

Evolutionary Developmental Psychology and Sex Differences in Social Interest and Orientation in Infancy

A Parental Report Study

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Preface

The study presented in this paper was based on the data from two independent studies. The first study was a pilot test of the Norwegian translation of the 6-month Ages & Stages Questionnaires: Social-Emotional. In addition to being one of two translators of the questionnaires, I planned and conducted the pilot test on behalf of Atferdssenteret, Unirand. The second study was an ongoing longitudinal study of children's social development conducted by researchers at Atferdssenteret. Atferdssenteret has been most accommodating with regards to giving me access to data from their first wave of data collection relevant to the present study's research questions.

I wish to acknowledge my supervisor, Harald Janson at Atferdssenteret. From the very beginning he has been nothing but supportive and enthusiastic about my wish to use an evolutionary approach to studying sex differences in social interest and orientation among infants. I would also like to acknowledge my co-supervisor, Jon Martin Sundet. He was helpful with sobering conversations at the time the present study was merely ambitious ramblings on my behalf.

Vibeke Kennair Ottesen, May 2007

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Abstract

The aim of the present study was to test the hypothesis that at the end of their second surge in testosterone production, male infants will on a group level have a slightly less pronounced tendency than female infants to exhibit a social interest and orientation towards people. The study is situated within the discipline of Evolutionary Developmental Psychology (EDP) as the hypothesis was derived by applying principles from modern evolutionary biology to understand the adaptive function of an interest and orientation towards other people in the ontogenetic process of development. Social interest and orientation was measured by 3 items on the 6-month questionnaire of the Ages & Stages Questionnaires: Social-Emotional (ASQ: SE). The participants in the study were the parents of 317 infants aged 5 – 8 months, recruited at child health clinics. The results showed that more male than female infants received responses indicating that their social interest and orientation was not strongly pronounced, indicating a support for the hypothesis. However, this sex difference was not statistically significant. On the other hand, a statistically significant sex difference was found among the participating parents in that fathers tended to rate their infant's pro-social behaviour as less pronounced than mothers did. Additionally, the mothers' marital status was found to be significantly correlated with their rating of the infants' social interest and orientation. The results of the present study are interpreted to coincide with evolutionary reasoning on the matter of parental investment and as testifying for the need for an evolutionary informed approach when choosing methods and variables when studying development.

Author Keywords: Evolutionary developmental psychology; testosterone; infancy; sex difference; parental investment; parental report.

One of the more consistent findings in the study of sex differences in infancy is the difference between male and female infants with regards to their social interest and orientation towards other people (Haviland & Malatesa, 1981; Baron-Cohen, 2003; Geary, 1998). In observation studies female infants have on average been found to look at faces and hold eye-contact more than male infants already within 24 hours of being born (Connellan, Baron-Cohen, et al., 2001). It has further been found that in the first few days after birth female infants on average orient themselves towards voices and establish eye-contact more than boys do (Haviland & Malatesa, 1981). This sex difference is also found among one year old infants (Lutchmaya & Baron-Cohen & 2002). Further it has been found that infants exposed to higher levels of testosterone in the perinatal stage of development are less likely to have a pronounced social interest and orientation towards others than infants exposed to lower levels of testosterone (Lutchmaya & Baron-Cohen & Ragatt, 2002). But does this mean that foetal testosterone levels affect infants' social interest and orientation?

It is established through numerous studies that perinatal testosterone levels play a central role in the brain's organisation and thus indirectly affects social behaviour in animals. It is further established that the effect testosterone has on the brains' organisation in perinatal stages are permanent and irreversible (for an extensive summary and review see Hines, 2004). In humans, the developing foetuses of both sexes are equally exposed to testosterone through sources such as the placenta and the maternal system; however the hormone environment for the two sexes becomes markedly different in the 6th week after conception due to the testes determining gene found on the Y chromosome. At this point in development the primordial gonads of male foetuses (defined as genetically male by their XY combination of sex chromosomes) are converted into testes which produce testosterone, whereas the primordial gonads of female foetuses (defined as genetically female by their XX combination of sex chromosomes) are converted into ovaries. Although females also produce testosterone, their levels of the hormone do not reach the male typical levels of the hormone as females do not have testes. Through its antecedent effects upon genital structures, testosterone impacts brain functioning. Around the 7th - 8th week after conception until about the 24th week after conception, the testes produce a surge in the male foetuses'

testosterone levels (Hines,2004: 22 - 23; Smail, 1981). This self produced exposure to the hormone causes the right hemisphere to develop faster than their left hemisphere causing a rightward shift in their functioning. The female foetuses do not go through this surge in testosterone production and their two hemispheres develop at the same pace resulting in an equal use of the two hemispheres (Hines, 2004). As the higher levels of testosterone which cause the rightward shift in hemispheric functioning are male typical, it is said that testosterone has a masculinising effect on the foetuses' brain (Baron-Cohen, 2003; Ellis, 2005).

The two hemispheres have been found to be the seat for different mental tasks. As male foetuses develop a rightward shift in hemispheric functioning it is perhaps no surprise that the two sexes' differ measurably in aspects of sensation, cognition and emotion (Baron-Cohen, 2003; Ellis, 200; Hines, 2004; Kimura, 2000; Pinker, 2002). For the present paper's scope it is of interest that the right hemisphere has been found to be more involved in negative/rejecting/unfriendly emotions compared to the left hemisphere which is involved in more positive, pro-social and empathetic emotions. The masculinisation of the brain by testosterone causes males to have a decreased advantage of the left hemisphere relative to females in turn causing a decreased ability for pro-social and empathic emotions relative to females (Alford & Alford, 1981; Davidson & Fox, 1989; Dawson et al., 1992; Fox et al., 1992; Hirskowitz et al., 1984; Moll, 2002; Schaffer et al., 1983; Silberman & Weingartner, 1986). The question now becomes *why* do the two sexes' neurology and hormonal system differ to such an extent as to cause differences in their social interest and abilities?

Evolutionary Developmental Psychology

Theodosius Dobzhansky, one of the more prominent evolutionary biologists in history wrote: "Nothing in biology makes sense except in the light of evolution" (in Majerus et al., 1996:6). Modern evolutionary theory has been confirmed through observations and experiments to such an extent that it is accepted as fact within the field of biology and is the guiding paradigm which unifies the field(Majerus et al., 1996; Maynard-Smith, 2000; Stearn & Hoekstra, 2000). Yet the theory of evolution has at best been a weak theoretical

reference within psychology until the emergence of evolutionary psychology in the mid 1980s (Gaulin & McBurney, 2001). In evolutionary psychology, natural and sexual selection is thought to operate on the individual's neurological network, creating certain biases in what information we take in, how we process this information and our reactions to the information (e.g., emotions and behaviour), and so the "[...] causal link between evolution and behaviour is made through psychological mechanisms" (Cosmides & Tooby, 1987, p.287). Through natural and sexual selection, humans have evolved specific social and cognitive mechanisms to deal with the recurring problems which our ancestors faced (e.g., obtaining food, acquiring a mate). These psychological mechanisms occur universally and can be both understood and predicted from principles of evolutionary biology.

Conventional evolutionary psychology has more or less focused exclusively on the social and cognitive mechanisms of adults. Although it is the adult individual who can reproduce, the *sine qua non* of evolutionary success, the adult has to have survived the extended period of infancy, childhood, juvenility and adolescence to reach reproductive maturity. It follows that selection pressures will have operated on the individuals' ability to survive throughout these life stages. As such, evolution will have formed the socio-cognitive competencies which characterise these respective stages of life. Also, the adult psychology does not appear unannounced upon the onset of reproductive maturity. Rather, as seen above, it emerges and develops from the point of conception. Evolutionary Developmental Psychology (EDP) is a discipline where evolutionary thinking is applied to the study of the adaptive function of the ontogenic process in our species' psychology (Bjorklund & Pellegrini, 2000). EDP is stated by two of the leading figures of this relatively new discipline as the "study of the genetic and ecological mechanisms that govern the development of social and cognitive competencies common to all human beings and the epigenetic processes that adapt these competencies to local conditions" (Geary & Bjorklund, 2000, p. 57).

Traits studied within EDP are divided into two categories: Ontogenic adaptations and deferred adaptations (Bjorklund & Pellegrini, 2000). Ontogenic adaptations are traits which serve an adaptive function limited to a specific stage in the individual's life span and are therefore only present in the given life stage (e.g. the sucking reflex).

Deferred adaptations are traits that are antecedents and preparations for adult roles. In particular, sex differences in childhood are considered as possible deferred adaptations towards the respective roles the two sexes have in reproduction. A deferred adaptation may be a bias in the child's interest in play and social interactions. The bias in interest enables the child to exercise and hone skills which will be of use once the child reaches reproductive maturity. Could the sex difference in early neurological development and the resulting biases in what information the sexes seek out in their environment be an evolved deferred adaptation? To answer this question one has to appreciate what selection pressures would have operated on males and females given their roles in reproduction in our evolutionary past.

Parental Investment theory by the evolutionary theorist Robert Trivers (1972) is an elaboration of Charles Darwin's theory on sexual selection (1871). The principal idea behind Trivers' theory is that the difference in what parental investment is required by the two sexes in a given species will drive the sexual selection in the species. The theory states what conditions influence the amount of investment parents put in their offspring. For example in humans, as in all other mammals, there is a life history which includes an internal fertilization and postnatal lactation. Trivers notes that this makes post-copulatory investment obligatory for females, whereas it is not so for males. This post-copulatory obligation has made females the sex which has been the main care taker of young children in our evolutionary past. Conventional evolutionary psychologists have derived specific hypotheses from Trivers' theory arguing that through sexual selection men and women have evolved different psychological and behavioural traits which ensure their genetic continuity. Evolutionary psychologist Anne Campbell (1999; et al., 2001) has proposed the specific hypothesis that as post-copulatory investment was obligatory for ancestral women, their reproductive success would first and foremost have been dependent on traits that would ensure their ability to stay alive throughout the period of pregnancy and lactation. Campbell therefore proposes that ancestral women would have been under a strong selection pressure compared to men to evolve a tendency to avoid risk taking in physically dangerous situations such as those including physical aggression. However, in an evolutionary past without child welfare services, the reproductive success of ancestral women would not solely depend on their ability to

stay alive, it would also depend on their ability to ensure the survival of their offspring. Simon Baron-Cohen (2003) has therefore proposed that women would have been under a strong selection pressure to perceive and to want to meet the needs of her child.

Trivers's theory on Parental Investment states further that as ancestral men were not the main care taker, they would not be 'out of the mating scene' so to speak, for an extended period of time like women were due to gestation and lactation. Trivers proposes that ancestral men would therefore have been under a selection pressure to compete for access to women. Evolutionary psychologists such as David M. Buss Schackelford, Martin Daly and Margo Wilson (e.g. Daly & Wilson, 1988; Buss, 1989; 2005; Buss, Larsen et al., 1992; Buss & Schackelford, 1997) have derived specific hypotheses from Trivers theory about the social and cognitive mechanisms men may have evolved in order to compete for and hold on to social positions that attract women, and by which men compete for and guard their partners.

It is important to appreciate that ancestral men were also under a selection pressure to have a social interest and orientation. Our ancestors lived in small hunter-gatherer groups (Lewin, 1998) and were mutually dependent on each other for their way of life (hunting, foraging, protection, war fare, etc.). A social interest and orientation would be necessary for being able to co-operate would therefore be naturally selected for both sexes in our ancestral way of life. In addition, ancestral men would have been required to co-operate with regards to rearing their offspring. As ancestral women evolved an ability to avoid physically threatening activities (e.g. hunting, fighting etc.), they were dependent on their male partners to provide meat and protection, not only for the sake of their offspring's survival but also for their own survival (Bjorklund & Pelligrini, 2000). As such, ancestral men would also be dependent on pro-social abilities such as wanting to provide and participate as a parent and a partner. However, as ancestral men were not physically obligated through lactation to be the main care taker of children, they were not dependent on the ability to perceive and to want to meet the needs of their offspring to the extent ancestral women were.

It is crucial to appreciate that Trivers was not proposing that the main care taker would evolve a non-discriminate tendency to invest in offspring. As the contribution from ancestral men in rearing young was crucial to the woman's ability to rear offspring

to reproductive maturity, a sensitivity on the woman's part to the man's desertion would be selected for. This aspect of Trivers' theory has inspired several evolutionary psychologists research on infanticide by mothers (e.g. Daly & Wilson, 1988).

The present paper proposes that female infants will have a more pronounced social interest and orientation than male infants as a deferred adaptation towards the role women had in our evolutionary past as the main care taker of offspring. The study is further interested in the potential sex difference in social interest and orientation as it may appear after male infants have gone through their postnatal surge in testosterone which, as mentioned, is thought to increase the difference between the sexes as the interest and orientation of males is masculinised even further. The predicted sex difference was not expected to be absolute in that it does not necessarily apply to each single individual. Rather, as in most psychological research, the sex difference was expected to be an average on group level.

The present paper suggests that the nurturing and competitive abilities proposed selected respectively for in women and men to aid their genetic continuity would be channelled by the neurological network which is already taking shape in the developing foetus. Postnattaly males further experience two surges in testosterone. The first postnatal surge lasts from about the second week after birth to 3 - 6 months after birth (Baron-Cohen, 2003, p. 129; Hines, pp. 22 - 23; Smail, et al.,1981). The last surge in male testosterone production comes prior to reaching puberty. These surges are thought to activate the structural underpinnings of the male's abilities and behaviour causing a further masculinisation of abilities and interests (Ellis, 2005). The present study was interested in measuring potential sex differences in pro-social behaviour among infants after the male infants have gone through their first post-natal surge in testosterone, and predicted a priori that after the first postnatal surge in testosterone male infants would on group level have a slightly less pronounced tendency to exhibit a positive orientation towards significant others than female infants.

Although the degree of social interest and orientation may differ between the sexes in infancy as a result of female infants being selected to have a more pronounced social interest and orientation towards others as a deferred adaptation, this type of behaviour will have been selected for in infancy and childhood as a means for survival (Geary &

Bjorklund, 2000; Bowlby, 1969; Lampart, 1997). Infants, regardless of their sex, would have been under a selection pressure in our evolutionary past to send signals which encouraged their carers to persist in taking care of them, and so the present study predicted that a potential sex difference would only be slight.

If the tendency for female infants to show more pronounced in their social interest and orientation compared to male infants is an evolved adaptation, it is a tendency which should be found cross-culturally. The present study is therefore of interest as sex differences in pro-social behaviour has to the knowledge of the present paper's author not been studied in Norway among infants as young as those included in the present study.

The present study is further of interest as it used a different methodology from the studies which were mentioned introductory to this paper. Whereas those studies were observation studies, the present study is a parental report study. Overt behaviour such as the general disposition the infant has to orient itself towards others might not always be exhibited by the infant within the given time frame in an observation study (Kagan, 1998; Rothbart, 1998). Using parental report as a method will have the advantage of the parents' vast knowledge of their own infant's social interest and orientation. Also, crucial to the present study, the method was considered ecologically valid as it asked for a report on the infants' behaviour in the situation it was adapted for, the communication with and the eliciting of interest in the care taker(s).

One of the critics of using parental report as a method in studying children's abilities is Jerome Kagan. Kagan (1998) argues that parental reports may merely be the product of the participating parents' abilities to perceive and interpret the child's abilities, and not necessarily the child's actual abilities. This potential weakness in using parental report to study infants' social interest and orientation could be a valid concern in the present study, and the reason lies inherently in the theoretical reasoning behind the present study. The present paper proposes that female infants will have a more pronounced social interest and orientation than male infants as a deferred adaptation which ensures that they practice and hone their ability to perceive their eventual offspring's needs through its emotional state. This ability would be selected for in females as they were the main care taker of offspring in our evolutionary past (Baron-

Cohen, 2003). Further, the present study is interested in the potential sex difference in social interest and orientation as it may appear after male infants have gone through their postnatal surge in testosterone which, as mentioned, is thought to increase the difference between the sexes as the interest and orientation of males is masculinised even further. Males go through a second surge in testosterone prior to entering puberty, which is also thought masculinise the males' interests and orientation further again (Ellis, 2005). Following this line of reasoning it is not surprising that women have cross-culturally been found to outdo men in perceiving the emotional state of others (see review in Baron-Cohen, 2003), and the present study was therefore interested in whether there was a sex difference among *parents* with regards to how pro-social they reported their infants to be.

Another concern with regards to using parental report is that the parents' ability to perceive the infant's social interest and orientation may depend on the parents' life situation. As mentioned earlier, Trivers (1972) argued that the main care taker, which in our species evolutionary history was the woman, will not have evolved an indiscriminate tendency to invest in their offspring. Circumstances such as being the sole care taker may diminish her parental investment and even cause her to abandon her offspring as a means to protect her parental resources from being wasted. As an infant's social interest and orientation is thought to be adapted to elicit the care taker(s) investment, could it be that a mother's ability to perceive the infant's behaviour will be influenced by whether she is in a relationship or not? The present study therefore compares the parental report from single mothers and married/co-habiting mothers.

Mothers' depression has been consistently found to correlate with children's development of social and emotional problems (Dawson, et al., 1999; Nærde, 2000). To control for that a potential correlation between the mothers' marital status and report on the infants' social interest and orientation was not caused by the mothers' depression, the present study tested for a correlation between the mothers' score on a depression and anxiety symptom checklist. The paper now turns to the details of the present study.

Method

Measures

Ages & Stages Questionnaires: Social-Emotional (ASQ: SE). The ASQ: SE (Squires, Bricker & Twombly, 2003) is a series of nine questionnaires developed in the U.S. for the purpose of screening for infants and children exhibiting delayed or problematic social and emotional development. The questionnaires include items concerning adaptive and maladaptive behaviours critical to the respective questionnaire's age interval. The present study used the first questionnaire for 6 month old infants. This questionnaire can be used +/- 3 months from the infant is 6 months old, which coincides with the age group of interest in the present study.

The ASQ: SE was developed in an attempt to enable the screening of large numbers of children for social and emotional problems. The questionnaires are therefore intended to be filled out by a parent or a guardian who spends more than 15 hours a week with the child. Not only does this save resources (e.g. time spent interviewing or observing the child), but it also takes advantage of the vast and crucial knowledge the parent or guardian has of the child. Also, it was an important aspect for the present study that the social disposition of an infant was adapted for interacting with its care taker(s).

The ASQ: SE was validated in the U.S. against two established child behaviour measures, namely the Child Behaviour Checklist and the Vineland Social Emotional Early Childhood Scale. The mean specificity for the 9 ASQ: SE forms was estimated at 95% and the mean sensitivity at 78% (Squires, Bricker & Twombly, 2003). The highest finding of specificity for a single form was 98% for the questionnaire used in the present study.

The three following items were selected from the 6-month ASQ: SE to measure the infants' social interest and orientation: Item 2 "Does your baby smile at you and other family members?"; item 5 "When talking to your baby, does he look at you and seem to be listening?"; and item 7 "When awake, does your baby seem to enjoy watching or listening to other people?"

The ASQ: SE uses a three-point response scale as following: 'Most of the time'; 'Sometimes'; 'Rarely or never'. The present study scored this scale 1 - 3 respectively, making the minimum possible sum score on the three selected items 3 indicating a

pronounced social interest and orientation, and the maximum possible score 9 indicating a lack of pro-social interest and orientation. For certain analyses the present study dichotomised the response scale into the two following categories: 'Most of the time'; and 'Other'. The latter category includes the responses 'Some times' and 'Rarely or never'.

The Hopkins Symptom Checklist (HSCL-13). The HSCL-13 is a 13-item self-report inventory concerning the experience of symptoms of depression and anxiety the past 14 days (Derogatis et al., 1974). The HSCL-13 has a four point response scale which the present study scored 1 - 4, making the minimal possible sum score on the thirteen items 13 indicating no symptoms of depression and anxiety, and the maximum possible sum score 52 indicating depression and anxiety.

Participants

The data used in the present study was collected in two independent studies using the 6-months form of the ASQ: SE (Sample 1 and Sample 2). Both studies recruited parents from the general population at child health clinics. In Norway, public child health clinics offer free of charge check-ups for infants around the age of 5 - 6 months, and a very large proportion of parents attended these check-ups with their infants.

Sample 1. The first sample which the present study used data from was a pilot test of the Norwegian translation of the ASQ: SE which was planned and conducted by the author of this paper. The recruitment to the pilot test took place in two child health clinics (Site 1 and Site 2). The nurses at the participating clinics would offer mothers and fathers who visited the clinics with infants aged 6 months (+/- 3 months) a letter informing about the pilot test, the questionnaire in paper form (see Appendix A), and a stamped and addressed envelope. The questionnaire included demographic variables, the Norwegian version of the HSCL-13 and the Norwegian translation of the ASQ: SE. Completing the whole questionnaire form was estimated to take about 10 minutes. The recruitment period lasted from August 2006 throughout February 2007. Participation was anonymous and voluntary and based on informed consent. The response rate was 37%, giving a total of 62 questionnaires returned to the project.

There were four cases where parents indicated that both the mother and the father of the infant had completed the questionnaire, although the questionnaire form instructed that only one person should complete it. One questionnaire missed an indication of which parent had completed it. The present study excluded these five questionnaires as well as three questionnaires completed by fathers from the following analyses.

As the present study was concerned with potential sex differences in pro-social behaviour after the end of male infants' second surge in testosterone, reports for two children younger than 3 months were excluded from the present study's analyses. The 52 remaining infant's ages ranged between 4.9 and 7.7 months. The median age was 5.6 months.

As the sample included participants from two sites, the present study did the following analyses to decide whether or not the two sites could be pooled into one sample for the present study's analyses. A *t*-test indicated that there was a significant difference between the two sites in Sample 1 with regards to the infants' age (Site 1 $M = 6.04$ $SD = 0.68$; Site 2 $M = 5.55$ $SD = 0.45$; $t[52] = 3.11$ assuming equal variances; $p < .05$ [2-tailed]). The difference between the two sites with regards to the distribution of male and female infants was nearly significant ($\chi^2 [1, N = 52] = 6.99, p = .01$). However, a *t*-test indicated no significant differences between the two sites with regards to the sum score the mothers obtained on the HSCL-13 (Site 1 $M = 1.53$ $SD = 0.52$; Site 2 $M = 1.33$ $SD = 0.40$; $t [51] = 1.50$ assuming equal variances; $p = .14$ [2-tailed]). In addition, a *t*-test (Site 1 $M = 3.06$ $SD = 0.25$; Site 2 $M = 3.08$ $SD = 0.27$; $t[52] = 0.21$ assuming equal variances; $p = .84$) did not find a significant difference between the two sites with regards to the sum score on the three selected items in the ASQ: SE. ($\chi^2 [1, N = 52] = 6.99, p = .01$). The present study therefore pooled the two sites into one sample.

Sample 2. The second sample from which the present study used data from was the first wave of data collection in an ongoing longitudinal study of children's development of behaviour problems and social competence (Janson et al., 2006, 2007). The recruitment to the longitudinal study took place at child health clinics with precisely defined geographic catchment areas of five municipalities in southern Norway. The population of the selected areas is largely representative of the range of variation on important demographic variables in the general population in Norway. All parents who came to

the 5-month visit (excluding those who were not able to participate in an interview without the aid of an interpreter) were asked by their child health nurse if they agreed to be contacted by project staff from the longitudinal study. An interviewer contacted those who agreed and suggested that they come to the first interview around the time when the child was 6 months old. Participation was based on informed consent. Recruitment began in September-October 2006. As of March 22, 2007, interviews including valid ASQ: SE data at age about 6 months had been collected for 265 children in the project. Final statistics concerning the participation rate was not available at the time when the present paper was written; however, up to the date when the current data was retrieved from the project's database, a vast majority of parents accepted to be contacted by project staff, and out of those, at least 75% participated in the first interview. The ASQ: SE and the HSCL-13 were included a parent-completed computer-administered questionnaire section, which covered infant, parent and family variables. Interviews took about 45 minutes to one hour to complete.

In Sample 2, reports for two children older than 8 months were excluded from further analysis. The remaining children's ages ranged between 4.7 and 7.9 months. The median age was 6.1 months.

The present study performed the following analyses to decide whether or not to pool Sample 1 with Sample 2. A *t*-test indicated a significant difference between Sample 1 and Sample 2 with regards to the infants' age (Sample 1 $M = 5.7$, $SD = 0.06$; Sample 2 $M = 6.2$, $SD = 0.38$; $t [63] = 6.32$ not assuming equal variance; $p < .01$ [2-tailed]). However, there was no significant difference between the two samples with regards to the distribution of male and female infants. In Sample 1, 27 out of 54 infants were male, and in Sample 2 131 out of 263 infants were male ($\chi^2 [1, N = 317] = 6.99$, $p = .01$). A *t*-test indicated no significant differences between the two samples with regards to the mean score the mothers obtained on the HSCL-13 (Sample 1 $M = 1.39$, $SD = 0.44$; Sample 2 $M = 1.37$, $SD = 0.41$; $t [305] = 0.37$ assuming equal variance; $p = .71$ [2-tailed]). Also, a *t*-test (Sample 1 $M = 3.07$, $SD = 0.26$; Sample 2 $M = 3.12$, $SD = 0.51$; $t [315] = 0.62$ assuming equal variance; $p = .54$ [2-tailed]) did not find a significant difference between the two sites with regards to the sum score on the three selected items from the ASQ: SE. The present study therefore pooled the two samples in the following analyses.

Results

The spread in responses in mothers' report on the three selected items on the ASQ: SE was positively skewed as most children received the score 'Most of the time' on all three selected items (table 1.). Of the study's 317 reports, 91.8% ($N = 291$) infants received the minimum sum score of 3, meaning they received the score 'Most of the time' on all three selected items. Only 6.9 % ($N = 22$) of the infants received a sum score of 4, and only one infant received the maximum score of 9 meaning the mother responded 'Rarely or never' on all three items.

Using the dichotomised scale of 'Most of the time' and 'Other' on mother's reports of their infants indicated that there were more male than female infants who received the poorer ratings on the three selected items. The proportion of male infants receiving 'Most of the time' on all three items was 90.5%, and the proportion of female infants receiving 'Most of the time' on all three items was 93.1%. This tendency was not statistically significant ($\chi^2 = [1, N = 317] = 0.70, p = .40$ [2-tailed]).

Table 1. Mothers' report for male and female infants on the three selected items in the ASQ: SE

ASQ: SE	Response	Male		Female	
		N	(%)	N	(%)
Does your baby smile at you and other family members? ^a					
	Most of the time	156	(98.7)	156	(98.1)
	Sometimes	1	(0.6)	3	(1.9)
	Rarely or never	1	(0.6)	0	(0)
When talking to your baby, does he look at you and seem to be listening? ^b					
	Most of the time	149	(94.3)	154	(96.9)
	Sometimes	8	(5.1)	5	(3.1)
	Rarely or never	1	(0.6)	0	(0)
When awake, does your baby seem to enjoy watching or listening to other people? ^c					
	Most of the time	151	(95.6)	153	(96.2)
	Sometimes	6	(3.8)	6	(3.8)
	Rarely or never	1	(0.6)	0	(0)

Note: ^a $\chi^2 (2, N = 317) = 1.99, p = .37$ (2-tailed); ^b $\chi^2 (2, N = 317) = 1.77, p = .41$ (2-tailed); ^c $\chi^2 (2, N = 317) = 1.01, p = .60$ (2-tailed).

The following analyses concern the influence the parents' sex, the mothers' marital status, and the mothers' self-reported symptoms of depression and anxiety has on the report for infants' social interest and orientation.

In sample 2 there were 148 couples of mothers and fathers where both parents had individually completed the ASQ: SE questionnaire for their shared child. When using the dichotomised scale (Table 2) the proportion of mothers reporting 'Most of the time'

on all three items was 92,3%, whereas the proportion of fathers reporting 'Most of the time' on all three items was 81.1 % ($\chi^2 [1, N = 286] = 6.99, p < .01$).

Table 2. Parental sex difference in report for shared infant

Response	Mothers		Fathers	
	N	(%)	N	(%)
Most of the time	132	(92.3%)	117	(81.8%)
Other	11	(7.7%)	26	(18.2%)

Note: $\chi^2(1, N = 286) = 6.99, p < .01$

A *t*-test indicated that the mothers' marital status was significantly associated with the sum score of the three selected items in the ASQ: SE. The correlation went in the direction of that when the mother was single the child was more likely to receive a poorer sum score on the three selected items (single mother $M = 3.65, SD = 1.5$; married or co-habiting $M = 3.1, SD = 0.32$; $t[16,1]$ assuming equal variances; $p < .01$ [2-tailed]). When the sum score on the three selected items was dichotomised into the categories 'Most of the time' or 'Other' (table 2.), the correlation between marital status and their report on the three selected items was significant ($\chi^2 [1, N = 309] = 11.00, p < .01$ [2-tailed]).

Table 3. Mother's marital status and the sum score on the dichotomised scale for response

Response	Married/co-habiting		Single	
	N	(%)	N	(%)
Most of the time	272	(93.2)	12	(70.6)
Other	20	(6.8)	5	(29.4)

Note: $\chi^2 (1, N = 309) = 11.00, p < .01$ (2-tailed).

Finally, there was no significant correlation between the mothers' mean score on the SCL-13 and the sum score on the three selected items ($\chi^2[1, N= 307] = 0.2, p = .77$ [2-tailed]).

Discussion

As expected, the present study received a positively skewed distribution of responses to the three selected items on the ASQ: SE as most children received the score 'Most of the time' on all three selected items indicating a pronounced social interest and orientation. Further the present study found a slight difference between the reports for male and female infants. As predicted a priori in the study's hypothesis slightly more female than male infants received reports of being strongly pronounced interested and orientated towards other people. This finding coincides with the previous studies on sex differences in social interest and orientation in infancy (Haviland & Malatesa, 1981; Connellan, Baron-Cohen, et al., 2001; Lutchmaya & Baron-Cohen, 2002). However, the present study did not find the sex difference to be statistically significant. If a strongly pronounced social interest and orientation towards others in infancy is a deferred adaptation in females, why did the present study find such a weak tendency for the predicted sex difference? It could be argued that it was too soon in the ontogenetic development for males and females to differ significantly from each other as both sexes would be equally dependent on eliciting parental investment from their care takers. The present study predicted that the reported sex difference in social interest and orientation would only be slight for the very reason that both male and female infants will have been under a selection pressure to be able to elicit parental investment from their care takers. However, as previous studies have found a significant sex differences in the social interest and orientation among infants younger than those in the present study, one must look for alternative explanations for the present studies modest finding than the infants' age. In the following sections, the paper will discuss why the reports for male and female infants did not differ significantly in light of the present study's auxiliary findings and the method the study used. As a closing remark the paper will make suggestions for future research on the development of sex differences in social interest and orientation.

The previous studies on sex differences in infants' social interest and orientation have been observation studies (Haviland & Malatesa, 1981; Connellan, Baron-Cohen, et al., 2001; Lutchmaya & Baron-Cohen, 2002). The present study was a parental report study. Parental report was considered a valid way to measure infants' social interest and

orientation as parents would be familiar with their infant's general social disposition. It was also crucial to the present study that the parental report would be ecologically valid as the infants' social interest and orientation would have been adapted for interacting with its care taker(s). Kagan (1998) has however argued that parental reports are the product of the given parents' abilities to perceive and interpret the child rather than accurate depictions of the child. His point may well be resonated in the present study's finding of a significant difference between mothers' and fathers' reports for their shared infants. The present study found that fathers tended to report their infants as less socially interested and oriented than mothers did. There are two possible explanations for the sex difference in parental reports. Both explanations consider what psychological mechanisms will have been selected for in women as a result of their role as the main care taker of young infants.

The first explanation is that as the main care taker of young infants, women would have been under a selection pressure to be able to read her infant's behaviour in order to be able to meet their infant's needs. As men were not the main care taker of infants, they would not be under the same selection pressures as women and would not necessarily evolve the ability to read their infant's behaviour. The suggestion that women are more acute than men in reading their infants is in accordance with the cross cultural finding that women outdo men in identifying emotional states from facial expressions (Baron-Cohen, 2003). Following this reasoning, it could be that the infants in the present study were actually more socially interested and orientated than their fathers reported, and that the mothers' more favourable reports are the accurate reports for the infants. This does however not answer the question of why male and female infants did not receive significantly different reports from their mothers.

The second explanation for why mothers and fathers differed in their reports on their shared infants may simultaneously answer why male and female infants did not receive significantly different reports from their mothers. The present paper has previously argued that male and female infants would be under the same selection pressure to be of a disposition that elicits the care taker(s) interest in persisting in their parental investment (Geary & Bjorklund, 2000; Bowlby, 1969; Lampert, 1997). This argument can be turned around and used on the selection pressure ancestral mother's

would have been under to perceive a disposition in their infant which elicited an interest in them to persist in their parental investment. If mothers perceived male infants as being less interested and orientated towards them, this could jeopardize the well being and ultimately survival of male infants as the mothers would not receive as much encouragement from their son's social disposition to persist in their parental investment compared to their daughter's social disposition. An ancestral woman who perceived her son as equally interested and orientated towards her would surely out-reproduce an ancestral woman who perceived her sons and daughters disposition too differently. Returning to the present study's main finding, the male and female infants in the present study may very well have differed in their social interest and orientation, but due to ancestral selection pressures their mothers were biased to perceive them as equally interested and oriented regardless of their actual and sex typical differences in behaviour. This explanation does not exclude the possibility for a co-evolution where male infants have evolved a social interest and orientation which elicits parental investment from their care taker(s) and mothers have evolved a biased view of their infants regardless of the infant's sex. Returning to the present studies auxiliary finding that mothers and fathers' report on their shared infants differed, it could be claimed that although women may generally be more acute than men in reading another person, a mother will not necessarily be acute in describing her own infant.

The present study found further that the mothers' marital status was significantly correlated with their reports on their infants' social interest and orientation. This second auxiliary finding could be argued to give further support for the notion that the mothers' reports in the present study were biased by a conditional perception of their infants rather than the infants' actual behaviour. As mentioned earlier, Trivers (1972) argued that there are certain predictable circumstances where the main care taker may be selected to refrain from investing parental effort in their offspring. One of these circumstances is when the main care taker lacks the assistance of the other parent in rearing the young. It may sound at odds with evolutionary reasoning that a woman could be selected to refrain from investing her own young. However, as Trivers (1972) noted, a tendency to hold back parental investment when being the sole care taker could have protected ancestral women from investing resources in offspring they ultimately

would not be able to rear to reproductive maturity on her own. A tendency to perceive ones infants behaviour as less rewarding as a reaction to being a single parent could help towards holding back parental investment. The original adaptive problem ancestral women had of not being able to raise a child on their own may no longer exists in current day Norway (or at least not to the same extent as in our ancestral environment), however women may still possess an evolved sensitivity to whether or not they are in a commitment with their infants' father. The notion of an evolved sensitivity to being a single parent resulting in refraining from investing parental resources is supported by correlation studies on infanticide and child abuse where such incidents have been found to be unusually common when parents have never been married or when the parents are divorced or separated (Daly et al., 1982; Daly & Wilson, 1988; Simons et al., 1993; Walsh, 1990; 1991; Zuravin, 1988).

Mothers' depression has repeatedly been found to be correlated with children's development of social and emotional problems (Dawson, 1999; Nærde, 2000) and depression is often correlated with the loss or absence of a partner (Nesse, 2000). This could open for the interpretation that being a single mother caused depression in the mothers in the present study, which in turn was a mediating variable to the infants receiving reports on being less socially interested and orientated, rather than that being a single mother is a cue to not perceive ones infant in a way that elicits parental care. However, the third auxiliary finding in the present study was that there was no significant correlation between the mothers' score on the HSCL - 13 and their reports on their infants' social interest and orientation. This further supports the argument that the mothers' report on their infants in the present study may have biased by a conditional perception and not an accurate depiction of their infants' social disposition.

To summarise, the present paper did not replicate previous studies findings of a significant tendency for female infants to be more socially interested and orientated than male infants. The present paper has argued that the lack of a significant sex difference may be due to the study being a parental report study and not an observation study as previous studies have been. As a result, the present study may well have studied parental perception rather than infant behaviour. The present studies' auxiliary findings

are interpreted as supporting this argument. There are important lessons to learn about the choice of variables and parental report as a method from the present study's results.

When using parental report as a method for studying children, one should appreciate how the parents' perception of infants may be significantly biased by their own life conditions and abilities. Only an evolutionary informed approach would be able to predict the ways in which parental reports were biased in the present study. The bias in parents' perception of their children does however not leave parental report a redundant method by which to study children's development. EDP holds that infants, children, and adolescents exercise and develop their social abilities in an interaction with their environment (Geary & Bjorklund, 2000; Bjorklund & Ellis, 2005; Bjorklund & Pellegrini, 2000; 2002a; 2002b). As the care taker(s) of young, parents are surely a crucial part of that environment. As argued in the present paper, how the parent perceives its own offspring will ultimately affect the way the parent treats the child. It should be noted that parents do not consciously *choose* or *decide* to perceive their infants more or less favourably depending on their own life. Selection did not require men and women to consciously calculate whether to invest in their offspring or not. Selection is thought to operate on the neurological network, creating biases in what information is taken in about environmental and social conditions and as such selection is indirectly operation on our the reactions (e.g., emotions and behaviour) to the information.

The present study's findings can be argued to be not only an important indicator of the environment (level of parent care) the participating infants have been raised in, but also an important indicator of the environment they are going to raised in in the nearest future. But this is nevertheless only a snap shot in the infants' lives. The present study testifies for the need for an appreciation that although there are evolutionary processes that have shaped our current day behaviour, our behaviour should in no way be considered determined or inevitable, but rather it conditional. The discipline of EDP has as an aim to identify not only the early bases of behaviour and abilities, but also identify how cognitive maturation, social experience and other ecologically relevant signals reinforce and modify initial patterns of behaviour and abilities. Following the developmental trajectories and possible sensitive periods in the development of traits can only be explored adequately through longitudinal studies. In reviewing the

literature there did not appear to have been done any longitudinal research on social orientation and interest in other people within the EDP framework. This is however not surprising considering the newness of the field.

As the present study indicates, an evolutionary approach to studying development has implications for what methods and what variables we should chose to ensure ecological validity. It will also have implications for how we should define and operationalise concepts to ensure ecological validity. This validity is only possible using an evolutionary informed approach in our research. The evolutionary informed approach gives us directing principles we can use so as to ensure that our definitions and measures are ecologically valid. It is the conviction of the author of the present study that an evolutionary informed approach can enrich our understanding of our behaviour, even in our modern times. As one of the most important evolutionary biologists of the 20th century, George C. Williams (1966, p.16) asked: "Is it not reasonable to anticipate that our understanding of the human mind would be aided greatly by knowing the purpose for which it was designed?"

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Appendix

	Meste parten av tiden	Av og til	Sjelden eller aldri	Kryss her dersom det skaper bekymring
13. Koser du og barnet dere sammen under måltidene (gjelder både om du ammer eller gir flaske)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
14. Har barnet spiseproblemer, slik som brekninger, oppkast eller _____ ? (Du kan skrive et annet problem.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
15. Om dagen, holder barnet seg våkent i en time eller lenger av gangen?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
16. Har barnet problemer med å sovne når det er hviletid, eller om natten?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
17. Sover barnet minst 10 timer i løpet av et døgn?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
18. Får barnet forstoppelse eller diaré?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
19. Har noen uttrykt bekymring for barnets atferd? Dersom du krysset av "Av og til" eller "Mesteparten av tiden", utdyp: _____ _____ _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
20. Er det noe ved barnets spise- eller søvnvaner som bekymrer deg? Dersom ja, utdyp: _____ _____ _____				
21. Er det noe ved barnet som bekymrer deg? Dersom ja, utdyp: _____ _____ _____				
22. Hva er det som gir deg størst glede ved barnet? _____ _____ _____ _____				



Et spørreskjema om barns temperament og sosiale ferdigheter

(For barn i alderen 3 til 8 måneder)

Deltagelse er anonymt.

Ved å sende inn skjema sier du deg villig til å ta del i prosjektet.

Vennligst fyll ut følgende informasjon:

Dagens dato: (dd/mm/åå)

___ / ___ / ___

Barnets fødselsdato: (dd/mm/åå)

___ / ___ / ___

Barnets kjønn:

gutt

jente

Første fødte:

ja

nei

Forelder:

mor

far

annen _____

Din fødselsdato: (dd/mm/åå)

___ / ___ / ___

Høyeste utdanning til begge foreldre:

grunnskole

videregående

inntil 4 år høyskole/universitetet

4 år eller mer høyskole/universitet

Foreldres sivilstand:

enslig

samboende/gift

Foreldrenes herkomst:

Norge

Europa

annen _____

SCL-13

Nå kommer det noen spørsmål om problemer eller plager.
Har du i løpet av de siste 14 dagene vært plaget av:

	Ikke plaget	litt plaget	ganske mye plaget	veldig mye plaget
1. Plutselig frykt uten grunn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Stadig redd eller engstelig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Matthet eller svimmelhet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Føler deg anspent eller oppjaget	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Lett for å klandre deg selv	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Søvnproblemer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Nedtrykt, tungsinn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Følelse av å være unyttig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Følelse av alt er et slit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Følelse av håpløshet med hensyn til fremtiden	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Nervøsitet, indre uro	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Mye bekymret eller urolig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Følt deg ulykkelig, trist eller deprimert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ASQ:SE

Viktig å huske:

Les hvert spørsmål nøye og

1. Kryss av i ruten som best beskriver barnets oppførsel og
2. Kryss av i sirkelen dersom oppførselen skaper bekymring

	Meste parten av tiden	Av og til	Sjelden eller aldri	Kryss her dersom det skaper bekymring
1. Når barnet er urolig, kan det roe seg innen en halv time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
2. Smiler barnet til deg og andre i familien?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
3. Liker barnet å bli løftet opp og holdt?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
4. Stivner barnet og spenner ryggen når det blir løftet opp?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
5. Når du snakker til barnet, ser det på deg og ser ut til å lytte?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
6. Gir barnet uttrykk for at det er sultent eller syk?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
7. Når barnet er våkent, virker det som om det liker å se på eller lytte til andre mennesker?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
8. Klarer barnet å roe seg selv (for eksempel ved å sutte på tommelen eller smokk)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
9. Gråter barnet lenge om gangen?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
10. Er barnet avslappet i kroppen?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
11. Har barnet ditt problemer med å suge fra flaske eller bryst?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
12. Tar det lenger tid enn 30 minutter å mate barnet?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>

