, 1991; Donnot et al., 2008; Weatherill et al., 2004). In that regard, in an exploratory study conducted by Bogren (1984), half of the right-cradlers were found to have experienced mental symptoms

prior to their pregnancy. Similarly, reduced left-cradling bias was found in women suffering from psychological difficulties such as depression and stress (De Château, 1991; Donnot et al., 2008; Reissland, Hopkins, Helms, & Williams, 2009; Weatherill et al., 2004). De Château (1991), interestingly, discussed the case of a right-cradling mother who regularly visited the Childcare centre because of the overwhelming anxiety she experienced in her life (i.e. financial and marital issues); then, once her situation was sorted out and she became more confident in her control over her life, he noted that her cradling side shifted to a leftward position. In addition, De Château (1991) also pointed out that right cradling was more common in mothers that had been separated from their infants *post-partum* (e.g. premature baby), and seemed to display less body contact with their babies.

Hence, anecdotal evidence suggests that right cradling may be related to psychological distress, and could also be a sign of a strained mother-infant relationship (De Château, 1991).

**Social affective disturbance and reduced left-cradling bias.**

De Château, Mäki, and Nyberg (1982) found that right-cradling mothers took longer to accept their baby, and had more difficulty adjusting to pregnancy. In addition, Bogren (1984) found that right cradling was more common in mothers that had not planned their pregnancies, or struggled to conceive. De Château (1991) similarly pointed out that left-cradling women had a tendency to prepare more for motherhood through reading about child-rearing practices than right-cradling mothers. Furthermore, right-cradlers have been found to be less emotionally involved with their infants, less responsive to their emotional needs and to spend less time in direct contact with them (Donnot et al., 2008; Sieratzki & Woll, 2002; Suter et al., 2007; Weatherill et al., 2004). This suggests that reduced left-cradling bias could be a sign of socio-affective disturbance in adjusting to motherhood.

In that regard, Pileggi, Malcolm-Smith, and Solms (2015) have hypothesised that leftward bias could be linked to the basic social-affective capacities of an individual to form a bond, an attachment, to others. Following this argument, Pileggi, Malcolm-Smith, Hoogenhout, Thomas, and Solms (2013) showed that children with Autism Spectrum Disorders do not display any bias in cradling babies, but rather choose the cradling side “by chance”. On their reasoning, this is because children with ASD are characterised by impaired social skills and lack of empathy, which prevents them from forming normal bonds with others (Pileggi et al., 2013; Pileggi et al., 2015).

Thus, reduced leftward cradling may be related to inner difficulties in forming attachments and relating socially and emotionally to others, including children (Pileggi et al., 2015).

**Attachment styles and left-cradling bias.**

One's abilities to care for others and develop relationships are largely shaped by one's own attachment style (Bowlby, 1988). In fact, attachment style is the primary determinant of an individual's internal working models of social and affective interaction (Rholes, Simpson, Blakely, Lanigan, & Allen, 1997). Four patterns of attachment style have been identified in the literature: dismissive-avoidant, fearful-avoidant, anxious-ambivalent and secure (Monk, Leight, & Fang, 2008). Attachment style typically endures throughout the lifespan, and it informs most social-affective processes (De Carli et al., 2015; Mazzeschi, Pazzagli, Radi, Raspa, & Buratta, 2015; Monk et al., 2008). For instance, Mazzeschi and colleagues (2015) have also shown that insecure attachment in a mother significantly impairs the quality of the emotional bond and sensitivity to their infants.

If individuals' inner abilities to form an attachment and relate to others are indeed a predictor of left-cradling bias, then attachment style should also interact with that bias. Yet, McGrath (2013) failed to identify a significant relationship between attachment style and cradling bias. This could potentially be due to the design of her study, which relied solely on online surveys and a non-supervised, imaginary cradling task: as such, the participants could have provided erroneous data (McGrath, 2013). Nonetheless, she did observe a correlation between attachment style and depression, which, in turn, strongly associated with reduced leftward cradling bias (McGrath, 2013). This suggests that attachment styles may impact leftward bias indirectly if the correct mediators are introduced (e.g. depression in her study), or simply that a factor *associated* with attachment may be more appropriate to explain a reduced leftward cradling bias.

**Attachment styles and working models of parenthood.**

As previously discussed, Rholes and colleagues (1997) have argued that attachment informs the working model of parenthood. That is, they found that women with insecure attachments shared more negative attitudes towards motherhood. Specifically, in their study, avoidant college students (who did not have children) displayed less desire to have children (Rholes et al., 1997). Interestingly, De Carli et al. (2015) have also found that insecurely attached women develop strongly negative (implicit) attitudes towards caregiving.
Rholes and colleagues (1997) further showed that both ambivalent and avoidant individuals were less likely to see themselves as able to relate to children. These findings were further

supported by the study conducted by Scharf and Rousseau (2017), who also identified that both dismissive and fearfully attached young adults displayed lower perceived ability to relate to children. Furthermore, their studies showed that participants with secure attachment perceived themselves as more emotionally competent to raise a (potential) child (Scharf & Rousseau, 2017). Hence, it seems that attachment is closely related to one's attitudes towards motherhood, and more specifically one's desire to have children as well as one's perceived ability to become a mother (Rholes et al., 1997; Scharf & Rousseau, 2017). Both these concepts also compose intrinsic socio-affective abilities to form a bond with a child.

**Working model of parenthood and leftward cradling bias: rationale for the present study.**

Overall, the literature on cradling bias lacks consensus concerning the factors leading to cradling side preference. Brain lateralization has received the most research and supporting evidence. Yet, lateralization alone fails to explain the social-affective component that seems to play a significant role in the bias, as shown by the work of Pileggi and colleagues (2015). As previously discussed, Rholes et al. (1997) found that attachment style could predict a woman's internal working model of motherhood, which includes their desire to have children and their perceived emotional competence to relate to a child. It thus suggests that one's representation of motherhood informs on one's intrinsic socio-affective capacities to emotionally bond and relate to others (specifically a child), which could be a factor in reduced leftward bias. However, surprisingly, no study has looked at a possible interaction between women's working model of motherhood and cradling bias.

Thus, this study hypothesises that women displaying a left-cradling bias are more likely to have positive expectations of motherhood than right-cradling women. In other words, the present study addressed the question: are right-cradling females more anxious about becoming mothers? Unlike De Château and colleagues' (1982) study, this study will investigate non-pregnant women. That is, the inquiry will not focus on their perceptions of a current pregnancy, but rather on their own perceived ability to relate to children as well as their desire to have children in the future.

## Aims and Hypotheses

This study was conducted simultaneously and in partnership with another study exploring possible correlations between brain lateralization, attachment styles, depression and cradling bias. As such, this study only focused on nulliparous females' expectations of motherhood and cradling bias. More precisely, this study sought to identify significant differences in expectations/representations of motherhood between left and right cradling

nulliparous females. Expectations of motherhood are operationally defined through two concepts, namely the desire to have children, and the perceived self-competence to emotionally relate to a child. Hence, this study tested the following hypotheses:

**$H_1$:** Right-cradling nulliparous females will show lower desire to have children than left-cradling nulliparous females.

**$H_2$:** Right-cradling nulliparous females will be more negative about their abilities to relate to children than their left-cradling counterparts.

## Methods

### Research Design

This study is a correlational exploratory study, seeking a possible association between cradling side and women's desires to become mothers as well as their self-rated ability to relate to children. The independent variable is a categorical one, composed of two groups: left-cradling and right-cradling nulliparous females. By contrast, the dependent variable measuring the participants' expectations of motherhood consists in two continuous scales: one measuring the desire to have children and one measuring the perceived ability to relate to children. Data was collected through cradling observations and self-report questionnaires.

### Participants

**Sampling method.** Non-probability convenience sampling was used in this study. Participants were recruited through the Student Research Participation Programme of the Psychology Department at the University of Cape Town. Participants were compensated for their time with 1 SRPP point.

**Exclusion criteria.** Given the aim of the study, only nulliparous female participants were invited into the study, in order to control for extraneous variables. Indeed, the expectations of motherhood, which include a measure of desire to have children and perceived ability to relate to children, are likely to differ from nulliparous female students to mothers, based on their actual past experiences with child rearing (Rholes et al., 1997). Hence, female students that already have had a child were excluded from this study. Race and ethnicity have been shown to have no effect on leftward bias since it exists across all cultures and countries (Harris, Spradlin, & Almerigi, 2007). Age was likewise previously shown to have no significant effect on cradling bias; De Château (1991) in fact showed that the leftward bias is present even in pre-school girls aged 6. Therefore, any female students without children were welcome to participate in the study, regardless of race, ethnicity, nationality and age.

**Sample characteristics.** A total of 135 female nulliparous participants took part in the study. 36 participants were right cradlers and 99 left cradlers, resulting in a rate of approximately 73,3 % left cradlers, which is in line with the previous literature (see, e.g., Dagenbach et al., 1988; Manning & Chamberlain, 1991; Sieratzki & Woll, 1996; Weatherill et al., 2004**).** While it is not relevant for the purpose of this study, it is of interest to note that our pool of participants was racially diverse, specifically made of 63 White (46,67 %), 33 Black (24,44 %), 18 Indian (13,33 %), 18 Coloured (13,33 %), and 3 Asian (2,22 %) nulliparous female students. Age ranged from 18 to 32 years old. In order to have equal samples across the left and right cradling groups, it was necessary to match the number of left-cradlers with that of right-cradlers. To do so, a simple random sampling was used to select our left-cradling sample. The final sample used for analysis is composed of a total of 70 participants, with 35 left-cradlers and 35 right-cradlers.

**Sample size and power analysis.** The sample size and statistical power was calculated a priori using the software G*Power (Version 3.1). We calculated an average effect size based on previous similar studies using nulliparous females, which yielded an effect size of approximately $f = 0.35$. To achieve a satisfactory target statistical power of 0.8, and given this moderate effect size (Cohen's $f = .35$), with alpha set at $\alpha = .05$ and two independent groups, it was calculated that a total sample size of 68 was required, with 34 participants in each group (i.e. left and right cradlers). Our final sample was made up of 70 participants, with 35 right cradlers and 35 left cradlers. Post-hoc power analysis shows that we achieved an actual power of 0.92, with an effect size of $f = .41$ for the Perceived Ability to Relate to Children variable, which is considered as a large effect according to Cohen (1988). Nonetheless, running a post-hoc power analysis with the Importance of Motherhood variable yielded an actual power of only 0.53, and an effect size of $f = .25$ (therefore ranging between a small and medium effect) (Cohen, 1988).

**Measures**

**Cradling side preference.** The cradling-side preference was measured through systematic observations. This study used a life-like doll, similar to previous studies in which this method elicited strong cradling bias (Manning & Chamberlain, 1991; Pileggi et al., 2013; Suter et al., 2007). Cradling side is defined as the side of the participants' body on which the baby doll's head is positioned (Reissland et al., 2009). Cradling was elicited through three different tasks, across three different instances, in order to establish definite cradling-side preference (Suter et al., 2007). First, the participants were presented with the doll and asked to pick it up and name it, thus creating a form of relationship between the doll and the

participants, which is necessary for a cradling bias to occur (Pileggi et al., 2015). Then, participants were told that the baby doll was crying, and they were required to soothe it; by doing so, we wanted to avoid "functional cradling" (i.e. cradling that could leave the dominant hand free in order to perform other tasks) (van der Meer & Husby, 2006). Lastly, participants were asked to pick up the baby doll in order to put it to sleep (hence further controlling for functional cradling) (Pileggi et al., 2015).

Each instance of cradling was counted to determine frequency and categorised as follows: if there were two or more instances of left cradling, then the participant was allocated to the left cradler group, and if there were at least two instances of right cradling, then the participant was categorised as a right-cradler. Consequently, cradling preference was a categorical variable with two distinct levels.

**Expectations of motherhood.** The expectations towards motherhood were measured in relation to the participants' desire to have children, as well as their perceived ability to relate to a child and become mother themselves.

***Importance of Motherhood Scale*** (McQuillan et al., 2012; see Appendix A). The Importance of Motherhood scale is a 4-item self-report questionnaire that includes "Having children is important to my feeling complete as a woman", "I always thought I would be a parent", "I think my life will be or is more fulfilling with children" and "It is important for me to have children". These items are answered on a Likert scale ranging from (1) strongly disagree to (5) strongly agree. Scoring higher on the scale signifies a greater desire to have children. In the study conducted by Kazyak, Park, McQuillan, and Greil (2014) the Importance of Motherhood scale yielded a Cronbach's alpha of $\alpha = .77$, which suggests high internal reliability. Similarly, McQuillan et al. (2012) obtained an alpha of $\alpha = .78$ on the Importance of Motherhood scale. It is therefore a reliable instrument for measuring women's desire to have children.

***Perceived Ability to Relate to Children Questionnaire***. The Perceived Ability to Relate to Children Questionnaire (Rholes et al., 1997; Appendix B) is an 11-item self-report questionnaire measuring the respondent's perceived self-efficacy in forming a bond with children. This questionnaire includes items such as "I worry that I would not be a good parent, and this makes me concerned about having children" and "I think children would be more demanding than I can handle". The fixed responses are constructed on a Likert scale ranging from (1) strongly disagree to (7) strongly agree. Scoring higher on the Perceived Ability to Relate to Children questionnaire refers to *lower* perceived self-efficacy in relating to children (and thus higher anxiety about becoming mother). Only Item number 10 has a

reverse score. Rholes et al. (1997) developed this measure in the context of their study associating attachment style with working models of parenthood, which yielded a reliability coefficient of $\alpha$ = .88. Similarly, the study conducted by Scharf and Rousseau (2017) yielded strong internal reliability for this questionnaire across both their pilot and actual study, scoring $\alpha$ = .88 and $\alpha$ = .83, respectively. In addition, this questionnaire displayed good discriminant predictive validity in concordance with their Desire to have Children scale (Rholes et al., 1997).

**Procedure**

Participants were invited to take part in the study through the Student Research Participation Programme (SRPP) used by the University of Cape Town Psychology department. Because we did not want to disclose the true intent of the study with regard to the cradling bias, the posted advertisement (Appendix C) only stated that this study aimed to explore female students' expectations of motherhood, for which they would be asked to engage in a role play with a doll and fill in a few questionnaires. The advert also stated the exclusion criteria (i.e. only nulliparous females were invited). Eligible participants were required to sign up and book an individual 15-minutes time slot on web-based software. By doing so, we wanted to avoid participants feeling uncomfortable cradling the doll with other participants looking on.

Upon arrival, the participant was given the informed consent form (Appendix D), which included a question for them to answer (i.e. "Have you ever been diagnosed with Autism Spectrum Disorder?"). We included this question in order to control for a possible extraneous variable: previous studies have shown that individuals with ASD did not show cradling bias, but rather chose the cradling side "by chance" (Pileggi et al., 2013). Nonetheless, no participant mentioned having been diagnosed with ASD. Once the participant read and signed the consent form, she was taken to another room where the baby doll was laid down on a table close by. The researcher then explained the procedure that was to follow. In addition, the participant was told that there was no right or wrong way to handle the doll, in order to make them feel more at ease. The first instance of cradling was elicited by requesting the participant to pick up the doll, cradle it and give it a name. The cradling side was subsequently recorded. The participant was then told that she could put down the doll. For approximately one minute, the participant and the researcher conversed casually, in order to provide a break between each instance of cradling. When the minute had passed, the baby doll started "crying": more precisely, the researcher played sounds of baby cries through speakers situated behind the baby doll. The researcher then asked the participant to

pick up the doll and soothe it. The side on which the participant cradled was recorded as the second instance of cradling preference. After the baby "stopped crying", the participant was told to put the baby back on the table. Following this, another break of approximately one minute was taken, during which the researcher and participant made small talk. Once the minute had passed, the researcher told the participant that the baby was getting tired, and requested her to pick it up as if to put it to sleep. That last instance of cradling was recorded.

After the participant put down the baby, she was taken to another room. There, the participant had to sit down and was provided with a pen to fill in the paper versions of the Perceived Ability to Relate to Children and Importance of Motherhood questionnaires. While the participant was answering both questionnaires, another researcher was also present in the room in case the participant had any issues with the items. Once the participant finished answering the questionnaires, she was provided with a receipt proving that she attended the session and was hence eligible to receive 1 SRPP point. Lastly, the participant was also given a debriefing form (Appendix E) and the opportunity to ask further questions about the study.

**Tests scoring.** Each participant had two questionnaires, and therefore has two scores: one reflecting on the perception of importance of motherhood and one relating to perceived self-efficacy to relate to children. Each questionnaire was manually scored (i.e. sum of scores on each items), with the Perceived Ability questionnaire ranging from a minimum of 11 to a maximum of 77, and the Importance of Motherhood ranging from 4 to 20. Only one item had a reversed score on the Perceived Ability to Relate to Children questionnaire, and was accounted accordingly.

**Final sample selection.** To achieve more stringent statistical analyses, it was necessary to have equal sample sizes across the left and right cradling groups (Field, 2013). As such, we needed to match the number of left cradlers with right cradlers. However, we could not accurately *a priori* predict how many participants we would need to reach our minimum sample of at least 34 right-cradlers. More precisely, we only reached our minimum of right cradlers after processing 135 participants, which included 99 left cradlers and 36 right cradlers. As such, it was necessary to remove some of the left-cradling participants' scores from the final sample analysis, to avoid having unequal groups. This was done following a simple random sampling technique. Firstly, participants who did not respond to all the items of the questionnaires were removed from the pool. Similarly, the data of participants that chose contradictory answers were also removed: for instance, some participants answered "strongly agree" on the item "I feel uncomfortable with infants", but responded "strongly disagree" on the item "I do not feel comfortable with infants", which

indicates that they did not pay close attention to the questionnaires and may therefore provide erroneous data. As a result, we only included 35 right cradlers, because one participant did not complete all the items on a questionnaire. Subsequently, we carried out a simple randomized sampling with the pool of remaining left-cradling participants. We assigned participants in numerical order from 1 to 95 (the pool size after discarding erroneous data), and generated a list of 35 random numbers (in the 1 to 95 range bracket) in Microsoft Excel. The numbers randomly generated designated the 35 left-cradling participants whose data were to be included in the final analysis to match our 35 right-cradling group.

**Ethical considerations**

This study received ethical clearance from the Psychology Department Ethics Committee at the University of Cape Town.

**Informed consent, confidentiality and voluntary participation.** A written consent form was provided to the participants (Appendix D). Nevertheless, considering the hypothesis of the study, its full purpose was not disclosed as it may have influenced the cradling side preference of the participants. They were only told that the study explores female university students' expectations of motherhood. The data captured remained anonymous and was kept confidential, and only the student numbers of the participants were taken down for the purpose of allocating the SRPP points. In addition, the participants were informed that participation in the study was purely voluntary, which meant that they were free to withdraw from the study at any moment, without incurring any risk or penalty (other than not receiving their SRPP point). This study, overall, involved little risk as it only consisted of self-report questionnaires and a cradling task.

**Debriefing.** All participants were debriefed about the full aims of the study, and were provided with the opportunity to discuss any discomfort they may have experienced during the session. Contacts details were also provided should they wish to ask further questions, or need to discuss any discomfort with a health practitioner (Appendix E).

**Statistical analysis**

The data was analysed using the statistical software SPSS, 24$^{th}$ edition. For all inferential statistics tests, alpha was set at $\alpha = .05$. Descriptive statistics are provided for each dependent variable.

**ANOVA, assumptions and non-parametric tests.** The inferential statistical test ANOVA was used rather than a t-test to compare our group means: essentially, t-test and one-way ANOVA (with only two levels for the independent variable) yield identical results, but ANOVA provides a more straightforward and easier way to interpret analyses. Our data

violated a few assumptions of ANOVA. For both dependent variables (i.e. importance of motherhood and perceived ability to relate to children), our data was not normally distributed, but rather strongly skewed. In addition, the Perceived Ability to Relate to Children variable did not yield homogeneous variances across the left and right cradling group. Whilst ANOVA is fairly robust to those violations when the sample sizes are equal, we also ran the Mann-Whitney U test, a non-parametric test equivalent to our one-way ANOVA, to compare and discuss results (Field, 2013). Nonetheless, the assumption of independence of observations was upheld for both analyses, as each participant was only scored once and only belonged to either the left or right cradling group.

## Results

### Hypothesis I: Right-cradling nulliparous females will show lower desire to have children than left-cradling nulliparous females.

### Descriptive statistics

Table 1 indicates that left-cradlers scored higher on average on the Importance of Motherhood scale ($M$ = 15.49, $SD$ = 3.99) compared to the right-cradlers group ($M$= 13.23, $SD$ = 5.24). Considering that the scale is measured out of 20, we can thus observe that for both groups of nulliparous females, becoming a mother is, on average, perceived as a fairly important milestone in their lives ($M$ = 14.36). Furthermore, the distribution appears largely homogeneous, with a fairly low variance in scores ($SD$ = 4.76).

Table 1.

*Importance of Motherhood Descriptive Statistics.*

| Cradling side preference | *M* | *SD* | *n* |
|---|---|---|---|
| Left cradling group | 15.49 | 3.99 | 35 |
| Right cradling group | 13.23 | 5.24 | 35 |
| Total | 14.36 | 4.76 | 70 |

Note. *SD* = standard deviation.

The boxplots (Figure 1) show that both the left-cradlers and right-cradlers group distributions are negatively skewed, with the left-cradlers more severely so. In addition, the right-cradling group displays a slightly larger variance than the left-cradling group. Nonetheless, ANOVA is fairly robust to violation of normality provided that the sample sizes are equal groups, which is the case in our study, $n$ = 35. We thus continued with our analysis of variance.

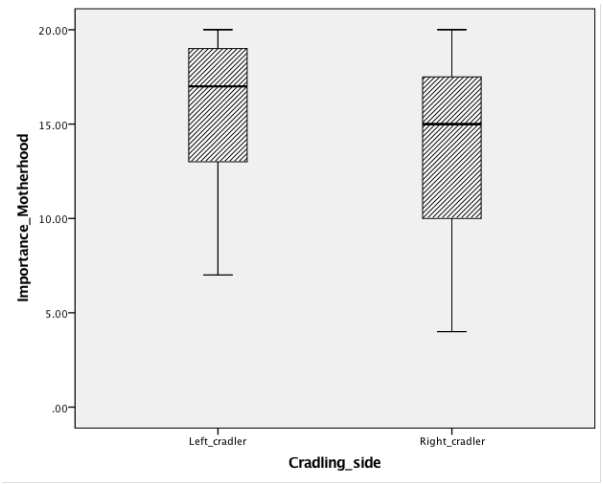


*Figure 1*. Boxplots of importance of motherhood scores by cradling preference.

**Inferential Statistics**

**One way ANOVA.** Levene's test of homogeneity was not significant, $p = .117$ and therefore the assumption of homogeneity was upheld. The one way ANOVA analysis yielded significant results (Table 2), $F(1, 68) = 4.11$, $p = .047$, with an effect size of $\eta^2 = .057$. However, the $p$ value is admittedly very close to the $\alpha = .05$ cut off. Nonetheless, it does suggest a very slight difference in means between groups: specifically, right-cradlers scored significantly lower on the Importance of Motherhood test compared to their left-cradling counterparts. In addition, the analysis yielded an effect size of $\eta^2 = .057$, which suggests that 5,7 % of variance in scores is attributable to the cradling side preference.

Table 2.

*Analysis of Variance in Importance of Motherhood Table.*

| | *SS* | *df* | *MS* | *F* | *p* | $\eta^2$ |
|---|---|---|---|---|---|---|
| Cradling side preference | 89.16 | 1 | 89.16 | 4.11 | .047* | .057 |
| Error | 1474.91 | 68 | 21.69 | | | |
| Corrected Total | 1564.07 | 69 | | | | |

Note. *p < .05

**Hypothesis II: Right-cradling nulliparous females will be more negative about their abilities to relate to children than their left-cradling counterparts.**

**Descriptive Statistics**

The descriptive statistics provided in Table 3 show that right cradlers have, on average, scored fairly high on the Perceived Ability to Relate to Children Questionnaire

(*M* = 32.20, *SD* = 12.41) compared to the left cradling group (*M* = 23.66, *SD* = 8.39). A higher score on this test suggests more negative views on one's perceived ability to relate to children, and more anxiety in having children rely on oneself (Rholes et al., 1997). On average then, nulliparous female (university) students do not appear to have high anxiety, - or low perceived self-efficacy regarding their ability to emotionally relate to children (*M* = 27.93). Nonetheless, the distribution varies largely in scores (*SD* = 11.36), which suggests that there are large intrinsic differences across participants.

Table 3.

*Perceived Ability to Relate to Children Scores Table.*

| Cradling side preference | *M* | *SD* | *n* |
|---|---|---|---|
| Left cradling group | 23.66 | 8.39 | 35 |
| Right cradling group | 32.20 | 12.41 | 35 |
| Total | 27.93 | 11.36 | 70 |

Note. *SD* = standard deviation.

The right cradling group's scores are fairly normally distributed, with a very slight positive skewness, as shown in Figure 2. The left-cradling group distribution is positively skewed as well, and even more strongly so. Nonetheless, as previously argued, ANOVA is fairly robust to violation of normality. The main point of concern here is the large difference in variance across the two groups, which suggests that the assumption of homogeneity is likely to be violated.

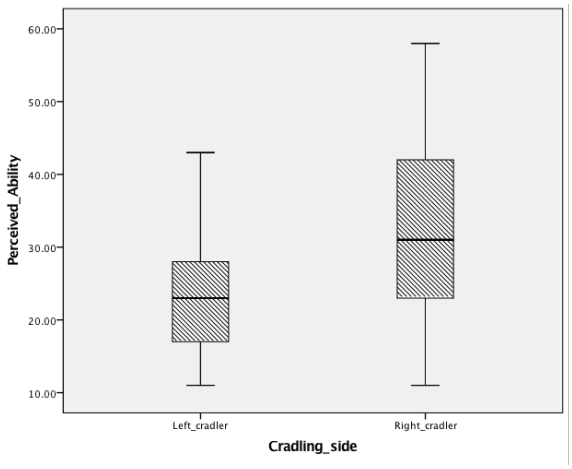


*Figure 2.* Boxplots of perceived ability to relate to children scores by cradling side.

**Inferential Statistics**

**One Way ANOVA.** Levene's test of homogeneity of variance was indeed significant, $p = .007$, which indicates that the error variances were not equal across groups, and therefore the assumption of homogeneity was not upheld. This could be an issue if the sample sizes were unequal, but in our study both groups have equal numbers of participants, $n = 35$. The analysis of variance was hence carried out with its results displayed in Table 4. The one-way ANOVA yielded significant differences, $F(1, 68) = 11.39$, $p = .001$, $\eta^2 = .143$. Specifically, right-cradlers scored significantly higher than the left-cradling group in the perceived ability to relate to children questionnaire, with an effect size of 14,3%. That is, the individual differences in their beliefs around whether they are able to emotionally relate to children accounts for 14,3% of variance across left and right cradlers.

Table 4.

*Analysis of Variance in Perceived Ability to Relate to Children Table.*

| Source | *SS* | *df* | *MS* | *F* | *p* | $\eta^2$ |
|---|---|---|---|---|---|---|
| Cradling side preference | 1277.16 | 1 | 1277.16 | 11.39 | .001* | .143 |
| Error | 7627.49 | 68 | 112.17 | | | |
| Corrected Total | 8904.64 | 70 | | | | |

Note. *p < .05

**Mann-Whitney Test.** Because both assumptions of normality and homogeneity of variance were violated for the Perceived Ability to Relate to Children variable, a non-parametric test was also run in order to compare results. Non-parametric testing does not assume normally distributed data, nor does it assume homogeneity of variance (Field, 2013). The Mann-Whitney nonetheless also yielded significant differences, $U = 359$, $p = .003$. The $p$ value differs slightly from the one indicated by the ANOVA analysis; however, this could be due to the fact that non-parametric tests have also less statistical power than their parametric equivalent (Field, 2013). Subsequently, we will only retain the results yielded from ANOVA in our discussion.

## Discussion

This study sought to find an association between cradling bias and nulliparous females' expectations of motherhood. Our pool sample of 135 participants yielded a ratio of

73,3% of left-cradlers against 26,7% of right cradlers, and is therefore aligned with previous findings (see, e.g., Dagenbach et al., 1988; Manning & Chamberlain, 1991). This study hypothesised that right-cradling nulliparous females would display lower desire to have children, as well as more negative views towards their perceived abilities to relate to children compared to the left-cradling group. Our results supported both those hypotheses.

Our first hypothesis was measured with the Importance of Motherhood questionnaire and yielded significant results, $p = .047$. This suggests that, on average, our sample of right cradling female students did not consider becoming a mother as important as the left-cradling sample group. Such finding could support De Château (1991) observation that left-cradlers seemingly prepared themselves more for childrearing by reading about childbirth prenatally than their right-cradling counterparts. Specifically, right-cradlers appear to be less willing to become mothers - or have less desire to mother - which could subsequently lead to a more negative stance towards their own pregnancy. Interestingly, Bogren (1984) has also discussed that women with unexpected pregnancies included more right cradlers. These unplanned pregnancies could suggest that these right-cradling women had less desire to have a child in the first place. This could explain why right-cradling mothers were found to display more negative attitudes towards their pregnancies, and took longer to accept the child as their own (De Château, 1991; De Château et al., 1982).

This idea of negative representations of motherhood was further tested with our second hypothesis, which stated that right cradlers would have more negative self-perceptions about their emotional competence to become a mother than left-cradling nulliparous females. Using the Perceived Ability to Relate to Children scale developed by Rholes and colleagues (1997), our analysis also yielded significant results, $p = .001$ and an effect size of $\eta^2 = .143$. In other words, we found that right cradlers were significantly more anxious about becoming mothers and displayed lower perceived capacity to relate to children. This finding thus provides further evidence supporting the hypothesis put forward by Pileggi et al. (2013), according to whom intrinsic socio-affective capacities could be a factor in reduced leftward cradling bias. Indeed, the Perceived Ability to Relate to Children specifically looks at *beliefs* around one's own competence to become emotionally attached to a child: as such, it questions whether one feels one has the necessary socio-affective tools to bond with others, and specifically a child (Scharf & Rousseau, 2017). Our results thus show that nulliparous female right-cradlers, on average, do not feel as confident in their socio-affective capacities to form a bond, compared to their left-cradling counterparts.

This perceived lack of "mothering competence" could also explain previous findings regarding maternal depression and stress as potential factors in reduced leftward bias (see, e.g., Donnot et al., 2008). That is, women that see themselves as unable to emotionally relate to others, or support others, are more likely to display postnatal depressive symptoms and anxiety (Mazzeschi et al., 2015; Thomason, Flynn, Himle, & Volling, 2015). Similarly, Leahy-Warren, McCarthy and Corcoran (2009) argued that having negative views of one's intrinsic ability to raise a child is strongly correlated with postnatal depression and stress. This could hence suggest that depressed and stressed right-cradling mothers share negative self-representations of their parenting competence, and overall are struggling with negative cognition relating to their socio-affective abilities. Interestingly, Bogren (1984) has also pointed out that right-cradling was more predominant in women that had experienced difficulties in conception. It could be hypothesised that these women developed negative cognition regarding their own biological/physiological abilities to have children, which subsequently influenced their perceived parenting competence as a whole.

Whilst this last hypothesis might be speculative, it is of interest that individual cognition regarding expectations of motherhood can potentially have such an effect on cradling bias. More precisely, if we follow our argument regarding negative representations of motherhood, it could be that depression is only a large contributor to reduced left cradling bias in *mothers* (or mothers to-be). For instance, McGrath's (2013) study looked only at nulliparous female students, which originally did not yield significant and strong correlations between depression and cradling preference. Only once she created a different dataset with the highest and lowest depression scores did she find a very slight effect size between depression and right-cradling preference – in nulliparous females (6.5% of variance) (McGrath, 2013). By contrast, previous studies have largely been consistent in associating reduced cradling bias with mothers suffering from depression, stress and/or anxiety (see, e.g., De Château, 1991; Donnot et al., 2008; Reissland et al., 2009). This could imply that depression is only correlated with reduced leftward bias in mothers (to-be), because of their negative cognitions regarding their emotional self-efficacy to raise their *own* children. Furthermore, a change in cognition could then potentially lead to a reversal in cradling preference. For instance, De Château (1991) pointed out that one right cradling mother, who was overwhelmed by anxiety, became a left-cradler once her financial and marital situation improved. This could potentially be explained by our findings: this woman might have perceived herself as not able to support her child (due to financial, relational difficulties in

her own life), but once her situation became stable, she felt affectively more able to relate to her child.

**Limitations of study and direction for future research**

There are a few limitations to this study that need to be taken into consideration. Firstly, it is necessary to point out that for the Importance of Motherhood test, our statistical *p* value sits very close to the $\alpha = .05$ threshold. In addition, our power analysis only yielded a fairly moderate power of 0.53. Considering these characteristics, we will retain our results but with extreme caution. That is, the power analysis indicates that there is an approximately 53% chance to reject/retain the null hypothesis whilst, in fact, there is no/is significant differences in nature (Field, 2013). As such, we will caution against making too strong assumptions regarding that specific finding. It seems necessary to carry further research with a larger sample in order to be able to make stronger claims regarding the association between cradling bias and perceived importance of motherhood.

Secondly, both questionnaires were self-report tests, and therefore may contain response biases depending on what is socially expected. That is, women are generally considered as the "nurturing" gender: as such, it is more socially expected of women to desire children, and be comfortable around them. Nonetheless, no other form of measure currently exists to evaluate beliefs around maternal self-efficacy or perception of importance of motherhood (see, e.g., Leahy-Warren et al., 2009). Developing a new tool measuring such beliefs may be necessary, but may be a potentially complex task.

Thirdly, because this study only looked at differences between means, we cannot make any inferences regarding the causality between importance of motherhood, perceived ability to relate to children and cradling bias. In addition, in order to achieve equal sample sizes, we removed participants from the left-cradling group and therefore could potentially have induced a bias in selection. Originally, we had wanted to only process 35 left-cradlers (that is, only make the first 35 left cradlers fill in all the questionnaires) in order to avoid such sampling; however, this option was raised as an issue with regards to ethics and the allocation of SRPP points. Thus, for future research, it would be preferable to either conduct a research that does not require equal sample sizes, or ensure that no selection bias can occur during the data analysis.

Fourthly, this study only aimed at identifying significant differences between the left and right cradling nulliparous female students around their expectations of motherhood. Whilst it has yielded significant results, it cannot make any empirically supported inferences in relation to other theoretical concepts such as attachments styles, depression, stress, and

cradling bias. Future research should focus on drawing a relationship between these concepts, and particularly how attachment styles, working model of motherhood and depression interact with one another and subsequently impact cradling bias. That is, variability in perceived ability to relate to children only amount for a 14,3% of variance across right and left cradlers; while this is a fairly large effect size, it is necessary to identify other factors that contribute to cradling bias. Subsequently, we have hypothesised that insecure attachment styles informed negative internal representations of motherhood, which in turn could lead to higher depressive symptoms in *mothers*, and subsequently disrupts the leftward cradling bias. Such hypothesis could be tested in future research using multiple regressions.

**Study contributions and significance**

The contributions and implications of this study are two-fold. Firstly, this is the first study looking at the specific beliefs around working models of motherhood and their possible association with cradling bias. Overall, our results provide empirical evidence supporting Pileggi and colleagues' (2013) hypothesis that cradling bias is related to intrinsic socio-affective abilities to form a bond with others. Specifically, it has shown that right-cradling nulliparous females are, on average, more anxious and less confident in their abilities to become mothers. Subsequently, it provides a potential rationale in explaining the larger rate of right-cradlers in depressed mothers, through the possibility that those women may have negative cognitions regarding their mothering competence. Hence, this study opens several routes for further research on cradling bias in relation to attachment styles, working model of motherhood and depression.

Secondly, for clinical practice, these findings could potentially help identify women that may require further social support in adjusting to motherhood. That is, our results suggest that reduced leftward cradling is, in fact, associated with more negative self-representations of child-rearing and mothering competence. Several studies have shown that negative cognitions around one's abilities to raise a child is strongly correlated with *post-partum* depression (Leahy-Warren et al., 2009; Thomason et al., 2015). In other words, women that display a right-cradling preference may be more at risk for depression, based on their maladaptive cognitions. Hence, health professionals should pay attention to the cradling side preference of pregnant women, in order to provide additional support where necessary.

## Conclusion

A large body of research has shown that the majority of women and girls share a tendency to cradle infants on the left side of their bodies (see, e.g, Manning & Chamberlain, 1991; Dagenbach et al., 1988; De Château, 1991; Suter et al., 2007). Several hypotheses have

been put forward to explain such bias, including handedness, heart location, and brain hemispheric lateralisation (Dagenbach et al., 1988; Manning & Chamberlain, 1991; Sieratzki & Woll, 2002; Suter et al., 2007; Todd & Butterworth, 1998; van der Meer & Husby, 2006). Nonetheless, research focusing on right-cradlers' characteristics have shown that psychosocial tensions such as depression and stress are significant factors in reduced leftward cradling bias (Donnot et al., 2008; Reissland et al., 2009; De Château, 1991). Similarly, Pileggi and colleagues (2015) have pointed out the potential role of intrinsic socio-affective capacities in reducing this leftward bias. Hence, this study hypothesised that right-cradling nulliparous female students were likely to show lower desire to have children, as well as more negative self-representations of their abilities to relate to a child compared to left-cradling females. Statistical analyses indicated significant differences for both measures of Importance of Motherhood and Perceived Ability to Relate to Children. Our findings therefore suggest that right-cradling nulliparous females, on average, see themselves as less competent to emotionally relate to children, and do not perceive mothering as being as important as their left-cradling counterparts. This study provided further empirical evidence supporting the hypothesis of differential socio-affective abilities in explaining cradling side preference. Subsequently, it opens further routes for research on cradling bias and intrinsic representations of motherhood, as well as providing evidence for practical and clinical implications involving pregnant women at risk for *post-partum* depression.

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## Appendix A
## Importance of Motherhood Scale

Based on the following scale indicate your degree of agreement with each item.

1- Strongly disagree
2- Somewhat disagree
3- Neither agree nor disagree
4- Somewhat agree
5- Strongly agree

1. “Having children is important to my feeling complete as a woman.”
2. “I always thought I would be a parent.”
3. “I think my life will be or is more fulfilling with children.”
4. “It is important for me to have children.”

## Appendix B
## Perceived Ability to Relate to Children Questionnaire

Instructions: Rate the following items on a 7-point scale: 1= I strongly disagree; 4 = neutral; 7 = I strongly agree.

1. I do not feel comfortable with children.

2. I would not feel comfortable having children depend on me.

3. I feel uncomfortable with infants.

4. I worry that I would not be a good parent, and this makes me concerned about having children.

5. I worry that it may be hard for me to feel close to a child.

6. Children require more patience that I have.

7. I think children would be more demanding than I can handle.

8. I'm just not a “baby person.”

9. My personality and children are not a good mix.

10. In regard to children, I see myself as being caring and warm. (Reverse Score)

11. I worry that I could not become emotionally attached to children.

**Appendix C**
**SRPP Advertisement**

**INVITATION TO PARTICIPATE IN STUDY**

**Subject Line: Get Your SRPP Point for Next Semester & Come Play with a Doll!**

Dear all,

**Aim of the study**
We are looking for participants to take part in our exciting study exploring female students' expectations of motherhood.

**INCLUSION CRITERIA: ALL** female participants that **DO NOT YET** have had a child are welcome to participate.

This criterion is due to the aim of our study looking at specific beliefs and expectations of motherhood; as such, female students that already have become mothers may have different views based on their real experiences.

**Procedure of the study**

You would need to come in to a data collecting session, during which you will be asked to participate in a role-playing task with a doll and fill in self-report questionnaires.
The overall session should not last longer than 30 minutes.

**Risks & benefits**

There is no associated risk with participating in this study, but you will be asked to provide personal information about your expectations of motherhood.

You will be rewarded with **1 SRPP point for one of the Second Semester Psychology course** for completing the session.

**If you are interested in participating, please RSVP for a time slot of your convenience in the Sign-up tab.**

If you have any further questions, please email me at prrmat003@myuct.ac.za.

**Thank you!**

**Mathilde Paraire & Natasha Jooste**

## Appendix D
## Informed Consent Form

**Dear Participant,**

Thank you for your interest in our study! Before starting the data collection, it is important that you read the following carefully. This consent form should provide you with all the information you need regarding this study. If you have any questions, please feel welcome to ask.

**Purpose of the study:**
The purpose of this study is to explore the expectations of motherhood of female university students. This study is carried out in the framework of my Honours' degree in Psychology, at the University of Cape Town.

**Procedure of study:**
This study will ask you to come in for a session lasting for about 20 minutes. You will be required to fill out questionnaires and complete several tasks involving a life-like doll.

**Benefits & Risks:**
There is no specific risk in taking part of the study, except of possible discomfort in providing personal information about your expectations of motherhood.
There is no personal benefit associated with taking part in the study. You will however be compensated with 1 SRPP point.

**Confidentiality & Anonymity:**
The data collected will be kept confidential and anonymous. The research will not include any personal details or information on the participants in any way. Only the researchers will have access to the information you provide.

**Voluntary Participation:**
Your participation in this study is voluntary, which means you are free to refuse to participate in this study, or withdraw from it at any point in time without risking any penalty. You may, however, not receive the full amount of SRPP points if you decide to withdraw from the study.

**Future use of the data:**
This research may be published in an academic journal, if meeting the requirements. However, the data collected will not refer to any individual or specific case, and will not be retraceable to you in any way.

**Contact Details:**
If you have any issues regarding this study, please feel free to contact the researcher:
Mathilde Paraire
Prrmat003@myuct.ac.za

Or **Rosalind Adams** (postgraduate administrative assistant):
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Telephone: +27 (0)21 650 3417

**Informed Consent:**

I acknowledge that I have read the above terms, and give my full consent to participate in this study.

If you do not have further questions, please fill in your information below, used for SRPP point allocation purposes:

**Participant name:**

**Student Number**:

**Course Code (you would like the SRPP point to be uploaded for):**

**Have you ever been diagnosed with Autism Spectrum Disorder?:**

Date: _____

**Signature:**

## Appendix E
## Debriefing Form

**Dear Participant,**

Thank you for taking part in this study! It is greatly appreciated.
At the beginning of this study, you were told that we were exploring female students' expectations of motherhood; however, that is not the full scope of our study. This form provides you with the deeper aims and rationale of the study. If you have any further questions, please feel free to ask them to the researcher.

**1- The title of this research is:**

*Exploring Nulliparous Female Students' Expectations of Motherhood: Are Right Cradlers More Anxious About Becoming Mothers?*

2- **Purpose of the study:**

The previous literature has found that approximately 70% of women and girls from age 6 share a tendency to cradle infants on the left side of their bodies. Many explanations have been put forward in order to explain this bias: the role of handedness, the heartbeat location, the brain lateralization for processing information and emotional inputs, and even social-affective processes. Our study specifically aimed to look for a possible relationship between women's expectations of motherhood as a possible factor in cradling bias. That is, this study hypothesised that female nulliparous students cradling on the right may perceive themselves as less willing to have children and/or relate to them.

**3- Deception**

Because we were looking at the participants' cradling side specifically, we did not wish to disclose this aspect of the study, as it could have influenced the results (that is, the cradling side preference).

**4- Individual Considerations**

Please bear in mind that answering in a certain way to the questionnaires, or cradling one side or the other, does not specifically suggest that you would or would not have difficulty relating to children or becoming a mother. These interactions are not yet understood, but it is certainly the case that other factors are involved in cradling side preference (e.g. brain lateralization of emotional processing).

## 5- Discomfort & further proceedings.

If this study has caused you any discomfort, please feel free to discuss it with the researcher, for instance by asking further questions regarding the study. It is important that you do not leave with negative feelings.
Alternatively, we can provide you with the contacts of a clinical psychologist, in the event you would like further counselling.

**Lastly, it is important that you do not reveal anything that happens in the study (or its aims) to other students, as it may influence the results.**

We will email you the findings of our study, so that you can also benefit from it.

Thank you again for your time!
Sincerely

Miss Mathilde Paraire
PRRMAT003@myuct.ac.za