

Attachment, Empathy and Social Ability as Correlates of Leftward Cradling in Students

Faieeza Khalfe

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Supervisor: Prof. Susan Malcolm-Smith

Co-Supervisor: Dr. Lea-Ann Pileggi

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List of Abbreviations

Abbreviations	Definitions
APA	American Psychiatric Association
ASD	Autism Spectrum Disorder
BAI	Beck Anxiety Inventory
BDI-II	Beck Depression Inventory
BEES	Emotional Empathy Scale
BPD	Borderline Personality Disorder
CB	Cradling Bias Trial
COVID-19	Coronavirus Disease of 2019
ECR	Experience in Close Relationships
ECR-RS	Experience in Close Relationships – Relationships Structure Questionnaire
EHI-S	Edinburgh Handedness Inventory – Short form
GAD	Generalized Anxiety Disorder
ICQ-15	Impersonal Competence Questionnaire
LMIC	Middle-Income Countries
LQ	The Laterality Quotient
M	Mean
MDD	Major Depressive Disorder
NPD	Narcissistic Personality Disorder
PBI	Parental Bonding Instrument
QCAE	The Questionnaire of Cognitive and Affective Empathy
SA	South Africa
SD	Standard Deviation
SDB	Social Desirability Bias
SRPP	Student Research Participant Program
SSP	Strange Situation Procedure
ToM	Theory of Mind
UCT	University of Cape Town

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Abstract

Many theories have been put forth in order to explain the emergence of leftward cradling bias - the universal phenomenon whereby humans tend to exhibit a bias for cradling to the left when trying to soothe an infant. Current research supports a cerebral laterality hypothesis, which suggests that this bias emerges because of the specialised decoding and processing of facial emotional expressions, affect, and socio-emotional stimuli, as well as non-verbal aspects of communication, all of which take place in the right cerebral hemisphere. The leftward positioning of the infant places them in the cradlers left auditory and visual fields. This placement is argued to allow for better monitoring of the infant. This has a reciprocal advantage for the infant – as they are able to perceive the more expressive side of the cradlers faces. This facilitates optimal relating and subsequent bonding, both of which contribute to developing future prosocial behaviors. Consequently, it has been recently argued that leftward cradling bias is reflective of better attachment, empathy, and social ability. It is also argued that mood-related states of depression and anxiety should disrupt leftward cradling bias, given that both disorders are associated with difficulties in socio-emotional relatedness.

This study aimed to investigate the relationship between leftward cradling bias and socio-emotional relatedness. To do so, I looked at the relationship between the preferred cradling side and (1) three variables of socio-emotional relatedness - attachment, affective empathy, and social ability - and (2) mood-related states and symptoms of both depression and anxiety. The sample in this study were undergraduate male and female Psychology students ($N = 677$) at the University of Cape Town in South Africa. It was conducted online. Participants first placed a demographic questionnaire, after which they completed a series of self-report questionnaires between four cradling bias task trials.

Despite a theoretical basis, hierarchical regression analysis indicated that none of the variables of interest predicted cradling side in this sample. Only handedness predicted cradling side, with right-handed individuals being significantly more likely to demonstrate the leftward cradling bias ($\beta = -.11, p = .003$). However, this variable only contributed 1% in explanation ($R^2 = .01$). Future research should consider a threshold hypothesis in relation to variables of socio-emotional relatedness. An argument can be made that clinically significant deficits in socio-emotional relatedness, as seen in clinical disorders such as narcissistic personality disorder and borderline personality disorder, could disrupt the otherwise universal leftward cradling bias.

Keywords: leftward cradling bias, university students, attachment, affective empathy, social ability, depression, anxiety, handedness

Leftward cradling bias is a universal phenomenon in which humans and non-human primates show a preference to cradle an infant to the left side of their body midline, when attempting to soothe (Dagenbach et al., 1988; Harris, 2010; Hopkins, 2004; Manning & Denman, 1994; Packheiser et al., 2019; Vauclair & Donnot, 2005). While this bias is evident across sex, it is described as more apparent in females, with roughly 74% of all females demonstrating leftward cradling bias (Packheiser et al., 2019). The bias is, however, also apparent in male samples (Packheiser et al., 2019). Leftward cradling bias is also seen across different cultures, and historical periods, regardless of age (Harris, 2010; Lockard et al., 1979; Salk, 1973). Furthermore, non-human primates have also been seen to demonstrate this bias (Hopkins, 2004; Manning & Chamberlain, 1990; Manning et al., 1994). The universality of the bias, its appearance in children, as well as non-human primates, and the fact that it comes about without conscious awareness, speaks to an innate biological basis for its emergence. Moreover, it speaks to a primitive mechanism for the emergence of a leftward cradling bias.

After decades of research regarding the explanations for the emergence of leftward cradling, a consensus has been reached that a cerebral lateralization hypothesis is the best explanation for the reason that this bias emerges (Bourne & Todd, 2004; Lockard et al., 1979; Malatesta et al., 2020; Oppler & Laubscher, 2021; Pileggi et al., 2013, 2015). It is generally agreed upon that the reason for the leftward preference when cradling an infant in the attempt to soothe, is due to the specialized role that the right cerebral hemisphere plays in the processing of facial expressions and emotions (Bourne & Todd, 2004; Campbell, 1982; Lindell, 2013; Salva et al., 2012; Yovel, 2016). To clarify, the right hemisphere processes information in the left auditory and visual hemispaces more quickly than information in the right hemispaces. To elaborate, when a caregiver places an infant in their left hemispace (i.e., leftward cradling) allows for the optimal *monitoring* of their infant's needs (Harris, 2010; Huggenberger et al., 2009; Karenina & Giljov, 2018; Manning & Chamberlain, 1991; Scola & Vauclair, 2010; Sieratzki & Woll, 2002; Vauclair & Donnot, 2005). Recent findings by Pileggi and colleagues (2013; 2015) found that there is an absence of leftward cradling in children with autism spectrum disorders (ASD). This finding resulted in the proposed refinement of this monitoring hypothesis. These authors found that leftward cradling bias was absent in samples of children on the autism spectrum (ASD). Bearing in mind (1) evidence for a cerebral monitoring explanation, which cites the specialized functioning of the right hemisphere in the processing facial emotional expressions, (2) evidence for a primitive

mechanism at play, and (3) the fact that ASD is characterized as a condition with known deficits in empathy and social communication (American Psychiatric Association [APA], 2013a), the authors proposed that leftward cradling bias may, in fact, be facilitated by the right hemisphere. More specifically, this is due to the specialised functioning in the right hemisphere that allows for the ability to relate to others on a socio-emotional level (i.e., a socio-emotional relatedness cerebral explanation – from here onwards referred to as the *socio-emotional relatedness hypothesis*).

Over the years, various variables have been proposed as potential predictors of leftward cradling bias. Given the more recently proposed socio-emotional relatedness hypothesis, there has understandably been a shift in focus to investigating how variables of social-emotional relatedness might predict cradling side. Specifically, while findings have been mixed, evidence has emerged that attachment, the ability to relate to others (i.e., empathy), and social skills could be associated with the preferred cradling side (Forrester et al., 2019; Huggenberger et al., 2009; Malatesta et al., 2019a; Pileggi et al., 2013, 2015). These findings can be understood in the context of the refined cerebral monitoring hypothesis (i.e., the social-emotional relatedness hypothesis): When an infant is placed in the left auditory and visual hemispace (i.e., leftward cradling), it allows for optimal social and emotional interactions, given the specialized role the right hemisphere plays in relating to others. Leftward cradling bias would therefore be reflective of better attachment, increased empathy, and better social skills.

A second line of investigation regarding the predictors of leftward cradling, also linked to the right hemisphere's specialized functioning in socio-emotional relating processes, has focused on mood states of depression and anxiety. For example, there is evidence demonstrating that the ability to recognize the emotions of others, social attachment and communication (specialized right hemisphere functions) are impaired in individuals who suffer from mood disorders, such as depression and anxiety (see Blake et al., 2013; Demenescu et al., 2010; Grimm et al., 2008; Hecht, 2014; Rotenberg, 2004; Scheuerecker et al., 2010; Semrud-Clikeman & Hynd, 1990).

This impairment would make it difficult for these individuals to relate to others socially and emotionally. In the context of the cradling scenario, if a caregiver is not able to relate to their infant optimally, it would consequently affect their ability to recognize and thereby adequately respond to the needs of their infant (Demenescu et al., 2010; Ley & Bryden, 1979; Liotti & Mayberg, 2001; Murray et al., 2010). This, in turn, has implications

for the caregiver-infant relationship. To date, however, there are mixed findings regarding the association between mood-related states and symptoms of depression and anxiety- and cradling bias (e.g., McGrath, 2013; Oppler & Laubscher, 2021; Pileggi et al., 2020; Reissland et al., 2009; Scola et al., 2013; Vauclair & Scola, 2009; Weatherill et al., 2004).

Pileggi and colleagues (2020) recently proposed a threshold hypothesis concerning depression and anxiety and leftward cradling bias. To elaborate, the threshold hypothesis suggests that a threshold about the severity of symptoms of depression and anxiety needs to be met for leftward cradling bias to be disrupted. Pileggi and colleagues (2020) therefore argue that mixed findings may be a consequence of previous studies employing non-clinical samples or very small clinical samples. Oppler and Laubscher's (2021) findings support a threshold hypothesis, in that they found that high depressive and anxiety symptoms did not disrupt the leftward cradling bias, while a clinical diagnosis of one or both of these conditions did. This threshold hypothesis may well apply to the aforementioned variables of socio-emotional relatedness - attachment, empathy, and social skills - given the mixed findings to date.

The socio-emotional relatedness hypothesis has led many to argue that leftward cradling has positive implications for socio-emotional development (Forrester et al., 2019; Huggenberger et al., 2009; Malatesta et al., 2019a; Pileggi et al., 2013, 2015). However, further investigation is warranted. This is particularly important as leftward cradling is argued to not only facilitate optimal bonding between cradler and infant but may also aid in developing the ability to relate to others and the development of prosocial behaviors. This study, therefore, aimed to investigate how variables of socio-emotional relatedness and variables related to socio-emotional relatedness (i.e., mood states) correlated with cradling side preference.

Explanations For the Emergence of Leftward Cradling Bias

Early Explanations

The Heartbeat Hypothesis

The heartbeat hypothesis was one of the earliest hypotheses that were proposed to explain the emergence of leftward cradling bias. It was originally proposed by Salk (1960) as he observed that monkeys tended to demonstrate a leftward preference when cradling their infant. Salk argued that this bias emerges because the sound of the cradler's heartbeat is more pronounced on the left-hand side, which is associated with a more secure/safe environment for the infant. Salk's (1960, 1962) theory is, however, reasonably difficult to test as to do so

reliably, a study would require participants to have their hearts on the right-hand side of their bodies. It is especially hard to do as the majority of people have their hearts on the left-hand side of their bodies. This is supported by the fact that only one study to date has managed to find and observe leftward cradling bias in an individual with dextrocardia (heart on the right), and it was found that despite the position of the heart, the mother still demonstrated leftward cradling bias with their infant (Todd & Butterworth, 1998). The heartbeat hypothesis has, thus, been discredited early due to (1) the lack of empirical support given numerous methodological flaws in the original and subsequent studies and (2) the inability of the theory to be contested (Detterman, 1978; Salk, 1960, 1962).

The Handedness Hypothesis

The handedness hypothesis posits that leftward cradling bias emerges as it leaves the dominant hand free to perform other tasks (Huheey, 1977). Notably, the right hand is dominant for 90% of the population. (Annett, 1970). Huheey (1977) was the first to suggest that caregivers leave their dominant hand free, to perform tasks such as opening a door, cleaning an infant's face, or giving them a bottle, to name a few. He argued that, consequently, cradling on one's non-dominant side may hold an evolutionary advantage (Huheey, 1977). Salk (1960) alluded to this hypothesis in his earlier work, stating that women often used it to explain their preferences. For example, mothers who were right-handed and demonstrated a leftward cradling bias said that it allowed them to perform other tasks with their dominant hand. However, mothers who were likewise right-handed but preferred to cradle to the right stated that they prefer to use their stronger (dominant) side to *support* their infant. Therefore, handedness could possibly be used as a post hoc rationalization of the side one prefers to cradle to.

Findings regarding the relationship between handedness and cradling bias have generally been inconsistent. While handedness is often the first variable to be thought of in explaining cradling bias, many studies found no relationship between cradling side preference and handedness (e.g., Huggenberger et al., 2009; Manning & Chamberlain, 1991; Turnbull & Lucas, 1996). Huggenberger and colleagues (2009), for example, found that while there was a clear leftward bias for the majority of the sample in their study, handedness was not associated with left versus non-left holders. Despite several studies finding no evidence of the association, a recent review has indicated that there may well be an association (see Packheiser et al., 2019).

Various reasons have been proposed for different findings across studies. For one, van der Meer and Husby (2006) highlight that caution should be applied when interpreting studies on cradling side preference, as the context of cradling has not always been consistent. To expand, there is a clear difference between the functional and non-functional cradling of an infant. The former is cradling an infant while performing other tasks, whereas the latter is cradling with the intention to soothe. Several studies on non-functional cradling have reported that left-handed individuals tended to cradle to the left, further supporting a lack of an association between handedness and non-functional cradling (De Château et al., 1978; Ginsburg et al., 1979; Saling & Bonert, 1983; Saling & Tyson, 1981; Salk, 1960). It should, however, be noted that while there is an increased chance of cross-lateralization of hemispheric functioning (i.e., that the right and left hemisphere switch functions) in left-handed individuals, as they tend to have unusual cerebral asymmetries (Carey & Johnstone, 2014). Neuroscientific studies using functional magnetic resonance found that most left-handed individuals often do not have cross-lateralized hemispheres (Johnstone et al., 2021).

Case in point, handedness is arguably a determining factor in functional, rather than non-functional cradling (van der Meer and Husby, 2006). To illustrate, van der Meer and Husby (2006) assessed handedness by instructing participants in their study to cradle a doll, and then requesting them to put a dummy into its mouth, arguing that this constituted non-functional cradling. The authors found that participants generally had a strong preference to cradle towards their non-dominant side (i.e., for most, their left), leaving their dominant hand free to perform the task given. They, therefore, argued that their findings demonstrate an association between functional cradling and handedness. However, inserting a dummy in an infant's mouth is usually done in the context of soothing the infant. Based on this finding, one could then argue that handedness is also associated with non-functional cradling. In addition to this, some studies have reported on side holding bias when transporting an infant (Bruser, 1981; Lockard et al., 1979; Saling & Cooke, 1984). In this instance, it is apparent that handedness is involved in holding side preference. Ultimately, studies have not always restricted their focus to non-functional cradling, thereby making it difficult to see in which context/s handedness plays a role, and if so, to what extent.

It is, therefore, unsurprising that findings regarding the role of handedness in predicting cradling bias have remained mixed, with many studies finding no relationship between handedness and cradling side preference (Manning et al., 1997; Manning & Chamberlain, 1991; Turnbull & Lucas, 1996). Most recently, Packheiser and colleagues

(2019), in their review, report that there is indeed a relationship between handedness and cradling side, with right-handed individuals showing a stronger tendency for leftward cradling. Several important points should, however, be taken into consideration when interpreting this conclusion. First, it should be noted that in the 40 articles reviewed in this meta-analysis, only 5 articles found that handedness was significantly related to leftward cradling bias. Secondly in their meta-analysis, Packheiser and colleagues (2019) also did not control for cradling context across the studies that were assessed. Third, one must consider that the reason for a significant relationship between handedness and cradling side preference, could be a statistical artifact of most people being right-hand dominant (approximately 90% of the population) and most people having a leftward cradling preference. Regardless, there is ample evidence to include handedness as a potential predictor of cradling side preference in investigations of the variables contributing to this universal phenomenon.

Cerebral Explanations

A Cerebral Laterality Hypothesis

Currently, research supports an evolutionary cerebral laterality hypothesis to explain the universal emergence of leftward cradling bias. To elaborate, the lateralization of function refers to the fact that one side of the brain is relatively specialized for several cognitive functions (Marshall, 1977). Lockard and colleagues (1979) were the first to theorize that the specialized processing in the right hemisphere of certain types of emotional information, may be a contributing factor in the emergence of a leftward bias.

Subsequently, there has been some evidence of an association between right hemisphere functioning and leftward cradling. Specifically, there is a general agreement that leftward cradling bias emerges because the brain processes facial emotional expressions more quickly in the left visual and auditory hemispaces (Bourne & Todd, 2004; Brancucci et al., 2009; Campbell, 1982; Salva et al., 2012; Yovel, 2016). This is due to the contralateral organization of the processing of information (e.g., the right hemisphere processes information in the left hemisphere more quickly, and vice versa; Bourne & Todd, 2004; Chiron et al., 1997; Harrison & Strother, 2020). Other specialized right hemisphere processes have also since been thought to contribute to leftward cradling bias, such as social attachment and the processing of non-verbal aspects of communication, including bodily gestures, prosody, and social perception (Leiva et al., 2022; Lindell, 2013; Pell, 2006; Schore, 2005).

Cerebral Monitoring Hypothesis. Stemming from a cerebral lateralization hypothesis, the notion of *cerebral monitoring* is concerned with the reciprocal advantage of leftward cradling for both caregiver and infant. It argues that positioning the to the left of the cradler offers an advantage for emotional, visual, and auditory signals to be processed by the right hemisphere of the brain (Huggenberger et al., 2009; Lucas et al., 1993; Manning & Chamberlain, 1991; Scola & Vauclair, 2010; Sieratzki & Woll, 2002). Sieratzki and Woll (1996) support this argument as they note these signals play an essential role in developing a cradling side preference. To elaborate, they explain that leftward cradling provides a somato-affective feedback channel between the cradler and the infant, which improves the communication between them. This is because the presentation of visual and auditory information in the left hemispace of the cradler is more speedily processed by the right hemisphere of the brain. Leftward cradling thereby allows both the cradler and infant to optimally recognize, interpret and monitor the emotional facial cues of each other - in essence, providing better *monitoring* of the infant (Harris, 2010; Huggenberger et al., 2009; Karenina & Giljov, 2018; Manning & Chamberlain, 1991; Scola & Vauclair, 2010; Sieratzki & Woll, 2002; Vauclair & Donnot, 2005).

Manning and Chamberlain (1991) propose that leftward cradling also places the infant in the cradlers left auditory and visual hemispace, thereby exposing the infant to the more emotionally expressive side of the caregiver. This leftward placement thereby facilitates better social communication and bonding between the two (Forrester et al., 2019; Lockard et al., 1979; Manning & Chamberlain, 1991). Leftward cradling similarly allows the cradler to better understand non-verbal communications from their infant, allowing them to be more equipped to respond to their needs. Research has thus shown that caregivers tend to choose leftward cradling due to a ‘deeply rooted’ preference which will aid in the better communication of emotional signals, via the right hemisphere of the brain, so that they may more effectively recognize cues of distress in their infants (Giljov et al., 2018; Karenina & Giljov, 2018). Notably, this has implications for child development, as this form of non-verbal communication takes place in the early developmental stages of the caregiver-infant interaction.

Socio-Emotional Relatedness Hypothesis. Before the emergence of a cerebral monitoring hypothesis, some studies had already recognized a link between socio-emotional relating and cradling bias. Weiland and Sperber (1970) were the first to suggest that leftward cradling bias had a socio-relational role. Their experiment consisted of instructing

participants to hold a pillow in two ways: they were first asked to hold it against their chest and then to do the same action, but this time they were expected to hold it as though it were an infant that they were attempting to comfort/soothe. They found that there was no side bias when participants were instructed to simply hold the pillow, but when they were instructed to cradle the pillow as though it were an infant, a leftward bias emerged. Consequently, they argued that this emergence occurs because a relationship was implied between the two. The formation of a bond was only possible when the cradler could imagine an actual infant (i.e., a living being) as opposed to when it was an inanimate object. This would suggest that cradling is facilitated by the ability to relate. In keeping with this, Turnbull and Collins (2000) provided anecdotal evidence that cradling to the right was associated with participants being more likely to behave in a distant and unresponsive manner toward their infants, in comparison to participants who demonstrated a leftward bias. This argument that socio-emotional relating may explain the emergence of leftward cradling bias is, notably, in keeping with a cerebral monitoring hypothesis. In essence, the cerebral monitoring hypothesis posits that cradling an infant to the left will allow for easier (i.e., optimal) recognition, interpretation, and monitoring of emotional facial expressions between cradler and infant (Forrester et al., 2019; Giljov et al., 2018; Harris, 2010; Huggenberger et al., 2009; Karenina & Giljov, 2018; Lockard et al., 1979; Manning & Chamberlain, 1991; Scola & Vauclair, 2010; Sieratzki & Woll, 2002; Vauclair & Donnot, 2005). It cites the right hemisphere's specialized role in these processes as the underlying mechanism.

Research further suggests that through the caregiver-infant interaction, the infant develops an internal working model of how to relate to others, impacting their later behavioral, cognitive, and emotional development and, consequently, their social functioning (Bowlby, 1973; Penney et al., 2010). Given this, the cradling scenario is one such caregiver-infant interaction experienced often in early life, which influences how one relates to others. Recent findings by Pileggi and colleagues (2013, 2015) have resulted in a proposed refinement of the cerebral monitoring hypothesis, positing leftward cradling bias emerges as the result of the specialized role that the right hemisphere plays in the more primitive processes, which allow one to *relate to others socially and emotionally*. Pileggi and colleagues (2013) were the first to demonstrate that children diagnosed with ASD exhibited an absence of the otherwise universal leftward bias (also see Pileggi et al., 2015). In their 2015 study, they demonstrated that leftward cradling emerges regardless of intellectual ability, as they found that while this bias was not present in children on the autism spectrum,

however, it was evident in both neurotypical and intellectually disabled children. They subsequently argued that their finding that leftward cradling bias emerged regardless of intellectual ability supported the argument that cradling side bias is facilitated by primitive right hemisphere processes. Bearing their findings in mind, as well as (1) consensus regarding the cerebral monitoring explanation, (2) evidence for a primitive mechanism at play (i.e., a universal phenomenon present in primates, non-primates, and children, which comes about without conscious awareness), and (3) the nature of ASD (characterized by deficits in social communication and empathy; APA, 2013a), they proposed this refined *socio-emotional relatedness hypothesis*. They go on to suggest that this bias is made possible by the innate ability to be able to relate to others.

In keeping with a socio-emotional relatedness hypothesis, two subsequent studies have demonstrated an association between autistic traits (i.e., no diagnosis) and cradling side in that those individuals scoring higher on autistic traits were significantly less likely to exhibit a leftward bias (Fleva & Khan, 2015; Herdien et al., 2021). Herdien and colleagues (2021) demonstrated this finding in a male sample, while Fleva and Khan (2015) recruited males and females for their study. Additionally, Fleva and Khan (2015), who used a typically developing sample of adults, found that in comparison to those who obtained scores within a normal range, participants who scored low on empathy (using the Empathy Quotient) and who also had lower scores with regards to their ability to perceive the emotions of others (measured using the Reading the Mind in the Eyes Task), were significantly less likely to demonstrate leftward cradling bias. These findings are in keeping with a hypothesis that leftward cradling bias is facilitated by our innate ability to empathize (i.e., relate to) with others (Bowlby, 1973; Decety & Lamm, 2006; Huguenberger et al., 2019; Penney et al., 2010; Pileggi et al., 2013, 2015; Turnbull & Collins, 2000; Weiland & Sperber, 1970).

Ultimately, the context of cradling offers a space in which a cradler and an infant can interact with one another. The healthy formation of the relationship between the cradler and infant is vital as it is one of the first socio-emotional experiences that an infant encounters, and it provides a template for their future relationships as they continue to develop (Ainsworth, 1969; Bowlby, 1988; Snyder et al., 2012). In keeping with the cerebral monitoring hypothesis, the socio-emotional relatedness hypothesis posits that specialized processes in the right hemisphere are responsible for the emergence of leftward bias, as it facilitates the formation of a positive relationship, given that it allows for the cradler to better monitor the infant and respond to their needs. To expand, leftward cradling is arguably linked

to the development of secure interpersonal relationships, as well as the ability to interact with and understand others as they mature (Huggenberger et al., 2009; Malatesta et al., 2019a).

Leftward cradling bias has been suggested to facilitate the development of future empathic and social abilities, which together aid in promoting positive socio-emotional interactions. In this way, leftward cradling has significant socio-emotional implications for child development. Specifically, it is proposed that leftward cradling bias would be reflective of more secure attachment, increased empathy, and better social skills (Bourne & Todd, 2004; Brancucci et al., 2009; Lindell, 2013; Malatesta et al., 2020; Schore, 2005; Shamay-Tsoory, 2008; Yovel, 2016).

Variables of Socio-Emotional Relatedness and Their Relationship to Leftward Cradling Bias

Attachment as a Predictor of Cradling Side Preference

Defining Attachment

The theory of attachment was originally developed to understand the tendency for an infant to form intimate bonds, and to monitor the caregiver-infant relationship by observing how an infant behaves and responds to their caregiver (Bowlby, 1979; Fraley & Shaver, 2000). Bowlby (1979) referred to attachment as the basic tendency for human-being to form emotional bonds with one another. In addition, Bowlby theorized that the type of attachment that an infant develops will impact their future expectations and interactions with others. According to Hunter and Maunder (2001), these attachments are a cluster of attitudes, behaviors, and emotional expressions that will be experienced mainly in close relationships with others.

Therefore, given the dependency of infants on their caregivers for protection and survival, early formations of attachment are very important, as caregiving is said to have significant consequences for their functioning and development (Bowlby, 1979; Fraley & Shaver, 2000; Schore, 2003). Waters and Cummings (2000) further state that infants/children will use their main caregiver as a 'secure base' that they can explore the world and consider as a source of safety and comfort. This was first illustrated in Ainsworth's Strange Situation Procedure (SSP; Ainsworth, 1978). The SSP consisted of placing children (aged 11-15 months old) in a strange environment (i.e., a playroom). Their behavior was then observed throughout 8 stress-inducing episodes, during which either their caregiver/parent or a stranger would periodically come in and out of the room. Ainsworth then determined three classifications of attachment based on the child's behavior, their trust in their caregiver, the

balance of how long it took to explore the environment, and the duration that they focused on the return of their caregiver. Ultimately, the way the child approached their caregiver when they returned, led to the determination and emergence of attachment classifications (Ainsworth, 1978, 1979; Van Rosmalen et al., 2015). Three types of ‘organized’ styles of attachment emerged: secure, ambivalent/resistant, and avoidant (Ainsworth, 1978; Benoit, 2004). An additional fourth category, ‘disorganized attachment’, was later included (Main & Solomon, 1986).

A child’s attachment style is classified as secure if they display distress when separated from their caregiver, but joy on their return. It is characterized by children being more inclined to explore their environment and to seek proximity to, as well as reassurance and comfort from, the caregiver - especially when frightened (Ainsworth, 1978; van Ijzendoorn et al., 1999). Hunter and Maunder (2001) noted that a person's attachment style is most apparent during times of stress, such as loss or separation. When securely attached, children are reassured that they can express negative emotions and that they will be comforted by their caregiver (van Ijzendoorn et al., 1999). The need for them to feel safe is therefore vital and can be met by ensuring that their attachment is secure. This type of attachment develops as a result of the caregiver being consistently available in response to the needs of their infant (Bowlby, 1988; De Wolff et al., 1997; Durrani, 2020). This also has an influence on future development in both childhood and adulthood, as securely attached children have a higher likelihood of trusting themselves and others. In addition, securely attached adults have been found to speak more positively about their occupation (i.e., work-life), and have a higher likelihood of seeking support if needed (Green & Campbell, 2000).

A child’s attachment style is classified as ambivalent if they become distressed when a parent/caregiver leaves and have a conflicting response when reunited with them. This is often a result of poor parental availability (Ainsworth, 1967). Children with an ambivalent style of attachment have an increased expression of negative emotions. They also tend to display attachment behaviors to gain the attention of their parental figures, who seem to be inconsistent in responding to their needs (Green & Campbell, 2000; Main, 1990). When these children are expected to explore and/or play in their environment, they tend to remain angrily and/or passively focused on their parental figure. This also influences future development, as children with ambivalent attachment are said to have been continuously uncertain regarding their caregivers’ availability, as a result of experiencing inconsistencies in caregiving (Bosman & Kerns, 2015). Hans and colleagues (2000) likewise argue that in middle

childhood, they may try to start a conflict with and provoke their caregivers to engage with them. Individuals with anxious-ambivalent attachment have also been found to show a reluctance to be close to others, tend to worry that their feelings are not being reciprocated, and spend less time investing in close relationships, due to their unwillingness to share their emotions in both their adolescence and adulthood (Feeny & Noller, 1991).

A child's attachment style is classified as avoidant if they display downregulation of their emotions when in the presence of a parent/caregiver. They also tend to reject or ignore their caregivers and often do not strongly signal the need for comfort from their parent/caregiver (Main, 1990). Children with an avoidant style of attachment rarely cry when their primary caregiver (e.g., mother) leaves the room and would be distant and/or avoid her when she returns (Ainsworth, 1978). Green and Campbell (2000) state that this attachment style develops when the caregiver is regularly unresponsive to their infant. This also has an influence on future development as these children, who have often experienced rejection and a lack of bodily contact from their caregiver, tend to display atypical attachment behaviors as a result. To illustrate, they are often emotionally distant, independent, and less likely to express the need for affection (Ainsworth, 1979; Green & Campbell, 2000). In adulthood, individuals with avoidant attachment similarly tend to remain independent and distant from others, do not express their feelings easily, and often deny intimacy with others (Li & Chad, 2012).

Lastly, a child's attachment style is classified as disorganized if they display a clear lack of a pattern of attachment. This is often characterized by behaviors and/or emotions that are contradictory, e.g., running up to their caregiver when reunited, but immediately running away or displaying behaviors such as hitting or kicking (i.e., random changes in behavior; Green & Goldwyn, 2002; Mains & Stadtman, 1981). Consequently, these children show apprehension around their parental figures (Main & Solomon, 1986). This is often due to caregivers being harsh and psychologically unavailable e.g., the parent is often easily distressed (Bosman & Kerns, 2015). This has future developmental outcomes, as similar to childhood, in adulthood they will also display the same contradictory behavior, i.e., having an extreme need for closeness but avoiding and pushing others away. Disorganized attachment in adulthood has also been linked to personality disorders in adulthood (e.g., Borderline Personality Disorder [BPD]) which is characterized by having difficulties in interpersonal relationships (Leischsenring et al., 2011). Adults with disorganized attachments tend to have fears in their romantic attachments (Main & Solomon, 1990; Paetzold et al., 2015). This

indicates that these individuals have a frequent tendency to display an extreme fear of rejection, and therefore difficulty connecting and trusting others.

To date, despite advances in investigating adult attachment, it is predominantly measured in infancy, and therefore literature remains limited regarding what attachment means in adulthood (Hazan et al. 2004; Main 1999). Notably, the understanding of adult attachment is still evolving, as there remains no clear consensus regarding relationships and attachment styles in adulthood (Sable, 2008). To illustrate the lack of literature, Bowlby (1969) states that attachment style will be a lifelong experience, however, neither his nor Ainsworth's research utilized adult samples.

There is an additional difficulty in exploring the topic of adult attachment, given the variety of differences in the measures that have been used to assess this to date. In particular, a recent review by Justo-Núñez and colleagues (2022) noted two main issues concerning measures of adult attachment. For one, there is a lack of self-reported measures that can be used to assess attachment security in adulthood. Secondly, of the measures that do exist thus far, there is a lack of empirical support in terms of the psychometric properties thereof. There is therefore a need to come to a consensus on whether to use three or four categorizations of attachment.

Another important consideration when deciding how to define attachment in adulthood is that attachment styles may vary based on different types of relationships. Research indicates that attachment can be conceptualized as a hierarchical network, with the primary attachment figures being people such as friends, romantic partners, and caregivers/parents (Bowlby, 198; Fraley, 2019; Mikulincer & Shaver, 2003). In addition, adults are likewise said to have an attachment to institutions as well as symbolic and abstract figures e.g., God. They may then seek proximity to any of these when they are in times of need (Mikulincer & Shaver, 2003).

Research has begun to explore different attachment styles depending on the type of relationship between people. Baldwin (1992) introduced a cognitive perspective of "relational schemas" that was built on the original idea by Bowlby (1969) who conceptualized attachment as a working model that individuals have which arises from their childhood experiences. Baldwin (1992) found that people have more than one relational scheme in memory. According to Baldwin (1992), an individual has three 'relational schemas' that consist of one for the self, one for a close other, and an idea of the patterns expected when the first two schemas interact. The vast majority of participants (88%) in their study reported

experiencing more than one attachment style. This demonstrates that while people tend to have one predominant style of attachment i.e., the most persistently accessible style, there are additional schemas available in their memory that may be activated by different conditions. For example, individuals with a secure attachment may activate an avoidant schema in response to reading about an avoidant attachment style in a novel (Green & Campbell, 2000).

Research regarding adult attachment often utilizes an approach that looks at attachment concerning two dimensions i.e., anxiety and avoidance (Bartholomew & Horowitz, 1991; Brennan et al., 1998; Mikulincer & Shaver, 2003). To clarify, an individual who scores high on anxiety in an adult measure of attachment will tend to demonstrate concerns about interpersonal abandonment/rejection and display distress when their partner is unavailable to meet their needs. Individuals scoring high on 'avoidance' have strong self-reliance to feel secure and may become easily distressed by interpersonal intimacy (Mikulincer & Shaver, 2003). Therefore, an insecure attachment style would correspond with receiving higher scores on both dimensions of anxiety and avoidance, whereas a secure style of attachment is indicative of lower scores on both of these dimensions (Mikulincer & Shaver, 2003).

One major issue regarding research on attachment is that it remains inconsistent in terms of the way attachment is conceptualized. Some studies focus on measuring attachment concerning specific figures in an individual's life (e.g., only mother or only father). Other studies have considered an individual's general attachment pattern in all relationships (i.e., global attachment) to be the more reliable way of understanding their attachment style (Fraley, 2007). This discrepancy is important to address since individuals are capable of having different attachment patterns, depending on their relational context (Baldwin, 1992; Malatesta et al., 2019a). This raises the question of whether to conceptualize attachment in terms of either a global or relationship-specific pattern attachment. Fraley (2007) suggests one solution to this issue is to take into account that both global and relationship-specific representations of attachment exist simultaneously, as both are instrumental in shaping the cognition, emotions, and behavior involved in one's close relationships. Furthermore, it has been difficult for the literature on attachment to reach a consensus on this issue given that other factors may also influence one's style of attachment.

Current research suggests that various contextual factors influence attachment dynamics and that are capable of moderating or overriding past internalized representations

and experiences (Mikulincer & Shaver, 2003). This is evident by the fact that the ability to establish and maintain secure bonds may be compromised within South Africa (SA) which is known as a Low and Middle-Income Countries (LMIC) due to contextual factors such as socioeconomic adversity (Cooper et al., 2009; Morgan et al., 2019; Schuitmaker et al., 2022).

Attachment in a South African Context

Before a discussion on what to consider when measuring attachment in SA, it is necessary to first consider what the term LMIC means. A LMIC is generally defined as a country with a lower gross domestic product and income per resident, compared to higher-income countries, and they tend to have limited access to education and healthcare services (Sanford & Sandu, 2002). People living in LMIC countries such as SA have a higher likelihood of experiencing stress, depression, and post-traumatic disorder - and related symptoms due to increased exposure to socio-economic risk factors which include unemployment, elevated levels of crime and violence, well as such as low income (Schuitmaker et al., 2022; Voges et al., 2019). The ability of an individual to adjust to and deal with such traumatic events may be affected by their attachment style (Lim et al., 2019). Such socioeconomic risk factors are said to put attachment security at risk, with the likelihood of disorganized attachment (Cyr et al., 2010). Therefore, when defining and investigating the relationship between attachment and leftward cradling in countries such as SA, it is essential to consider the impact of these factors.

It may also be worth mentioning that the SSP, which forms our understanding of attachment, is based on studies by Ainsworth (1967) and Ainsworth and colleagues (1978) which were conducted in Africa (Uganda), and the West (Baltimore). Therefore, from the onset, the characterization and foundation of attachment were based on both a non-western and western population. Interestingly, infant attachment research in Africa, according to descriptive reviews, does, however, remain sparse (Voges et al., 2019). According to Voges and colleagues (2019) currently out of the 54 African countries and states, attachment in infancy has to date, only been quantitatively assessed in five countries (i.e., South Africa, Kenya, Mali, Uganda, and Zambia). While initially attachment was thought to be sensitive to non-western populations, how attachment is currently measured may not be applicable or culturally sensitive.

Another factor to consider when measuring attachment in SA is the relationship between mood-related states and disorders of depression and anxiety and attachment styles

(Cooper et al., 1999; Tomlinson et al., 2004). Clinical depression has, for example, been found to be significantly correlated with an insecure style of attachment; more specifically, symptoms of depression are associated with anxious/ambivalent attachment styles (Gerlsma & Luteijin, 2000). Muris and colleagues (2000) similarly found that children who were insecurely attached, presented with increased symptoms of depression and anxiety, compared to children who were securely attached. These findings support research that found insecurely attached adults tend to also exhibit increased symptoms of anxiety and depression in comparison to securely attached adults (Priel & Shamai, 1995). However, other studies have not found a relationship between depression and insecure attachment (Mickelson et al., 1997). These inconsistencies in findings may be, in part due to issues in the methods used e.g., the use of small sample sizes in studies (Bifulco et al., 2002).

There is, however, evidence, albeit small of an association between depression and insecure attachment style (Bifulco et al., 2002; Muris et al., 2000; Whiffen et al., 2001). Cooper and colleagues (2009) aimed to assess both the success of an intervention that was employed in Khayelitsha in an attempt to improve the mother-infant relationship and to determine if it would consequently improve the security of attachment between them. Khayelitsha is a peri-urban community in SA, known for having adverse socio-economic problems. Their results showed that the intervention was able to significantly enhance the relationship between them, as they found that in comparison to the control group, those who received the intervention were significantly less intrusive and more sensitive when interacting with their infants. Lastly, it was found that 18 months post-intervention, there were increased levels of secure attachment in infants. This finding may indicate that attachment style may vary and can be altered if circumstances change i.e., it is not always constant.

On the other hand, Tomlinson and colleagues (2005) found that South Africans had larger than expected levels of secure infant-mother attachment (62%). They stated the reason for the secure attachment being high, despite the psychosocial stresses experienced by SA mothers, is because of the culture of 'ubuntu'. This refers to the compassion and spirit that exists in many communities, whereby the mother can rely on people in the community to assist her in caregiving, as infants/children are seen as being the responsibility of and belonging to the whole community (Chalmers, 1990; Tomlinson et al., 2005)

Given all of this, it is unsurprising that Mesman and colleagues (2016) note the need for the theory of attachment to be sensitive to different communities and cultures. The understanding of attachment needs to account for the dynamics of relationships in

communities (Hinde & Stevenson-Hinde, 1990). Different cultures may have different socio-economic issues and the mother/infant dyad needs to be able to adapt accordingly. While western and non-western cultures acknowledge there are several attachment figures, more empirical research is necessary to understand how the experiences with each of these attachment figures would combine into one global attachment style (Sagi-Schwartz & Aviezer, 2005). This further highlights the issue of there being no clear consensus on whether patterns of attachment should be assessed in general or concerning specific relationships. This difficulty is aggravated in a context like SA which has multiple factors that need to be considered when measuring attachment. Therefore, research on patterns of attachment needs to take into account both resource availability and cultural perspectives (Mesman et al., 2016; Tomlinson et al., 2005).

The Relationship Between Attachment and Cradling Bias

While attachment has only recently been investigated as a potential predictor of cradling side preference, there is some early support for this relationship. Turnbull and Collins (2000) reported anecdotal evidence that mothers who were more emotionally detached tended to cradle to the right compared to those who demonstrated a leftward bias. Likewise, they found leftward cradling bias in new fathers, compared to those without children. Based on this, they posited that leftward cradling preference is stronger once a relationship between the cradler and infant has been established. To date, there are mixed findings on whether or not there is an association between cradling side preference and attachment. There have also been only a handful of studies that have explored the relationship between these two variables. It is of note that in part this could be due to a publication bias (i.e., studies are less likely to be published when findings were not significant). This may mean that one cannot know how many have not found an association between these variables.

Two of the studies that investigated this relationship found attachment style was not associated with the cradling side. Herdien and colleagues (2021) examined leftward cradling and lateralized emotion processing in a male sample and found no association between their measure of attachment and leftward cradling. To elaborate, they found that there was no relationship between scores of anxiety and avoidance-related attachment and leftward cradling. Herdien and colleagues (2021) consequently argued that socio-affective attachment processes may only be determined in the early attachment bonds between caregiver and infant and that they may not necessarily be linked to the course of an individual's style of

attachment throughout their lifespan. Similarly, McGrath (2013), found that in a sample of students, attachment style did not significantly predict leftward cradling bias. However, they did find that cradling side preference was a positive correlation -albeit small - between cradling side preference and an insecure style of attachment in the sample of participants presenting with notable depressive symptoms. This is important to note as in their study, depression was the only variable that significantly predicted cradling bias. This, therefore, suggests that while attachment style may not be directly influential on cradling side preference, the relationship between attachment style and cradling side may be mediated by depressive symptoms.

In contrast, two studies have reported a significant relationship between these variables. First, Malatesta and colleagues (2019a) found that young adult females with secure attachments to their mothers and romantic partners had a significantly higher likelihood of cradling to the left. They also found that in comparison to rightward cradlers, the participants who had a significantly higher likelihood of cradling to the left had a secure attachment to their current partners. Consequently, Malatesta and colleagues (2019a) argued that leftward cradling bias could be an innate measure of the socio-emotional relationship between the cradler and the infant. Second, Jooste's unpublished thesis (2018) similarly found secure attachment to be associated with leftward cradling. In their study, Jooste (2018) aimed to activate the attachment systems of the cradlers using a face-to-face cradling task. This was done in two ways. Firstly, Jooste (2018) asked participants to name the doll that they were asked to cradle. Secondly, the researcher played a life-like sound of a baby crying during the experiment. The participant was then asked to soothe the infant doll (i.e., non-functional cradling) upon hearing this sound. According to Fraley and Shaver (2000), the attachment system of adults is sensitive to socio-emotional cues such as crying. It is therefore possible that the significance found was at least in part since the cradling task used aimed to activate the participants' attachment system.

Similarly, leftward cradling bias should be expected to be found in typically developing healthy individuals, as irrespective of their caregiving experience, their innate mechanisms of attachment are expected to be intact and well-functioning. The reason for this belief is the same form of innate attachment processes seems to affect both the quality of the caregiver-infant relationship, as well as childcare behavior (Donnot & Vauclair, 2007, 2011; Weiland & Sperber, 1970). This attachment between the cradler and infant consists of mutual

empathy i.e., the ability to relate to one another, as this increases the bond between the two (Huggenberger et al., 2009; Malatesta et al., 2019a, 2019b).

This is in line with the findings that diagnoses of ASD are linked to an absence of leftward cradling bias (Pileggi et al., 2013, 2015). To elaborate, in 1943, Kanner suggested that autistic individuals “...come into the world with an innate inability to form the usually biologically provided affective contact with other people” (p. 250), effectively implying that difficulties with being able to empathize with (i.e., relate to) and bond with others, is a characteristic of a diagnosis of ASD. Pileggi and colleagues (2015) suggested that leftward cradling bias is instinctively a psychobiological process that is aided by an individual's need to emotionally relate to another person. Given that our basic socio-emotional processes that underly our ability to empathize with, and form attachment to others, facilitate leftward cradling bias. It is therefore expected that leftward cradling should be linked to an optimal/more secure attachment style (Huggenberger et al., 2009; Malatesta et al., 2019a, 2019b).

Affective Empathy as a Predictor of Cradling Bias

Defining Empathy

Empathy is a term that is notoriously difficult to define. While various definitions have been put forth, it can be argued that in essence, empathy refers to the ability to relate to and recognize the emotions and experiences of others (Decety & Lamm, 2006). While this definition does not fully encompass what empathy is, the literature clearly distinguishes between cognitive and affective empathy. Cognitive empathy is a working model that requires higher-order thinking, to shift attention continuously back and forth between one's own and another person's cognitive and emotional states, for them to be compared (Reniers et al., 2011; Spinella, 2005). This is done by making use of auditory, situational, and visual cues, to represent the state of another person's cognition (Reniers et al., 2011). According to Blair (2005), it emerges to represent an individual's internal state such as the Theory of Mind (ToM). This is all said to help an individual understand another person's point of view (Beadle & de La Vega, 2019).

Affective empathy, in contrast, relies on being able to quickly recognize the emotional state of another person based on their gestures, voice prosody, and facial expressions (Blair 2005). It allows for the sharing of emotions and emotional states between people (Decety & Jackson, 2004; Singer & Lamm, 2009; Thompson et al., 2022). To

elaborate, this process allows an individual to communicate emotional responses and emotional states to another person (Reniers et al., 2011; Spinella 2005).

The Neurobiological Processes Underlying Empathy

Empathy, much like other process related to social cognition, relies on various structures and corresponding systems in the brain, in addition to the cortex, including but not limited to the hypothalamic-pituitary-adrenal axis (HPA), endocrine system, and the autonomic nervous system (ANS), all of which aid in regulating bodily states of reactivity and emotions (Decety, 2011). While there is an overlap of the neural circuits underlying both types, cognitive and affective empathy are associated with their distinct neurobiological processes (Blair 2005; Reniers et al., 2011). For one, cognitive empathy is linked to functioning in the ventromedial prefrontal cortex, whereas affective empathy is related to functioning in the midcingulate cortex, and anterior insula, and may also involve the inferior frontal gyrus (Walter, 2012). Cognitive empathy is, therefore, a more advanced system as in comparison, it involves higher-order cognitive functions, such as mental state attribution, executive functioning (e.g., working memory), cognitive flexibility, and self-regulation (Decety & Jackson, 2004; Langford et al., 2006; Zelazo et al., 2008). Given that the prefrontal cortex only reaches maturation later in life compared to other brain areas, cognitive empathy has been found to continue to develop later in adolescence (Bunge et al., 2002).

Affective empathy, in contrast, is present during early developmental stages (starting at approximately 10 weeks old; Field et al., 1982). It is said to be associated with more primitive functions such as the processing of emotional expressions (Braak, 1976; Hatfield et al., 2011). To elaborate, affective empathy is seen as involuntary and it relies on the resonance between oneself and another person, as well as the mimicry of basic emotional expressions which allow for affective sharing (Decety, 2011; Field et al., 1987; Haviland & Lelwica, 1987). Given the proposed hypothesis of socio-emotional relatedness, and that leftward cradling bias is said to come about without conscious awareness, affective empathy is likely the more important type of empathy regarding cradling side preference.

The Relationship Between Affective Empathy and Cradling Bias

The relationship between affective empathy and cradling bias, however, is still unclear, as evidence to date has been largely indirect. For example, evidence from Weiland and Sperber demonstrated that the leftward cradling bias emerges when a relationship is implied (Weiland & Sperber, 1970). Likewise, anecdotal evidence from Turnbull and Collins (2000) found that individuals cradling to the right had difficulty relating to an infant

compared to those cradling to the left. More recently, Pileggi and colleagues (2013; 2015) provided stronger, albeit indirect, evidence for an association between affective empathy and cradling side preference in their findings that children diagnosed with ASD do not exhibit a side bias for cradling. These authors proposed that having trouble with the ability to relate to other people on a visceral level (i.e., deficits in affective empathy) could be responsible for the lack of leftward cradling in their sample as (1) deficits in socio-emotional relatedness (including empathy) long been described to characterize ASD (APA, 2013a), and (2) they found the leftward bias to be present regardless of intellectual level (Pileggi et al., 2015).

To date, only one study has been able to provide direct evidence indicating a relationship between empathy and cradling side preference (see Malatesta et al., 2019b). Malatesta and colleagues (2019b), in a sample of healthy mothers with children between the ages of 0-3 years, found leftward cradling to be positively related to empathy. Their study made use of the Balanced Emotional Empathy Scale (BEES). The BEES is a self-report measure that assesses how frequently an individual shares their emotional experience with other people. The BEES is commonly known as a measure of emotional empathy, a term used interchangeably with affective empathy (Blair, 2005; Decety & Jackson 2006). While the relationship would be classified as small ($r = -.32$), it did indicate that higher affective empathy significantly increased the likelihood of exhibiting the leftward cradling bias. In sum, while an investigation is limited by direct evidence from one study only, the theoretical basis for affective empathy as a predictor of cradling side preference is evident.

Social Ability as a Predictor of Cradling Bias

Another variable that has recently received some attention concerning leftward cradling bias is social ability. Social ability can be defined as having the necessary skills to communicate either verbally or nonverbally, interact with others, and it also refers to the ability to adapt to and behave in a socially acceptable manner (Soto Icaza et al., 2015). The socio-emotional hypothesis would posit that rightward cradling would be associated with decreased social ability. To clarify, it is argued that cradling to the left would facilitate optimal interactions between cradler and infant, given the faster recognition of socio-emotional cues when the infant is placed to the left of the body midline. This, in turn, facilitates better bonding and socio-communication between the two. Subsequently, the innate ability that typically developing individuals have to be able to relate to others helps to create, enhance, and maintain social bonds (Forrester et al., 2019; Huggenberger et al., 2009; Malatesta et al., 2019b). The initial relationship in the caregiver-infant dyad is therefore

important as this will aid in the future development of both empathetic (i.e., ability to relate) and social abilities (i.e., prosocial behaviors), which in turn will promote optimal and positive socio-emotional interactions.

The Relationship Between Social Ability and Cradling Bias

Only one study to date has reported direct evidence of a relationship between social ability and leftward cradling preference (see Forrester et al., 2019). Forrester and colleagues (2019) explored the association between leftward cradling bias and the socio-communicative abilities of neurotypical children, around five years of age. In their study, they had three cradling trials. All of the trials were conducted under the same conditions, with the researcher presenting either of the dolls saying, “I am going to give you something to hold. Can you hold it like this?” (p. 122). They first presented the child with either the no-face or proto-face pillow and then each child was presented with both the primate infant doll and the human infant doll in an upright position. Once in the correct position, they were asked to hold each in an upright or lateral position to their midline, and the cradling side for each trial was recorded once held for at least 30 seconds.

To measure the basic socio-communicative abilities of the children, they asked the teacher of each respective child to fill out a socio-communicative survey that consisted of 14 items rated on a 5-point Likert scale ranging from strongly disagree to strongly agree, where teachers had to respond to statements about the child. Items assessing social skills were concerned with social milestones (e.g., “wants to please their teacher; is likely to follow rules; can tell the difference between real and imaginary/pretend; and engage in eye contact when speaking to others”; Forrester et al., 2019, p.125). Items assessing communication skills reflected language, speaking, and communication milestones (e.g., “can use a long and detailed sentence, such as we went to the park, but we came home because Mary hurt herself; can speak of imaginary conditions; describes options and events with lots of detail”; Forrester et al., 2019, p.125).

Their findings indicated that children who cradled to the left had a significantly higher social ability score compared to children who cradled to the right. They also found that a leftward cradling bias emerged when cradling an infant human doll as well as when cradling a proto-face pillow. Interestingly, a rightward bias was observed when participants cradled an infant primate doll (Forrester et al., 2019). This suggests that leftward cradling bias emerges when cradling an object with human-like features (i.e., a human infant doll and proto face pillow), in comparison to when cradling objects without the same human-like facial features

(i.e., a primate infant doll). This may be because the ability to relate more to an object being cradled is a defining feature of leftward cradling bias (see Weiland & Turnbull, 1970). It could therefore be argued that species-specific features (e.g., human-like facial features in this study) help to facilitate the social communication underlying this bias. As leftward cradling bias is made possible through the formation of a socio-emotional relationship between a cradler and infant, this finding that demonstrates the importance of the ability to relate is in keeping with the socio-emotional relatedness hypothesis.

In addition to this, indirect evidence for social ability as a predictor of cradling side bias comes in the form of findings linking high levels of autistic traits and ASD diagnoses to reduced or absent leftward cradling bias (Fleva & Khan, 2015; Herdien et al., 2021; Pileggi et al., 2013, 2015). To elaborate, socio-communicative deficits are a defining characteristic of individuals diagnosed with ASD (APA, 2013a). It could therefore be argued that with increased autistic traits, deficits in social communication ability may contribute to the absence or reduction of the leftward bias.

While only one study has provided direct evidence for a relationship between social ability and cradling bias, a recent line of investigation arguably provides the strongest evidence yet. Research has looked at the evolutionary benefits of left-side biases linked to other social interactions such as kissing and hugging (Ocklenburg et al., 2018; Packheiser et al., 2019; Sedgewick & Elias, 2016). These side biases are also associated with specialized right hemispheric processing. The importance of the right hemisphere's dominance is thus further highlighted by the fact that a reduction in both social ability and emotional processing is associated with decreased leftward cradling (Fleva & Khan, 2015; Manning & Chamberlain, 1991; Ocklenburg et al., 2018; Pileggi et al., 2013, 2015). Thus, while the investigation is limited by direct evidence from only one study, the theoretical basis for a possible relationship between social ability and leftward cradling is evident.

Mood-related States of Depression and Anxiety and Their Relationship to Leftward Cradling Bias

Depression and Anxiety as Predictors of Cradling Bias

Depression and anxiety cause significant distress in various areas of functioning. For one, depression is characterized by individuals having significant symptoms such as a depressed mood, slowing down of physical and mental abilities, feeling worthless or guilty, diminished ability to concentrate or think, recurring thoughts of death/suicidal ideation, and

sleep disturbances (hypersomnia/insomnia; APA, 2013d). For example, Hecht (2010) mentions that the failure to initiate and maintain sleep in individuals diagnosed with depression is partly due to the right hemisphere's specialized role in maintaining vigilance and alertness. Symptoms related to negative cognitions such as pessimism, guilt, and self-blame are also associated with activity in the right hemisphere, likewise highlighting the relationship between depression and right hemispheric functioning (Hecht, 2010). Anxiety is similarly characterized by sleep disturbances, as well as excessive anxiety, difficulty concentrating, and controlling worry (APA, 2013c).

Additionally, symptoms of depression in the postnatal period may affect maternal bonding and have prolonged effects on developmental outcomes for a child. Edhborg and colleagues (2011) showed that mothers with postnatal depressive symptoms had a lower emotional bond with infants aged 2-3 months old. Similarly, the literature further states that mothers with postnatal depression exhibiting behaviors such as withdrawal have reduced sensitivity and responsiveness toward their infant, thereby resulting in difficulties in communication in the caregiver-infant relationship (Murray et al., 2010). The effects of such impairments on the initial bonding between mother and infant can be seen even eight years post-maternal depression (Moehler et al., 2006; Reck et al., 2006). Moehler and colleagues (2007) further stated that non-clinical symptoms of maternal depression may still have an impact on a child's development and behavioral outcomes.

In keeping with this, depression and anxiety have both been found to compromise emotional processing, which is linked to right hemispheric functioning (Demenescu et al., 2010; Scheuerecker et al., 2010). To elaborate, socio-emotional relatedness is facilitated by the specialized role that the right hemisphere plays in the ability to recognize, process, and/or respond to emotional facial expressions, (Hecht, 2010; Ley & Bryden, 1979; Demenescu et al., 2010; Scheuerecker et al., 2010). Individuals with mood-related states of depression and/or anxiety have, however, been found to have an impairment in the ability to communicate, as well as in the ability to recognize the emotions of others, thereby affecting their socio-emotional relationships (Blake et al., 2013; Demenescu et al., 2010; Grimm et al., 2008; Hecht, 2014; Rotenberg, 2004; Scheuerecker et al., 2010; Semrud-Clikeman & Hynd, 1990).

Additionally, studies have found that patients with Major Depressive Disorder (MDD) have trouble recognizing the emotions of people based on their facial expressions (Persad & Polivy, 1993). These cognitive deficits associated with MDD illustrate how depression

disrupts functioning in the right hemisphere. Depressed individuals have demonstrated difficulty in being able to accurately decode facial expressions, which may be indicative of struggling to adapt their behavior, and subsequent emotions, in response to the facial expressions exhibited by others (Persad & Polivy, 1993). Likewise, research has found that anxiety disorders moderately impair the recognition of facial emotions in adults. For example, adults will have a higher likelihood of classifying neutral expressions as angry (Mohlman et al., 2007).

Findings regarding the effects of MDD and Generalized Anxiety Disorder (GAD) on the ability to accurately identify specific emotional expressions have, however, been mixed. For one, Arteche and colleagues (2011) found that neither MDD nor GAD affected the ability to accurately identify sad infant faces. Their study consisted of three groups: mothers with MDD, GAD, and a healthy control group. In contrast, when identifying happy faces, participants with MDD and GAD, in comparison to the control group, were less accurate in their identifications. This suggests that mothers with MDD and GAD find it harder to identify happy faces. As a result of this difficulty in responding to emotional cues, with regards to the socio-emotional relationship between a caregiver and infant, the difficulty in accurately identifying the facial emotions of their infant would mean that they have a higher likelihood of responding more negatively, as opposed to positively to their infant.

Maternal depression and anxiety, therefore, have developmental consequences for infants. It was found that infants with mothers who were depressed had a decreased tendency to look at their mothers' facial expressions during a task requiring infants to look at their mothers' facial expressions, i.e., a peek-a-boo game (Field, 2007). Additionally, Field (2007) found that these infants exhibited more negative emotions and an increased cortisol level in comparison to healthy controls with non-depressed mothers. This further illustrates the impact that these mood-related disorders may have as they not only affect the individual with the disorder but their infants as well. Anxiety disorders may likewise disrupt the caregiver-infant relationship due to the attentional biases present in anxiety disorders. This impacts the caregiver and infant relationship, as non-verbal interactions are key in this stage, and a caregiver needs to be able to identify and respond to the facial expressions of their infant (Darwin, 1872).

In keeping with this, anxiety and depression are also linked to deficits in cognition. For example, MDD is associated with difficulties in cognitive flexibility and attention, as well as impairments in the ability to perceive positive stimuli (Austin et al., 2001;

Demeneşcu et al., 2010; Lee et al., 2012; Persad & Polivy, 1993; Pizzagalli, 2014; Zakanis et al., 1999). Anxiety disorders such as GAD, panic disorders, and social phobias, have similarly been found to be associated with negative cognitive biases in memory, the interpretation of stimuli, attention, and difficulties with the maintenance of vigilance (Clark & McManus, 2002; Demeneşcu et al., 2010; Hirsch & Clark, 2004; Lang & Sarmiento, 2004; Mathews, 1990). These deficits in cognition and emotional recognition associated with both of these disorders may therefore contribute to disruptions in socio-emotional functioning, thereby affecting socio-emotional relatedness (Demeneşcu et al., 2010).

In the context of the cradling scenario, the symptoms of negative mood, impaired concentration, and lack of alertness associated with both depression and anxiety may all imperative for the mother to be able to recognize, process, and respond to the needs of their infant (APA, 2013c, 2013d). It can therefore be argued that a combination of these factors, could result in a mother or caregiver with depression and/or anxiety finding it more difficult to respond appropriately to the needs of, as well as bond and interact with, their infant. Aside from ASD samples, there have also been findings to suggest that the otherwise universal leftward cradling bias is reduced in individuals diagnosed with depression and/or anxiety disorders (McGrath, 2013; Oppler & Laubscher, 2021; Pileggi et al., 2020; Weatherill et al., 2004). Therefore, the presence of depression and/or anxiety may disrupt the future development of the caregiver-infant relationship which would usually be facilitated during leftward cradling. Due to this important role that it seems to play in the emotional processing underlying leftward cradling bias, it is clear that the alteration of these functions could disrupt this relationship.

The Relationship Between Depression and Anxiety, and Cradling Bias

Findings to date regarding the relationship between leftward cradling bias and depression and anxiety have been relatively mixed. For example, Weatherill and colleagues (2004) found that depressed mothers, some of whom had experienced domestic violence, showed a reduced leftward cradling bias. Likewise, a longitudinal study on maternal depressive symptoms and cradling hold by Scola and colleagues (2013), found a significant association between the two variables of interest. Their study consisted of a sample of mothers who were tested at three-time points; namely, during their pregnancy, two months postnatal, and lastly when their infant was 19 months old. In keeping with previous research, the majority of mothers (i.e., approximately 65.8%) in their study demonstrated a left-side preference in all three-time intervals. However, it was noted that there was a change in the

holding preference in 30% of their sample which was demonstrated between the prenatal and first postnatal session. To elaborate, while prior and concurrent depression was not found to be predictive of changes in their holding-side biases, they found that the holding-side preferences of some women when their infants turned two months old, were predictive of depressive symptoms in the pre-to-post-natal period. More specifically, there was a higher likelihood of women who favored a right-side holding preference to report increased symptoms of depression, in comparison to those who favoured a left-side holding bias tending to report fewer depressive symptoms.

In keeping with this, a study by Vauclair and Scola (2009) found that mothers demonstrating a vertical or right-side hold tended to report more affective symptoms. However, these symptoms, using a combined anxiety and depression scale, found affective symptoms were associated with a decreased leftward cradling bias, in comparison to their control group. Their study also highlights that the interaction between anxiety and depression (comorbidity) has a combined effect on leftward cradling. There has, however, only been a few studies conducted on anxiety and leftward cradling bias which had mixed findings. Scola and colleagues (2013) did not find a significant link between cradling side preference and anxiety. However, Reissland and colleagues (2009) found that mothers who expressed stress were significantly less likely to demonstrate a leftward cradling bias. Their study, however, did not examine anxiety directly, but rather they examined the effect of stress and linked that to anxiety. The reason for the mixed findings could be due to the lack of consensus regarding how 1) how both cradling and anxiety are inconsistently defined, and 2) how both studies had a sample size.

Recent findings have supported a threshold theory concerning depression and anxiety symptoms. To elaborate, in a sample of nulliparous female students, Pileggi, and colleagues (2020) found that while the cradling side was not significantly related to depressive symptoms, their research showed that when symptom severity increased, so did the tendency to cradle to the right, as well as the lack of consistency for a preferred side. In keeping with this, Oppler and Laubscher (2021) found that depressive and/or anxiety symptoms alone did not predict leftward cradling bias in their large sample, but that clinical diagnoses of depression and/or anxiety disorders were associated with a disrupted leftward cradling bias. Based on these findings, the authors proposed that a threshold needs to be met with regard to the severity of depressive and/or anxiety symptoms for leftward cradling bias to be disrupted.

Mixed findings could therefore be because studies have employed subclinical samples and/or small clinical samples.

It should also be noted that the lack of consensus in findings could be due to how cradling is defined in these studies. The definition of cradling put forth by Pileggi and colleagues (2020) and Oppler and Laubscher (2021) refers to the holding of an infant in a cradling position, with the intention to soothe them. Weatherill and colleagues (2004), on the other hand, coded for side preference by measuring various holding types (e.g., arm, shoulder, or lap) and the purpose of holding the infant (e.g., to transport or comfort them). Additionally, Scola and colleagues (2013) and Vauclair and Scola (2009) mention a holding bias, measuring through the vertical and horizontal holding of an infant. Given that literature states that the function of holding will influence holding preference, it is imperative that studies are consistent in their definition of cradling bias, and do not use different types of definitions, thereby making interpretation of findings across the literature difficult.

Rationale, Aims, and Hypotheses

There is ample evidence supporting a cerebral lateralization explanation for the universal leftward cradling bias. Specifically, this bias is said to emerge as a result of the specialized processing of socio-emotional stimuli that occurs in the right cerebral hemisphere (Bourne & Todd, 2004; Brancucci et al., 2009; Huggenberger et al., 2009; Lindell, 2013; Malatesta et al., 2019a; Manning & Chamberlain, 1991; Ocklenburg et al., 2018; Pileggi et al., 2013, 2015; Salva et al., 2012; Yovel, 2016). Leftward cradling offers an evolutionary and reciprocal advantage, as the positioning of the infant in the left hemispace (i.e., auditory and visual) of the cradler, grants them the ability to be better equipped to monitor the infant. It likewise allows for the infant to be able to see the more expressive side of the cradler's face. This information subsequently gets processed in the right hemisphere of the brain, thereby aiding the cradler in understanding/interpreting the infant's emotions, improving communication and thus the relationship between them.

A further argument has more recently emerged suggesting that the bias is facilitated by the innate ability to empathize with (i.e., relate to) others (Pileggi et al., 2013; 2015). Cerebral laterality hypothesis extends to variables of socio-emotional relatedness, in which bonding which is facilitated by the ability to relate (i.e., affective empathy) aids in the development of prosocial behaviors. This, in turn, has led to investigations of attachment, empathy, and social skills as predictors of leftward cradling bias, as the ability to relate to others, is closely linked to these variables (Huggenberger et al., 2009; Malatesta et al., 2019a,

2019b; Pileggi et al., 2013, 2015). While there is a theoretical basis for the proposed relationship between variables of socio-emotional relatedness (i.e., attachment, affective empathy, and social ability), mood-related states of depression and anxiety, and handedness, only a few studies have looked at these variables concerning the preferred cradling side. Moreover, the theory of socio-emotional relatedness still lacks empirical support. This study is therefore an attempt to add empirical support, as findings to date have been relatively mixed.

Leftward cradling has potential implications in child development as its proposed association with the socio-emotional relatedness variables of increased secure attachment, affective empathy, and social ability, may aid the child in the future, by aiding in the development of their socio-emotional abilities, and interpersonal relationships (Forrester et al., 2019; Huggenberger et al., 2009; Malatesta et al., 2019a; Pileggi et al., 2013, 2015). In addition, the absence or reduction of leftward cradling may be indicative of depression and/or anxiety in cradlers, given that rightward cradling may be related to depression and anxiety (Oppler & Laubscher, 2021; Pileggi et al., 2020; Scola et al., 2013; Vauclair & Scola, 2009; Weatherill et al., 2004). Given the proposed potential implications of leftward bias, further exploration into the relationship between these variables and leftward cradling bias is required.

The following hypotheses were therefore proposed:

H1: Leftward cradling will be associated with more secure attachment (i.e., lower scores of anxiety and avoidance).

H2: Leftward cradling will be positively associated with higher affective empathy

H3: Leftward cradling will be positively associated with higher social ability scores

Notably, several other known variables must be taken into consideration when investigating the above-mentioned variables, namely depression and/or anxiety diagnoses, and handedness, I therefore also expect to find:

H4: Leftward cradling will be inversely associated with Depression and/or Anxiety diagnoses

H5: Leftward Cradling will be associated with handedness; it will be more prominent in right-handed individuals.

Methods

Design and Setting

This study made use of a cross-sectional correlational design. Six potential predictors were investigated in relation to leftward cradling bias, namely attachment in general close relationships (i.e., global attachment), affective empathy, social ability, depression and/or anxiety (i.e., clinical diagnosis), sex, and handedness. The outcome variable in this study was cradling bias, which was assessed on four separate occasions. Cradling bias was coded as both a categorical and a continuous variable. As data collection took place during the Corona Virus (COVID-19) pandemic, the study was conducted online using Google Forms.

Participants

Participants were recruited using convenience sampling via an advertisement that was placed on the University of Cape Town's (UCT) Psychology Department's Student Research Participant Program (SRPP; Appendix A). Overall, six hundred and eighty-nine students from UCT aged 18 to 46 years, participated in this study. Given the known association between sex and cradling side preference (see Packheiser et al., 2019), 9 participants were excluded as they did not specify their sex. A further 3 were excluded based on an ASD diagnosis, given evidence that the leftward bias is absent in ASD samples (see Pileggi et al., 2013; 2015). The final sample, therefore, consisted of six hundred and seventy-seven participants ($n = 677$), of which 564 self-identified as female and 113 as male. Using G*Power 3.1.9.4, an *a priori* calculation for linear multiple regression (fixed model, R^2 increases) indicated that a minimum sample size of 98 participants was needed to achieve a statistical power of 0.80, given a medium effect size of $d = 0.15$, with a statistical significance of $\alpha = 0.05$ (in keeping with similar studies).

Measures

Demographic Questionnaire

All participants completed a demographic questionnaire (Appendix B). This questionnaire asked participants for basic demographic information including age and sex, as well as whether they had previously been diagnosed with depression and/or anxiety, or ASD. The questions asked therefore concerned key variables in the study, and information collected from this questionnaire was used to determine eligibility for participation.

Cradling Bias Task

This study employed an imaginary cradling task as a measure of cradling side preference. Participants were shown an image on the screen (see Figure 1), with the

following prompt: “Imagine that you are holding a small infant in your arms. Try to imagine the infant’s face, eyes, mouth, body, and arms. Now position your arms as if you were gently soothing the infant or putting it to sleep. Turn your head to look at the infant’s face. To which side are you looking? To your left or right side?” The participant was shown the image and was provided with this prompt on four separate occasions. This protocol was taken from both Herdien and colleagues (2021) and Pileggi and colleagues (2013).

Cradling side was coded as a categorical variable for descriptive analysis (i.e., left or not left), depending on the side preferred across most trials. For example, those who cradled to the left three to four times were categorized as “left” and the others were categorized as “not left.” For inferential analysis, the cradling side was coded as a continuous variable, ranging from -4 to 4. Each leftward cradle was coded as -1 and each rightward cradle was coded as +1. Cradling to the left three times, for example, would result in a cradling side score of -3.

Figure 1

Demonstration of the Cradling Position



Note. This is taken from “Cradling bias is absent in children with autism spectrum disorders” by Pileggi, Malcolm-Smith, Hoogenhout, Thomas, and Solms, 2013, *Journal of Child and Adolescent Mental Health*, 25(1), p. 57.

The Experience in Close Relationships- Relationship Structures Questionnaire

The Experience in Close Relationships - Relationship Structures Questionnaire (ECR-RS). The ECR-RS was adapted from the full version of the Experience in Close Relationship Scale (ECR; Fraley et al., 2000). The ECR-RS is widely used as a self-report measure of an adult’s attachment style (Fraley et al., 2000). This questionnaire measures attachment patterns in five different relationship domains, namely mother, father, romantic partner, best friend, and global (Appendix C).

The ECR-RS consists of 9 items, of which 6 items relate to attachment-related avoidance, and 3 items relate to attachment-related anxiety. Fraley and colleagues (n.d.) created two sets/versions of these 9 items. The first set is used to separately measure attachment in relation to each of the specific relationship domains (i.e., mother, father, romantic partner, and best friend). When using this set of ECR-RS items, all of the 9 items are asked in relation to each of these relationship domains (Fraley et al., 2011). The second set of items, on the other hand, was later created as a supplement to the first, as a measure of general or global attachment (i.e., close relationships in general). The 9 items in both sets have similar themes and are scored similarly. The first set is worded about the specific relationship the participant is answering the question about (e.g., “It helps to turn to this person in times of need”) while the second set is worded in relation to people in general (e.g., “It helps to turn to people in times of need”). It makes use of a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Given the findings of Malatesta and colleagues (2019a) that there was a difference in the relationship between cradling and attachment depending on which attachment figure was being assessed, it can be argued that attachment styles cannot be completely generalized across all relationships, for example with a persons’ romantic partners, friends, parents, and children (Hazan & Zeifman, 1994; Malatesta et al., 2019a; Zayas et al., 2011). For the purpose of this study, the results from the ECR-RS items assessing general attachment were therefore used instead of the relationship-specific results. This was done as the former encompasses participants’ attachment to their parents, friends, and romantic partners (i.e., global attachment) as it could thus be considered a more robust measure of attachment (Malatesta et al., 2019a).

The avoidance score was calculated by averaging items 1 to 6 and the anxiety score was found by averaging items 7 to 9. Once the average for each subscale was calculated, they were added to create a continuous composite variable for attachment. A higher score for anxiety and avoidance was therefore indicative of increased anxiety/avoidance (i.e., lower security of attachment) whereas lower scores of anxiety and avoidance corresponded with increased security of attachment.

The full version of the ECR has yielded sound psychometric properties which are comparable internationally (e.g., Sibley et al., 2005; Vogel & Wei, 2005), as well as in South African samples (e.g., Maunder et al., 2006; Thomas & Viljoen, 2020). Furthermore, the shorter version (i.e., the ECR-RS) yielded sound psychometric properties similar to that of

the longer version of the ECR (e.g., Rocha et al., 2017; Sarling et al., 2021; Siroňová et al., 2020). It has been reported to be a valid measure with significant correlations found between the avoidance and anxiety subscales of the ECR-RS and the investment, satisfaction, commitment and desire to seek other partners subscales of the Investment Model Scale (assessing the functioning and quality of relationships), with the most notable values ranging from $r = -0.28$ to 0.38 in the romantic domain of the ECR-RS (Fraley et al., 2011; Rusbult et al., 1998). Fraley and colleagues (2011) additionally reported that it is a highly reliable measure as the Cronbach alpha reliability values for both subdomains of the anxiety and avoidance scales ranged between $.83 - .87$ and $.81 - .92$., respectively. Similarly, Donbaek and Elklit (2014) reported high internal consistency for both the anxiety and avoidance subscales of the ECR-RS ($\alpha > .81$ and $\alpha > .86$, respectively). The ECR-RS has furthermore been successfully used cross-culturally (Deveci Şirin & Şen Doğan, 2021; Siroňová et al., 2020; Wickham et al., 2018).

The Questionnaire of Cognitive and Affective Empathy

The Questionnaire of Cognitive and Affective Empathy (QCAE) was employed as a self-report measure of dispositional empathy (Reniers et al., 2011; Appendix D). While the QCAE has been constructed to measure aspects of both affective and cognitive components of dispositional empathy, this study was interested in items measuring affective empathy (i.e., sharing of emotions and emotional states; Decety & Jackson, 2004), as it is the more primitive aspect of empathy associated with the processing of emotions (Braak, 1976; Hatfield et al., 2011). This questionnaire consists of 31 items, of which 19 items relate to cognitive empathy, and 12 items relate to affective empathy. It makes use of a 4-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). The total scores on the affective subscale items were summed and used as a measure of affective empathy, with higher scores indicative of higher dispositional affective empathy. The QCAE has been widely employed and has yielded sound psychometric properties both internationally and locally (e.g., Di Girolamo et al., 2019; Griqua & Mlomo, 2020; Reniers et al., 2011). For example, convergent validity was established with strong significant positive correlations found between the cognitive empathy ($r = 0.62$) and affective empathy ($r = 0.76$) subscales of the QCAE and the Basic Empathy Scale (Jolliffe & Farrington, 2006; Reniers et al., 2011).

Di Girolamo and colleagues (2019) additionally reported adequate internal consistency with reliability values ranging from $\alpha = .58$ to $.87$ for the subscales and an overall reported $\alpha = .77$. Similarly, Reniers and colleagues (2011) reported reliability values (α)

between .65 and .72. Several South African studies have also reported good internal consistency reliability (e.g., Griqua & Mlomo; Kozloff et al., 2021; Pileggi, 2018; Viglietti, 2014).

The Interpersonal Competence Questionnaire

The Interpersonal Competence short-form questionnaire (ICQ-15) was employed as a measure of social competence (Coroiu et al., 2015; Appendix E). This questionnaire is a self-report measure that was adapted from the original ICQ which consisted of 30 items (Buhrmester et al., 1988). The original ICQ has been used internationally as a measure to help identify participants with deficiencies in social skills across multiple domains (Coroiu et al., 2015). The shorter ICQ-15 is said to be a pragmatic measure often used in health research, given that it can be used in diverse settings, and that it prevents burdening participants with lengthy questionnaires, thereby impacting willingness to participate (Coroiu et al., 2015; Glasgow & Riley, 2013). It comprises 15 items that measure 5 domains: a) initiation, with regards to relationships (e.g., “finding and suggesting things to do with new people whom, you find interesting and attractive”); b) negative assertion (e.g., “confronting your close companion when he/she has broken a promise”); c) emotional support (e.g., when a close companion needs help and support, being able to advise on ways that are well received); d) disclosure of personal information (e.g., confiding in a new friend/date and letting him/her see your softer, more sensitive side.”; and e) conflict management “e.g., being able to take a companion’s perspective in a fight and really understand his or her point of view”). While the items from the ICQ were shortened in the ICQ-15, they both assess the same domains of interpersonal competence (Buhrmester et al., 1998; Coroiu et al., 2015).

It makes use of a 4-point Likert scale whereby participants rate their confidence in their ability to complete an action described in each statement. Response options range from 1 (*I am always poor at this*) to 4 (*I am always good at this*). A higher overall score is therefore indicative of higher interpersonal competence (i.e., social skills in each of these domains).

The ICQ-15 has yielded sound psychometric properties internationally (e.g., Coroiu et al., 2015; Huang et al., 2022; Park et al., 2019). For one, the ICQ-15 is reported to have good structural/factorial validity within an adult population (aged 18 to 90 years), and it has been shown to assess interpersonal competence in various environmental contexts (Coroiu et al., 2015; Huang et al., 2022). It has also been reported to have moderate to strong concurrent validity as established by Huang and colleagues (2022) between the subscales and total of the

ICQ-15 and the Five-Item World Health Organization Well-Being Index ($r = 0.51$), Ten-Item Connor-Davidson Resilience Scale ($r = 0.53$) and the Patient Health Questionnaire ($r = -0.32$; Campbell & Stein, 2007; Kroenke et al., 2001; Topp et al., 2015).

Coroiu and colleagues (2015) furthermore reported good internal consistency ($\alpha = .87$). Similarly, Park and colleagues (2019) reported an overall value of $\alpha = .82$, with the individual subscales yielding an acceptable range of values ($\alpha = .56$ to $.74$). The psychometric properties for a South African context have yet to be established.

Edinburgh Handedness Inventory-Short Form

The short-form version of the Edinburgh Handedness Inventory (EHI-S) was employed as a measure of dominant handedness (Veale, 2014; Appendix F). The original full-form version (EHI), which consists of 10 items, is used internationally as a standard measure of handedness (Oldfield, 1971). Veale (2014), however, found the short form to be more reliable in identifying if participants were left, right, or mixed-handers, in comparison to the original which often over-categorized mixed-handers. The short-form version consists of only 4 items asking participants to indicate their preferences in the use of hands in the following activities or objects: “writing, throwing, brushing your teeth, and using a spoon.”

The EHI-S makes use of a 5-point Likert scale ranging from “Always right” to “Always left.” The participant’s responses to each of the 4 items regarding which hand/s they prefer to use were awarded the following values: “Always right” = 100, “Usually right” = 50, “Both equally” = 0, “Usually left” = -50, and “Always left” = -100. Handedness was coded as a categorical variable for descriptive analysis (i.e., right-handed, left-handed, or mixed-handed) depending on their overall laterality quotient score. The laterality quotient (LQ) was determined by adding the values awarded for the responses for the four items and dividing the total by 4. Participants with an LQ ranging from 61-100 were classified as right-handed, -100 to -61 as left-handed, and any quotient between was classified as mixed-handed. For inferential analysis, handedness was coded as a continuous variable ranging from -100 to +100 (i.e., the LQ). In terms of psychometric properties, this measure has demonstrated good reliability ($\alpha = .93$; Veale, 2014). The psychometric properties for a South African context have yet to be established.

Beck Depression Inventory-II

The Beck Depression Inventory-II (BDI-II) was employed as a self-report measure of the severity and presence of depressive symptoms (Beck et al., 1996; Appendix G). It consists of 21 items using a 4-point Likert scale ranging from 0 (“*I do not feel sad*”) to 3 (“*I*

am so sad or unhappy that I cannot stand it"). Higher scores are indicative of an increased number of depressive symptoms reported (also increased severity). In addition, this study used item 9 as a stand-alone measure of depression severity, as it asks about suicidal ideation and intent. Green and colleagues (2015) examined the predictive validity of item 9 in the BDI (which is the same as item 9 in the BDI-II). They found that it significantly predicted both deaths by suicide as well as repeated suicide attempts.

The BDI-II has yielded good psychometric properties internationally as well as in South African samples (e.g., Arnau et al., 2001; Kagee et al., 2014; Makhubela & Mashegoane, 2015; Saal et al., 2018). For example, Arnau and colleagues (2001) furthermore established convergent validity between the scores of the BDI-II and the perception of overall health, mental health, physical functioning, role functioning and pain subscale scores of the Short-Form General Health Survey, with significant values ranging from $r = -.19$ to $r = .65$ (Stewart et al., 1988) The BDI-II is also reported to have excellent internal consistency and construct validity, with reliability values ranging from $\alpha = .88$ to $\alpha = .94$ (Arnau et al., 2001; Beck et al., 1996; Kagee et al., 2014; Oppler & Laubscher, 2021).

Beck Anxiety Inventory

The Beck Anxiety Inventory (BAI) was employed as a self-report measure of the presence of clinical anxiety disorders and traits (Beck et al., 1988; Appendix H). The BAI makes use of 21 self-report items, using a 4-point Likert scale ranging from 0 (*not at all*) to 3 (*severely - it bothered me a lot*). Higher scores were indicative of an increased number of anxiety symptoms reported (also increased severity).

The BAI has yielded good psychometric properties internationally as well as in South African samples (e.g., Kagee et al., 2015; Saal et al., 2019). For example, the BAI has been found to have good concurrent validity when correlated with the SCL-90-R anxiety subscale ($r = .81$; Derogatis, 1983; Steer et al., 1993). It is also reported to have good to excellent internal consistency with values ranging from $\alpha = .83$ to $.93$ (Kagee et al., 2015; Sanz et al., 2012; Ulusoy et al., 1998).

Procedure

This study was conducted online because of restrictions preventing in-person participation based on the COVID-19 pandemic. Once ethical approval was obtained, the SRPP administrator was contacted to place the advertisement for the study on the SRPP site (see Appendix A). A link was provided in the advertisement which took participants to the study should they be interested in participating. Once participants had read and electronically

signed the informed consent forms (see Appendix I), they were asked to complete all of the questionnaires. The four trials of the imaginary cradling bias task were interspersed between questionnaires. The tasks/questionnaires were presented in the following sequence: CB1 (i.e., Cradling Bias trial 1), ECR-RS, QCAE, CB2, ICQ-15, BDI-II, CB3, BAI, CB4, EHI-S.

Overall, this study took approximately 45 minutes to complete. Upon completion, participants were given a debriefing form which contained more information about the study as well as the contact information of the primary researcher and the Psychology Department's Ethics Committee, should they have any further questions about the study (Appendix J). Participants were also provided with contact information for mental health resources at the debriefing stage. Finally, participants were awarded 1 SRPP point for their participation, which the researcher uploaded after their participation.

Data Analysis

Statistical analyses were completed using IBM SPSS Statistics (Version 25.0; IBM Corporation., 2017). A conventional significance threshold of 0.05 was maintained. Before the inferential tests started, the following assumptions were checked, namely normality, linearity, homoscedasticity, and an absence of multicollinearity. Descriptive statistics were calculated to explore and summarise the data. The influence of handedness was first assessed using a chi-squared test to investigate whether it was significantly associated with leftward cradling bias. Informed largely by existing literature, hierarchical regression analysis was used for inferential analyses. To test both the primary and secondary set of hypotheses, a single hierarchical regression model was built, with each variable being added in succession at each step to assess if each addition resulted in an increased R^2 (i.e., explained variance in leftward cradling bias; Kim, 2016).

In the first step, handedness was considered as a predictor given the significance indicated by previous research (see Huheey, 1977; Packheiser et al., 2019; Salk, 1960; van der Meer & Husby, 2006). Next, sex was considered as a predictor given the long-standing question of sex differences in cradling bias. A preliminary analysis indicated that there was no significant difference in cradling side preference across sex in this sample. This is in keeping with what has been recently found by Packheiser and colleagues' (2019) review (i.e., no *significant* difference across sex). Sex was therefore omitted from the regression analysis. In step 2, a clinical diagnosis of anxiety and/or depression vs. no reported diagnosis was entered. In step 3, attachment (i.e., global attachment) was added to the model given that literature suggests that it facilitates leftward cradling bias (Malatesta et al., 2019b; Pileggi et

al., 2013). In step 4, the social ability was added given that only one study to date has found evidence of its relation to leftward cradling bias (Forrester et al., 2019). Lastly, in step 5, affective empathy was added, given that there is some evidence suggesting a relationship between the two variables (Malatesta et al., 2019a).

Notably, while a theoretical argument could be made that all of these variables of socio-emotional relatedness would correlate, there was no evidence of multicollinearity. They were therefore not grouped as one variable in the hierarchical regression equation. It is, however, difficult to differentiate which of these would be the strongest predictor/s of leftward cradling based on existing literature. An attempt was thus made to organize these predictors in a way, where predictors assumed to be the strongest, was placed last.

Ethical Considerations

This research study was approved by both the Ethics Review Committee of the Faculty of Humanities and the Psychology Department's Ethical Committee at UCT (Appendix K). Participants needed to give their informed consent before they continued with the study, as per the signing of the informed consent form (Appendix I). They were made aware that participation was voluntary and that they would be able to withdraw their participation without any consequences at any point during the research study. The study did not have any foreseeable risks; participants were, however, provided with information about appropriate healthcare services resources at the end of the survey, if they experienced any distress, particularly in answering the questionnaires related to depression and or anxiety. In addition to this, participants benefited from being able to receive 1 SRPP point for their participation in this study.

The confidentiality of participants was upheld as all of the data gathered was only available to the primary researcher, supervisor, and co-supervisor of this research study. The identities of the participants will remain anonymous in all presentations of their data as they were each given a participant number instead of having to use their actual names. The only instance where names were asked for was for the allocation of SRPP points to their respective courses. To further ensure the confidentiality and privacy of the participants, all of the data collected in this study were stored on a password-protected laptop which was only accessible by the primary researcher, supervisor, and co-supervisor. This has been maintained through the data collection, as well as the presentation of the data. Finally, all participants were thanked for their participation in the study. They were provided with email contact details for

the researcher, department ethics committee, and supervisors of the study, should they have any queries or concerns.

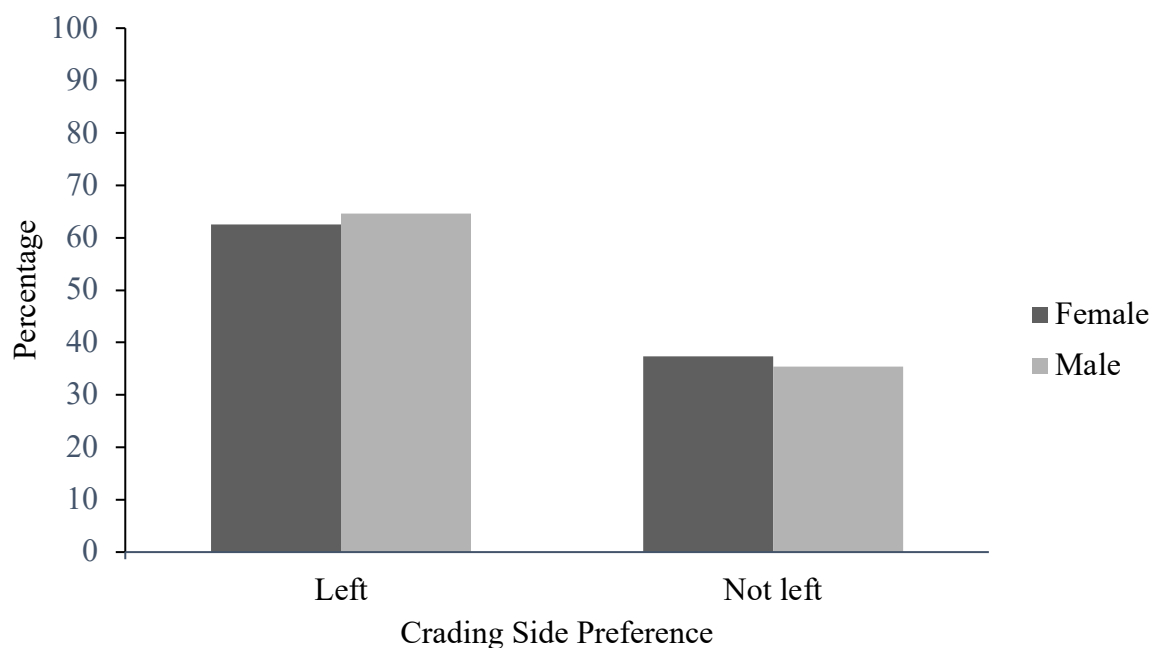
Results

Descriptive Statistics

Sample characteristics are shown in Table 1. A total of 677 participants (564 female and 113 male) between the ages of 18 and 46 years ($M = 20.23$, $SD = 2.41$) took part in this study. Overall, 62.93% ($n = 426$) of participants cradled to the left. As expected, continuous coding of cradling side also reflected this general leftward bias ($M = -1.38$, $SD = 3.17$). This leftward bias was also evident across sex with 62.59% of females ($M = -1.39$, $SD = 3.16$) and 64.60% of males ($M = -1.31$, $SD = 3.40$) preferring to cradle to the left. An independent samples t -test revealed that this difference across sex was not significant, $t(675) = -.40$, $p = .686$, Cohen's $d = -.04$. Cradling side preference across sex is presented in Figure 2 below

Figure 2

Cradling Side Preference Across Sex



The distribution of handedness was as expected from a typically developing sample in that most participants were right-handed (89.51%, $n = 606$) and only a few were left-handed (5.47%, $n = 37$) and mixed-handed (5.07%, $n = 34$). A chi-squared test of independence revealed that the cradling side was not contingent on handedness, $\chi^2(15, N = 677) = 25.02$, p

= .050, *Cramer's V* = .19. Correlational analysis, however, revealed a significant negative correlation between these variables ($r = -.11, p = .003$). This correlation, albeit small, indicated that right-handed individuals were more likely to cradle to the left.

Regarding reported symptoms of depression and anxiety, findings across sex were as expected, in keeping with the literature (Faravelli et al., 2013; Hou et al., 2020; see Table 1). An independent samples *t*-test showed that females reported significantly more symptoms of depression ($M = 17.79, SD = 11.67$) than males ($M = 12.00, SD = 7.8$), $t(176.27) = 5.38$, with a medium effect size, Cohen's $d = .50$. Likewise, females reported significantly more symptoms of anxiety ($M = 18.59, SD = 13.77$) than males ($M = 9.47, SD = 9.73$), $t(213.11) = 8.41$, also with a medium effect size, Cohen's $d = .69$. In keeping with this, females were significantly more likely to report a previous diagnosis of depression and/or anxiety than males as the clinical diagnosis was contingent on sex, $\chi^2(15, N = 564) = 8.68, p = .023$, *Cramer's V* = .11. Furthermore, the cradling side was not significantly correlated with depression symptoms ($r = -.01, p = .987$) or anxiety symptoms ($r = .02, p = .671$).

Participants were divided into two groups, namely non-clinical ($n = 521$) and clinical ($n = 156$) based on self-reported previous diagnoses by an independent clinician. The clinical group was further subdivided into those who have at some stage in their life received a clinical diagnosis of depression only ($n = 22$), anxiety only ($n = 54$), or comorbid diagnoses of depression and anxiety ($n = 80$). Of those in the non-clinical group, 63.92% ($M = -1.47, SD = 3.17$) cradled to the left whereas 59.62% of the clinical group cradled to the left ($M = -1.08, SD = 3.18$). Therefore, while both groups showed a tendency to cradle to the left, it was slightly more pronounced in the non-clinical group. Despite this, cradling side was not contingent on a diagnostic group (i.e., non-clinical vs. clinical), $\chi^2(1, N = 677) = .95, p = .329$, *Cramer's V* = .04. Furthermore, cradling side was not contingent on either of the four diagnostic groups (non-clinical diagnosis, depression diagnosis only, anxiety diagnosis only, or comorbid diagnoses of depression and anxiety), $\chi^2(3, N = 677) = 1.58, p = .665$, *Cramer's V* = .05. Cradling side across diagnostic groups is presented in Figure 3.

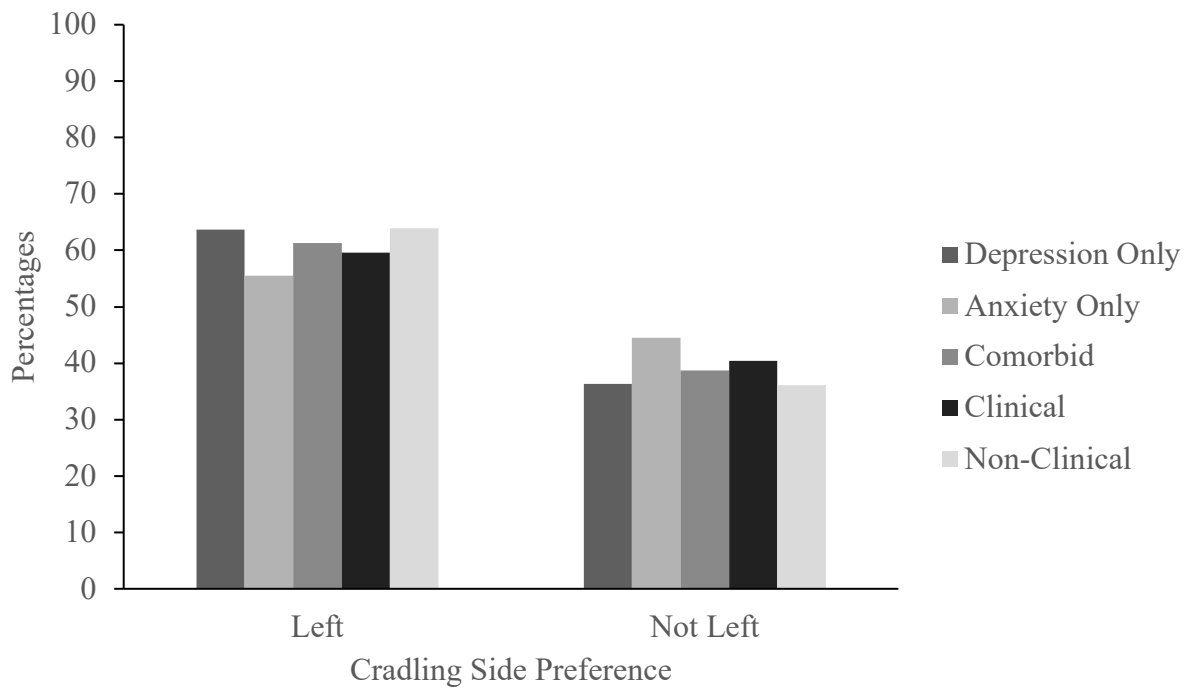
Figure 3*Cradling Side Preference Across Diagnostic Groups*

Table 1*Sample Characteristics for the Overall Sample and Across Sex*

Variable	Overall group (<i>N</i> = 677)	Female (<i>n</i> = 564)	Male (<i>n</i> = 113)	<i>t</i> / χ^2	<i>p</i>	<i>ESE</i>
Cradling bias						
Left: Not left	426:251 62.93%:37.0%	353:211 62.59%:37.41%	73:40 64.60%:35.40%	-.16	.686	.02
Degree of bias	-1.38 (3.17)	-1.40 (3.13)	-1.31 (3.4)	-.26	.798	-.04
EHI-S	80.56 (45.50)	80.61 (45.66)	80.31 (44.88)	11.33	.729	.13
BDI-II	16.97 (11.63)	17.97 (11.75)	12.00 (9.63)	5.38	<.001	.50
BAI	17.06 (13.61)	18.59 (11.75)	9.47 (9.73)	8.41	<.001	.69
Clinical diagnosis: No clinical diagnosis	156:521 23.04%:76.96%	142:422 25.18%:74.82%	14:99 12.39%:87.61%	8.68	.023	.11

Note. Mean scores are presented with standard deviations in parentheses. EHI-S = short-form version of the Edinburgh Handedness Inventory; BDI-II = The Beck Depression Inventory-II; BAI = The Beck Anxiety Inventory; ESE = Estimated Effect Size, calculated using Cohen's *d* for *t*-test and *phi* or *Cramer's V* (where applicable) for chi-squared analysis. Clinical Diagnosis was self-reported by participants, and it was made by a clinician independent of this study. Values in bold indicate statistical significance.

Inferential Statistics

Hierarchical Regression Analysis

Informed by existing literature, hierarchical regression analysis was utilized for the inferential analysis. Consequently, the primary model was as follows: Handedness was entered in Step 1 given previous and recent literature supporting a relationship between handedness and leftward cradling bias (e.g., Huheey, 1977; Packheiser et al., 2019; Salk, 1960). Next, sex was considered as a predictor given that it has long been believed that leftward cradling bias is more pronounced in females, despite mixed findings (de Château, 1983; Manning 1991; Packheiser et al., 2019). However, a recent review has revealed that the leftward bias is present across sex and that is no significant difference in the degree of the bias (see Packheiser et al., 2019). Descriptive analysis was in keeping with this more recent finding, revealing no difference in leftward cradling bias across sex in this dataset. Sex was therefore omitted from the regression analysis. Next, the diagnostic group (i.e., reported a clinical diagnosis of anxiety and/or depression vs. no reported diagnosis) was added in Step 2. I chose to use a diagnostic group instead of symptoms of depression and/or anxiety (i.e., score on the BDI-II or BAI) as predictor/s in light of recent evidence supporting a threshold hypothesis in relation to these mood states (Oppler & Laubscher, 2021; Pileggi et al., 2020). In Steps 3, 4, and 5, I added the three variables of social-emotional relatedness, namely attachment (i.e., global attachment style), social ability, and empathy (i.e., affective empathy), respectively.

These were each added given findings implicating them as potential predictors of non-functional cradling (see Forrester et al., 2019; Malatesta et al., 2019a, 2019b; Pileggi et al., 2013; 2015). These variables were organized based on limited existing research findings, with the variable which was assumed to be the strongest predictor of cradling bias being placed last. Notably, these variables of socio-emotional relatedness were added separately despite the theoretical relationship between them as there was no evidence of multicollinearity among them. Intercorrelations are presented in Table 2. As can be seen in Table 2, of the potential predictors, only handedness was correlated with cradling bias ($r = -.11, p = .003$). Regarding intercorrelations between predictors, namely attachment and social ability ($r = -.27, p < .001$) and as well as having a diagnosis of depression and/or anxiety and affective empathy ($r = -.15, p < .001$) were intercorrelated. The intercorrelations between the potential predictors in conjunction with tolerance statistics revealed no problem with multicollinearity between variables, despite this expectation.

Table 2*Intercorrelations Between Potential Predictor Variables and Cradling Bias*

	1.	2.	3.	4.	5.	6.
1. Cradling bias	-	-.11*	-.05	.04	-.01	.04
2. Handedness		-	-.06	-.01	-.00	-.02
3. Diagnostic Group			-	-.02	.03	-.15**
4. Attachment				-	.27**	-.03
5. Social Ability					-	.03
6. Affective Empathy						-

Note. * $p < .01$. ** $p < .001$.

The final inclusive model (model 5) was significant, $F(1, 671) = 2.37, p = .038$, despite explaining less than 1% in the variance of cradling side preference. Upon further investigation, it was apparent that the significance stemmed from the one significant contributor to the model, namely handedness (see Tables 3, 4, and 5). As can be seen in Step 1 in Table 3, handedness contributed significantly to the regression model, $F(1, 675) = 8.75, p = .003$, and accounted for 1.3% of the variation in cradling side. Each of the subsequent steps were not significant. In fact, the addition of these variables seemed to decrease the variance explained by the model, and the statistical significance of the overall model decreased with each step (see Tables 3 and 4).

Table 3*ANOVA Results*

Model	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>
1	86.994	1	86.994	8.753	.003*
2	99.758	2	49.879	5.021	.007*
3	109.425	3	36.475	3.672	.012*
4	109.458	4	27.364	2.740	.027*
5	117.976	5	23.595	2.371	.038*

Note. * $p < .01$.

Dependent Variable (continuous coding leftward cradling bias)

1. Predictors (constant), handedness
2. Predictors (constant), handedness, diagnostic group
3. Predictors (constant), handedness, diagnostic group, attachment
4. Predictors (constant), handedness, diagnostic group, attachment, social ability
5. Predictors (constant), handedness, diagnostic group, attachment, social ability, affective empathy

Table 4*Model Summary Table*

Model	<i>R</i>	<i>R</i> ²	<i>SEE</i>	Change statistics				
				<i>R</i> ²	<i>F</i>	<i>df1</i>	<i>df2</i>	<i>sig. F</i>
1 ^a	.133	.01	3.15	.01	8.75	1	675	.003
2 ^b	.121	.02	3.15	.00	1.29	1	674	.257
3 ^c	.127	.02	3.15	.00	.97	1	673	.324
4 ^d	.127	.02	3.15	.00	.00	1	672	.954
5 ^e	.132	.02	3.15	.00	.86	1	671	.355

Note.

^a Predictor: handedness

^b Predictors: handedness, diagnostic group

^c Predictors: handedness, diagnostic group, attachment general

^d Predictors: handedness, diagnostic group, attachment general, social ability

^e Predictors: handedness, diagnostic group, attachment general, social ability, affective empathy

^f Outcome Variable: cradling bias (continuous coding)

Table 5*Coefficients Table*

Model	Coefficients			<i>t</i>	<i>p</i>	Tolerance
	B	<i>SE</i>	Beta			
Constant	-1.255	1.192		-.053	.293	
Handedness	-.008	.003	-.111	-2.894	.004	.995
Diagnostic group	-.293	.292	-.039	1.003	.316	.972
Attachment:						
general	.104	.118	.035	.888	.375	.923
Social ability	.002	.017	.004	.095	.924	.923
Affective empathy	-.021	.023	-.036	-.925	.355	.975

Further Inferential Analyses

Further analyses were conducted to assess hypotheses 4 and 5. To recap, I was interested in whether depression and/or anxiety could predict cradling side preference. To investigate this, I chose to group individuals based on a self-reported previous diagnosis of depression and/or anxiety. Consequently, depression and/or anxiety were grouped together in one step in the regression model. These variables had to be grouped in the regression analysis given the problem of multicollinearity. Ideally one would like to separate these. This section aims to do so. Furthermore, I chose to use a diagnostic group instead of symptoms of depression and/or anxiety (i.e., scores) as a predictor in the regression analysis given the previously described threshold hypothesis. However, I was also interested in investigating whether symptoms could predict cradling side preference, as some studies have found that symptoms alone can predict cradling side (Pileggi et al., 2020; Scola et al., 2013; Vauclair & Scola 2009).

Table 6 presents the descriptive statistics for cradling side preferred across diagnostic subgroups (also depicted in Figure 3 presented earlier). As can be seen in Table 6, a leftward bias can be seen across all diagnostic subgroups. Notably, a leftward bias is apparent in the non-clinical group ($M = -1.47$, $SD = 3.17$), whereas the remaining subgroups have a mean of

around -1, indicating that the bias is more pronounced in the non-clinical group, albeit not significantly so.

Table 6

Descriptive Statistics of Cradling Side Within Each Sub-Group

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	%
Cradling Side				
Depression	22	-1.00	3.13	63.63
Anxiety	54	-.96	3.24	55.56
Comorbid	80	-1.20	3.18	61.25
Clinical	156	-1.09	3.18	59.62
Non-clinical	521	-1.47	3.17	63.92

Note. Non-clinical refers to no diagnosis of either depression and/or anxiety. % refers to the number of participants which cradled to the left in each of these subcategories.

Correlation analysis revealed that there was no significant correlation between cradling bias and depression and/or anxiety scores. The correlation between BDI-II scores ($M = 16.82$, $SD = 11.57$) and leftward cradling bias was $r = -.01$, $p = .987$. Furthermore, the correlation between BAI scores ($M = 17.06$; $SD = 13.61$) and leftward cradling bias was $r = .02$, $p = .671$. As expected, BAI and BDI-II scores were significantly correlated, $r = .69$, $p < .001$.

Notably, the demographic questionnaire did not require patients to state when their clinical diagnosis was made. It could then be considered that self-reported diagnosis might not reflect the current severity of symptoms or clinical significance. A potential way to assess whether the clinical significance of depressive symptoms is associated with cradling side was to look at the 9th question (Q9) of the BDI-II. This item queries suicidal thoughts (i.e., ideation or intent). The BDI-II asks questions related to the presentation of symptoms of depression in the last two weeks, therefore item 9 could arguably be used as a crude measure of clinical severity. Any indication of suicidal ideation or intent was coded as yes (i.e., response options 1 -3 were coded as yes, while response option 0 was coded as no). However, a chi-squared test of independence revealed that cradling side was not contingent on suicidal

ideation (BDI-II Q9), $\chi^2(1, N = 677) = .620, p = .431, Cramer's V = .03$. Likewise, a correlational analysis yielded a non-significant correlation between these variables ($r = .02, p = .467$).

Discussion

The broad aim of this study was to investigate the relationship between socio-emotional relatedness and leftward cradling bias in a student sample, namely male and female undergraduates from the Psychology department at UCT in South Africa. To this end, this study explored (1) the relationship between three variables of socio-emotional relatedness, namely attachment, affective empathy, and social ability and cradling bias, and (2) the relationship between mood-related states of depression and anxiety and cradling bias. To date, studies considering these variables as potential predictors of leftward cradling bias (i.e., non-functional cradling bias - the focus of this study) have been few and far between, and have produced relatively mixed and therefore tentative findings, despite there being a theoretical basis for these relationships (Fleva & Khan, 2015; Forrester et al., 2019; Herdien et al., 2021; Huggenberger et al., 2009; Jooste, 2018; Malatesta et al., 2019a, 2019b; Reissland et al., 2009; Oppler & Laubscher, 2021; Pileggi et al., 2013, 2015; Scola et al., 2013; Sieratzki & Woll, 2002; Turnbull & Collins, 2000; Vauclair & Scola, 2009; Weatherill et al., 2004; Weiland & Sperber, 1970). In this sample, a hierarchical regression analysis showed that none of these variables was significantly predictive of leftward cradling bias. Analysis indicated that only handedness - a variable included based on the literature - predicted leftward cradling in this sample.

Overall, the universal leftward cradling bias was evident in my sample, with 62.93% of participants showing a preference to cradle to the left. Cradling bias (left or not left) was categorized based on the participants' most preferred cradling side across four trials. Furthermore, while 64.60% of males cradled to the left and 62.59% of females cradled to the left, the difference was not statistically significant. Cradling side was also not contingent on sex. This is in keeping with what is predicted by most recent literature (see review by Packheiser et al. 2019). To elaborate, it was previously believed that females demonstrated a more pronounced leftward bias (De Château, 1983; Manning, 1991; Salk, 1960; Packheiser et al., 2019). Packheiser and colleagues (2019), however, found no statistical difference with regard to the prevalence of leftward cradling across sex, supporting the findings of this study. Participants were also grouped according to clinical diagnosis based on whether they had

self-reported that they had previously been diagnosed with depression and/or anxiety disorder. Leftward cradling bias was not found to be contingent on any of the four diagnostic groups. However, while both groups demonstrated a tendency to cradle to the left, a leftward bias was slightly more pronounced in the non-clinical group (63.92) % compared to the clinical group (59.62%). This is contrary to what is suggested by research (Oppler & Laubscher, 2021). I discuss these findings in more detail below.

The Relationship between Handedness and Cradling Side Preference

I hypothesized that leftward cradling would be associated with handedness; it was expected to be more prominent in right-handed individuals. This hypothesis was informed by the argument that handedness has long been considered a variable to take into account when investigating cradling bias (Packheiser et al., 2019; van der Meer & Husby, 2006). Both the study by van der Meer and Husby (2006) and a comprehensive review of studies by Packheiser and colleagues (2019) on the association between handedness and leftward cradling have reported findings that handedness is significant in relation to cradling side. The majority of the samples in both (see review by Packheiser et al., 2019 and the study by van der Meer & Husby, 2006) found an association between a tendency to cradle to the left and being right-handed. To elaborate, van der Meer and Husby (2006) found that the majority of the participants in their study demonstrated a leftward cradling bias, with handedness being significantly associated with functional cradling. Packheiser and colleagues (2019) similarly observed that in comparison to right-handed individuals, left-handed individuals demonstrated a significantly less pronounced leftward bias. This provided evidence that there was a significant relationship between handedness and a cradling bias.

Despite a theoretical basis for this relationship, the results of my study were mixed. For one, the cradling side was not contingent on handedness, but there was a small significant correlation between the variables ($r = -.11$). Moreover, in the regression model, handedness was the only variable that contributed significantly to predicting cradling side ($\beta = -.11, p = .003$). However, it explained only an extremely small proportion of the variance in cradling ($R^2 = .01$). Furthermore, while my findings were in line with the literature, the fact that the majority of my sample was right-handed with most of them cradling to the left, is something worthwhile considering when interpreting the results as well. While a relationship was found, it could be possible that this was in part due to this difference in the prevalence of right, left, and mixed-handed individuals in this study.

However, the findings regarding the relationship between cradling side bias and handedness are mixed. While the findings in my study are in support of the two studies that did find a significant association between these variables (Packheiser et al., 2019; van der Meer and Husby, 2006), other research has found that there is no link between cradling side bias and handedness (e.g., Huggenberger et al., 2009; Manning & Chamberlain, 1991; Saling & Bonert, 1983; Turnbull & Lucas, 1996). For example, Huggenberger and colleagues (2009) found that even though the majority of their sample demonstrated a leftward bias, there was no association between left versus non-left holders and handedness in their study. There are potential explanations for these mixed findings, which I discuss next.

Inconsistencies in the Contextualization of Cradling

While Packheiser and colleagues (2019) found a significant association between handedness and cradling bias in their meta-analysis, it is of note that the studies they reviewed were not consistent in their contextualization of cradling when assessing the association between the two. Cradling should be differentiated into functional cradling and non-functional cradling. To reiterate, the former relates to cradling the infant while trying to perform other tasks, and the latter refers to cradling with the intention to soothe the infant (van der Meer & Husby, 2006). This is especially important to distinguish between given research, finding that handedness is associated with functional, rather than non-functional cradling (De Château et al., 1978; Ginsburg et al., 1979; Salk, 1960; Saling & Tyson, 1981; van der Meer & Husby, 2006).

On the other hand, while findings by van der Meer and Husby (2006) demonstrated an association between handedness and functional cradling (i.e., participants preferring to cradle toward their non-dominant side), it can be argued that the instruction they used in their study, asking participants to insert a dummy into the mouth of the doll when cradling it, could also be showing a relationship between handedness and non-functional cradling (i.e., cradling with the intention to soothe). Additionally, side holding bias has been reported in relation to transporting an infant, in this case, handedness plays a role in the holding side preference (Bruser, 1981; Lockard et al., 1979; Saling & Cooke, 1984). Ultimately this reinforces the need for studies to restrict their research to non-functional cradling, thereby allowing for a clear consensus on 1) the context/s in which handedness plays a role, and 2) to what extent it does so. It is therefore important to differentiate between the two and/or to specify which is being assessed. This is especially imperative given that handedness seems to play a different role in each context of cradling - due to the role of handedness in these different contexts

seeming to be different – handedness certainly appears to be implicated in functional cradling, whereby the dominant hand, is left free with the purpose of using it to perform other tasks.

To summarise, I investigated the relationship between leftward cradling and handedness, given the theoretical basis for this argument. While I did not find cradling side to be contingent on handedness, I did find a significant negative correlation between these variables. This shows that there is weak evidence for some role of handedness in cradling bias.

The Cerebral Laterality Explanation for Leftward Cradling

To reiterate, current research supports a cerebral laterality hypothesis which explains how cradling side preference emerges as a result of the specialized processing of facial emotional expressions in the right hemisphere of the brain (Bourne & Todd, 2004; Lockard et al., 1979; Malatesta et al., 2020; Oppler & Laubscher, 2021; Pileggi et al., 2013, 2015). Specifically, a cerebral monitoring hypothesis explains how leftward cradling has a reciprocal advantage for caregiver-infant relationships. The placement of an infant in the left auditory and visual hemisphere of the cradler allows for them to optimally monitor and respond to the infant's needs, as the right hemisphere of the brain is quicker in being able to process and respond to information from the contralateral hemispace (i.e., left hemispace; Harris, 2010; Huggenberger et al., 2009; Karenina & Giljov, 2018; Manning & Chamberlain, 1991; Scola & Vauclair, 2010; Sieratzki & Woll, 2002; Vauclair & Donnot, 2005). Leftward cradling likewise exposes the infant to the more expressive side of the cradlers face, consequently allowing for optimal recognition, interpretation, and monitoring of emotional facial cues between cradler and infant (i.e., better monitoring of the infant).

More recently, researchers have proposed a refinement of this explanation in the form of a socio-emotional relatedness hypothesis for leftward cradling bias (Pileggi et al., 2013, 2015). This hypothesis proposes that it is the right hemisphere's specialization in processing socio-emotional stimuli, such as faces, as well as its specialized role in emotional communication, attachment, and social cognition that may be facilitating leftward cradling bias (Bourne & Todd, 2004; Brancucci et al., 2009; Gorno-Tempini et al., 2001; Lindell, 2013; Malatesta et al., 2020; Pileggi et al., 2013, 2015; Schore, 2005; Yovel, 2016). Consequently, measures of socio-emotional relatedness, namely attachment, empathy, and social skills have begun to receive attention as potential predictors of leftward cradling bias.

Variables of Socio-Emotional Relatedness and Cradling Side Preference

In the context of the cradling situation, socio-emotional relatedness refers to the innate ability to relate to the infant emotionally and socially. For example, as a result of being able to quickly understand, and react to the facial expressions and emotional states of their infant, cradlers can adequately address their needs (Harris, 2010; Huggenberger et al., 2009; Karenina & Giljov, 2018; Manning & Chamberlain, 1991; Scola & Vauclair, 2010). These interactions enable the optimal formation of a relationship between an infant and the cradler. It has therefore been argued to ultimately assist in the development of socio-emotional abilities (Malatesta et al., 2019a; Pileggi et al., 2015; Sieratzki & Woll, 2002). Variables of socio-emotional relatedness, therefore, refer to variables that facilitate the ability to relate to others and could be measured through attachment, empathy, and social skills. Since all of these variables measure the overarching construct of socio-emotional relatedness, it is expected that there would be some correlation between them. This was demonstrated in the correlational analysis in this study (i.e., there was a significant intercorrelation between social ability and attachment).

Overall, the social-emotional relatedness hypothesis is supported by tentative findings that cradling bias is associated with increased attachment, higher empathy, and better social skills (Fleva & Khan, 2015; Forrester et al., 2019; Jooste, 2018; Malatesta et al., 2019a, 2019b; Manning & Chamberlain, 1991; Ocklenburg et al., 2018; Pileggi et al., 2013, 2015; Turnbull & Collins, 2000; Weiland & Sperber, 1970). Consequently, it could be argued that the absence of leftward cradling bias could be a sign of a non-optimal attachment, deficits in affective empathy, and deficient social ability.

Given the proposed socio-emotional relatedness hypothesis related to cradling side, research has begun to investigate how these variables predict cradling side preference. Although there is evidence that attachment, the ability to empathize with others, and social skills are associated with cradling side preference, findings to date have been relatively mixed (Forrester et al., 2019; Huggenberger et al., 2009; Malatesta et al., 2019a; Sieratzki & Woll, 2002; Pileggi et al., 2013, 2015).

The Relationship between Attachment and Cradling Side Preference

I hypothesized that leftward cradling would be positively associated with more secure attachment (i.e., low anxiety and avoidance scores). This hypothesis was informed by the argument that basic socio-emotional processes, which underpin our ability to relate to, and form connections with others, facilitate leftward cradling bias (Sieratzki & Woll, 2002).

Other researchers have furthered this reasoning by arguing that this innate ability to relate to others results in a better bond between parent and infant, thereby facilitating the development of secure attachment throughout one's adult life (Huggenberger et al., 2009; Malatesta et al., 2019a, 2019b). This reasoning is in keeping with a socio-emotional relatedness explanation for leftward cradling bias. Despite a theoretical basis for a relationship between attachment and cradling bias, attachment style did not predict cradling side in my sample.

Only one published study to date has reported that a better quality of social attachment is significantly related to leftward cradling bias (see Malatesta et al., 2019a). Malatesta and colleagues (2019a) found that a higher proportion of participants with secure attachment ($p = .012$) to their mother demonstrated leftward cradling as well as secure attachment to their romantic partner ($p = .001$). Consequently, they proposed that the leftward cradling bias could indicate the socio-emotional attunement between cradler and infants. Similarly, Jooste's (2018) unpublished thesis found a strong significant relationship between cradling bias and attachment style. To elaborate, they found that anxiety-related attachment ($p = .04$) as well as an avoidance-related attachment were associated with cradling side preference ($p < .001$). In particular, they found that an increase in anxiety scores resulted in a decrease in leftward cradling. They also found that when the avoidance score increased, the percentage of leftward cradling decreased. These findings suggest an association between insecure attachment (i.e., indicated by higher scores of anxiety and avoidance) and a reduction in leftward cradling (Mikulincer & Shaver, 2003). Both of these studies (i.e., Jooste, 2018; Malatesta et al., 2019a) therefore found that leftward cradling was positively associated with a more secure attachment style.

Despite the theoretical basis, this study did not find a relationship between cradling bias and attachment security. In keeping with my study's findings, others investigating cradling side preference and attachment have also not found a relationship (Herdien et al., 2021; McGrath, 2013). For one, Herdien and colleagues (2021) likewise found no association between attachment-related avoidance/anxiety scores and leftward cradling. Additionally, McGrath (2013) found attachment style (measured once again in terms of the degree of security) was likewise not a significant predictor with regards to cradling side preference. There are several potential explanations for these mixed and limited findings, which I discuss next.

Differences in Methods. A difference in methods employed to measure cradling bias could account for differences in findings across studies. Cradling in the current study was

assessed using an imaginary task, which instructed participants to imagine holding a small infant in their arms while imagining what the infant would look like. They were further instructed to position their arms with the intent to soothe/put the infant to sleep and to look at the infant's face (following the protocol of Herdien et al., 2021). This imaginary approach to assessing cradling side preference is commonly employed in various studies on cradling bias (Harris et al., 2010; Herdien et al., 2021; Oppler & Laubscher, 2021; Pileggi et al., 2013, 2020), as research has revealed that the leftward cradling bias comes about regardless of the method of measurement. However, to date, studies investigating attachment and its relation to leftward cradling which have not found a significant relationship (i.e., the current study, and Herdien et al., 2021, as well as McGrath, 2013) have this in common - they all employ an online cradling bias task which requires the use of one's imagination of the cradling scenario.

In contrast, the two studies to date which have reported that there is a relationship with regards to attachment and leftward cradling (i.e., Jooste, 2018 and Malatesta et al., 2019a) both employed a face-to-face cradling bias task, incorporating a life-like doll. Although some may argue that the reason for the significant findings in the study by Jooste (2018) could be because they activated the participants' attachment style in the cradling task used. To elaborate, in their protocol, Jooste (2018) requested that participants each give their infant doll a name, and additionally prompted the participants to pick up the doll by playing a recording of an infant crying, to facilitate a bond between the two. An argument could be made therefore that, while it is common practice to employ an imaginary task when assessing cradling bias, an imaginary task may not be ideal when measuring attachment in relation to cradling bias.

It is, however, of note that this argument may not apply to the non-significant findings in my study given that the attachment measured in this study was based on participants' responses to the questionnaire as opposed to being assessed in the context of the cradling task.

Measurement Error/s. It can also be argued that the measure of attachment employed in this study did not accurately capture participants' attachment styles. Measuring an individual's attachment style is notoriously difficult, and even more so in adulthood, for various reasons. For one, a review of the literature reveals that several of the generally employed questionnaires on adult attachment lack good psychometric properties (Graham & Unterschute, 2015; Jacobvitz et al., 2010; Justo-Núñez et al., 2022). Graham and Unterschute (2015) conducted a meta-analysis of studies using commonly used adult measures of

attachment security, many of which used the ECR. Consequently, the current study employed the ECR-RS so that comparisons could be drawn across studies. However, it should be noted that Graham and Unterschute (2015) report that the ECR should be used with caution, given that they found that the measure may not be appropriate for comparing groups across different cultures due to the variation of its reliability in different studies. The psychometric properties of this scale had yet to be established in South Africa at the time of this study.

Cultural factors and resource availability also need to be taken into consideration when conceptualizing and defining attachment in a LMIC, such as SA. Research indicated that given the multitude of socioeconomic adversities in this population, people tend to have issues in establishing, and maintaining secure bonds in these countries (Cooper et al., 2009; Morgan et al., 2019; Schuitmaker et al., 2022). Further factors such as low income, and high levels of violence, may result in a high prevalence of clinical disorders such as depression, and Posttraumatic Stress Disorder (PTSD) as well as an increased likelihood of experiencing stress as a consequence of prolonged exposure to these risk factors (Schuitmaker et al., 2022; Voges et al., 2019). Therefore, how attachment is considered globally, (i.e., in western cultures) may not be culturally relevant in SA. While initially attachment was thought to be sensitive to non-western populations, how attachment is currently measured may not be applicable or culturally sensitive (Ainsworth, 1967; Ainsworth et al., 1978; Hinde & Stevenson-Hinde, 1990; Mesman et al., 2016). For one the current understanding of attachment does not account for the different dynamics of relationships. Children in SA often have more than one attachment figure, due to the notion of “ubuntu” (e.g., mothers relying on people in the community to assist them in caregiving; (Chalmers, 1990; Tomlinson et al., 2005). Although research acknowledges that an individual is capable of having several attachment figures, there is limited research on how these experiences with each figure would be summed up into a global attachment style (Sagi-Schwartz & Aviezer, 2005).

In addition to this, the self-report nature of the attachment measure introduces an increased chance of measurement error. To be clear, self-report measures of attachment rely heavily on the conscious appraisals of an individual’s own romantic and other relationships, and this may often be inaccurate (Shaver & Mikulincer, 2002). Furthermore, when answering questions, for example, about themselves, individuals tend to answer in a way that would highlight the positive aspects of their thoughts, attitudes, or behaviors due to Social Desirability Bias (SDB; Larson, 2019). In an attempt to mitigate the influence of this desirability bias, researchers often employ online surveys. In doing so, they believe that

ensuring participants' anonymity will decrease the need for individuals to present themselves positively. However, according to Brenner and DeLamater (2016), further steps are necessary to reduce SDB. For one, encouraging participants to be honest by using "false" statements such as telling them their responses will be verified using a lie scale (i.e., directly reducing SDB; Bryan et al., 2013). Additionally, a distractor task can be used, which will increase participants' cognitive load, for example, playing background music during a survey or telling participants to remember a random set of numbers (i.e., indirectly reducing SDB; Stodel, 2015). Lastly, studies could employ a social desirability test as part of their survey and consequently exclude the participants who score highly on measurements of SDB by dropping them from the sample (i.e., testing for bias; Goetzke et al., 2014). Overall, the lack of significant findings in this study regarding the relationship between leftward cradling and attachment could be a consequence of measurement error.

The Conceptualization of Attachment. The impact of these discrepancies between measures of attachment on studies assessing cradling side is highlighted by Malatesta and colleagues (2019a). To assess attachment in relation to leftward cradling bias, they used both the ECR and the Parental Bonding Instrument (PBI) to assess the participants' attachment to both their romantic partners and their perception of their attachment to their parents in the first 16 years of life, respectively. When participants' attachment to their partners was assessed using the ECR and to their mothers using the PBI, they found a significant relationship between leftward cradling bias and optimal (i.e., secure) attachment. However, when using the PBI to assess their relationship with their father, they found that leftward cradling was associated with non-optimal attachment. The difference in these results regarding the association between cradling and attachment shows that it differed based on the relationship/s that were being assessed by each measure.

Zayas and colleagues (2011) found that attachment in early infancy continues to adulthood. They found that participants who had a secure attachment to their caregiver as an infant demonstrated wanting to be near their parents, regarding them as a 'haven' i.e., being securely attached to them. The type of attachment continued in their adulthood and to a greater extent was generalized to their peers and romantic partner/s as well. However, they also found that while some people were still securely attached to their caregivers in adulthood, they would turn to their peers and romantic partners if they required emotional support. They furthermore demonstrated that individuals whose mothers had been sensitive and not controlling when looking after them at 18 months old, were found to have less

anxiety about their partners and less avoidance of their friends and partners by the time they were 22 years old.

Similarly, Hazan and Zeifman (1994) noted that older adolescents with a secure base increasingly begin to shift their attachment functioning from their parents, more toward their peers. In addition, they tended to increase their exploration and have greater distress when separated from their peers rather than their parents. These attachment behaviors are, however, more likely to occur with their romantic partners rather than peers (Hazan & Zeifman, 1994).

This combined with the findings of Malatesta, and colleagues' (2019a) study described above, may indicate that attachment styles cannot be completely generalized across all relationships, for example with their romantic partners, friends, parents, and children (Hazan & Zeifman, 1994; Malatesta et al., 2019a; Zayas et al., 2011). Individuals are thus capable of having different styles of attachment which is dependent on the nature of the relationship being assessed. Consequently, studies need to measure attachment in relation to a specific person. The ECR-RS, employed in this study, however, measured attachment generally (i.e., a score is given that is said to determine an individual's overall attachment in all their relationships). It, therefore, did not tap into a specific kind of attachment (i.e., in relation to different types of relationships; Fraley et al., 2000).

More recently, Dewitte and De Houwer (2011) stated that global and specific attachment styles should co-exist with one another, and studies should consider both in their research. Although my study did consider that attachment may be relationship-specific, the reason for this study using the ECR-RS, which was used as a global/general measure of attachment, was because it was found that it was better at predicting personality traits than those relationship-specific measures. The short form also allowed for the assessment of attachment across relationship domains, eliminating the unnecessary burden of longer questionnaires such as the ECR (Fraley et al., 2011). Literature does, however, state that we need to be mindful that attachment styles cannot be generalized to other figures (Malatesta et al., 2019a; Zayas et al., 2011). It is therefore difficult to assess attachment in relation to leftward cradling bias, as there seem to be contentions within the literature on attachment, regarding which measure/s to consistently use.

Lastly, another consideration regarding the conceptualization that often measures used in the studies investigating the relationship between attachment and cradling bias conceptualized attachment in terms of attachment security. In other words, attachment is often scored on a continuum from insecure to secure (Ainsworth et al., 1978; Brunmariu &

Kerns, 2008). This may not necessarily be the most fitting way to classify attachment in relation to cradling bias, as it does not consider attachment organization (i.e., organized versus disorganized). For example, disorganized attachment has been linked to having a clinical diagnosis of BPD (Leischsenring et al., 2011). This supports the need for more measures that can reliably and practically assess disorganized attachment given that self-report measures of attachment style tend to not this type of attachment well (Berry et al., 2017).

Attachment and Stress. It is also possible that stress could indirectly be influencing the relationship between attachment and leftward cradling. To elaborate, Morgan and Colleagues (2019) found that there was no cradling side preference in their sample of mothers living in Khayelitsha in Cape Town. Therefore, even though their findings regarding depression and/or stressful living environments were not significant, it still suggests that mothers who reside in dangerous living conditions may have a decreased socio-emotional engagement with their infants. They further found that no cradling preference was strongly related to obtaining higher scores on the PSI. Stress, may, therefore, be a factor that needs to be considered when assessing the relationship between attachment and cradling bias. This study employed a sample of university students, which is a population known to present with elevated chronic stress, as a result of academic pressure, psychological stress, and socio-economic factors (e.g., financial pressure; Cooke et al., 2006; Ryan et al., 2010; Stallman, 2010). Additionally, this study was conducted during the COVID-19 global pandemic, an arguably stressful time for many people, including students (Zhen et al., 2021). It is therefore possible that the exposure to such stressors may have impacted the attachment styles of participants in my study. Although there were expected levels of leftward cradling found in my sample, the lack of an association between secure attachment and leftward cradling suggests that the variable of stress may need to be looked at closely as a possible mitigating factor in studies.

To summarise, I investigated the relationship between secure attachment (i.e., low scores of anxiety and avoidance) and a leftward cradling bias. This was investigated given the theoretical basis for this argument. Despite this theoretical basis, I did not find an association between attachment security and cradling bias in my sample. In this section, I have discussed several potential reasons for the lack of an association between these two variables. These reasons include; the difference in methods used in the studies on attachment and cradling side preference to the date, the errors in the measurements used to assess attachment in adults, the

need to take into account cultural factors when defining attachment, the theoretical considerations regarding how current measures of attachment in relation to cradling side preference are not consistent across literature regarding relationship-specific vs general attachment, and that stress may be a mitigating factor which could be influencing the lack of significant findings between attachment and cradling side.

It may, however, be possible that there is no association between attachment and cradling side preference. A possible reason for no association could be the fact that this study did not test for a threshold hypothesis. This argues that a clinically significant deficit in attachment, e.g., disorganized attachment, would be needed to see an effect on the relationship between leftward cradling and attachment.

The Relationship between Affective Empathy and Cradling Side Preference

I hypothesized that leftward cradling would be positively associated with higher affective empathy scores. Affective empathy is the sharing of emotions and emotional states between people, essentially, it refers to the ability to relate (Decety & Jackson, 2004; Singer & Lamm, 2009; Thompson et al., 2022). My hypothesis was informed by the theoretical argument that leftward cradling is facilitated by innate processes associated with empathy. To elaborate, since the bias comes about without conscious awareness, is present in children as well as primates, and non-human primates and is also present regardless of intellectual level (Hopkins, 2004; Manning et al., 1994; Manning & Chamberlain, 1990 (Pileggi et al., 2013, 2015), it is argued that it is the primitive brain processes involved in relating to others that should predict cradling side preference (Pileggi et al., 2013; 2015). In other words, emotion-sharing brain processes, often referred to as affective empathy, are responsible for this bias (Decety & Jackson, 2004; Thompson et al., 2022). Affective empathy is associated with primitive functions such as processing emotional expressions (Braak, 1976; Hatfield, 2011). To illustrate, individuals who had an increased response to mimicking the facial emotions of others have been found to have higher affective empathy scores (Sonnby-Borgstrom, 2002; Thompson et al., 2022). It encompasses the somatic-sensorimotor resonance of emotional states between people as well as the ability to imitate the emotional expression of others, which in turn promotes affective sharing (Decety, 2011; Field et al., 1987; Haviland & Lelwica, 1987). Therefore, in the context of cradling, affective empathy is involved in the ability of the cradler and infant to be able to relate to one another which occurs as a result of being able to recognize and respond to emotions denoted by facial expressions. This is in keeping with the proposed hypothesis of socio-emotional relatedness, since leftward cradling bias is

said to come about without conscious awareness, affective empathy is likely the more important type of empathy that is of interest regarding cradling side preference. Despite a theoretical basis for a relationship between empathy and cradling bias, affective empathy did not predict cradling side in my sample.

Direct evidence for an association between empathy and cradling side preference has only been demonstrated by one study to date (see Malatesta et al., 2019b). Malatesta and colleagues (2019b) found a small relationship indicating that leftward cradling is positively related to empathy, i.e., higher scores of affective empathy scores were found to be associated with leftward cradling bias. It is, however, of note that Malatesta and colleagues (2019b) found a weak relationship between empathy and leftward cradling. To elaborate, they assessed empathy in a sample of healthy mothers using the BEES self-report questionnaire. Notably, while it is commonly used to measure emotional i.e., affective empathy (Blair, 2005; Decety & Jackson 2006), Malatesta and colleagues (2019b) did not specifically differentiate between affective and cognitive empathy in their study, thereby impacting the way we interpret the results.

The relationship between empathy and leftward cradling is unclear given the fact that findings are limited by direct evidence from only one study (Malatesta et al., 2019b). Additionally, support for the theoretical relationship is largely indirect. Weiland and Sperber (1970) for example showed that a relationship needs to be implied between cradler and infant, for leftward cradling bias to emerge. Turnbull and Collins (2000) similarly, via anecdotal evidence, observed that in comparison to individuals cradling to the left, those who cradled to the right tend to find it difficult to relate to an infant, further supporting the theoretical relationship between leftward cradling and empathy. More recently, Pileggi and colleagues (2013; 2015) provided stronger, albeit also indirect, evidence suggesting that there may be an association between affective empathy and cradling side preference. To elaborate, this was based on their findings that children diagnosed with ASD do not exhibit a side bias for cradling. These authors proposed that difficulties in empathizing with (i.e., relating to) others on a visceral level (i.e., deficits in affective empathy) could be responsible for the absence of leftward cradling in their sample as (1) deficits in socio-emotional relatedness (including empathy) long been described to characterize ASD (APA, 2013a), and (2) they found the leftward bias to be present regardless of intellectual level (Pileggi et al., 2015).

Despite the theoretical basis for a relationship between affective empathy and cradling bias, affective empathy did not predict cradling side in my sample. In keeping with my

study's findings, others investigating this relationship have also not found a relationship (Blacher & Levetan, 2019). To elaborate, the findings in this study support the findings by Blacher and Levetan (2019) who, using a sample in SA, likewise found no association between affective empathy and a leftward bias. There are several potential explanations for these limited and mixed findings, which I discuss next.

Measurement Error/s. It can be argued that the measure of empathy employed in this study did not accurately measure participants' affective empathic abilities. Given the clear differences between affective and cognitive empathy, measuring the affective component may be better suited to physiological rather than self-report measures, given its primitive nature. The discrepancies in the findings may therefore be due to two reasons, why the findings were not significant:

For one, research has indicated that commonly used self-report questionnaires used to measure empathy, have low reliability and validity, and introduce human errors in perception such as SDB. As previously mentioned, participants are likely to answer questions about themselves in ways that they consider to be more positive and socially acceptable (SDB; Larson, 2019). A second argument is that self-report questionnaires of empathy often look at dispositional empathy i.e., combining cognitive and affective empathy; this essentially tells us how people generally choose to behave, rather than affective empathy in and of itself. The QCAE measure used in this study to measure affective empathy has been found to indirectly measure dispositional empathy (Reniers et al., 2011). Therefore, this study may not have been able to accurately identify scores of affective empathy. The field of psychophysiology and the use of more physiological methods may offer a more objective way of recording an individual's affective empathy, as it would allow for the assessment of activity in their central and autonomic nervous system associated with this type of empathy. For example, electroencephalography (EEG), skin conductance, and/or facial electromyographic activity (EMG), could be used to assess the autonomic aspect of affective empathy (Neumann & Westburg, 2011). Researchers consequently argue that to measure this type of empathy more accurately, a more robust way of doing so would be to make use of a combination of self-report and physiological measures of affective empathy.

To elaborate, as affective empathy is more primitive (i.e., processing emotional expressions; Hatfield et al., 2011), and the fact that it is concerned with relating unconsciously and viscerally, the use of psychophysiological methods in assessing it, could further increase the knowledge thereof as well as how it influences behavior (Neumann &

Westbury, 2011). The use of psychophysiological methods would additionally aid in measuring affective empathy which involves the imitation of basic emotional expressions in the sharing of emotional states between people, as such measures also study related factors e.g., the mimicry of facial expressions and associated responses in the nervous system as well (Decety, 2011; Neumann & Westbury, 2011).

A threshold hypothesis for the relationship between affective empathy and leftward cradling is also evident in individuals with ASD. To elaborate, one of the only populations to date where there is a clear reduction in a leftward cradling bias in individuals diagnosed with ASD. An argument can be made that this is due to deficits associated with empathy which are characteristic of this disorder (APA, 2013a). Pileggi and colleagues (2013) furthermore confirmed an absence of leftward cradling in children with ASD. Given research that children with ASD often have difficulty in pretend play (Jarrold et al., 1996; Lillard, 2017), Pileggi and colleagues (2013) checked if participants were able to engage successfully in pretend play scenarios (e.g., watering a plant). Contrary to the research that they would have deficits in doing so, their findings indicated that all ASD children passed the four pretend-to-play tasks, which showed that pretend-play abilities could not be a reason for the lack of leftward cradling found in their sample (Pileggi et al., 2013). Nonetheless, their study sample showed that these children had no side preference when it came to cradling (Pileggi et al., 2013).

In addition, they found that cradling bias is not dependent on intellectual abilities, given that leftward cradling was found in samples of both neurotypical children and non-autistic children with intellectual disabilities. Additionally, Herdien and colleagues (2021) found that neurotypical individuals who were not diagnosed with ASD or presented with few autistic traits, presented with a strong leftward bias, whereas this bias was reduced where such traits or a diagnosis were present (Herdien et al., 2021; Pileggi et al., 2015), further supporting a relationship between the ability to relate and leftward cradling.

Therefore, deficits in empathy were found in samples with ASD, indicating that the deficits in affective empathy may have to be clinically significant, for it to disrupt leftward cradling, providing further support for a threshold hypothesis. We have to remember that affective empathy is subserved by innate and primitive processes in the brain. Deficits in affective empathy are therefore not found in a typically developing sample. In contrast, cognitive empathy continues to develop and can be found to be deficient in typically developing samples. A critical acknowledgement is that recent research on ASD indicates that affective empathy remains intact, and it is within the cognitive empathy domain where

there are deficits (Fletcher-Watson et al., 2014; Mazza et al., 2014; Rueda et al., 2015; Senland & Higgins-D'Alessandro, 2016). Research to date has, however, not reconciled the findings regarding which aspects of empathy are affected in ASD, as there is no clear consensus.

To summarise, I investigated the relationship between leftward cradling and higher affective empathy scores. This was investigated given the theoretical basis for the argument that affective empathy, which is also associated with attachment and prosocial behaviors, may be important in enhancing the quality of the relationship between the cradler and the infant (Pileggi et al., 2013, 2015), hence the expectation that there would be a relationship between the two.

The Relationship Between Social Ability and Cradling Side Preference

I hypothesized that leftward cradling would be positively associated with higher social ability scores. This hypothesis was informed by the argument that leftward cradling is facilitated by having the ability to better monitor and relate to an infant's social-emotional cues. This aids in the future development of empathetic and social abilities (e.g., prosocial behaviors), all of which allow for optimal social, emotional, and positive interactions (Forrester et al., 2019; Huggenberger et al., 2009; Malatesta et al., 2019b).

To date, there is very limited evidence for such a relationship, with only one study providing direct evidence (i.e., Forrester et al., 2019). In their study, Forrester and colleagues (2019) found that children who showed a leftward bias compared to those who cradled to the right had significantly higher social ability scores. Indirect evidence is provided in the form of several studies which have described finding negative associations between autistic traits/ASD and leftward cradling (Fleva & Khan, 2015; Herdien et al., 2021; Pileggi, 2013, 2015). An argument is made that leftward cradling is absent or decreased in these individuals as deficits in social skills (also social-emotional reciprocity) which is a clinically significant symptom associated with individuals on the autism spectrum (APA, 2013a). As per previous literature, it is expected that neurotypical individuals, who do not have these difficulties with social-emotional reciprocity, would display a leftward cradling bias in comparison (Herdien et al., 2021; Huggenberger et al., 2019; Malatesta et al., 2019a, 2019b; Pileggi, 2013, 2015). Furthermore, while the literature is limited, with only one study proving direct evidence in support of this relationship, research findings that the specialized processing in the right hemisphere is associated with other left-side biases linked to social interactions such as kissing and hugging, support the proposed relationship between social ability and right

hemispheric processing (Ocklenburg et al., 2018; Packheiser et al., 2019; Sedgewick & Elias, 2016). Lastly, the theoretical relationship between cradling side preference and social ability is supported by indirect findings that an absence and/or reduction of leftward cradling is associated with autistic traits and ASD diagnoses are associated with a reduced or absent leftward cradling bias (Fleva & Khan, 2015; Herdien et al., 2021; Pileggi et al., 2013, 2015). This supports the threshold hypothesis discussed in relation to attachment and affective empathy mentioned above.

Despite a theoretical basis for an expected relationship between social ability and cradling bias, leftward cradling bias was not associated with higher social ability scores in my study. This lack of an association between social ability and a leftward cradling bias is not as surprising given the non-significant relationships between attachment, affective empathy, and leftward cradling discussed thus far. All of these variables were expected to contribute to the development of abilities that may aid in optimal socioemotional interactions and prosocial behaviors (Huggenberger et al., 2009; Malatesta et al., 2019b). There is one potential reason for the lack of significant findings in this study.

Measurement Error/s. It is difficult to compare the results of this study to the only significant study which found a relationship between leftward cradling and social ability (See Forrester et al., 2019). A difference in methods employed to measure cradling bias could account for differences in findings across studies. The lack of significant results in my study in comparison to that of Forrester and colleagues (2019) may furthermore in part be due to the difference in participant age groups and the method used in each study. The sample in the study by Forrester and colleagues (2019) consisted of five-year-olds, whereas my study looked at university students over the age of 18. How social ability was defined in their study using the five milestones of socio-communicative abilities, is different in that this study made use of an interpersonal competence questionnaire (ICQ-15) looking at individuals' social competence. Therefore, how social ability was conceptualized was different, making it difficult to compare the results across these two studies.

A threshold hypothesis for the relationship between social ability and leftward cradling is also evident in individuals with ASD. To elaborate, individuals with ASD are also characterized by deficits in socio-communicative abilities. Children with ASD, for example, have difficulties in being able to use non-verbal social gestures (e.g., pointing towards and showing someone an object of interest, which is something that neurotypical individuals tend to do to share their experiences via shared interests (Frye, 2017; Rohlfs et al., 2017).

Similarly, ASD is characterized by both deficits in cognition and metacognitive processes associated with a social ability such as ToM and initiation respectively (Berenguer et al., 2018; Frye, 2017; Miranda et al., 2017), adding further support for the need for clinical deficits in these abilities for an effect on the disruption of cradling side bias to be seen.

To summarise, I investigated the relationship between social ability and leftward cradling bias. This was investigated given the theoretical basis for this argument. Despite this theoretical basis, I did not find an association between social ability and cradling bias in my sample. In this section, I have discussed measurement errors as a potential reason for the lack of association between these two variables. These reasons include: differences between the methods used in my study and the only study to date which has investigated this relationship (i.e., Forrester et al., 2019), as there are differences in the sample, age groups the measures employed to measure social ability.

The Findings Regarding Leftward Cradling and Variables of Socio-emotional Relatedness

Overall while I did not find a relationship between leftward cradling and any of the key variables of socio-emotional relatedness, namely attachment, empathy, and social ability, there were some interesting findings. This study, for example, shows that further research is required to understand what other mitigating factors such as sex, and stress could predict a reduction in leftward cradling. Therefore, the lack of significant findings may be due to factor/s such as errors in measurement, the cultural applicability of measures and sensitivity in the conceptualization of attachment, the possible influence of social desirability bias, the mediating effect of stress, the need for more psychophysiological measures of affective empathy, differences in methods used, all of which were not explored fully, by this study. Lastly, a threshold hypothesis is evident as a possible explanation for the association between these variables of socio-emotional relatedness and leftward cradling, as explained below.

Threshold Hypothesis for Socio-Emotional Variables of Cradling Side

Preference. Research suggests that leftward cradling is associated with secure attachment, adequate empathy, and adequate social skills. However, the absence of the universal leftward cradling bias that is argued to influence the development of socio-emotional skills that are key for prosocial behavior, would suggest that innate abilities may be deficient, as would only be seen in clinical samples. Therefore, instead of speaking about leftward cradling associated with variables of socio-emotional relatedness, research should rather investigate it in terms of what rightward cradling or no cradling bias preference may mean, i.e., poor attachment, deficits in affective empathy, and social skills. This will however only be seen in

clinical samples given its innate nature. As alluded to previously, it is necessary to consider a threshold hypothesis in relation to the socio-emotional relatedness hypothesis for leftward cradling bias. A threshold hypothesis refers to the possibility that populations studied would need to exhibit clinically significant deficits in these socio-emotional variables to see an effect on the preferred cradling side. The reason for this argument is that studies that have looked at clinically significant samples such as those with diagnoses of ASD and autistic traits have found a clear absence of leftward cradling (Fleva & Khan, 2015; Herdien et al., 2021; Pileggi et al., 2013, 2015).

Bearing in mind a cerebral laterality hypothesis, the absence of leftward cradling in these populations may be due to the key difficulties that they have with relating and bonding with others. Conditions such as ASD, therefore, need to be further investigated in relation to these variables. In addition, clinical disorders such as BPD and Narcissistic Personality Disorder (NPD) should be investigated in relation to attachment and affective empathy. The rationale for including BPD participants is that individuals with this disorder are characterized by showing “pervasive patterns of instability of interpersonal relationships” (APA, 2013b, p. 663), which in turn may reflect their ability to have a secure style of attachment. Similarly, individuals with NPD may present with a lack of empathy due to the “unwillingness to recognize or identify with the feelings and needs of others” (APA, 2013e; p. 669). The lack of significant findings in my study may therefore in part be due to the fact that my sample did not present clinically significant symptoms related to attachment, empathy, and social abilities.

A threshold hypothesis would posit that this may be necessary if there is to be a clear disruption of leftward cradling. Recently, a threshold hypothesis was posited in relation to depressive and anxiety symptoms (Pileggi et al., 2020; Oppler & Laubscher, 2021). The authors argued that the bias is disrupted when individuals experience clinically significant symptoms of depression and anxiety, but not when these are subclinical (Oppler & Laubscher, 2021).

Mood States and Their Relation to Cradling Side Preference

The Relationship Between Depression and/or Anxiety and Cradling Side Preference

I hypothesized that leftward cradling would be inversely associated with depression and/or anxiety diagnoses. This hypothesis was informed by a cerebral laterality hypothesis. Given the aforementioned cerebral laterality hypothesis, it is assumed that mood-related symptoms associated with depression and anxiety would disrupt this leftward bias (Pileggi et

al., 2020). In support of this, studies have found a link between postnatal depression and right hemispheric dysfunction in mothers (Grimm et al., 2008; Rotenberg, 2004). Studies have furthermore found that depression negatively impacts the quality of care in the caregiver-infant dyad (Grimm et al., 2008; Murray et al., 2010; Rotenberg, 2004). Murray and colleagues (2010) for example, found that mothers diagnosed with postnatal depression demonstrated difficulty when it came to responding to their infant. To expand, emotional processing which is often associated with right hemispheric functioning is said to be compromised by both depression and anxiety (Demenescu et al., 2010; Scheuerecker et al., 2010). To elaborate, these mood-related states are associated with a disruption in the ability to communicate with and recognize and respond to the emotions of others. Given that the right hemisphere specializes in the recognition, response to, and processing of an emotional facial expression, which plays a key role in socio-emotional relatedness (Demenescu et al., 2010; Hecht, 2010; Ley & Bryden, 1979; Scheuerecker et al., 2010). Therefore, as leftward cradling is facilitated by socio-emotional relatedness (Harris, 2010; Huggenberger et al., 2009; Karenina & Giljov, 2018; Manning & Chamberlain, 1991; Vauclair & Donnot, 2005), alterations in the functioning of the right hemisphere associated with the mood-related states of depression and anxiety are expected to disrupt emotional processing, thereby leading to a reduction in leftward cradling (Pileggi et al., 2020).

It was therefore expected that mood-related disorders, namely, depression and anxiety would be associated with a reduced leftward bias in my study. Despite this expectation, as mentioned above, I did not find a relationship between anxiety and leftward cradling in my study. The literature regarding the relationship between leftward cradling and depression and anxiety has to date, however, been relatively mixed (Scola et al., 2013 Sieratzki & Woll, 2002; Reissland et al., 2009; Weatherill et al., 2004). To illustrate, Weatherill and colleagues (2004) reported a reduced leftward cradling bias in women experiencing depression. Similarly, Scola and colleagues (2013) found that during the perinatal period, women who tended to cradle an infant to the right reported increased symptoms of depression in comparison to the women who tended to cradle their infant to their left. On the other hand, Reissland and colleagues (2009) further argue that there is an association between depression and leftward cradling, they suggest that the reduction in a leftward bias could be explained by stress (Reissland et al., 2009). To expand, exposure to stressful events could result in the reduction or absence of leftward cradling due to alterations it causes to an individual's mood. This is supported by the fact that the participants in the study by Weatherill and colleagues

(2004) which did find that increased depressive symptoms were correlated with a reduction in leftward cradling, had a sample of mothers who had experienced domestic violence (i.e., living in a stressful environment).

Reissland and colleagues (2009) additionally examined the relationship between depression and stress, which was linked to anxiety and leftward cradling. According to them, since anxiety is a normal stress reaction, it would be expected that mothers experiencing stress would show a rightward bias. The literature on anxiety symptoms and cradling preference is, however, limited. For example, Scola and colleagues (2013) sought to explore the relationship in their study, but due to non-significant findings between the two variables, they stated that they would explore the findings further. Furthermore, some studies have reported finding links between stress and anxiety. Often studies examine the combined relationship, such as Cameron and colleagues (2005) who found that mothers who were stressed/anxious presented with less sensitive behaviors towards their infants and consequently tended to be more negligent or rigid in their caregiving. While related, I would argue that stress and anxiety cannot be conflated. Stress can be seen as a physiological and behavioral reaction to perceived or real internal and external threats, accompanied by an emotional response (Anderson & Adolphs, 2014; Chrousos, 2009; Daviu et al., 2019; Koolhaas et al., 2011). Anxiety, however, can be seen as persistent and excessive worrying regardless of whether the stressor is absent or not (Anderson & Adolphs, 2014). However, anxiety disorders are more persistent, and research shows they disrupt the right hemisphere of the brain (Sieratzki & Woll, 2002). Therefore while the evidence is mixed, given the argument that the mood-related disorders of depression and anxiety are said to disrupt the emergence of leftward cradling bias, there is some support for this relationship, (Pileggi et al., 2020; Reissland et al., 2009; Scola et al., 2013; Sieratzki & Woll, 2002; Weatherill et al., 2004).

Despite the theoretical basis for an expected relationship between these variables, my study found that there was no relationship between mood-related symptoms of depression and/or anxiety and reduced leftward cradling. My study focused on two aspects of the aforementioned, firstly participants were asked if they had ever received a diagnosis of depression and/or anxiety, and secondly, it looked at their scores on the BDI-II (for depression) and BAI (for anxiety), which were also analyzed to look at the symptom severity on each respective measure. With regards to the question of ever having received a diagnosis, this study found the following: 63.64% of the non-clinical group (those who reported no

diagnosis of depression and or anxiety) cradled to the left, whereas only 59.62% of the clinical group showed a leftward bias. This difference, however, was not statistically significant. There are several potential explanations for these mixed and non-significant findings, which I discuss next.

Threshold Hypothesis. While I did not find a significant relationship between leftward cradling bias and depression and or anxiety, the findings regarding the symptoms of depression and/or anxiety reported by participants on the BDI-II and BAI respectively in this study, are in support of a threshold theory. To elaborate, while there was a slightly more pronounced leftward bias in the non-clinical group in this study, a correlation analysis showed no statistically significant correlation between leftward cradling bias and depression and/or anxiety diagnosis. Furthermore, the cradling side was ultimately not found to be contingent on any of the four diagnostic groups which were investigated as potential predictors (non-clinical, depression diagnosis only, anxiety diagnosis, or comorbid diagnoses of depression and anxiety). Additional analysis of item 9 in the BDI-II, which is an item that queries suicidal thoughts (i.e., ideation or intent), similarly found that cradling preference was not contingent on suicidal ideation.

My study, therefore, found that although leftward cradling bias was found regardless of a clinical diagnosis, leftward cradling was more pronounced in the nonclinical group. This is supported by Pileggi and colleagues (2020) who found that although the symptoms of depression were not significantly dependent on cradling side, they found evidence to suggest that when depressive severity increased so did the tendency to cradle to the right or show no side preference (Pileggi et al., 2020). A threshold hypothesis may be a necessary determining factor for there to be a reduction in leftward cradling. Oppler and Laubscher (2021) likewise found that symptoms of anxiety and depression alone could not predict cradling side, however, they found that having a clinical diagnosis by a clinician could be associated with a disruption in the tendency to cradle to the left. This is important to note as in my study, the questionnaire for clinical diagnosis asked if participants had “ever” received a diagnosis of depression and/or anxiety, however, it did not ask if they are currently diagnosed, which could be the reason for the non-significant results between depression and/or anxiety and a leftward cradling bias in this sample of SA students.

Lack of Accessibility to Clinicians. Firstly, given the high poverty rate in South Africa, many individuals may struggle in accessing healthcare services, this factor should be taken into account as it may result in a lack of accessibility (Burger & Christian, 2020);

Mdluli & Dunga, 2022; Statistics South Africa, 2018). Some individuals who meet the criteria for a diagnosis of depression and/or anxiety may not be able to receive an official diagnosis. Secondly, participants in this study were not expected to disclose any use of assistive medication, such as the use of antidepressants and/or anxiolytics. Therefore, participants who reported receiving any of these diagnoses could have been on medication that may have alleviated some of their symptoms during the period in which they completed this study, possibly influencing the results. As noted previously, the relationships between leftward cradling and depression and/or anxiety symptoms/diagnoses were not significant in this study.

Stress as a Mediating Factor. Research on leftward cradling therefore would need to look at these two variables separately to gain a clear understanding of what specifically is impacting leftward cradling. As stressful events can affect an individual's mood, exposure to these events could lead to the reduction or absence of leftward cradling. It was interesting to note that Morgan and colleagues (2019), who also used a South African sample, highlight that stressful living environments may impact cradling preference in this population. Furthermore, the focus of my study was on university students, which is a population that numerous studies have reported present with elevated chronic stress, due to factors such as academic pressure, psychological stress, socio-economic factors, such as financial pressure (Cooke et al., 2006; Ryan et al., 2010; Stallman, 2010).

Sex Differences. Statistics, however, have shown that the differences across sex regarding diagnoses of depression and/or anxiety were significant, which could be a consequence of the well-documented prevalence of increased depression and/or anxiety symptoms in females (Garnefski & Kraaij, 2018; Oppler & Laubscher, 2021; Van Der Crujisen et al., 2019). This study also found that the females in our sample presented with more symptoms of depression and/or anxiety as opposed to males. This was seen by the fact that males tended to report both less depressive and anxiety symptoms in comparison to females.

In summary, overall, there was no relationship between mood-related states of depression and/or anxiety diagnosis/or symptom severities and leftward cradling. Some of the reasons for the lack of significant findings could be that more research is required to understand what other mitigating factors such as lack of accessibility, stress, and sex could predict a reduction in leftward cradling. Therefore, the lack of significant findings may be due to a factor/s which were not explored fully, by this study.

Limitations and Directions for Future Research

This study experienced several limitations, which should be addressed by future research. These include the lack of a representative sample in assessing the potential predictors of the leftward cradling bias, the need to consider a threshold hypothesis, limited literature based on publication bias, the medium through which the cradling task was administered, as well as additional measures and questions that could have aided in better assessing these variables. These will each be discussed below.

Representative Sample and the Potential Predictors

The current study would have benefited from a more representative South African sample. Although leftward cradling bias emerges universally, irrespective of culture and gender, the assessment of the variables may have been influenced by the type of sample used. While the sample was adequate for the hierarchical analyses, the participants were possibly not representative of the wider population. For one, all of the participants were university students, therefore it did not consider how the variables of socio-emotional relatedness that were assessed, would impact individuals from different educational backgrounds.

Future research should therefore aim for a more representative sample to aid in the study findings regarding the relationship between the variables and leftward cradling bias being more generalizable. In keeping with this, using a strictly UCT student sample did not allow for this study to sample more broadly about language diversity. Since all UCT students have a reasonable grasp of the English Language, future studies should aim to recruit students from other South African universities to account for other languages in this diverse population.

Furthermore, this study aimed to recruit equal numbers of males and females, and even though gender difference was not statistically significant in relation to cradling side, there was an unequal gender distribution; this study had 564 females and 113 males. So, while leftward cradling bias was present overall regardless of gender, the assessment of the other variables may have been influenced by this factor. For one, males have reported scoring lower than females on self-report empathic functioning (Baron-Cohen & Wheelwright, 2004). Therefore, even though there is evidence that there is no significant difference across sex, in relation to leftward cradling bias, future studies should aim for a more equal distribution of gender. The literature is currently not clear: to be thorough it is important to consider sex as a potential variable, given that the literature still seems to show a pronounced

cradling bias in females, although a recent review by Packheiser and colleagues (2019) found no difference.

Threshold Hypothesis

Furthermore, while there was no relationship between leftward cradling and high depression and/or anxiety, this study provided descriptive evidence that there is a reduced tendency for individuals who have a clinical diagnosis to cradle to the left. Also, studies by Pileggi and colleagues (2013, 2015) show us that having a clinical diagnosis such as that of ASD which shows a clear reduction in a cradling bias. Therefore, future studies need to aim to broaden their sampling to include clinical populations, more specifically such as disorganized attachment, NPD, and BPD, as well as a current diagnosis of MDD and/or GAD as an inclusion criterion.

Publication Bias

Notably, this study was limited in the literature it was able to review in that only studies which found significant findings tend to be published. Therefore, it might be that numerous studies have likewise found a lack of significant findings between the variables in this study and leftward cradling bias. It is recommended that non-significant findings are also considered for publication.

Measures

Cradling Bias Task. This study used an online imaginary protocol to examine cradling side preference, as it was said to reduce social desirability associated with cradling a lifelike doll and it was successfully used in a recent South African Sample (Herdien et al., 2021). To elaborate, Herdien and colleagues (2021) used the same imaginary cradling task in an attempt to reduce the effects of social desirability in the male subsample, as stereotypically they tend to be apprehensive with regards to interacting with dolls, thereby influencing cradling in males (Forrester & Todd, 2018; Todd & Banerjee, 2015). However, if measuring the cradling side and their association with other variables in the future, researchers may need to consider animating the instructions for the online task. For example, a distractor task could be employed as part of the online survey, and then the sound of an infant crying can be played, at which point the participant can indicate which side they cradled to during this task. The study by Jooste (2018) showed that having participants hold the actual doll with more life-like features rather than an imaginary task, would assist in further activating their attachment style. This may not have been possible in this study as it was completely online

and imaginary. Finally, given the COVID-19 pandemic, online participation was necessary as having face-to-face interactions was restricted at the time of this study.

Alternatively, having a face-to-face task has its benefits. Jooste (2018) further highlighted the importance of having an interaction between the researcher and participant (i.e., a conversation during the cradling task trials) which would aid in making participants feel more comfortable. This would have also allowed us to have qualitative data and interpret how participants interacted with and responded to the infant/doll during the cradling task. Scola and Vauclair (2010) have, for example, made use of naturalistic observation of parents in maternity wards to access cradling, which allows researchers to observe cradling preference in a more natural environment. More research could consider incorporating qualitative methods to help with this as well.

Although this was a limitation of this study, it was restricted to having the study online, as to keep up with the timeline of this study, data collection had to take place during the COVID-19 pandemic. Future studies should aim to incorporate more environmental studies in their online and in-person cradling task if they are to accurately activate the attachment styles of participants.

Attachment Measure. Another limitation of this study was using a general measure of attachment (ECR-RS) to predict leftward cradling. I focused on assessing participants' general pattern of attachment to all figures in their life as opposed to specifically their parents, romantic partners, and best friends. The use of more thorough measures of attachment is necessary for future studies aiming to explore the relationship between a leftward bias and attachment.

Another issue regarding the ECR-RS is that while it is a reliable measure with sound psychometric properties, it may introduce social desirability bias since it is a self-report measure, and participants are more likely to report attitudes and behaviors which are more socially acceptable. The ECR-RS is also weighted towards avoidance rather than anxiety, although convergent validity with other attachment measures indicated that these were the best items to include. The ECR-R does not have a direct assessment of security, nor disorganized attachment (fourth attachment style).

Additionally, the examination of qualitative aspects regarding attachment and cradling may have been beneficial in this study. The quality of interaction between participants and the doll could not be analyzed, given the online nature of this study. However, it may have provided rich data regarding how participants with different types of

attachment styles interact with a doll. For example, Jooste (2018) noted that when participants were asked to name their infant doll, the majority immediately took on a caregiver role and held the doll in a cradling position, while thinking of a name. On the other hand, participants who did not present with a leftward cradling bias placed the doll on the right or held it vertically while the researcher was giving further directions. This suggests that the method used to assess attachment in this study was not ideal so future studies should find a better measure of attachment.

Empathy Measure. I employed the QCAE, a psychometrically sound questionnaire for this sample (Di Girolamo et al., 2019; Griqua & Mlomo, 2020; Reniers et al., 2011). Despite this, we need to acknowledge that the QCAE, also being a self-report measure, has the same concerns regarding SDB. In addition, future studies may benefit from a more direct measure of empathy. According to Herdien and colleagues (2021), it would be better to use a facial mimicry electromyographic recording of a participant's facial muscle in response to emotion-eliciting stimuli would be a non-obtrusive index of an individual's empathic abilities, rather than just using a self-report measure. A future direction for measuring affective empathy would be to use more than one measure of empathy and, where possible, to use physiological measures for affective empathy.

Social Ability Measure. While the ICQ-15 which was used to assess social ability is considered to be a reliable measure, it may be too short to accurately measure all sub-scales of social ability. Each of the five domains measured in the ICQ-15 only had three questions. In the future, other measures are more elaborate in measuring this broad construct of social ability.

Autistic Traits Measure. Although this study controlled for individuals with a diagnosis of ASD, it would have benefitted further from including an additional measure, such as the Autism Spectrum Quotient questionnaire (AQ), which would assess if any of the participants had high autistic traits, given that this is said to disrupt the universal leftward bias.

Depression and Anxiety Diagnosis. Similarly, as mentioned above this study would have benefitted from specifying if participants currently had a diagnosis of depression and/or anxiety, rather than whether a diagnosis had ever been present, as well as from asking if they were on any assistive medication. Both of these variables should be considered in future studies to be able to accurately assess the extent to which individuals are experiencing symptomatology.

Parenting Experience Questionnaire. Given that the leftward bias is weaker/less apparent and/or absent in males who are not parents (some literature has suggested that parenting experience may have a significant association with cradling side preference (Bourne & Todd, 2004; Turnbull & Lucas, 1990). There is, however, no real evidence of a relationship between leftward cradling and parenting experience, although many studies have considered it an important variable.

This study did not ask participants about their parenting experience as since all participants were undergraduate students, an assumption was made that the majority would not have children or significant child-care experience. Future studies should thus include a parenting experience questionnaire to reach a clear consensus in the literature on this topic.

Significance of the Research

This study found that the majority of participants demonstrate a clear leftward bias, irrespective of age and ethnicity, and the wide study sample size; it is, therefore, plausible to contend that if leftward cradling is apparent despite these factors, there may be an innate biological basis for its emergence. Therefore, this study supports the cerebral laterality hypothesis, whereby leftward cradling is believed to appear in individuals as a result of a right hemispheric specialization, which is responsible for processing socio-emotional stimuli (Brancucci et al., 2009; Lindell, 2013; Salva et al., 2012; Yovel, 2016). The data in this study furthermore shows in a single sample, both socio-relational variables and mood states are not related to leftward cradling bias. Therefore, it may be possible that for both these sets of variables, a current clinical threshold may need to be met for them to exert an effect on leftward cradling bias.

Conclusion

According to the majority of research, the leftward cradling bias, a well-known phenomenon, can be explained by a cerebral laterality hypothesis. Given that the role of the right hemisphere is so prominent in this bias, it is surprising that research to date has relatively mixed findings regarding attachment, affective empathy, social ability, depression and/or anxiety, and handedness. This study, therefore, investigated whether or not these variables could predict leftward cradling bias in a sample of university students in SA. Similarly, to some of the research, the socio-emotional relatedness variables of attachment (i.e., global attachment), affective empathy, social ability, as well as mood states of depression/and or anxiety were not found to be predictors of the cradling bias in this study. Handedness was the only significant predictor of leftward cradling, as right-handed

individuals were more significantly likely to demonstrate a leftward bias. According to the hierarchical regression analysis, handedness only contributed 1% to the explanation. This study also had several limitations which may be a reason for the lack of significant findings, such as needing a more representative sample, having additional measures for the respective variables, and having more specific questions related to diagnosis and medication. Future studies should aim to examine the threshold hypothesis when examining predictors of the leftward cradling bias.

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Appendix A

SRPP Advertisement



UNIVERSITY OF CAPE TOWN
 IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

Dear Student,

You are invited to participate in a research study investigating attachment, empathy and social ability to **Earn 1 SRPP Point!**

I am currently completing my Master's Degree in Psychology at UCT and am in the process of conducting research for my thesis. This study has been approved by the Department of Psychology Research Ethics Committee.

Anyone **over the age of 18** is welcome to participate in this study. You will be expected to fill out six short questionnaires as well as take part in a pretend task where you will be asked to demonstrate an action and record your results. Participation should only take you approximately 45 minutes and will be **completely online**.

If you are interested in taking part in this study, please click on the link at the bottom of this email which will direct you to the consent form and study link.

If you have any questions about the research, please contact the primary researcher, Faieeza Khalfe or her supervisors. If you have questions about your rights as a research participant, please contact the Department of Psychology Research Ethics Committee. All contact information is available below.

Faieeza Khalfe (MA candidate)	Supervisor	Co-Supervisor
Department of Psychology	Dr. Susan Malcolm-Smith	Dr Lea-Ann Pileggi
University of Cape Town	University of Cape Town	University of Cape Town
khlfai002@myuct.ac.za	susan.malcolm-smith@uct.ac.za	lea-ann.pileggi@uct.ac.za

Department of Psychology Research Ethics Committee

Rosalind Adams. Department of Psychology

University of Cape Town

rosalind.adams@uct.ac.za

Appendix B
Demographic Questionnaire

Name: _____ Student Number: _____

Age: _____

Sex (tick one): Male / Female / Nonbinary

1. Have you ever received a diagnosis of Autism Spectrum Disorder?
 - a. Yes / No

2. Have you received a diagnosis of a Depressive Disorder?
 - a. Yes / No

3. Do you have received a diagnosis of an Anxiety disorder?
 - a. Yes/ No

Appendix C

The Experience in Close Relationships- Relationship Structures Questionnaire

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Agree	Strongly Agree
1. I worry that others won't care about me as much as I care about them.							
2. I talk things over with people							
3. I often worry that other people do not really care for me.							
4. I don't feel comfortable opening up to others.							
5. I find it easy to depend on others.							
6. I'm afraid that others may abandon me							
7. I prefer not to show others how I feel deep down.							
8. I usually discuss my problems and concerns with others.							
9. It helps to turn to people in times of need.							

Appendix D

The Questionnaire of Cognitive and Affective Empathy

Instructions

This questionnaire contains 31 statements. Please, read each statement and circle a number that best reflects the degree to which a particular statement relates (or does not relate) to you.

By indicating either 1 (strongly agree), 2 (slightly agree), 3 (slightly disagree), and 4 (strongly disagree)



1. I sometimes find it difficult to see things from the "other guy's" point of view.
2. I am usually objective when I watch a film or play, and I don't often get completely caught up in it.
3. I try to look at everybody's side of a disagreement before I make a decision
4. I sometimes try to understand my friends better by imagining how things look from their perspective.
5. When I am upset at someone, I usually try to "put myself in his shoes" for a while.
6. Before criticizing somebody, I try to imagine how I would feel if I was in their place.
7. I often get emotionally involved with my friends' problems.
8. I am inclined to get nervous when others around me seem to be nervous
9. People I am with have a strong influence on my mood.
10. It affects me very much when one of my friends seems upset.
11. I often get deeply involved with the feelings of a character in a film, play, or novel.
12. I get very upset when I see someone cry.
13. I am happy when I am with a cheerful group and sad when the others are glum.
14. It worries me when others are worrying and panicky.
15. I can easily tell if someone else wants to enter a conversation.
16. I can pick up quickly if someone says one thing but means another.
17. It is hard for me to see why some things upset people so much.
18. I find it easy to put myself in somebody else's shoes.

19. I am good at predicting how someone will feel.
20. I am quick to spot when someone in a group is feeling awkward or uncomfortable.
21. Other people tell me I am good at understanding how they are feeling and what they are thinking.
22. I can easily tell if someone else is interested or bored with what I am saying.
23. Friends talk to me about their problems as they say that I am very understanding.
24. I can sense if I am intruding, even if the other person does not tell me.
25. I can easily work out what another person might want to talk about.
26. I can tell if someone is masking their true emotion.
27. I am good at predicting what someone will do.
28. I can usually appreciate the other person's viewpoint, even if I do not agree with it.
29. I usually stay emotionally detached when watching a film.
30. I always try to consider the other fellow's feelings before I do something.
31. Before I do something I try to consider how my friend will react to it.



Appendix E

The Interpersonal Competence Questionnaire

Instructions

Please read the following statements and indicate how confident you feel in your abilities to complete the described action by choosing one of the choices below each question.

Answer categories

1 = I'm always poor at this **2** = I'm only fair at this **3** = I'm OK at this **4** = I'm always good at this

1. Finding and suggesting things to do with new people whom, you find interesting and attractive.
2. Introducing yourself to someone you might like to get to know/date.
3. Calling (on the phone) a new date/acquaintance to setup a time to get together and do something.
4. Confronting your close companion when he/she has broken a promise.
5. Telling a companion that he/she has done something to hurt your feelings.
6. Telling a date/acquaintance that he/she has done something that made you angry.
7. Helping a close companion get to the heart of the problem he/she is experiencing.
8. Being able to say and do things to support a close companion when she/he is feeling down.
9. When a close companion needs help and support, being able to give advice in ways that are well received
10. Confiding in a new friend/date and letting him/her see your softer, more sensitive side.
11. Letting a new companion get to know the "real" you.
12. Letting down your productive "outer shell" and trusting a close companion.
13. Being able to admit that you might be wrong when a disagreement with a close companion begins to build into a serious fight.
14. Being able to take a companion's perspective in a fight and really understand his or her point of view.
15. Not exploding at a close companion (even when it's justified) in order to avoid a damaging conflict

Appendix F
Edinburgh Handedness Inventory- Short Form

Please indicate your preferences in the use of hands in the following activities or objects:

	Always right	Usually right	Both equally	Usually left	Always left
Writing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Throwing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Toothbrush	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spoon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix G

Beck Depression Inventory-II

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully. And then pick out the one statement in each group that best describes the way you have been feeling during the past two weeks, including today. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

1. Sadness
 0. I do not feel sad.
 1. I feel sad much of the time.
 2. I am sad all the time.
 3. I am so sad or unhappy that I can't stand it.
2. Pessimism
 0. I am not discouraged about my future.
 1. I feel more discouraged about my future than I used to.
 2. I do not expect things to work out for me.
 3. I feel my future is hopeless and will only get worse.
3. Past Failure
 0. I do not feel like a failure.
 1. I have failed more than I should have.
 2. As I look back, I see a lot of failures.
 3. I feel I am a total failure as a person.
4. Loss of Pleasure
 0. I get as much pleasure as I ever did from the things I enjoy.
 1. I don't enjoy things as much as I used to.
 2. I get very little pleasure from the things I used to enjoy.
 3. I can't get any pleasure from the things I used to enjoy.
5. Guilty Feelings
 0. I don't feel particularly guilty.
 1. I feel guilty over many things I have done or should have done.
 2. I feel quite guilty most of the time.
 3. I feel guilty all of the time.
6. Punishment Feelings
 0. I don't feel I am being punished.
 1. I feel I may be punished.
 2. I expect to be punished.
 3. I feel I am being punished.
7. Self-Dislike
 0. I feel the same about myself as ever.
 1. I have lost confidence in myself.
 2. I am disappointed in myself.
 3. I dislike myself.
8. Self-Criticalness
 0. I don't criticize or blame myself more than usual.
 1. I am more critical of myself than I used to be.
 2. I criticize myself for all of my faults.
 3. I blame myself for everything bad that happens.
9. Suicidal Thoughts or Wishes
 0. I don't have any thoughts of killing myself.
 1. I have thoughts of killing myself, but I would not carry them out.
 2. I would like to kill myself.
 3. I would kill myself if I had the chance.
10. Crying
 0. I don't cry anymore than I used to.
 1. I cry more than I used to.
 2. I cry over every little thing.
 3. I feel like crying, but I can't.
11. Agitation
 0. I am no more restless or wound up than usual.
 1. I feel more restless or wound up than usual.
 2. I am so restless or agitated, it's hard to stay still.
 3. I am so restless or agitated that I have to keep moving or doing something.
12. Loss of Interest
 0. I have not lost interest in other people or activities.
 1. I am less interested in other people or things than before.
 2. I have lost most of my interest in other people or things.
 3. It's hard to get interested in anything.
13. Indecisiveness
 0. I make decisions about as well as ever.
 1. I find it more difficult to make decisions than usual.
 2. I have much greater difficulty in making decisions than I used to.
 3. I have trouble making any decisions.
14. Worthlessness
 0. I do not feel I am worthless.
 1. I don't consider myself as worthwhile and useful as I used to.
 2. I feel more worthless as compared to others.
 3. I feel utterly worthless.
15. Loss of Energy
 0. I have as much energy as ever.
 1. I have less energy than I used to have.
 2. I don't have enough energy to do very much.
 3. I don't have enough energy to do anything.

16. Changes in Sleeping Pattern

- o. I have not experienced any change in my sleeping.
- 1a I sleep somewhat more than usual.
- 1b I sleep somewhat less than usual.
- 2a I sleep a lot more than usual.
- 2b I sleep a lot less than usual.
- 3a I sleep most of the day.
- 3b I wake up 1-2 hours early and can't get back to sleep.

17. Irritability

- o. I am not more irritable than usual.
- 1. I am more irritable than usual.
- 2. I am much more irritable than usual.
- 3. I am irritable all the time.

18. Changes in Appetite

- o. I have not experienced any change in my appetite.
- 1a My appetite is somewhat less than usual.
- 1b My appetite is somewhat greater than usual.
- 2a My appetite is much less than before.
- 2b My appetite is much greater than usual.
- 3a I have no appetite at all.
- 3b I crave food all the time.

19. Concentration Difficulty

- o. I can concentrate as well as ever.
- 1. I can't concentrate as well as usual.
- 2. It's hard to keep my mind on anything for very long.
- 3. I find I can't concentrate on anything.

20. Tiredness or Fatigue

- o. I am no more tired or fatigued than usual.
- 1. I get more tired or fatigued more easily than usual.
- 2. I am too tired or fatigued to do a lot of the things I used to do.
- 3. I am too tired or fatigued to do most of the things I used to do.

21. Loss of Interest in Sex

- o. I have not noticed any recent change in my interest in sex.
- 1. I am less interested in sex than I used to be.
- 2. I am much less interested in sex now.
- 3. I have lost interest in sex completely.

Total Score: _____

Appendix H

The Beck Anxiety Inventory

Below is a list of common symptoms of anxiety. Please carefully read each item in the list. Indicate how much you have been bothered by that symptom during the past month, including today, by circling the number in the corresponding space in the column next to each symptom.

	Not at all	Mildly, but it didn't bother me much	Moderately – it wasn't pleasant at times	Severely – it bothered me a lot
Numbness or tingling	0	1	2	3
Feeling hot	0	1	2	3
Wobbliness in legs	0	1	2	3
Unable to relax	0	1	2	3
Fear of worst happening	0	1	2	3
Dizzy or lightheaded	0	1	2	3
Heart pounding / racing	0	1	2	3
Unsteady	0	1	2	3
Terrified or afraid	0	1	2	3
Nervous	0	1	2	3
Feeling of choking	0	1	2	3
Hands trembling	0	1	2	3
Shaky / unsteady	0	1	2	3
Fear of losing control	0	1	2	3
Difficulty in breathing	0	1	2	3
Fear of dying	0	1	2	3
Scared	0	1	2	3
Indigestion	0	1	2	3
Faint / lightheaded	0	1	2	3
Face flushed	0	1	2	3
Hot / cold sweats	0	1	2	3

Appendix I

Informed Consent Form

You are invited to participate in my research study investigating attachment, empathy, and social ability.

Study procedures: If you decide to take part in the study, you will be asked to fill out six short questionnaires as well as take part in a pretend task where you will be asked to demonstrate an action and record your results. Thereafter, you will be debriefed on the purpose of the study.

Time: Your participation in this study will require approximately 45 minutes.

Possible benefits: You will receive 1 SRPP point after completion of the study.

Possible Risks: The study does not feature any foreseeable risks, however, if you are experiencing any emotional distress, please do contact the relevant healthcare services (information will be provided at the end of this survey).

Voluntary participation: If for any reason during this study you do not feel comfortable, you may exit the survey.

Confidentiality: All information you provide will remain confidential and will not be associated with your name.

Questions and further information: When this study is complete you will be provided with the aim of the study. If you have any further questions concerning this study, please feel free to contact me at KHLFAI002@myuct.ac.za.

Signature

I have read and understand the above consent form, I certify that I am 18 years old or older, and, by selecting “Yes” below, I indicate my willingness to voluntarily take part in the study.

Yes, I give my consent to participate.

No, I do not give my consent to participate.

Date: _____

Appendix J

Debriefing Form

Dear Participant

Thank you for taking the time to participate in my research study! The title of the study is Attachment, Empathy, and Social Skills as Correlates of Leftward Cradling Bias in Students.

Please provide your course number for the allocation of SRPP points below:

Course Number: _____ Student Email: _____

Student Number: _____

What is the leftward cradling bias?

Leftward Cradling Bias is a well-known phenomenon whereby humans and non-human primates show a preference to cradle an infant (baby) to the left of the body midline when attempting to soothe. The study you took part in will be adding to existing research to see if scores on measures of attachment, empathy, and social skills are associated with the leftward cradling bias.

You were invited to participate in this study because you are a UCT student and met the inclusion criteria of being over the age of 18. In the study, you were asked to answer 6 questionnaires and to perform four tasks. The questionnaires were looking at particular attachment patterns, affective and cognitive empathy, social competence, depression and anxiety, and hand preference, given research that cradling side is influenced by these factors. You also did four cradling tasks, during which you were asked to report which direction you were looking at, to see if you have any side preference. This was done to assess if there was no preference or if the leftward cradling bias was present or absent.

If you have any further questions or would like more information on the study, please do not hesitate to contact me at KHLFAI002@myuct.ac.za. If you have any complaints about the study or questions about your rights as a research participant, please contact the Psychology Department Research Ethics Committee at rosalind.adams@uct.ac.za

If any aspect of this study has caused you to feel any distress, please contact 021 650 1017 or 021 650 1020 (UCT Student Wellness Centre) or 0800242526 (free UCT 24-hour counselling Student Careline).

Appendix K
Ethical Approval from the Faculty of Humanities

UNIVERSITY OF CAPE TOWN



Department of Psychology

University of Cape Town Rondebosch 7701 South Africa
Telephone (021) 650 3417
Fax No. (021) 650 4104

23 July 2021

Faieeza Khalfe
Department of Psychology
University of Cape Town
Rondebosch 7701

Dear Faieeza

I am pleased to inform you that ethical clearance has been given by an Ethics Review Committee of the Faculty of Humanities for your study, *Attachment, Empathy and Social Ability as Correlates of Leftward Cradling Bias in Students*. The reference number is PSY2021-029.

I wish you all the best for your study.

Yours sincerely

A handwritten signature in cursive script, appearing to read 'Lauren Wild'.

Lauren Wild (PhD)
Associate Professor
Chair: Ethics Review Committee