The Role of Childhood Adversity in Reproductive Trajectory and Interest in Infants

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Abstract

Life history theory posits that an organism accelerates reproductive timing in response to cues of a harsh external environment. Indeed early reproductive timing in human females, including early menarche, is associated with living in dangerous and deprived neighbourhoods, being poor, experiencing familial stress and parental absence. There is some evidence that adversity acts on reproductive timing through an increased interest in infants. Interest in infants is thought to be an adaptation for acquiring caretaking skills to ensure offspring survival. Compared to males, females display greater interest in infants, which peaks prior to reproductive viability and declines with age. My research investigated the relationship between childhood adversity, intended reproductive timing, menarche and interest in infants in females. I explored methods for measuring interest in infants using four tools: 1) a forced choice paper and pencil preference task (PT), 2) self-reported fondness for babies questionnaire item, 3) a computer based delayed recognition task (CPTT) and 4) a computer based attention task using eye tracking (ETT). All of the tools, except the ETT indicated increased interest in infant stimuli compared to adult or neutral stimuli. However, there were weak correlations between measures suggesting the construct of interest in infants is not easily defined. In a large school study I measured interest in infants using the PT, the CPTT and the self-reported questionnaire item along with childhood adversity and reproductive trajectories in a sample of adolescent girls. I found that girls who experienced greater adversity stated a younger ideal age at parenthood and experienced earlier menarche. However, contrary to my predictions, girls who experienced less adversity showed greater interest in infants on the preference task. Investing in offspring requires adequate resources and adversity indicates resource scarcity. Thus instead of a mechanism between childhood adversity and reproductive trajectory, it is possible interest in infants might be an indicator of future parental investment. These findings support theories that there is a sensitive period in childhood when children form parental investment strategies.

For David.
Thank you for your unfaltering belief that I could do this.
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Chapter 1. Introduction

Teenage pregnancy, at least in the western world, is often viewed as an undesirable life course for young women and one that should be actively avoided. On the whole there is both overt and underlying hostility toward early child bearers. Teenage mothers are often regarded as irresponsible abusers of the welfare system and have been blamed for the rise in divorce rates and the demise of family life (Selman 1997). Academics have argued that the media has played a large role in perpetuating the rates and outcomes of teenage pregnancy as catastrophic by misinformed reporting of figures (Arai 2009). Despite the fact that becoming a teenage mother can in fact be a positive experience for some young women (Seamark & Lings, 2004) the UK government has been tackling the issue for the last two decades.

Beginning in the 1990s and continuing until today politicians have attempted to reduce teenage pregnancy rates by introducing intervention measures. These interventions have tended to target teenage adolescents and largely dealt with sex and relationship education, contraceptive advice and various well-being programs (DCSF 2010). However, to date information on the success of sexual health related interventions are equivocal. Despite knowledge of the well-studied predictors related to teenage pregnancy (social deprivation, poor educational attainment, low aspiration, early life stress) few interventions actually focus on ameliorating these factors (Arai 2003). As well, there is research to suggest that a female's early environment will condition her to adopt a reproductive strategy quite early on in her life (Belsky et al. 1991). Thus intervening in the adolescent years may be too late. Interestingly, research suggests the same risk factors which lead to an accelerated reproductive strategy may also lead to earlier age of sexual initiation and early onset of puberty (Ellis & Garber, 2000; Wellings, Wadsworth, Johnson, Field, & Macdowall, 1999).

Much of the current literature explores the antecedents and outcomes of teenage pregnancy and precocious puberty but there have been few investigating the possible psychological mechanisms at work in these girls. However, Maestripieri , Roney, DeBias, Durante and Spaepen .(2004) investigated how childhood adversity relates to menarche and interest in infants.. They found indirect evidence that childhood adversity not only speeds up menarche, their proxy measure for reproductive timing, but also increases interest in infants. The literature suggests that interest in infants is a possible adaptation in order to acquire care taking skills necessary for offspring survival. Indeed

empirical research supports this theory with females displaying an increased interest in infants compared to males with sex differences as early as infancy (Melson et al. 1986; Alexander et al. 2009). Interest in infants tends to be highest in adolescents (Maestripieri & Pelka, 2002) and becomes more focused on own offspring with mothers showing greater interest in own versus other infants (Leibenluft et al. 2004).

Similar to Maestripieri et al. (2004) , I aimed to test whether interest in infants mediates the relationship between childhood adversity and reproductive trajectories in a sample of peripubertal girls. However, my research differed from their work in a number of ways. I collected data on a broader range of childhood adversity measures, which included both family level and neighbourhood level factors. I used a larger sample of participants with a wider age range (nine to 14 years), this gave me adequate power to use more complex statistical methods where I could control for the effect of individual variables.

Prior to investigating these relationships I also explored various methods for measuring interest in infants. These included both explicit and implicit measures. This approach was taken because there is evidence to suggest that reward, a proxy for interest, is not one-dimensional but rather is made up of three components: liking, wanting and learning (Berridge & Robinson 2003). Each of these components can be expressed either implicitly or explicitly. Recent interest in infants research has focused on the explicit 'liking' and the implicit 'wanting', however, these have not yet been used in an adolescents sample. The explicit measures included in this research are the Preference Task, as designed and used by Maestripieri and Pelka (2002), and self-reported Fondness for Babies questionnaire item. The implicit measures included two novel computer based tasks created specifically for this thesis.

In Chapter 2 I review the literature around teenage pregnancy, early sexual initiation and early puberty and their collective relationship with early adversity. I also review the interest in infant literature and how it may be related to childhood adversity, reproductive and pubertal timing. In Chapter 3 I will review methods previously used to measure interest in infants and discuss how I developed the two novel computer tasks. I will also describe the three lab studies where I explored different methods for measuring interest in infants and their relationships with childhood adversity. In Chapter 4 I describe my larger study that took place in schools. In this school study I investigated the relationship between childhood adversity, intended reproductive timing and interest

in infants in a large sample. In Chapter 5 I investigate the relationship between childhood adversity and menarche in this same sample of girls. In Chapter 6 I discuss the findings from all the studies and conclude the thesis.

The research studies outlined in this thesis arose from North Tyneside council's concern over local teenage pregnancy rates. North Tyneside council was interested in knowing more about the development and well-being of girls living in the borough. The council helped to support and fund this research and as such the main fieldwork was carried out in local schools (nine primary schools, one middle and four secondary schools). North Tyneside side is one of five metropolitan boroughs in the Tyne and Wear County in the North East region of England. It is approximately 80km^2 and has an overall population of 200,801, as of the 2011 census, with 40,344 of these under the age of 16. The borough has low ethnic diversity with 96.3% of the population identifying as 'White British' or 'White Other'. Seventy per cent of adults (aged 16-74 years) were classified as economically active. Twenty-five per cent of adults hold a degree, 47% have some academic qualification and 23% have no academic qualification. The socio-economic position of the adult population in North Tyneside as of the 2011 census data was made up of: 11% higher managerial professional/administrative, 7% higher professional, 22% lower managerial professional,/administrative, 16% intermediate, 7% small employers/own account workers, 7% lower supervisory/technical, 27% semi-routine/routine and 5% unemployed. Seventy-nine per cent of homes owned a car and 78% of adults felt they were in good or very good health. North Tyneside ranks 124 out of 326 for most deprived local authorities in England (DCLG, 2011). However, deprivation within North Tyneside varies greatly, with some wards such as Chirton classified as in the 1% most deprived areas in England and Wales while wards such as St Mary's were in the 2% least deprived (DCLG, 2011).

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Chapter 2. Literature Review

2.1.1 Teenage Pregnancy and Conception Trends

On a global level, teenage pregnancy rates show broad variation.. Economy, health, education and life expectancy differences between countries contribute to the vast differences in reproductive timing. However, even within the world's developed countries, considered to be relatively equal in the above indices, a wide spectrum still exists. At one extreme is Korea with 0.6 births per 1000 women aged 15-19 years while at the other is the United States with a rate of 39.7 births 1000 (UNICEF 2001). Currently, the United Kingdom is situated at the higher end of this spectrum with the third highest rate of teenage pregnancy (25.8 births per 1000 women) in developed countries and the highest rate in Western Europe (Figure 2.1). Teenage pregnancy rates in general are highest in older teenage females aged 18-19 years and much lower among 15-17 year olds. Differences in rates across developed countries can be seen in Figure 2.2 (Please note: the latest figures for the comparisons in Figure 2.2 are from 1998)

Even within England variation exists.. Overall the rate for under-18 conceptions in England is 27.9 per 1000 women and ranges from 23.2 in the South East and East regions to 35.5 in the North East (ONS 2014) (Table 2.1). This trend follows a similar pattern for the younger teens (girls 13-15 years) with the North East again the highest at 8.4 conceptions per 1000 women down to 4.4 conceptions per 1000 in the East and London (ONS 2014) (Table 2.1). Within the North East region the under-18 and under -16 conception rates vary between the five metropolitan boroughs of Tyne and Wear (Gateshead, Newcastle upon Tyne, North Tyneside, South Tyneside and Sunderland) (ONS 2014) (Table 2.2). North Tyneside has one of the lowest teenage conception rates in the Tyne & Wear (6.5 per 1000) for under-16s and is in the intermediate (33.7 per 1000) for under-18s (ONS 2014).

2.1.2 Termination Trends

The national, regional and local data presented above is concerned with conception rates only which does not take into account the percentage of pregnancies ending in abortion. Although abortion can refer to a miscarriage occurring very early in the pregnancy in this data it was used to mean an active termination of pregnancy. Currently at the

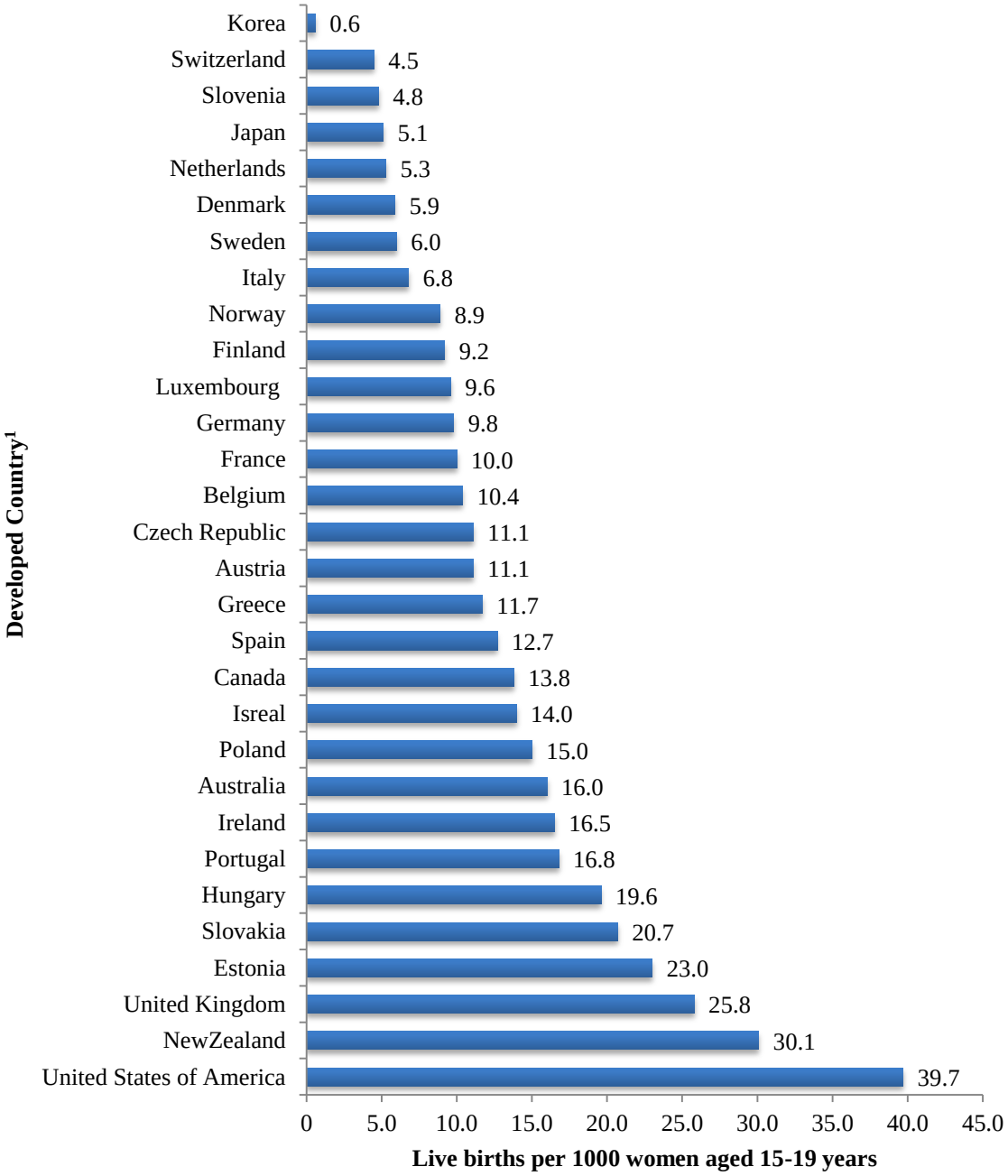

Figure 2.1 The Number of Live Births to Women Aged Below 20 years (15-19 years) per 1000 Women. Data are an Average from Calendar Years 2005-2010.

[1]Developed Country: this is based on the Organisation for Economic Co-operation and Development's (OECD) categorisation of advanced countries.
Source: his reference is the United Nations Population Division Global Population Policy Database

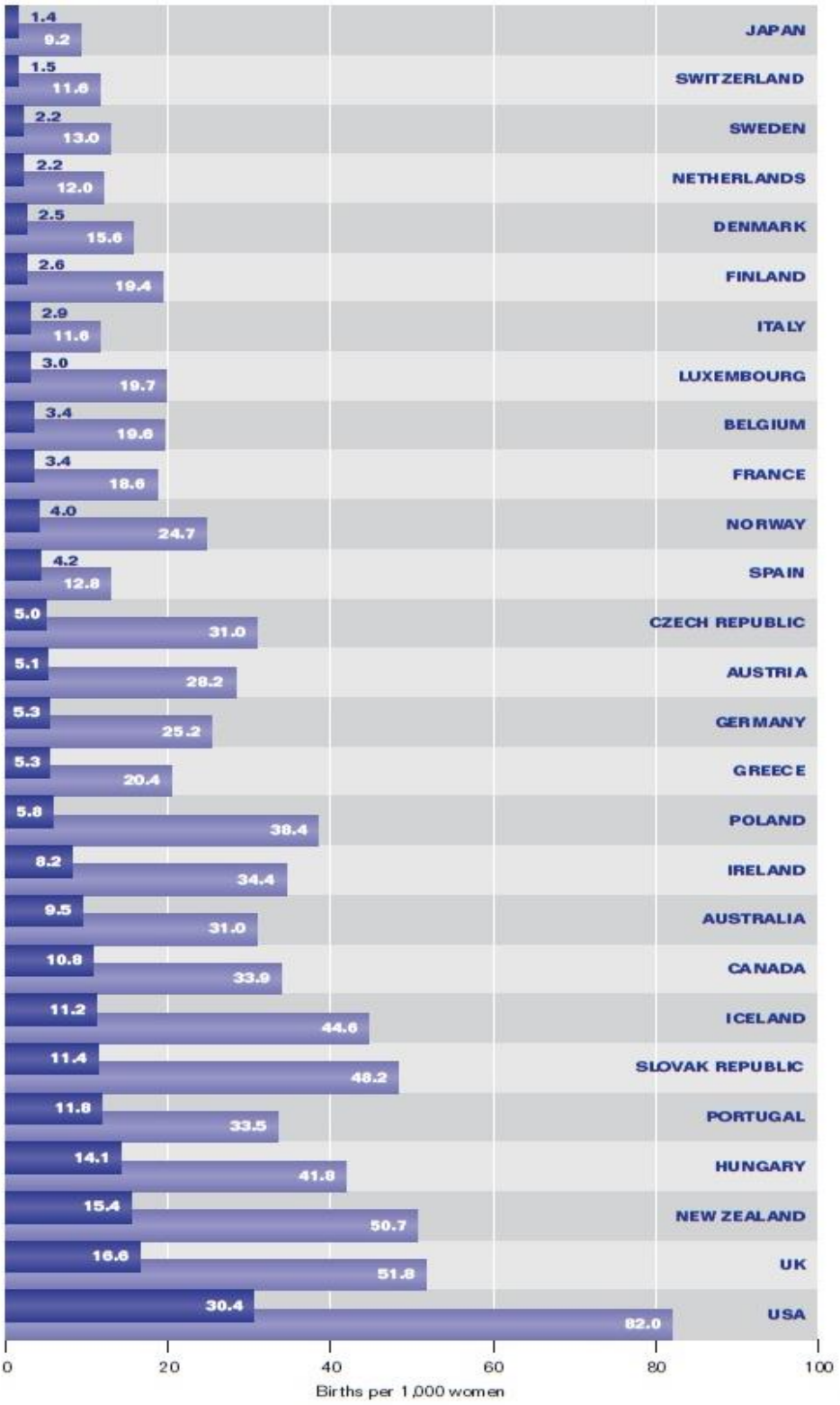

Figure 2.2 The Number of Births per 1000 Women Aged 15 to 17 (dark bars) and Aged 18 to 19 (light bars). Data is for 1998. Countries are Ranked by Birth Rate for Younger Cohort. There was No Breakdown of Birth Rate by Age Group Available for Korea.

Source: (UNICEF 2001)

Table 2.1. Conception Rates per 1,000 Women and Percent of Conceptions Leading to Abortion for Under 16 and Under 18 Year Olds by Region in England.

Region	Under-16 Conception Rates	Percent leading to abortion	Under-18 Conception Rates	Percent Leading to Abortion
England	5.6	60.1	27.7	49.1
North East	8.4	59.0	35.5	44.5
North West	6.6	60.7	31.6	48.5
Yorkshire and the Humber	6.8	56.3	31.7	41.3
East Midlands	5.5	53.4	28.3	42.5
West Midlands	6.6	56.3	32.0	46.5
East	4.4	58.0	23.2	49.2
London	4.4	69.7	25.9	62.2
South East	4.5	63.3	23.2	52.1
South West	4.9	62.2	24.8	48.9

Source: Data taken from Under-16 and Under-18 conception statistics (ONS 2014).

Table 2.2 Conception Rates per 1,000 Women and Percent of Conceptions Leading to Abortions for Under 16 and Under 18 Year Olds by Metropolitan Borough of Tyne & Wear.

Area	Under-16 Conception Rates	Percent leading to abortion	Under-18 Conception Rates	Percent Leading to Abortion
Tyne and Wear	8.6	57.1	34.9	47.3
Gateshead	7.9	53.8	30.2	49.1
Newcastle upon Tyne	9.4	55.0	33.1	52.4
North Tyneside	6.5	47.6	33.7	49.6
South Tyneside	7.1	72.2	31.1	39.3
Sunderland	10.5	59.2	43.1	44.9

Source: Data taken from Under-16 and Under-18 conception statistics (ONS 2014).

national level, 49.1 per cent of conceptions end in abortion for females under-18 years of age (ONS 2014), see Table 2.1. The North East region has one of the lowest percentages of teenage pregnancies ending in termination (44.5%) with a low of 41.3% in Yorkshire and Humber and a high of 62.2% in London. Nationally, 60% of conceptions in under-16 year old women lead to abortions, see Table 2.1. In this age group the North East sits in the middle of the spectrum with 59% of conceptions leading to abortion compared to a low of 53.4% in the East Midlands and a high, again in London, of 69.7%. The national average for under-16s at 61.4 per cent (ONS 2014).

Locally within the Tyne and Wear metropolitan area, North Tyneside abortion rates do not vary much from the regional average at 49.6 and 47.6 per cent of pregnancies leading to abortions in the under-18 and under-16 cohort respectively (ONS 2014) (Table 2.2).

The rate of abortion for teenagers under-18 in England has increased in the last 14 years by 14%, while the rate for under-16s, has increased by 13%. Overall approximately half (49.7%) of teenagers 18 years and younger in England today terminate their pregnancies (ONS 2014). The abortion rates in the North East region have also increased by 21% over the last 14 years for under-18s and three per cent over the last 10 years for under-16s. However, the abortion rates still remain some of the lowest in the nation. Thus not only are more North East teens conceiving but many are choosing to keep their baby resulting in some of the highest prevalence of teenage motherhood in the country.

2.1.3 The Government and Public Perceptions of Teenage Pregnancy

Reducing the incidence of teenage pregnancies has been on the UK government agenda for the last two decades. It has been estimated that teenage pregnancy costs the NHS alone an estimated £63 million pounds a year (DES 2010), with additional cost of between £19,000 and £25,000 over three years for keeping young teenage mothers on benefits after birth of their child (DES 2007). However, overall cost to the government is open to debate. A study done in the US addressing this issue of teenage pregnancy costs to the state found that women who delay childbirth end up decreasing their overall lifetime earnings thus contributing less to the economy via reduced total taxable income (Geronimus, 1997).

Public opinion on teenage childbearing has changed over the last 70 years. Originally, teenage pregnancy, specifically for out-of-wedlock teens, was viewed largely as a moral

issue. From the 1940s through to the late 1960s, teenage mothers were judged as lacking in honour and self-respect (Arney & Bergen 1984). As attitudes toward premarital sex become more permissive and cohabitation rates rose in the 1970s, teenage pregnancy began to be seen more as a scientific problem and one which required investigation and management as opposed to punishment and ostracism (Arney & Bergen 1984). However, despite this shift in perspective, by the latter half of the 20th century teenage mothers were far from being embraced by the nation. The Conservative government of the late 1980s and early 1990s viewed teenage mothers, particularly those who were poor and on state benefits, as a strain to the country's economy (Isaac 1994). As a result any related policies introduced by the government were done to primarily to reduce this supposed economic burden (Pheonix 1996).

In 1992 the Tory government introduced the Health of the Nation white paper, which amongst the five key areas of focus was the reduction of pregnancy rates by half in 13-15 year olds by the year 2000 (DoH 1992). However, when the New Labour government was elected into office in 1997 their predecessor's target had not been met. Keeping teenage pregnancy rate reductions on the agenda, New Labour decided to take a different approach. In place of the perceived accusatory stance of the Tories (Daguerre 2006), New Labour sought to decrease the incidence of teenage mothers by encouraging social inclusion by young people at risk of being excluded by society (Arai 2009). Still, within this somewhat softer approach, teenage pregnancy in itself continued to be seen as a problem that needed fixing. This opinion was apparent in the New Labour document Teenage Pregnancy where party leader, Tony Blair, speaks of 'shattered lives and blighted futures' for teenage mothers (SEU 1999, page 4). The document set out a strategy known as the Teenage Pregnancy Strategy (TPS) that aimed to reduce under-18 conceptions by half and create a downward trend in under-16 conceptions by the year 2010. Additionally, the TPS included the aim of avoiding social exclusion for young mothers or those deemed to be at risk by increasing participation in education, training and employment (Arai 2009).

2.1.4 The Government and the Timing of Intervention Strategy

At the time of the TPS initiative, as is still the case now, the rates of teenage pregnancy in the UK were comparatively high. However, attention from the government mixed with increased media coverage and condemnation of teenage sexual behaviour led to rates being interpreted by the public as spiralling out of control (Arai 2009).

Interestingly, both the Tory and New Labour governments had decided to intervene at times when teenage pregnancy rates were comparable to or lower than those recorded for the middle half of the 20th century (Wellings & Kane 1999). By the time the Tory government had decided to target teenage pregnancy in 1992 the rates of teenage fertility in England and Wales were 37% lower than the highest rate in 1971 (50.6 per 1000 births to women under 20) (Wellings & Kane 1999). Likewise, by the advent of the TPS initiative of the New Labour government in 1998 the rate had fallen a further 5% from the 1992 level (Wellings & Kane 1999).What's more, the median age of first sexual intercourse had decreased by 4 years from the 1940s (21 years) to the early 1990s (17 years) (Wellings et al. 1999). Specifically the birth rate began to decline from the late sixties to late seventies thanks to the introduction of free contraceptives and contraceptive provisioning services on the NHS as well as the option to have a legal abortion (Wellings & Kane 1999). The effect that these contraceptive measures had on reducing teenage pregnancy rates can be seen in decreases in contraceptive use and subsequent increases in pregnancy in years following the release of scientific reports claiming adverse effects of contraceptives (Wellings & Kane 1999). Thus although young women, during this time were initiating sexual activity at a younger age, they were becoming more effective at preventing and terminating pregnancy even before the government decided to intervene.

2.1.5 The Government and Teenage Pregnancy Intervention

Government plans for tackling teenage pregnancy, as set out in the TPS, focused on Sex and Relationship Education in schools (SRE), increased confidential access to contraceptives and support for the health and well-being for those teens who have already become mothers (SEU 1999). Despite the initiatives being introduced over a decade ago, as of 2010 SRE in schools for years one to 11 (ages five to 16) was not mandatory (DCSF 2010). As well, training in implementing SRE has only relatively recently became a requirement of all newly qualifying teachers, previously being an elective module. The government also planned to reduce teenage pregnancy by encouraging parents to be more open with their children and discuss matters related to sex and relationships. The most recent government strategy to achieve this was via a 'Sex: Worth Talking About' campaign which provided web-based materials and leaflets to help facilitate these conversations (DCSF 2010).

Since the introduction of the TPS in 1998 the under-18 teenage pregnancy rates have almost consistently declined from 47.1 per 1000 women to 27.9 per 1000 women in 2012. Although the government did not meet its proposed target reduction of 50% fertility rate for under-18s by 2010 (reaching a rate of 34.3 per 1000 women or a 27% reduction by that time point) latest figures show they are nearly there with a 43% reduction as of 2012. It is possible that this reduction is due to the government initiatives outlined in the TPS. However, although it took 12 years (1998-2010) to see a 27% reduction in rates it took only two-years (2010 to 2012) to see a comparable 19% reduction (ONS 2014). It is difficult to be sure how much of these reductions can be attributed to government initiatives, particularly since, as outlined above, the delivery of these interventions were inconsistent. However, even if delivery was consistent the literature on the effectiveness of sex education on teenage pregnancy outcomes is mixed (DiCenso et al. 2002; Henderson et al. 2007; Oringanje et al. 2009; Poobalan et al. 2009; French et al. 2007).

2.1.6 Teenage Pregnancy and Interventions

Interventions aimed at reducing incidence of teenage pregnancy, delaying sexual debut and promoting safe sex habits are not exclusive to the UK. Of the world's 28 advanced developed countries, 15 of them have taken government led action to reduce fertility rates among women under-20 years old (UNICEF 2001) (Figure 2.3). Indeed the recognition that some method of intervention or guidance in terms of sexual health could be beneficial for young people has been raised by academics for quite some time (McEwan et al. 1974).

As mentioned above, the current government TPS initiative focuses on SRE type interventions. Poobalan et al.(2009), reviewed 30 systematic reviews of SRE interventions carried out in industrial and non-industrial countries. The interventions targeted either HIV/AIDS prevention, teenage pregnancy, or a combination of all sexual health outcomes related to being sexually active. Outcome measures were the incidence of teenage pregnancy post intervention, increase in sexual health, well-being and knowledge, more positive attitudes towards sex and improved sexual behaviour and intentions. Poobalan et al. (2009) found that the most effective interventions for reducing risky sexual behaviour in young people were those which were geared toward the developmental stage of the adolescence, addressed social and media roles in sexual behaviour, trained young people in decision making and negotiation skills as well as

Figure 2.3 Teen Pregnancy Rates and Concern Regarding Rates by Country. Dark Bars 'Major Concern', Pale Bars 'Minor Concern', White Bars 'Not a Matter of Concern'. Dark Type Indicates the Country is Actively Intervening.

Source: (UNICEF 2001)

teaching young people the correct way to use condoms. Education on sex and relationships delivered to young people before they were sexually active, in multiple short sessions over a period of time delivered by people who had experienced the adverse outcomes of risky sexual behaviour (such as a person living with AIDS) . As well, interventions that avoided solely promoting sexual abstinence were a better way of modifying risky sexual behaviour. There was some uncertainty in the review about the extent to which the results could be generalised as many of the interventions involved ethnic minorities with post intervention behaviour varying by ethnicity.

Programs designed to change the behaviour of young people are often designed in absence of their views and first-hand knowledge of what life is like for teenagers today. A study done by Chambers, Boath and Chambers (2002) compared young people and professional's (medical and teaching staff, social and youth workers and various others from community based sectors) views on preventing teenage pregnancy and found substantial differences to proposed approaches. The young people provided a wealth of ideas asserting that programs needed to be youth centred. They suggested personal consultations and communications about sexual health needed to be more private. The young people promoted the use of colour, cartoons, television, internet, posters, peers problem page articles in magazines and even safe sex messages printed on toilet paper as methods of increasing their knowledge and awareness. They requested more help in saying 'No' to peer pressure and in identifying myths about sex. In contrast the professional's recommendations tended to be more focused on re-organising and improving sexual health and education services.

2.1.7 The Trouble with Interventions

Criticism of government policy on interventions has been on-going since the release of the TPS in 1999. Academics have argued that policy was based on evidence of risk factors from cross-sectional instead of longitudinal studies as well as evidence that was dated and therefore not representative of the current social context (Allen et al. 2007). And although the policy set out to target ethnic minorities, as this was seen as a risk factor to teenage pregnancy, the government had little reliable ethnically coded data to go on and thus targeting these groups proved difficult (Aspinall & Hashem 2010). Indeed some recent research from the US has shown that norms toward teenage pregnancy varied by ethnicity with Caucasian teens significantly more likely to report feeling embarrassed by the prospect of teenage pregnancy than an African-American or

Latino teens (Mollborn 2010). Mollborn (2010) argues this may be essential to understanding why some ethnic groups experience higher rates of teenage pregnancy than others.

An additional criticism of the TPS was that although the government had identified risk factors that were associated with teenage pregnancy, (low socio-economic position, low educational attainment, difficult home life, and delinquent behaviour) their methods were not targeted at ameliorating these factors. In the TPS the government illustrates the positive relationship between inequality and teenage pregnancy in some of the world's richest countries (SEU 1999). Despite this, they focused on sex and relationship education and contraceptive services instead of modifying the effects of the risk factors themselves. Harden, Brunton, Fletcher and Oakley (2009) conducted a systematic review of interventions, which addressed social disadvantage and the eventual outcomes on incidence of teenage pregnancy. Although small in size, the study did find evidence that early child development interventions aimed at improving a child's social and cognitive skills in preschool and providing support and training for parents did help to significantly lower subsequent teenage pregnancy rates. Similar results were found for the two youth development interventions included in the study which increased young people's sense of well-being through encouragement of positive aspirations and training in skills related to work, education, volunteering and life in general. Still the failure to address and improve the risk factors of teenage pregnancy is unlikely the result of simple ignorance on the part of the government. Unfortunately, at least in this context, SRE interventions are relatively cheap, easier to implement and satisfy the electorate by promoting the image of a proactive government.

Within the initiatives put forward by the government to reduce early childbearing there was a definite lack of appreciation that some young women might actually want to become young mothers. In a qualitative study on the attitudes of young mothers Arai (2003) argues that perhaps teenage childbearing should not exclusively be perceived as a sign of immaturity but rather as a sign of maturity. Mothering for some is seen as a vocation and in some instances as a way to make up for the love they missed out on in an adverse childhood.

2.1.8 Teenage Pregnancy as a Positive Choice

Teenage pregnancy is believed to have multiple associated negative outcomes for both mother and child such as reliance on benefits, being unemployed, reduced educational

attainment, depression, slower recovery from mental health issues, larger families and poorer cognitive development of the child by age five (Berrington et al. 2002; Biello et al. 2010; Fletcher & Wolfe 2009; Nettle 2010). Young mothers recognise that early childbearing does have implications in terms of being isolated from friends, being unprepared for the hard work that is parenting and being worse off economically (Coleman & Cater 2006). Indeed although young mothers do often re-enter the work force after their children reach school age these women tend not to become economically equal to those women who have delayed childbirth (Furstenberg et al. 1989).

However, evidence from a quasi-experimental study shows that teenage mothers may end up better off in the job market compared to their peers from similar backgrounds who do not become teenage mothers (Hotz et al. 1997). Research has suggested that teenage pregnancy could possibly be a means of helping young people out of social disadvantage because it can be a strong motivator in getting young mothers (and young fathers) back into education and employment in order to support their child (Duncan 2007). Some young women view early childbearing as a chance to turn their lives around and do not necessarily see it as an obstacle to further education and employment. They realise by having children at a younger age there is still time for such ventures as the children get older (Seamark & Lings, 2004). A study of planned teenage parenthood by Coleman and Cater (2006) included young women who implied that childhood environment, anti-social behaviour, experiencing parental separation and dislike of school were among the factors which led them to choose to become a mother. Some of the women felt that becoming pregnant was a form of escaping a previous life they viewed as negative and a chance to gain a new identity. This idea of having a baby as a means of modifying a difficult life has been echoed in other qualitative work (Lee et al. 2004). Some of the women interviewed by Coleman and Cater (2006) felt there were benefits of young motherhood such as being better able to keep up with their child and enjoying a stronger parent-child bond due to a smaller gap in age.

In light of this it is not surprising then that early childbearing is not necessarily happened on by accident with studies showing young women doing everything from actively discussing plans with partners through to possessing a ‘positive ambivalence’ toward pregnancy (Coleman & Cater 2006). In some cases a strong willingness to have a baby can be seen in the perseverance of teenage women who get pregnant after

miscarriage (sometimes multiple miscarriages), previous terminations or visiting a fertility clinic (Seamark, 2001).

Debate regarding the acceptability of teenage childbearing often focuses on the physical health of mother and child (Lawlor & Shaw 2002). There is some evidence for an increased risk of preterm births (Leibenluft et al. 2004; Otterblad-Olausson et al. 1999; Fraser et al. 1995), low birth weight, babies born small for gestational age (Fraser et al. 1995) and maternal mortality (Conde-Agudelo et al. 2005) in teens compared to mothers aged 20-24. Others have found no difference between teens and older women in terms of pre-term delivery and low birth weight with evidence for a lower incidence of caesarean delivery among teenage women (Kramer & Lancaster 2010; Reichman & Pagnini 1997). Even teenage children of teenage mothers appear to do no different, health wise, compared to their peers born to older mothers (Shaw et al. 2006). Scholl, et al. (1992) and Kramer and Lancaster (2010) stress the importance of physical maturity as opposed to age when discussing healthy pregnancy outcomes. Physical maturity and pelvic maturity are linked to the timing of menarche with the majority of girls reaching physical maturity approximately two years post-menarche (Moreman 1982). Females in their later teen years but still considered chronologically young, will have reached physical and pelvic maturity. Indeed, very young teens with less time between menarche and conception appear to have the greatest risk of adverse pregnancy outcomes for themselves or their new born (Kramer & Lancaster 2010; Conde-Agudelo et al. 2005). Kramer and Lancaster (2010) argued that lumping all teens into one group might overstate the health risks of teenage pregnancy.

Many of the differences in health risks for teenage pregnancy are confounded by other factors, particularly disadvantaged backgrounds (Geronimus, 1987). Geronimus and Korenman (1993) compared health outcomes in teen mothers from disadvantaged backgrounds and their sisters who had delayed childbirth. Teen mothers initiated prenatal care visits less often, were less likely to breast feed and more likely to smoke during pregnancy compared to older mothers. However, Geronimus and Korenman (1993) found there was no difference in neonate birth weight between these age groups after controlling for their similar backgrounds. One could argue that prenatal care, breast feeding and smoking during pregnancy are all behaviours that, with the right support, can be improved. The fact that birth weights did not differ between the groups suggests, at least biologically, that early childbearing might not be inherently risky. In fact delaying childbirth, particularly past the age of 40, may be more risky with

evidence for increases in still birth, preterm and very pre term delivery, large and very large size for gestational age, caesarean delivery and pre-eclampsia (Kenny et al. 2013; Duckitt & Harrington 2005).

2.1.9 Teenage Pregnancy: A Life History Perspective

Some have argued that teenage pregnancy needs to be viewed through the evolutionary life history lens. Specifically, Geronimus (1987) and Johns, Dickins and Clegg (2011) highlighted that early childbearing may be an adaptive life history strategy to a risky or uncertain environment. Life history theory posits that when the risk of mortality in the environment is high an organism should stop investing in its own growth and development and redirect resources to mating and reproduction (Chisholm et al. 1993). This strategy will benefit the organism's inclusive fitness by increasing the likelihood that its offspring will survive and also reproduce. Compared to still developing nations and non-human animals, cues to mortality risks can be less overt in modern developed human societies where mortality rates across of the age range are relatively low. Although overt cues to mortality do still exist (such as high homicide rates, high morbidity, natural disasters) in developed countries mortality cues are also evident by perception of resource availability and are often described as: environmental stress, psychosocial stress or adversity. For the purposes of this thesis I will use the term 'adversity' or more specifically 'childhood adversity' to include all factors relating to both overt risks to mortality and perception of resource availability. Evidence from the literature supports the relationship between adversities and accelerated reproductive timing; I review some of this literature below.

2.1.10 Adversity and Reproductive Timing

2.1.10.1 Mortality Risks

Women from countries with low life expectancies begin having children at a younger age and continue to have children more often as they age (Low et al. 2008). There is a non-linear relationship between mortality rates and reproductive timing such that where mortality rates are extremely high one must ensure one's own survival needs are met before mating and reproducing. Alternatively where mortality rates are extremely low one can delay reproduction and invest more in somatic growth and accrual of resources ultimately investing more in future offspring (Placek & Quinlan 2012). Placek and Quinlan (2012) analysed data on age at first birth from 161 countries and found that

infant mortality rates had the largest effect on adolescent fertility rates. This relationship was partially mediated by current mortality risk (measured as adult mortality rate).

This positive correlation between life expectancy and age at first birth exists even at a within country level and even when controlling for resource availability such as income (Krupp 2012). Wilson and Daly (1997) found that neighbourhood life expectancy was associated with early reproductive timing in a sample from the Chicago in the US. Although Wilson and Daly did not look directly at the relationship between homicide rates and age at first birth there was a strong correlation in their sample between life expectancy and homicide rates (r=-0.88) (after removing homicides from life expectancies). Thus it may be that external risks to mortality, that is risk, which are beyond our control, are particularly salient. Indeed others have found that US counties with higher levels of violent crimes have a lower age a pregnancy (Griskevicius et al. 2010) . Pepper and Nettle (2013) found that it was not any known deaths but the number of close bereavements that mattered most when it came to ideal and actual age at first birth. They argued that this could be due to the fact that a close bereavement will be from either a family member or close friend who are likely to share genes with the participant, share environment or share both, increasing the chance that mortality risks will also be shared. Interestingly Griskevicius et al., (2010) demonstrated that the accelerating effect of mortality on intended reproductive timing could be shown experimentally by priming people to think about mortality risks. However, the effect was mediated by relative childhood deprivation. Others have performed similar experiments but found the effect of mortality priming on intended reproductive timing was only present in male participants (Mathews & Sear 2008; Wisman & Goldenberg 2005).

2.1.10.2 Healthy Life Expectancy

Even cues to local morbidity appear to inform reproductive timing. Nettle (2011) found a with-in England difference of seven years for age at first birth from the most deprived to the least deprived areas. This difference was found to follow the gradient of expected healthy years for females from the spectrum of deprivation such that females from more deprived areas could expect 16.8 fewer healthy years than women from more affluent areas. Nettle (2011) also calculated the age at which a woman would have to give birth in order to ensure she was still in good health by the time her first grandchild reached age five. Not only did these predicted ages of first birth decrease as the neighbourhood

deprivation increased but they were remarkably similar to the actual ages of first birth seen in these neighbourhoods. A similar phenomenon was found by Geronimus, Bound and Waidmann (1999) in poor urban African-American women in the US who on average experience higher, in some cases three times higher, probabilities of morbidities and mortality than white American women. There is evidence this difference in fertility timing reflects a conscious decision explicitly expressed in terms of ideal age for reproduction (Jewell et al. 2000) and based on their own healthy life expectancies as well as that of their kin support network (Geronimus, 1996). Wilson and Daly (1997) argued that in areas characterised by high mortality rates early childbearing was part of an active strategy toward completing reproductive goals.

2.1.10.3 Environmental Deprivation

The indices of deprivation used in England and Wales focuses on small geographic areas measuring seven domains: income; employment; health and disability; education, skills, and training; barriers to housing and services; crime; and the living environment to produce an Index of Multiple Deprivation.Teenage pregnancy rates in England follow a similar gradient to the level of deprivation throughout the country (DCLG, 2004; ONS, 2014) (see Table 2.3 and 2.4). Places such as the North East of England which has 38% of its areas considered to be in the 20% most deprived areas in England and Wales also has the highest rates of teen pregnancy for under-18s and under-16s (35.5 and 8.4 per 1000 respectively). Conversely, areas such as the South East region with only 5% of its areas in the lowest levels of deprivation has the lowest under-18 pregnancy rate (23.2 per 1000) and the second lowest under 16 pregnancy rate (4.5 per 1000) (ofs 2012) (compare Tables 2.3 and 2.4). Likewise, teenage pregnancy rates follow a similar pattern in Scotland with rates in the last two decades of the twentieth century decreasing or remaining the same for older and younger teens respectively in more affluent areas where as more deprived areas saw an increase in rates for both cohorts (McLeod 2001). Similar to rates of pregnancy, abortion rates have been shown to follow the gradient of social deprivation. In England and Wales the percentage of conceptions leading to abortions for teens under -18 is 71% in the most affluent areas compared to 39% in the most deprived (Uren et al. 2007) (Table 2.3).

Table 2.3 Rates of Conceptions Leading to Maternity and Abortion and Percentage of Conceptions Leading to Abortion per 1000 Women Aged 15-17: by Deciles of Deprivation in England and Wales.

Deciles of Deprivation	Conceptions leading to maternity (Rate)	Conceptions leading to abortion (Rate)	Percent of conceptions leading to abortion
1 (Least)	4.8	11.5	71
2	7.6	13.0	63
3	10.1	15.0	60
4	13.6	16.3	55
5	17.8	18.7	51
6	22.8	19.6	46
7	28.9	21.4	43
8	37.1	23.4	39
9	41.3	25.6	38
10 (Most)	43.1	27.8	39
Total	23.3	19.4	46

Source: Data taken from 'Teenage conceptions by small area deprivation in England and Wales 2001-2002' (Uren, et al., 2007)

Table 2.4 Number of SOAs[1] in the Most Deprived 20% of SOAs in England: by Region.

Region	Number of SOAs in most deprived 20% of SOAs in England	Number of SOAs in the Region	% of SOAs in each region falling in the most deprived 20% of SOAs in England
South East	271	5319	5.1
East	220	3550	6.2
South West	278	3226	8.6
East Midlands	482	2732	17.6
West Midlands	917	3482	26.3
London	1260	4765	26.4
Yorkshire & the Humber	976	3293	29.6
North West	1461	4459	32.8
North East	631	1656	38.1
Total	6496	32482	20

Source: Data Taken From 'The English Indices Of Deprivation 2004: Summary (Revised) (DCLG, 2004)**.**

[1] SOA refers to Super Output Area. SOAs are geographic areas that are similar in population size created by the Office for National Statistics to improve the representativeness of small scale statistics. Specifically, the data presented here represents the Lower Layer Super Output Areas of which England has 32,482.

In the evolutionary literature deprivation accelerates reproductive timing because of the implications for low resource availability. Availability of resources is an indicator of risks to mortality. Where resources are scarce mortality risks will be higher and faster reproductive trajectories will benefit fitness. Areas with low income, high unemployment rates and low housing and living standards provide cues to the scarcity of resources. If resources are scarce then survival will be more difficult. Indeed age at first birth has been correlated with income in the UK and poverty in the US (Nettle 2011; Barber 2001). Brooks-Gunn, Duncan, Klebanov and Sealand (1993) found that neighbourhoods that contained more professionals and managers had fewer teenage pregnancies and suggested that these people may act as a sort of role model for young people. And it is not necessarily area deprivation that affects age at first pregnancy rather the individual's personal circumstantial deprivation (McCulloch 2001) and their own subjective view of their neighbourhood quality (Johns 2011). There is some evidence that decisions regarding continuation of pregnancy are also affected by resource availability. Jewell, Tacchi and Donovan (2000) found differences in acceptance of abortion use of emergency contraceptives among groups of women from different backgrounds with those from more affluent backgrounds more willing to take advantage of emergency contraceptives and those from more deprived backgrounds being more averse to the option of abortion. Abortion rates have also been linked to level of education where women with more or higher levels of qualifications more likely to opt for a termination (Wellings et al. 1999).

2.1.10.4 Parental Investment

An organism's resources are finite and as such they must decide between investing in their own somatic growth, redirecting resources toward mating opportunity or investing resources in current offspring (Chisholm et al. 1993). In today's modern societies those resources are both quantifiable such as income, food and housing, as well as the less quantifiable such as embodied and social capital. In order for offspring to grow and develop they require investment from one or preferably both parents. Draper and Harpending (1982) hypothesised that girls growing up in father absent homes would learn from their mother's reproductive success that long term pair bonds are not to be expected or essential for offspring survival and thus they will be less choosy and will engage in sex at earlier ages. Belsky, Steinberg and Draper (1991) later expanded this theory to encompass an overall adverse early childhood experience, characterised by parental marital stress, negative parent child relationships and harsh rearing practices

which would lead to early sexual maturity and ultimately early sexual experience. It should be noted that both of these models used attachment theory rather than parental investment per se to explore the reproductive timing-early environment relationship. Chisholm et al. (1993) argued that parental attachment styles would be contingent on resource availability and related local mortality rates thus bridging the gap between these models with the life history theory of reproductive strategies). Since then a wealth of evidence has emerged for the relationship between parental investment and reproductive timing.

Both maternal and paternal investments in childhood play a role in reproductive timing. Absence of one or more parents from the home, and therefore a reduction in available resources, is associated with early childbearing (Ellis et al., 2003; Nettle, Coall, & Dickins, 2010b; Wellings et al., 1999). In the US and New Zealand girls who experienced father absence early in their childhood had 25% and 23% higher rates of teenage pregnancy than girls whose fathers were still present (Ellis et al., 2003). Having a young mother, who has had less time to accrue resources (Seamark & Pereira Gray, 1997), experiencing reduced duration of breastfeeding and of a low birth weight for gestational age (Nettle et al. 2010b) are all associated with earlier age at first birth in females. Interestingly even less overt indicators of resource availability such as poor parent-child relationships (Chisholm et al. 2005) tends to speed up reproductive timing. What is more, instability in the home by way of frequent residential moves in early childhood is also more common in young mothers (Nettle et al. 2010b). Unsurprisingly, these indicators of low resource availability tend to cluster in geographical areas (Nettle 2010). There is some evidence that females use not only indicators of resource availability during development to inform reproductive timing but also current resource availability. Barber (2001) found that when the opportunity for parental investment is reduced due to higher unemployment, poverty and high male incarceration rates, teenage childbearing increases.

One of the strains on parental investment is the presence of siblings. As sibling size increases there will be more offspring vying for resources. Nettle (2010) found that duration of breast-feeding, paternal involvement and activities between mother and child were reduced when there were more siblings present. This struggle for resources between siblings might historically have had real implication for survival. Analysis of contemporary hunter-gather and agricultural societies and western pre-industrial societies showed a positive relationship between number of siblings and survival rates

of siblings (Lawson & Mace 2011). Although the effect of number of siblings on fertility was inconsistent Lawson and Mace (2011) argued this was likely due to variation in socioecological context. Admittedly, overall fertility is not reproductive timing per se, but it is a facet of life history strategy nonetheless. However, evidence for the effect of sibling size on reproductive timing can be found closer to home. A greater number of siblings was related to both higher fertility rates and earlier child bearing in large contemporary English samples (Russell 2002; Wellings et al. 1999).

2.1.10.5 Heritability

Offspring of teenage mothers are often already at a higher chance of becoming a young mother themselves. A small general practice study by Seamark (1997) found that young women whose mothers had themselves been a teenage mother were more likely to conceive in their teenage years. This finding accords with larger studies done by others (Furstenberg Jr et al. 1990; Kahn & Anderson 1992). Specifically, Kahn and Anderson (1992) found a significant increase in chance of a daughter having a child in her teens as the age of her own mother at first pregnancy decreased. However, it is unlikely these effects are solely caused by genetic factors. As Nettle (2011) argues 1) genes are not constrained to a location and therefore if any early childbearing gene did exist it would be present in the wider society and 2) changes in ecology bring about rapid changes in reproductive timing. If reproductive timing was a heritable trait then it should persist despite the surrounding ecology. However, there is some evidence for the plasticity of gene expression depending on environment (Belsky & Pluess 2009) so it is possible that under certain circumstances, such as scarcity of resources, a gene to reproduce early is more likely to be expressed.

2.1.10.6 Teenage Pregnancy, Early Sexual Activity and Precocious Puberty

In the human literature females engaging in sexual activity at a younger age tend to also reproduce at a younger age (Wellings et al. 1999). There is some evidence that, similar to reproductive timing, adverse early environments also speed up coitarche. Alvergne, Faurie and Raymond (2008) found that compared to girls from non-disrupted families, father absence in early adolescent years was associated with a decreased age at coitarche by six months, while stepfather presence reduced the age of first sexual intercourse up to one year. Others have found similar accelerating effects of father absence on coitarche (Ellis et al. 2003; Boothroyd et al. 2013). What is more, a younger age at coitarche tends to be more prevalent in girls with early onset of menarche

(Andersson-Ellström et al. 1996; Garriguet 2005; Jorm et al. 2004; Udry 1979). Tucker-Halpern, Udry and Suchindran (1997) suggested that the link between sexual initiation and menarche could be due to an increase in testosterone release before puberty. Interestingly, both earlier age at first sexual intercourse and younger age at menarche have been associated with a greater preference for more masculine faces (Cornwell et al. 2006; Jones et al. 2010). This facial morphology tends to be more common in men preferring shorter pair bonding (Boothroyd et al. 2008), a sexual strategy resulting from poor parental attachment/investment (Draper & Harpending 1982; Belsky et al. 1991; Chisholm 1999).

2.1.10.7 Puberty and Early Adversity

The literature relating to early adversity and pubertal timing is vast, much more so than the literature relating to adversity and coitarche. Pubertal timing is often used in life history models as a proxy for reproductive strategies. Puberty is comprised of adrenarche, the maturing of the adrenal glands and the surge in androgen production followed by gonadarche, the production of the gonadotropin-releasing hormone and subsequent maturing of primary sex organs and secondary sex characteristics. In females the maturation of the secondary sex characteristics manifests in the first visible signs of breast buds and pubic hair (Marshall & Tanner 1969). Marshal and Tanner (1969) categorised puberty by the progression through five stages of these secondary sex characteristics with menarche occurring in the later stages of pubertal development. In UK menarche tends to occur around 12.3 years, which is roughly two years after the first visible signs of pubertal onset (Simmons et al. 1973; Morris et al. 2011). However, duration between pubertal onset and menarche is not necessarily fixed. Girls with early pubertal onset can experience a greater time lapse to menarche while girls with later pubertal onset can have a shorter time lapse to menarche (Dorn & Biro 2011). Ellis, Shirtcliff, Boyce, Deardorff and Essex (2011) investigated puberty tempo in girls and boys and found puberty tempo was accelerated in children living in stressful family environments. However, this was only the case for children identified as having higher stress reactivity.

Adversity in early childhood often stems from the family environment. A poor relationship with parents, which can include conflict, feelings of rejection and low emotional closeness is related to earlier menarche (Ellis & Garber, 2000; Kim & Smith, 1998; Kim, Smith, & Palermiti, 1997). This effect can even be seen when parents own

wellbeing and relationships are unhealthy such as in the case of partner unhappiness, paternal dissatisfaction and lack of emotional support, and maternal psychopathology (Ellis & Garber, 2000; Kim et al., 1997; Saxbe & Repetti, 2009).As with teenage pregnancy and sexual debut presence of both parents in the home has an impact of puberty timing. Father absence, particularly in the early years (Alvergne et al. 2008; Matchock & Susman 2006) has been linked with earlier age at menarche in girls (Bogaert, 2005; Ellis & Garber, 2000; Neberich, Penke, Lehnart, & Asendorpf, 2010; Romans, Martin, Gendall, & Herbison, 2003) as has the presence of a stepfather in the home (Mendle et al. 2007) and half or stepbrothers (Matchock & Susman 2006). Early menarche has been associated with living in urban areas (Matchock & Susman 2006) and having a lower socio-economic positions (Ellis & Essex, 2007). Studies investigating the role of adversity in early puberty have found that higher levels of anxiety and internalising symptoms are related with earlier puberty in girls (Kim & Smith, 1998; Reardon, Leen-Feldner, & Hayward, 2009). Some research has shown that early childhood sexual abuse was the strongest predictor of earlier menarche (Romans et al. 2003; Wise et al. 2009).

A number of studies have shown that the strongest predictor of menarche in girls is the age of menarche in their mother (Belsky et al., 2007; Blell, Pollard, & Pearce, 2008; Campbell & Udry, 1995; Ellis & Essex, 2007; Ersoy, Balkan, Gunay, & Egemen, 2005; Maisonet et al., 2010), an outcome supported by research championing genetics as the predominant factor in pubertal timing (Ge et al. 2007). Comings, Muhleman, Johnson and MacMurray (2002) found that an X-linked androgen receptor gene in fathers, which predisposes these fathers to impulsive and deviant behaviour could be passed on to his daughter, which in turn predisposes her to early puberty. However, even amongst those supportive of the genetic heritability of pubertal timing there is some acknowledgment of the role environment does play (Segal & Stohs 2007). An interesting study that addresses the genetic versus environment debate was conducted by Tither and Ellis (2008). They compared timing of menarche in older and younger sisters to account for similar genetic make-up in both disrupted and intact families. They found in disrupted families younger sisters, who by experimental design could be assumed to have lived longer period of their life in a father absent home than their older sister, had an earlier age of menarche. This affect was not present in the younger sisters from the non-biologically disrupted families. Similar effects of disrupted families on menarcheal timing have been seen in other studies (Quinlan 2003; Teilmann et al. 2006).

2.1.11 The Mechanism of Adversity on Reproductive Strategy

As outlined in the first half of this literature review there is wide variation in teenage pregnancy rates both between and within countries. Globally governments consider teenage pregnancy to be a problem that needs addressing. The UK government is no different. Typically interventions are implemented to increase young people's knowledge of the risks of sex and how to protect themselves against such risks. However, some academics argue that it is not a lack of knowledge that leads to high teenage pregnancy rates rather it is adversity. Adversity can take on many forms but ultimately it signals a lack of resources and an increased risk to mortality. Life history theory proposes that such signals tend to accelerate reproductive timing in order to benefit inclusive fitness (Chisholm et al. 1993). The role that adversity plays in reproductive strategies is well researched, however, the mechanisms by which it might alter reproductive timing is less so. Nettle and Cockerill (2010) have posited three social mechanisms of early reproductive timing: intergenerational (mother to daughter),oblique (young mother to young mother) transmission and low parental investment. In terms of biological mechanisms there is a vast research base to suggest that adversity leads to early sexual maturity thus physically preparing females for reproduction (Blell et al., 2008; Ellis & Garber, 2000; Kim & Smith, 1998; Romans et al., 2003). With the exception of some, (Maestripieri et al., 2004) psychological mechanisms have received relatively little attention. Maestripieri et al. (2004) investigated the relationship between adversity (specifically father absence) on interest in infants in a sample of adolescent girls. Interest in infants is regarded as an adaptation linked to the accrual of care taking skills. They posited that girls who had experienced father absence would be on a faster reproductive trajectory and should show increased interest in infants compared to father present girls.

The role of parenting tends toward the individual with the most to lose if the offspring fails to survive to reproductive age (Trivers 1974). In humans the time and energy invested into ovum production, foetal gestation and lactation means females are unavoidably the default parent. Indeed this is the case in over 300 non-human primates (Maestripieri & Roney, 2006). To avoid wasting invested resources it is in the human female's interest to garner the necessary skills to ensure her offspring survive. For human females paying more attention to young and being more interested in them holds an adaptive advantage. It is possible that if interest in infants is an adaptive female function to ensure the acquisition of sufficient caretaking skills then girls experiencing

more adversity and who are on faster reproductive trajectories should have an increased interest in infants. Similar to Maestripieri et al. (2004) I will be exploring the relationship between adversity, reproductive trajectory and interest in infants. However, Maestripieri et al. (2004) only looked at family level childhood adversity factors. Because reproductive timing is also related to neighbourhood level adversity factors I felt it was important to also include these factors in my studies. As well, Maestripieri et al. (2004) used only subjective measures, (i.e. Preference Task and rating scales) to measure interest in infants. There is evidence to suggest reward, and by extension interest, is multifaceted and includes both implicit and explicit components (Berridge & Robinson 2003). Recent studies investigating interest in infants have begun to measure the construct both implicitly and explicitly. Still, to date no studies have used both implicit and explicit measures in an adolescent population. Using both measures in this population could provide valuable insight into the development of interest in infants in females. Below I review some of the interest in infants literature.

2.1.11.1 The Phenomenon of Interest in Infants

Infants seem to possess an inherent ability to capture and hold our attention (Brosch et al. 2007; Sato et al. 2012). This ability seems to get stronger with attractiveness (Langlois D P 1995). Lorenz (1943) proposed that, the characteristic morphology of round face and forehead and large eyes, called Kindchenschema or baby schema, is what makes an infant attractive to us thus motivating nurturing behaviour. Other primate species also display this relationship between infantile features and nurturing behaviour (Gerald et al. 2006; Higley et al. 1987). Indeed the stronger the baby schema is, the more attractive infants seem to be (Sanefuji et al. 2007). Baby schema appears to be a generalised mechanism for judging attractiveness occurring in animal as well as baby-faced adult stimuli (Zebrowitz et al. 2009; Little 2012; Archer & Monton 2011; Borgi & Cirulli 2013) and across facial expressions (Hildebrandt 1983). Manipulation of these features in experimental studies has demonstrated their salience in attractiveness ratings (Hildebrandt & Fitzgerald 1979a; Sternglanz et al. 1977) by adults and in motivation towards caretaking in females specifically (Glocker, Langleben, Ruparel, Loughead, Gur, et al. 2009). Likewise, activation of the nucleus accumbens, an area of the mesocorticolimbic system linked to the brain's reward centre, is visible when women see images of infants with increased baby schema (Glocker, Langleben, Ruparel, Loughead, Valdez, et al. 2009). What's more infants are viewed as less attractive as they age and their skeletal growth reduces the baby schema (Luo et al.

2011). Lobmaier, Sprengelmeyer, Wiffen and Perrett (2010) proposed that female's increased sensitivity to infantile features is an adaptation important for mother-infant bonding and ultimately resource allocation amongst multiple offspring. Adults show increased activation in communication areas of the brain when viewing infant faces (Caria et al. 2012) and new mothers specifically have increased grey matter in areas of the brain associated with maternal care and bonding (Kim et al., 2010).

2.1.12 A Brief Background to Interest in Infants

Interest in infants was historically regarded as behaviour predominantly relevant to females in light of their role as mothers. Early research into the area began four decades ago and tended to interpret the behaviour, with the exception of some (Sternglanz et al. 1977; Fullard & Reiling 1976), within the context of sex roles. Studies described the effect of sex on the behaviour as a product of society's gender specific socialisation of boys and girls and often employed Bem Sex-Role Inventory questionnaires to measure participant's position on the scale of femininity/masculinity (Berman, Goodman, Sloan, & Fernander, 1978; Blakemore, 1981; Feldman & Churnin Nash, 1979a; Frodi & Lamb, 1978; Goldberg, Blumberg, & Kriger, 1982; Nash & Feldman, 1980). Largely they argued that nurturing type behaviour, typical of parenting, is socialised in girls from a young age via sex-role stereotypes and therefore more appropriate for females (Berman et al. 1975). Blakemore (1985) argued that contrary findings of no sex difference in interest in infants were a reflection on the population being studied, such that sex differences found in participants from the midwestern United States could be accounted for by their conservative backgrounds and therefore likely adherence to traditional female roles (Blakemore 1981), whereas, the lack of sex difference in participants from the west coast US could be explained by their more liberal environment (Feldman & Churnin Nash 1978) and thus less likely adherence to a traditional female role. However, by comparing traditional and feminist men and women in an attempt to elucidate the effect of socialisation from innate biological preference for infants, Blakemore (1985) found that women from both groups were more interested in babies than men.

Research related to caretaking behaviour, during this time, was for the most part regarded within sociological paradigms of human behaviour. E.O. Wilson's (1975) attempt to marry evolutionary biology and sociology as a method of studying human behaviour was only just taking shape and receiving much resistance (Segerstrale 2001).

Though some did claim to view interest in infants through an evolutionary lens, sex differences emerging in adolescence were still being explained as girls retreating to the safety of the familiar cultural female stereotype to cope with the insecurities of growing up (Feldman et al. 1977). Subsequent adaptationist approaches to the psychology of human behaviour put forward by Tooby and Cosmides (1992) ushered in a new way of thinking about psychology. They posited human behaviour could be explained as a consolidation of psychological mechanisms that allowed ancestral humans to adapt successfully to their environment. As such more recent research has largely used evolutionary psychology or behaviour ecology paradigms. Under these models interest in infants is regarded as a behaviour, or group of behaviours (implicitly or explicitly expressed), that ensure the acquisition of caretaking skills necessary for offspring survival (Fairbanks 1990; Silk 1999).

2.1.12.1 Interest in Infants and Acquisition of Caretaking Skills

Ensuring offspring survival will ultimately benefit one's inclusive fitness thus parental investment is essential. Investment in offspring will have different costs for males and females. A male can never be 100% certain of paternity and a female must decide where best to direct resources (e.g. it may be more costly in the long run to invest in unhealthy offspring). In a hypothetical adoption scenario men placed more importance on the resemblance of the infant where as women were more concerned with health and cuteness (a putative marker of health) (Volk & Quinsey, 2002). The likelihood of investing in healthy infants has been found by others (Waller et al. 2004). Indeed a magnetoencephalography study found that infants with facial abnormalities, such as cleft palate, produce a blunted response compared to healthy looking infants in the orbitofrontal cortex, the part of the brain related to early emotional response to visual stimuli (Parsons et al. 2013).

Interest in infants appears to be useful at different stages of the reproductive trajectory. As mentioned previously, prepartum it is important to gains skills to protect and invest in offspring. Indeed studies have found that engaging effect of infant stimuli on behaviour and neuronal activity can be seen even in nulliparous females (Glocker, Langleben, Ruparel, Loughead, Valdez, et al. 2009) as compared to multiparous females (Waitt et al. 2007). In response to infant stimuli neuronal activity in new lovers appears to mirror that of new parents as opposed to unromantically attached adults (Weisman et al. 2012). Alternatively, postpartum parents must decide how and when to invest in

offspring. Parents' physiological responses are heightened toward the emotional state of infants generally (Seifritz et al. 2003; Proverbio et al. 2006; Nishitani et al. 2011; Bleichfeld & Moely 1984) and perhaps more importantly their own offspring specifically (Spangler et al. 2005; Leibenluft et al. 2004; Barrett et al. 2012; Doi & Shinohara 2012). Swain, Lorberbaum, Kose and Strathearn's (2007) review of the functional brain imaging and infant stimuli literature concludes that there is a parental brain network that involves areas related to motivation and reward. Rhesus macaques with lesioned amygdala, part of the mesolimbic reward pathway, display fewer affiliative vocalizations toward infants than non-lesioned macaques. It is perhaps telling just how important the acquisition of maternal skills when high dominance rank in female baboons is positively related to interactions with unrelated infants (Ramirez et al. 2004).

The majority of the interest in infants literature related to parenting tends to focus on comparisons between mothers and non-mothers. Compared to non-pregnant and pregnant women, new mothers' heart rates increased when listening to recordings of infant cries (Bleichfeld & Moely 1984). Infants capture the attention of mothers (Thompson-Booth et al. 2014) and the effect tends to be stronger for new mothers (Nash & Feldman 1980). As suggested by Lobmaeir et al. (2010) interest in infants acts as a mechanism for mother-infant bonding. The emotional response area of the brain, the orbitofrontal cortex, and those areas rich in oxytocin receptors (i.e. 'periaqueductal gray') are more active when mothers view images of their own infants compared to unknown infants or adults (Nitschke et al. 2004; Bartels & Zeki 2004). Oxytocin has been linked to maternal bonding (Levine et al. 2007). New mothers with secure attachment style had higher activation in the hypothalamus/pituitary where oxytocin is produced, when viewing images of their own infant smiling (Strathearn et al. 2009). Attachment to infant provides cues to investment. Parents with insecure attachment style show reduced arousal to infants displaying negative emotions (Spangler et al. 2010). Postnatal depression can create an obstacle to bonding with infants. Mothers with depressed mood had blunted responses in reward centres of brain when viewing images of their own distressed and joyful infants (Barrett et al. 2012; Laurent & Ablow 2013) and were less distracted by distressed infant images (Pearson et al. 2010; Thompson-Booth et al. 2014). Interestingly, a study using near infraredspectroscopy, a method for measuring blood flow in the brain, found both mothers and infants show

activation in the orbitofrontal cortex when viewing images of each other (Minagawa-Kawai et al. 2009).

2.1.12.2 Interest in Infants and Sex Differences

Based on the higher parental investment of females it is probable that interest in infants is a more important and relevant adaptation for females compared to males. Indeed Feldman and Nash (1978) found that mothers looked longer at photos of infants, were more responsive to unknown babies and ignored them less than fathers. Fairly consistently females demonstrate higher levels of interest in infants than males (Berman et al., 1978; Blakemore, 1981; Frodi & Lamb, 1978; Fullard & Reiling, 1976; Hess & Polt, 1960; Hildebrandt & Fitzgerald, 1978). These sex differences are present even in non-human primates (Hassett et al. 2008; Herman et al. 2003). Females are quicker and more accurate at discriminating infant facial expressions (Babchuk et al. 1985). However, a more recent study has shown males to be just as good as women at discriminating infant facial expressions and at judging the age of a baby, but they were less accurate at judging the 'cuteness' of a baby (Lobmaier et al. 2010). Women, compared to men, tend to rate infants as more attractive and show greater motivation to view images of infants when given the opportunity (Charles et al. 2013; Hahn et al. 2013). Though, some have found no sex difference in motivation to view infant stimuli (Yamamoto et al. 2009; Parsons, Young, Kumari, et al. 2011; Parsons, Young, Parsons, et al. 2011).

2.1.12.3 Interest in Infants and Hormones

For this adaptation to be useful for females, in terms of maximising their inclusive fitness, interest in infants needs to be present before reproduction viability. Indeed there is evidence that females show a greater interest in infant stimuli, in terms of life course and as compared to males, from infancy (Alexander et al. 2009), early childhood (Melson & Fogel 1982; Berman et al. 1983), late childhood and early adolescence (Blakemore, 1981; Feldman et al., 1977; Frodi & Lamb, 1978; Fullard & Reiling, 1976; Maestripieri & Pelka, 2002). Female sex hormones may be the driving force behind this heightened preference for infants and related stimuli. Girls with congenital adrenal hyperplasia, a disorder of the adrenal gland resulting in an excess of androgen, were less interested in infants than their sisters (Leveroni & Berenbaum 1998) and were more likely to play with masculine toys (Nordenstrom 2002). Goldberg, Blumberg and Kriger (1982) found that post-menarcheal girls liked images of infants more than pre-

menarcheal girls. Similarly, Maestripieri et al.(2004) found that it was timing of menarche that mattered most such that girls who had experienced early menarche preferred images of human infant silhouette more than girls who has experienced late menarche. It should be noted that Maestripieri et al. (2004) defined late menstruation as anything after the median of menarche of the sample. As such, late for this sample was anything after 11.6 years of age which was approximately 9 months earlier than the U.S.A national average of 12.43 years (Chumlea et al. 2003). Thus the effect of timing of menarche might have been weaker or non-existent had the groupings been based on national trends in menarche.

Scientists have also examined the relationship between sex hormones and interest in infants in adult cohorts. Sprengelmeyer et al. (2009) reported that women of reproductive age were better at judging cuteness of infant faces than similar aged men and older women. Moreover, by comparing pre- and post-menopausal women and oral contraceptive users to non-users they found that pre-menopausal and oral contraceptive users had higher cuteness acuity. Sprengelmeyer et al. (2009) linked this ability to higher levels of female sex hormones, oestrogen and progestogen, in the premenopausal and oral contraceptive groups. However, a follow up study failed to replicate these findings (Sprengelmeyer, Lewis, Hahn, & Perrett, 2013). Still the replication only included men, regular cycling women and oral contraceptive users and did not include older women. Other have shown a preference for infant stimuli declines in females with age (Maestripieri & Pelka, 2002). Pregnant women show an increase in positive feeling toward their foetus as pregnancy progresses (Fleming et al. 1997). For these women an increase in their oestrogen/progesterone ratio from early to late pregnancy was related to higher feelings of attachment to infant post-partum. Conversely, Feldman and Nash (1978) found that expectant mothers behaviour toward unknown children and infant photo viewing time was no different to childless women. However, it is likely these childless women were taking oral contraceptives because they were classed as married or cohabiting thus this could account for the null findings. Evidence from the nonhuman primate literature has found that affiliative behaviours with infants in prepartum baboons were related to high oestrogen/cortisol ratio (Ramirez et al. 2004). Pigtailed macaques displayed increased infant handling in late pregnancy when oestrogen and progesterone levels are at their highest (Maestripieri & Zehr, 1998). Additionally ovariectomized pigtailed macaques that were given oestrogen treatment showed

increased infant handling and postpartum Japanese macaques with lower cortisol/oestrogen ratios were more responsive to infants (Bardi et al. 2003).

2.1.12.4 Interest in Infants and Adversity

The relationship between female sex hormones and increased interest in infants should exist regardless of age of the individual female. If it is the hormones driving the interest then increased interest in infants should be stronger in earlier developing girls. Interest in infants has only been studied in the context of early adversity relatively recently in the form of family support and father absence in humans (Maestripieri et al., 2004) and maternal care in rhesus macaques (Maestripieri, 2005). As outlined above a variety of early life stress factors are associated with precocious puberty, early sexual initiation and early childbearing, suggesting that females are altering their life history strategy to fit their environment. If interest in infants is an adaptation to ensure accrual of sufficient mothering skills then girls who have experienced early adversity should be on a faster reproductive trajectory and show an increased level of interest in infants.

2.1.12.5 Measuring Interest in Infants

Interest in infants has previously been measured using a variety of methods. At present there is no 'gold standard' measurement tool. In general, however, they fall into six categories: behavioural, physiological, preference, self-reports, psychophysics and non-human primate comparative studies. After reviewing the interest in infants literature it is clear that the wide variety of methods used to measure this construct is due to a lack of consensus on what 'interest' entails. In Chapter 3 I will review the methods used by others to measure interest in infants. I will also outline three lab studies I designed to explore four different methods of measuring this construct.

2.2 Summary

For the last few decades in the UK, teenage pregnancy has been viewed as a life course with detrimental outcomes and one that requires urgent intervention. Although it has always been viewed as a problem that needed fixing the language and attitude toward teenage mothers has changed with the times and the ruling political party. In the middle of the 20th century the focus was on condemnation of teenage mothers' lack of moral compass. In the seventies and eighties teenage pregnancy was viewed as a scientific problem that was putting strain on the country's economy. Most recently teenage motherhood has been viewed as an issue of social exclusion. In 1999 the UK Labour

government set itself an ambitious target of halving teenage pregnancy rates in ten years through sexual health related initiatives outlined in the Teenage Pregnancy Strategy (TPS). However, although teenage pregnancy rates did decline the target was not met. Oddly, although only a 27% decline in teenage pregnancy rates was seen in that ten-year period a further 19% reduction was seen in the subsequent two years (i.e. 2010 to 2012). Although the TPS acknowledged that adversity was not only an outcome but also a precursor to teenage pregnancy academics have since argued that the government failed to modify the effects of adversity (Johns et al. 2011).

A wealth of research suggests that girls who experience early adversity tend to have a younger age a first birth often preceded by an earlier sexual initiation and precocious puberty. In the evolutionary biology/psychology and behaviour ecology literature faster reproductive trajectories are considered in terms of life history strategies. Life history theory posits that organisms are continually making trade-off decisions between somatic growth and mating based on local cues to mortality (Chisholm et al. 1993). When risks to mortality are high it will benefit an organism's fitness (i.e. propagation of genes) to cease investing resources in somatic growth and redirect them toward mating and reproduction. Local life expectancy and healthy life expectancy act as cues to local mortality rates. Additionally, in humans, particularly in modern industrialised societies, indicators of resource availability such as environmental deprivation and parental investment will act as indirect cues to mortality risks. The literature uses a variety of terms such as 'environmental stress', 'psychosocial stress', 'adversity' to describe these direct and indirect cues to mortality as 'adversity'. In this thesis I will use the term 'adversity' or specifically 'childhood adversity'.

The antecedents and outcomes of teenage pregnancy have been studied extensively. Possible mechanisms by which the antecedents produce the outcomes have been proposed (Blell et al., 2008; Ellis & Garber, 2000; Kim & Smith, 1998; Nettle & Cockerill, 2010; Romans et al., 2003), however these tend to concentrate on social and biological processes. Psychological mechanisms have received less attention, however, one proposed by Maestripieri et al. (2004) was that females on a faster reproductive trajectory (as a result of experience early adversity) would show increased interest in infants. Interest in infants is thought to be an adaptation necessary for the accrual of care taking skills for offspring. Indeed research suggests that females tend to show more interest in infants than males and that this interest increases around adolescence and declines with age (Blakemore, 1981; Maestripieri & Pelka, 2002). Maestripieri et al.

(2004) and (2005) found evidence for increased interest in infants in human and nonhuman primate females who experienced early adversity, and in the case of the human females, were on faster reproductive trajectories. Similar to Maestripieri et al. I will be exploring the relationship between childhood adversity, reproductive timing and interest in infants. However, I will be using a broader range of childhood adversity measures as well as two measures of reproductive trajectory, menarche and intended reproductive timing. As well, because of the lack of consensus on the best tool for use in measuring interest in infants I will also explore different methods for measuring this construct using two novel computer based tools, one previously used paper and pencil based tool and one questionnaire item.

2.3 Aims

The research described in this thesis had two overall aims. The first was to explore how interest in infants might act as a mechanism between childhood adversity and reproductive trajectory in adolescent girls. To achieve this I measured interest in infants, childhood adversity and reproductive trajectory in girls aged nine to 14 years in school settings. The second was to explore and compare different methods for measuring interest in infants. To achieve this I examined the intercorrelations between different methods for measuring interest in infants in a lab setting. Specifically I compared a forced choice paper and pencil preference task, two novel computer tasks designed to measure attention paid to infant stimuli and a simple self-reported fondness for babies questionnaire item. In these lab studies I also piloted childhood adversity questionnaires.

Chapter 3. Measuring Interest in Infants

3.1 Introduction

Although a wealth of research spanning fifty years has attempted to understand interest in infants as a behavioural phenomenon at present there is no gold standard, or standard at all, for measuring this construct. Indeed, interest in infants has been measured using a wide variety of methods. In general, these methods fall into one of six groups: behavioural, preference, self-report, psychophysics, physiological and non-human primate comparative studies. This chapter begins by spanning these six categories and reviewing the methods used by others to measure interest in infants. I then describe two new tools I designed to measure interest in infants and the three lab studies I undertook to investigate these and other interest in infants methods. Two of the lab studies also piloted questionnaire items measuring childhood adversity, menarche and intended reproductive timing. Although the main aim of the lab studies was not to investigate the relationship between individual differences and interest in infants, an exploratory analysis was performed. The three lab studies were carried out in adult and adolescent female samples.

3.1.1 Behavioural

Behavioural measures were one of the more popular methods for measuring interest in infants in the early days of this area of research. These measures were often observational in nature and took place in a waiting room or nursery setting depending on the participant type (i.e. child or adult). Researchers measured many interactive behaviours with confederate infants including looking at infant, facial gestures, talking, giving objects, proximity, touch, play (Berman et al., 1983; Blakemore, 1981; Culp, Cook, & Housley, 1983; Feldman et al., 1977; Feldman & Churnin Nash, 1978, 1979a, 1979b; Frodi & Lamb, 1978; Melson & Fogel, 1982; Nash & Feldman, 1980). Others have used preference of toy type during play where more interaction with dolls, compared to masculine or neutral toys (e.g. toy trucks, sketch books), were used as an indirect measure of interest in infants (Alexander et al. 2009; Nordenstrom 2002). Parental report of interest in infant behaviour has also been used to measure interest in infants in children (Leveroni & Berenbaum 1998). Although observational studies can be very informative and the findings have greater applicability, compared to other study methods, to behaviours outside of the lab they are susceptible to confounders. For example many of the waiting room and nursery interaction studies mentioned above,

with the exception of two (Berman et al. 1983; Blakemore 1981), were done in the presence of either the infant's mother or another caretaker (e.g. teacher). Interactions between mother/caretaker and participant varied from none (Melson & Fogel 1982) to direct (Frodi & Lamb, 1978). It is possible that adult and/or child participants may have altered their behaviour in order to look favourable in the eyes of the caretaker. What is more in some instances behaviours were arguably unspontaneous because participants were either informed of the role of the infant in the study they were participating in (Blakemore 1981; Culp et al. 1983) or instructed to take care of the infant (Berman et al. 1983).

3.1.2 Preference

Baby schema in infants is widely regarded as the releasing mechanism driving caretaking behaviour (see Chapter 2 literature review for references). As such studies subjectively measure the attraction to infantile features in different populations. Most often this is achieved via ratings of attractiveness or cuteness of infant visual stimuli. For these measures static photographic images of infant faces were most often used to rate attractiveness or cuteness of infants. This has sometimes been done using a Likert Scale with infant images presented on their own (Hildebrandt & Fitzgerald, 1979b; Reiner Sprengelmeyer et al., 2013; Volk, 2007; Yamamoto et al., 2009); alongside images of human adults (Parsons, Young, Kumari, et al. 2011; Parsons, Young, Parsons, et al. 2011; Luo et al. 2011), or images of animal infants (Berman et al. 1975; Sanefuji et al. 2007) or even teddy bears (Archer & Monton 2011). Some studies have gone one step further and investigated ability of participants to judge attractiveness or cuteness of infants after manipulating the amount of baby schema (Alley, 1981; Glocker, Langleben, Ruparel, Loughead, Gur, et al., 2009; Little, 2012; Lobmaier et al., 2010; Sprengelmeyer et al., 2009; Sternglanz et al., 1977). As well as attractiveness and cuteness measures, researchers have investigated other aspects of infants facial stimuli likely important for sufficient caretaking such as emotion and health (Hildebrandt, 1983; Volk & Quinsey, 2002; Waller et al., 2004). Aside from these types of preference measures there has been some use of forced choice tasks (Fullard & Reiling, 1976; Goldberg et al., 1982; Maestripieri & Pelka, 2002; Maestripieri et al., 2004). In these tasks participants decided if they preferred an infant or an adult, human or animal, image. Many of these studies have found differences in preference for infant stimuli in their respective populations. As with the behavioural method, both forced choice and scale measures are explicitly measuring interest in infants and as such are open to

response bias. What is more forced choice task inherently contains two confounders: 1) it imposes a difference in preference where one might not exist and 2) it may indicate which stimuli the participants find less aversive rather than which stimuli they actually prefer.

3.1.3 Self-Report

Self-report has been the least widely used method. An exhaustive search of the literature found only three studies that used self-report interest in infants alongside other measures. Maestripieri and Pelka (2002) and Charles, Alexander and Saenz (2013), included three questionnaire items in their study answering; 1) how they would interact with an unknown baby in a room full of people in 10 different situations, 2) if they would prefer to spend 15 minutes with an adorable baby or an attractive adult and 3) how much they liked babies on a three point scale. Brase and Brase (2012) had participants rate if they desired to have a baby and the strength of that desire. Self-report is the most simple and direct method of measuring interest in infants yet it is the least used. Similar to the preference type study designs, self-report is prone to social desirability bias with participants perhaps feeling they need to respond in line with sex/gender norms. As well as with all questionnaire items they are open to subjective interpretation and constrained by response options.

3.1.4 Psychophysics

Psychophysics methods for measuring interest in infants have become more popular in recent years. However, there were early attempts at rudimentary eye tracking tasks (Hildebrandt & Fitzgerald 1978; Power et al. 1982) as well as participant controlled viewing tasks (Nash & Feldman 1980) to measure attention paid to infant stimuli. More recently attentional capture paradigms in this field have included the Dot- Probe task, where latency to identify the spatial location of a dot on a computer screen after the presentation of salient stimuli is measured (Brosch et al. 2007), Go/No Go task, where participants must inhibit a response when presented with certain stimuli (Pearson et al. 2010), attentional allocation tasks such as an exogenous orienting of attention paradigm (Proverbio 2011), and irrelevant feature visual search paradigm (Thompson-Booth et al. 2014). Essentially these tasks measure the reaction time and error rates to neutral targets in the presence and absence of salient stimuli, in this case infant. Desire to view infant stimuli, often referred to in the literature as ‘wanting’ because of the implicit nature of the task, has been operationalised in a number of studies via the ‘key-press’ or ‘pay-per-

view' task (Charles et al., 2013; Hahn et al., 2013; Parsons, Young, Kumari, et al., 2011; Parsons, Young, Parsons, et al., 2011; Sprengelmeyer et al., 2013; Yamamoto et al., 2009). These tasks allow the participant to increase or decrease the length of time an image is presented on a computer screen through key presses on a keyboard. Others have used different methods to implicitly measure interest in infant stimuli. Golle, Lisibach, Mast and Lobmaier (2013) used an adaptation paradigm for testing the existence of a baby schema processing mechanism in the brain. This task measured the after-effects of viewing cute and less cute infant stimuli on subsequent cuteness ratings of new infant stimuli. Charles et al. (2013) designed a visual attention task where an eye-tracking device tracked participant's eye gaze fixations while viewing computer generated scenes of 'high ecological validity' that included infant stimuli. All of these measures are implicit in nature and as such reduce the probability of some of the confounders present in the self-report and behavioural methods, such as social desirability bias. However, psychophysics tools are lab based with stimuli, usually, tightly controlled. Thus it is difficult to be confident in the external validity of these measures.

3.1.5 Physiological

Similar to the psychophysics measures of interest in infants physiological measures also reduce the probability of social desirability bias from participants. In many of these study designs components of the sympathetic nervous system are used as outcome variables and have included changes in pupil size, heart rate, skin conductance, facial muscle movements, blood pressure and startle response when viewing various infant stimuli (Bleichfeld & Moely, 1984; Frodi & Lamb, 1978; Furedy et al., 1989; Hess & Polt, 1960; Krippl, Ast-Scheitenberger, Bovenschen, & Spangler, 2010; Power et al., 1982; Spangler et al., 2005, 2010). With the advance in functional and structural brain imaging technology the physiological measurement of interest in infants has increasingly involved the investigation of neural correlates associated with viewing emotionally salient, familiar and attractive infant stimuli (Barrett et al. 2012; Bornstein et al. 2013; Brosch et al. 2007; Caria et al. 2012; Kuo et al. 2012; Laurent & Ablow 2013; Leibenluft et al. 2004; Minagawa-Kawai et al. 2009; Nishitani et al. 2011; Nitschke et al. 2004; Noll et al. 2012; Parsons et al. 2013; Proverbio et al. 2006; Strathearn et al. 2009; Zebrowitz et al. 2009; Weisman et al. 2012; Glocker, Langleben, Ruparel, Loughead, Valdez, et al. 2009; Doi & Shinohara 2012). Also, though not necessarily treated as outcome variables, Sprenglemeyer et al. (2009) and others have

investigated the role sex hormones, specifically oestrogen (Kuo et al., 2012; Sprengelmeyer et al., 2013) and androgen (Leveroni & Berenbaum 1998) play in interest in infants in both women and men. Physiological measures of interest in infants have been able to corroborate many of the findings from previous studies using explicit measures. However, it is worth remembering that even implicit physiological measures such as these are not completely free from issues of validity. The field of neuroscience is still very much in its infancy. As such we cannot be sure we are mapping behaviour and cognition to the appropriate neural correlates. For example, there is some debate regarding the accuracy of BOLD (blood oxygen level-dependent) functional magnetic resonance imaging (fMRI) in representing underlying neuronal activation (Heeger & Ress 2002).

3.1.6 Non-human Primate Comparative

Finally, interest in infants has also been observed through comparative studies using non-human primates, most often rhesus macaques, using similar methods to those outlined above. Maestripieri and Roney (2006) argued that these types of studies are incredibly useful in adding to our knowledge of human behavioural and psychological traits. They highlighted that studying these traits in non-human primates makes it easier to demonstrate potential adaptations. Maestripieri and Roney (2006) state many advantages for comparative studies such as: few changes to the living environments of wild animals compared to humans, strong selection pressure on reproductive behaviour, lack of cultural factors affecting reproductive behaviour, easily measured reproductive success and subsequent correlations with individual differences due to short life spans and more flexibility in terms of possible experimental manipulations. Many of the studies investigating interest in infants in non-human primates have used similar methods to that used in humans. Similar to preference for infant stimuli in humans, preference for non-human primate infant images has been measured via visual gaze duration (Gerald et al. 2006; Sato et al. 2012) as well as behaviour toward images (Waitt et al. 2007). Sex differences in interest in infants have been operationalised using observation of gender stereotyped toy preference and play in rhesus macaques (Hassett et al. 2008). Behavioural measures of infant handling are also a widely used marker of interest infants in the non-human primate literature (Fairbanks, 1990; Herman et al., 2003; Maestripieri, 2005; Silk, 1999). As in humans the effect of sex hormones and the role of neural correlates in terms of interest in infants have also been investigated (Ramirez et al. 2004; Toscano et al. 2009). Again, as with all the measures,

findings in comparative studies must be interpreted with some caution. Although animal models can be useful they are not human models. Some of the advantages listed by Maestripieri and Roney (2006) of using animal models such as, stable living environments and lack of culture, are arguably disadvantages for comparing across species as these factors arguably impact human reproductive strategies.

3.2 Summary of Measures

As highlighted in this review there are multiple approaches but little consensus on the best method or tool to use when investigating interest in infants. Preference and self-report methods have the advantage of being simple and direct measures that require minimal resources. However, some preference measures are relative, not absolute, so any level of interest in infants is only relevant in comparison to other stimuli, usually adult. Also, unlike the scale methods, preference methods are not able to naturally give us a continuous measure of strength of the interest. However, for both preference and self-report methods the participant is required to explicitly express their feelings towards infants. This could motivate some participants to respond in ways contrary to their true feelings, for example, in instances where they want to appear in line with gender norms. Psychophysical and physiological methods measure participants' physical or biological response to stimuli while unaware of experimental hypotheses, thus reducing the likelihood that the participant will (or can) consciously alter their response. As such these methods are thought to measure a participant's true feelings/intentions toward the stimuli. However, because of their inherently indirect nature the accuracy of these methods in measuring the constructs they intend to measure is debateable. This is most notably the case for brain imaging methods such as fMRI. Psychophysical and physiological methods have the advantage of being more tightly controlled with participation often taking place in a lab setting, nevertheless, this means any findings are more difficult to extrapolate to behaviour in the real world. What is more physiological methods can also be resource intensive and costly to run. One method for which poor external validity is not an issue is the behavioural method, which is principally interested in how participants would behave in similar situations in the real world. As well, like preference and self-report methods behavioural methods require fewer resources. Non-human primate studies have given us the opportunity to make more direct links between the interest in infants and advantage for reproductive fitness. Still as with any comparative study ecological pressures are never identical and so caution must be used when interpreting the findings.

Despite the wide variation in methods for measuring interest in infants little consideration had been paid to deconstructing the construct of 'interest' itself. This, however, appears to be changing with some researchers in the area interpreting 'interest' as a response to reward. As such they have focused on two specific facets of reward, 'liking' and 'wanting' (Parsons, Young, Kumari, et al., 2011; Sprengelmeyer et al., 2013; Yamamoto et al., 2009). This definition of reward is based on relatively new neurobiological research suggesting that reward is made up of three components, 'liking' and 'wanting' and 'learning', which have dissociable neural substrates and processes (Berridge & Robinson 2003; Charles et al. 2013). According to Berridge (1999) and Berridge and Robinson (2003) each of these components can be expressed both explicitly and implicitly. If we consider the two components that interest in infants research appears to be focusing on, 'liking' and 'wanting', explicit 'liking' involves conscious pleasure (e.g. subjective rating of pleasure) and implicit 'liking' involves core hedonic impact (e.g. objective affective reactions such as smiling), whilst explicit 'wanting' involves cognitive incentives (e.g. subjective ratings of desire) and implicit 'wanting' involves incentive salience (e.g. attentional capture, approach behaviour). This new approach to investigating interest in infants, that is attempting to first define what we mean by 'interest', is essential in order to design and refine effective methods for investigating this construct.

3.3 STUDY 1: Investigating Methods for Measuring Interest in Infants in a Female Adult Sample

In line with Berridge and Robinson's (2003) research of the parsed components of reward, I aimed to measure interest in infant in terms of 'liking' and 'wanting'. As outlined in Berridge and Robinson's (2003) paper one can also measure 'liking' implicitly and 'wanting' explicitly. For example, implicit 'liking' can be facial expression of the participant upon viewing the stimuli and explicit 'wanting' can be a rating of how much desire the participant has for a certain stimuli. However, measuring participant facial expression upon viewing stimuli would introduce subjectivity (if rated by a researcher) or would be too costly if using an electromyogram and so was not used in this research. Also, because of the similarity in hypotheses between this research and that of Maestripieri et al. (2004) I wanted to use the Preference Task measure used in their study (outlined in detail in the Methods section of Study 1, section 3.3.4.2.3). This measure is an explicit measure of 'liking' or more specifically preference. Thus, I chose to measure interest in infants via explicit 'liking' (i.e. conscious pleasure) and implicit

'wanting' (i.e. incentive salience). Others measuring the construct via 'liking' and 'wanting' have used similar measures (Parsons, Young, Kumari, et al., 2011; Sprengelmeyer et al., 2013; Yamamoto et al., 2009). Below I have outlined multiple methods I used to measure interest in infants in three lab studies. The aim was to explore the correlations between these different methods.

3.3.1 'Liking' Tasks

Maestripieri et al. (2004) investigated the relationship between father absence, menarche and interest in infants in a sample of adolescent girls. To do this they created a Preference Task, which is a forced-choice adult versus infant stimuli paper and pencil task. To my knowledge Maestripieri et al. (2004) are the only group, outside of my research, who have looked at these relationships. Because the wider aim of my research was to investigate similar hypotheses to that of Maestripieri et al. (2004) in a similar participant sample I used the same Preference Task. It could be argued that, unlike a subjective rating of pleasure, choosing preference for infant or adult stimuli is not necessarily an operationalisation of conscious pleasure ('i.e. 'liking'). However, the participant does in a sense rate the relative pleasure of the images by choosing one over the other. Aside from the Preference Task, a simple self-reported rating scale of Fondness for Babies was also included in Study 3 to measure 'liking'.

3.3.2 'Wanting' Tasks

Berridge (1999) proposed that a stimulus with incentive salience was by its nature attractive and desired thus capturing the attention of the viewer. As such I operationalised 'wanting', or incentive salience, for infant stimuli through attention paid to infant and other stimuli. Some popular methods for measuring attention include, but are not limited to, visual attention using eye tracking devices (Duchowski 2007), orienting paradigms such as dot probe tasks (Schmukle 2005) and motivation driven key-press tasks (Parsons, Young, Kumari, et al. 2011; Yamamoto et al. 2009). Some of these methods have been used to measure interest in infants (Yamamoto et al. 2009; Parsons, Young, Kumari, et al. 2011; Brosch et al. 2007). However, I was concerned that a key-press task might confuse our participants, particularly those at the younger end of the age range, which could lead to disengagement with the task; and reliability of dot-probe tasks in non-clinical participants has been contested (Schmukle 2005). Thus I decided to design a tool to measure 'wanting' using an Eye Tracking Task. The Eye Tracking Task measured participants' attentional capture by adult, infant and neutral

stimuli intermixed with performing an unrelated reaction time task. However, I was aware that data collection for my school study (see Chapter 4) would take place in schools, not a laboratory setting, and therefore would require a tool that was easily portable and not costly to run (unlike a mobile eye tracking device). Therefore, I also developed a portable and less resource intensive tool, the Count the Purple Triangles Task that could easily be used in school settings. The Count the Purple Triangles Task was computer based and centred on the idea that certain images (e.g. infants), with incentive salience for the participant, would capture attention more easily than other images (e.g. adults). Because of this greater attentional capture the infant images would be better remembered at a later time.

Study 1 investigated interest in infants using three methods: a paper and pencil based force-choice adult versus infant stimuli task (the Preference Task, (Maestripieri & Pelka, 2002)), an eye tracking task measuring attention via participant eye gaze duration to adult/infant/neutral stimuli and a novel tool measuring attention to and memory for infant and adult stimuli while performing an unrelated task. This study also piloted potential questionnaire items relating to childhood adversity, menarche and reproductive timing to be used in the main school study. The main thesis of my research focused on interest in infants, reproductive and menarcheal timing and childhood adversity in adolescent females, however, I chose to first pilot the tools in an opportunity sample of female undergraduate students. This allowed me to investigate group differences in interest in infants in two age groups, one peripubertal and one post pubertal.

3.3.3 Aims

The aim of Study 1 was to develop the methodology for the school studies reported in chapters 4 and 5. There were three aims to this study: 1) To explore the intercorrelations between and usability of three different methods of measuring interest in infants; 2) To pilot the questionnaire for measuring childhood adversity, intended reproductive timing and menarcheal timing; 3) to explore the relationships between childhood adversity, intended reproductive timing, menarche and interest in infants.

3.3.4 Methods

The study included three interest in infants measures: two computer tasks (i.e. Eye Tracking Task and Count the Purple Triangles Task) and one paper and pencil task (i.e. Preference Task). It also included a questionnaire that collected information on

demographics, family structure, menarcheal, intended reproductive timing, experience taking care of babies and feelings regarding family and childhood neighbourhood.

3.3.4.1 Sample

The participants were recruited from emails sent to female undergraduate students at Newcastle University. In total 47 participants aged 18-25 were recruited. Ethics approval for this study was obtained from the Newcastle University Ethics Committee (see Appendices A & B). Participants were given verbal and written information on the study and the opportunity to ask questions. Participants provided written consent prior to participation.

3.3.4.2 Materials

Computer tasks were programmed using EPrime 2.0 software. The eye tracking was done using Applied Science Laboratories Eye Trac 6 desk mounted device. This device tracked monocular eye movement (i.e. only the right eye was tracked) at 60Hz.

3.3.4.2.1 Questionnaire

For example of this questionnaire please see Appendix E.

Neighbourhood deprivation

Participants provided the postcode for their non-term time home address. The post code was converted into an Index of Multiple Deprivation rank based on the UK government's ranking of deprivation in seven domains (income; employment; health and disability; education, skills, and training; barriers to housing and services; crime; and the living environment) for 32,482 small geographical areas in England and Wales. A rank of 1 indicates the most deprived area in England and Wales while a score of 32482 indicated the least deprived area.

Duration of residence

Participants indicated length of time they had lived their current non-term time residence.

Family Structure

Participants indicated if a mother, father or step-parent lived in the same house as them during three different time periods: birth to five, six to ten and 11-16 years. Participants also indicated the number of brothers, sisters, half/stepbrothers and half/stepsisters they had.

Family Support, Feelings of neighbourhood, Trust in neighbours, Experience with babies

Participants answered the following four questions: 'Growing up, I often did activities with one or both of my parents', 'Growing up, I liked the neighbourhood I live in', 'Growing up, I felt the people in my neighbourhood could be trusted', 'I have a lot of experience taking care of babies' on a seven point scale from 1 'Strongly Disagree' to 7 'Strongly Agree'.

Menarcheal timing

Participants reported the year and month of their first period.

Reproductive timing

Participants reported if they would like to be parents one day and if so the age they would like to be when they had their first child.

3.3.4.2.2 Eye Tracker Task and Count the Purple Triangles Task

For examples of stimuli of the Eye Tracking Task and the Count the Purple Triangles please see Appendices F, G, respectively.

Forty-eight images were taken from a stock photography website (Shutterstock 2014). The images were all professional photographs with similar levels of brightness and contrast. All the face images were facing the camera directly to ensure the entire face was in view. All clothing was cropped out. For women long hair was cropped out.. All adult images were smiling. All baby images had neutral or happy facial expressions. To avoid confounding factors such as skin colour of the participants all human image stimuli were white. Sex of the infants was unknown. Sex of adult images was divided equally across the trials. Because the images were taken from a stock photography website ages of the infant and adult images cannot be exact. However, facial morphology of the infants and adults implied the infants were in the range from three months to one year with adults in the age range of 20 to 45 years.

3.3.4.2.3 Preference Task

For examples of stimuli used in the Preference Task please see Appendix H.

The image stimuli used in the Preference Task were was the same used by Maestripieri and Pelka (2002) and Maestripieri et al. (2004). They consisted of 40 images presented in the following pairs and order: five infant/adult human silhouettes, five infant/adult

animal silhouettes, five infant/adult animal photographs, five infant/adult human photographs.

3.3.4.3 Design

Participants completed Eye Tracking Task, the Count the Purple Triangles Task and the Preference Task in a counterbalanced order. The questionnaire was filled out following completion of the three interest in infants tasks.

3.3.4.4 Procedure

3.3.4.4.1 Eye Tracker Task

The participant was brought into the computer lab and asked to sit on the chair and rest their chin on the chin rest in front of the computer screen. Next the participant's eye gaze was calibrated. After calibration participants were given written instructions on the computer screen prior to beginning the task followed by three practice trials. First a fixation cross appeared on the screen for 1500 milliseconds (ms). After the fixation cross disappeared two images appeared on the left-hand and right-hand sides of the screen for 2500 ms. The images consisted of either a baby face and a flower or an adult face and a flower. This was followed by the letter 'z' or 'm' appearing for 150 ms on either the left or right hand side of the screen (see Figure 3.1). Participants were asked to indicate which letter they saw by pressing the appropriate key on the keyboard. The purpose of the letter pressing task was to keep the participant alert during the trial and was not used as an outcome variable in analysis. There were 48 trials in total that consisted of 24 baby/flower trials and 24 adult/flower trials. The trials were presented in a random order within and across participants. All face and flower images were counterbalanced such that each image was shown on the left and right side of the screen. The outcome variable for the Eye Tracking Task was the duration of time (dwell time) spent viewing the different types of stimuli (i.e. infant, adult, flower).

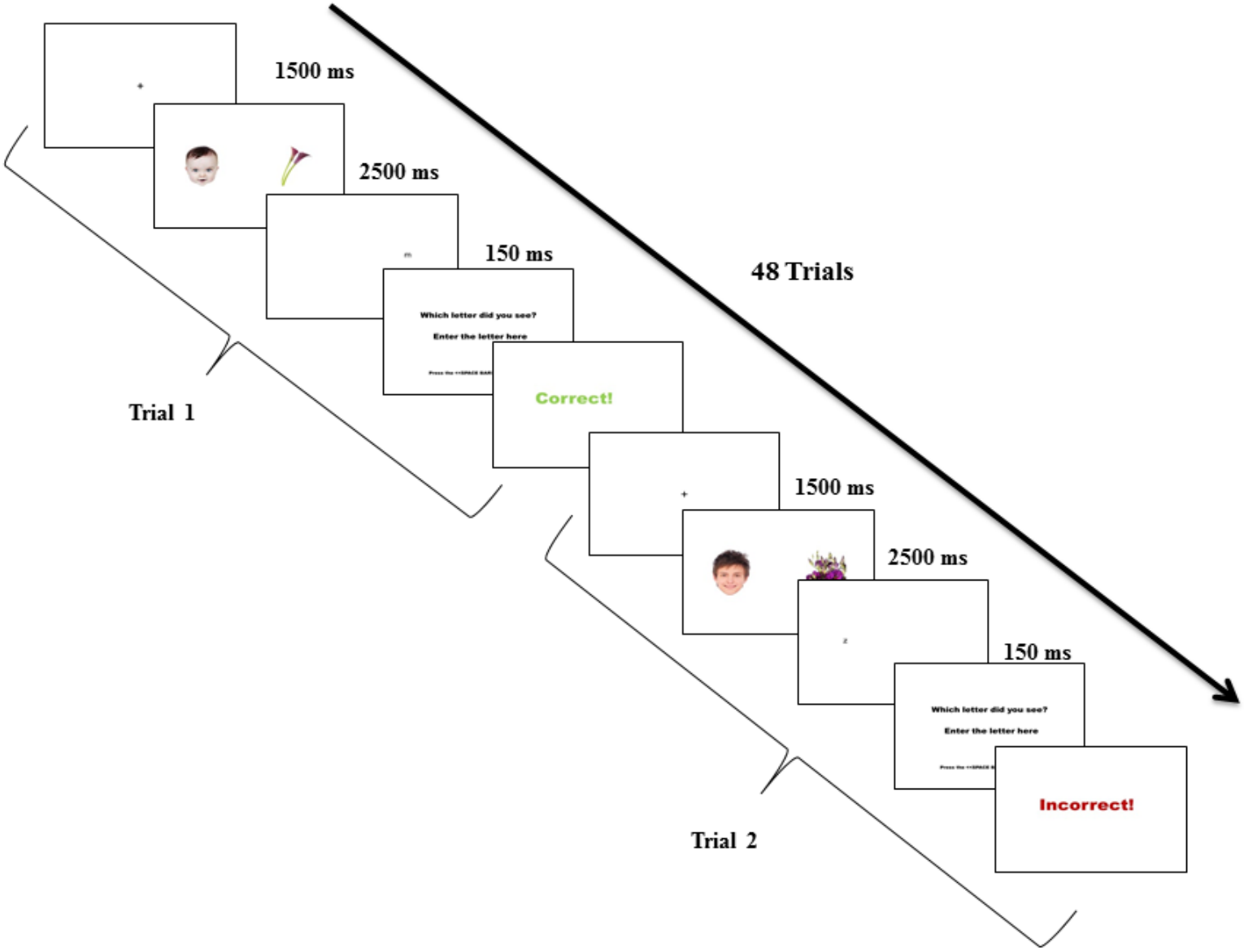

Figure 3.1 Example Eye Tracking Task.

3.3.4.4.2 Count the Purple Triangles Task

The participant was brought into the computer lab and sat in front of the computer screen. Participants were given written instructions on the computer screen prior to beginning the task followed by three practice trials. First a fixation cross appeared on the screen for 1500 ms. Next a baby face or adult face appeared in the centre of the screen surrounded by purple and blue triangles and purple squares. The participants were asked to count the number of purple triangles before pressing the space bar and entering the number. There were 24 trials in total that consisted of 12 infant and 12 adult face images (six of which were male and six female). The number of purple triangles presented ranged from two to seven with their occurrence evenly distributed across baby and adult trials (see Figure 3.2).

After the 24 trials were completed participants were given an unexpected recognition task. This consisted of 12 baby face and 12 adult face images presented on the screen one at a time. Half of the images (six baby, six adults) were presented during the counting phase trials with the other half (six baby, six adults) not previously presented. The participants were asked to indicate whether or not they remembered seeing each face by pressing the 'Y' (Yes) 'N' (No) keys. There were two outcome variables from this task: 1) time taken to count the purple triangles during the initial counting stage of the task and 2) the accuracy for recognising previously presented baby and adult images.

3.3.4.4.3 Preference Task

The participant was brought into a quiet room to complete this task. They were given verbal and written instruction on how to complete the task. Participants viewed the 20 image pairs, which always consisted of a baby versus and adult image. They were asked to indicate which of the images they preferred by ticking the appropriate box on the answer sheet. The outcome variables for the Preference Task were the number of infant and adult images chosen as preferred by the participant across all four categories (i.e. animal photos, animal silhouettes, human photos, human silhouettes).

3.3.4.4.4 Questionnaire

Participants completed the short questionnaire after completing the three interest in infants tasks. Participants were given written and verbal instructions on how to fill out the questionnaire and encouraged to ask any related questions.

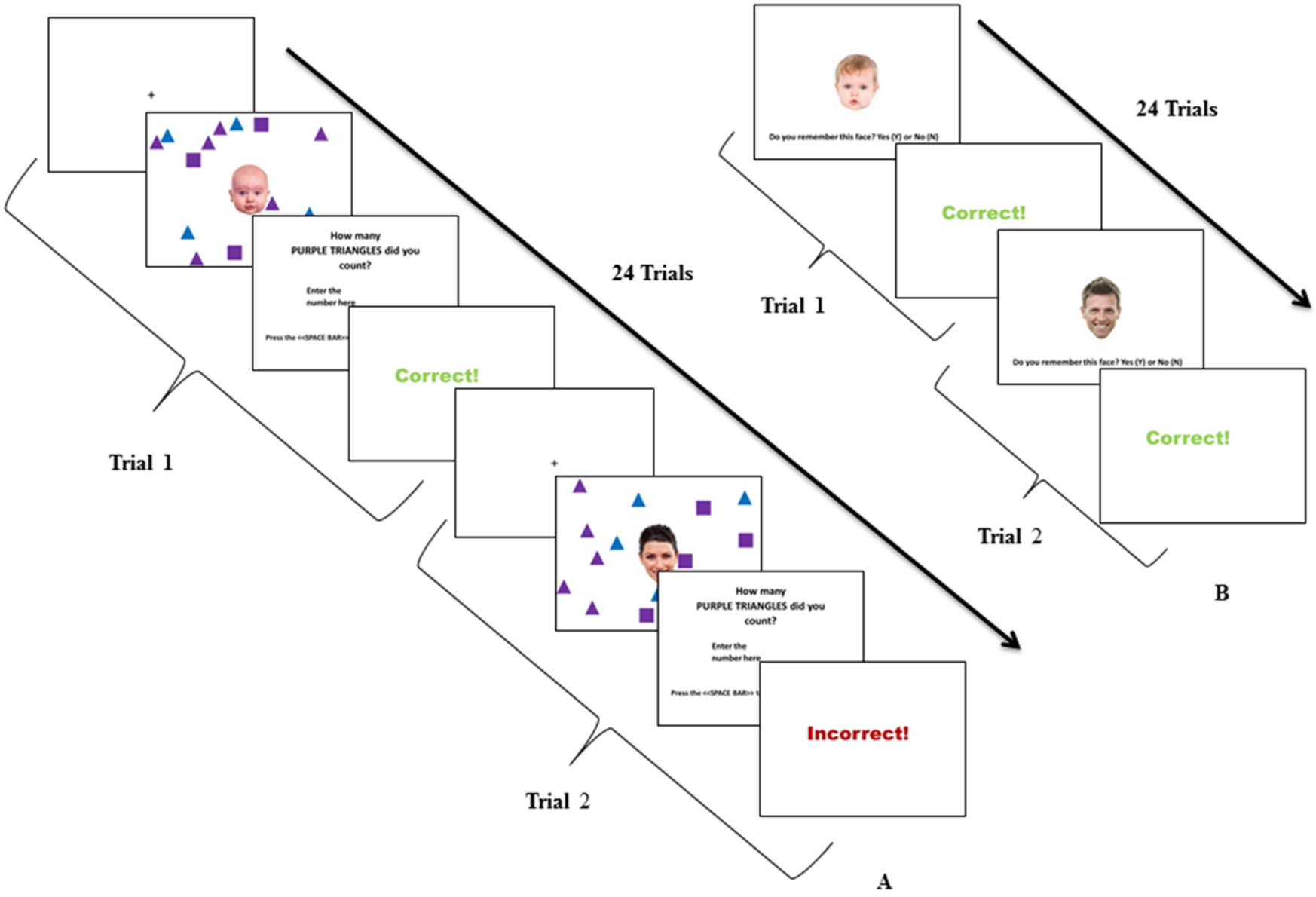

Figure 3.2 Example Count the Purple Triangles Task, A: Counting Phase, B: Unexpected Recognition Phase.

Table 3.1 is a summary table of the various study measures.

3.3.4.5 Data Analysis

For the Eye Tracking Task regions of interest (ROI) were first drawn around each image (i.e. faces, flowers and fixation crosses) using the Applied Science Laboratories analysis software. Duration of eye gaze fixation points within these ROI were used to calculate dwell time (i.e. the average time spent looking at) data for the baby, adult and flower images in milliseconds (ms) for each participant. Because the 2500ms of image presentation included not only attention paid to images but also attention paid to random points on the screen, saccades between images as well as loss of contact with the eye tracker, I wanted to ensure the dwell time data was dependent only on the time spent looking at an image (either the face or the flower images). As such I in order to get a measure of interest in looking at the face images, baby or adult, the time spent looking at the flowers in each trial was subtracted from the time spent looking at the faces. This resulted in a baby dwell time variable and an adult dwell time variable. A difference variable was calculated by subtracting the adult dwell time variable from the baby dwell time variable (ETT:Dwell Time). Thus a negative value for this difference variable indicated longer dwell time for adult images. ROI were also drawn around the fixation crosses for each trial. If there was no eye gaze fixation points in the ROIs around the fixation cross during the final 250 ms before the stimuli presentation then the first 250 ms of eye gaze fixation points for the stimuli presentation was discarded. This was done to avoid inflation of dwell time for baby/adult/flower in the event the participant failed to look at the fixation cross and instead focused on a spot on the screen where a face or a flower would next appear. Also if more than one third of either the infant or adult trials (i.e. more than eight trials) were missing eye gaze fixation point data than that participant was removed from the dwell time analysis.

Two outcome variables were obtained for the Count the Purple Triangles Task. The first was the time spent searching for triangles during the baby and adult trials in milliseconds. Time spent searching while an adult image was on the screen was subtracted from the time spent searching while a baby image was on the screen to give a difference in time variable, (CPTT: Time). Also the participant's accuracy at remembering baby and adult faces was calculated. This was done using a Cohen's kappa score in order to control for accuracy by chance. Again a difference variable was obtained by subtracting adult kappa scores from baby kappa scores (CPTT: Accuracy).

Table 3.1 Summary Table of the Study Measures for Study 1.

Interest in Infants	Childhood Adversity	Intended Reproductive Timing	Puberty Timing
[1]PT:Animal Infant Silhouettes	Neighbourhood Deprivation	Ideal Age at Parenthood	Age at Menarche
[1]PT:Human Infant Silhouettes	[4]Mother Absence zero to five years		
[1]PT:Animal Infant Photographs	[4]Mother Absence six to 10 years		
[1]PT: Human Infant Photographs	[4]Mother Absence 11 to 16 years		
[2]CPTT: Accuracy	[5]Father Absence zero to five years		
[2]CPTT: Time	Father Absence six to 10 years		
[3]ETT: Dwell Time	Father Absence 11 to 16 years		
	[6]Step-Father Presence zero to five years		
	[6]Stepfather Presence six to 10 years		
	[6]Step-Father Presence 11 to 16 years		
	Biological Brothers		
	Biological Sisters		
	Half/Stepbrothers		
	Half/Stepsisters		
	Activities with Family		
	Feelings about Neighbourhood		
	Trust in Neighbours		

[1]PT refers to Preference Task. [2]CPTT refers to Count the Purple Triangles Task. [3]ET refers to Eye-Tracking Task. [4]Mother Absence (all levels): these variables were not used in the final analysis because only 2% had experiences this event. [6]Step-Father Presence zero to five years: this variables not included in final analysis because no participants had experience this event.

In all cases where a difference variable was calculated positive values indicated a relatively increased interest in infant stimuli and negative values indicated a relatively increased interest in adult stimuli.

For the Preference Task there were four outcome variables: number of human baby silhouettes, number of animal baby silhouettes, number of human baby photos and number of animal baby photos chosen as preferred over their adult alternative images.

To obtain a measure of age at menarche the year and month of first period was converted to an age at menarche for each participant.

For this, as well as in Studies 2 and 3, I carried out exploratory parametric paired samples t-tests and correlations were used to analyse potential relationships between childhood adversity, reproductive trajectory and interest in infants. Although the variables 'age' and 'experience taking care of babies' were not childhood adversity variables they were included in analysis that explored childhood adversity. In all instances p values of less than 0.05 were considered statistically significant.

3.3.5 Results

3.3.5.1 Descriptive Data

Descriptive statistics for demographics, ideal age at parenthood and menarcheal age can be found in Table 3.2. One quarter of the sample had a non-term time residence in the 30% most deprived areas of England and Wales. Another quarter of the sample had non-term time address in the 17% least deprived areas of England and Wales. Ninety-six percent (n=45) of the sample had a mother living in the same house as them during the ages of zero to 16 years. The same was true for the sample in the zero to five year category for father presence. However this number fell to 92% (n=43) in the six to 11 year category and 83% (n=39) in the oldest age group. None of the participants had a stepparent living with them in the first five years of life, with one gaining a stepfather during the six to 10 year age group and one gaining a stepfather in the 11 to 16 year category. Of the 92% (n=43) of participants who indicated they would like to have children one day the ideal age ranged from 24 years to 33 years of age. The youngest reported age at menarche was 10.5 years and the oldest was 15.5 years. Biological brothers were the most likely type of sibling amongst participants with 66% (n=31) having at least one brother. Biological sisters were somewhat less common with 55%

Table 3.2 Descriptive Statistics for Demographics, Ideal Age at Parenthood, Menarche for Study 1.

	N	Mean	St Dev.
Age		21.13	1.72
Neighbourhood Deprivation [1]LSOA		19177.36	8772.35
Duration at Residence (years)		12.76	6.89
Ideal age at parenthood (years)		27.94	1.96
Age at menarche (years)		12.85	1.26
Mother Absence (age at occurrence)			
0-5 years	1		
6-10 years	1		
11-16 years	1		
Father Absence (age at occurrence)			
0-5 years	1		
6-10 years	3		
11-16 years	7		
Step Father Presence (age at occurrence)			
0-5 years	0		
6-10 years	1		
11-16 years	2		
[2]Pts with one or more Brother	31		
[2]Pts with one or more Sister	26		
[2]Pts with one or more Half/Stepbrother	8		
[2]Pts with one or more Half/Stepsister	6		

[1]LSOA: Lower Super Output Area. It is an Index of Multiple Deprivation ranking small areas in England and Wales on a scale from 1 (most deprived) to 32,482 (least deprived). [2]Pts refers to participants.

(n=26) of the participants having at least one. Comparatively only 17% (n=8) and 4% (n=6) of the sample had a half/stepbrother or half/stepsister respectively.

3.3.5.2 Interest in Infants

3.3.5.2.1 Eye Tracking Task

Five of the 47 participants were removed from the analysis because they did not reach the criteria of having at least two thirds of their dwell time data for either the infant or adult trials. In total there were 53 instances where dwell time data was discarded because participants failed to look at the preceding fixation cross in the final 250ms of presentation. There was a significant difference in time spent looking at infant (M=677.73, SD=248.17) versus neutral images (M=526.90, SD=225.76), t(41)=3.86, p=0.001 and a significant difference in time spent looking at adult (M=685.37, SD=250.84) versus neutral images (M=524.46, SD=229.21) t(41)=3.98, p=0.001 (see Figure 3.3). However, there was no difference between time spent looking at adult images (M=160.91, SD=261.82) compared to baby images (M=150.82, SD=253.37), t(41)= -0.387, p=0.70 (see Figure 3.4).

3.3.5.2.2 Count the Purple Triangles Task

Participants spent significantly longer counting purple triangles when a baby image was present on the screen (M=1130.93, SD=445.86) compared to when an adult image was present M=1064.39, 429.59), t(46) 2.55, p=0.0 (see Figure 3.5). However, they were more accurate at remembering adult faces (M=0.39, SD=0.36) than remembering baby faces (M=0.08, SD=0.27), t(46)=-5.54,,p=0.001 (see Figure 3.6).

3.3.5.2.3 Preference Task

Participants indicated they preferred images of babies (M=11.38, SD= 3.12), compared to images of adults (M=8.62, SD=3.12), t(46)=3.04, p=.004 . This difference was carried by the animal images as participants preferred these infant images (M=7.38, SD=1.91) more than the adult alternative (M=2.61, SD=1.91), t(46)=8.57, p=0.001. This was not the case for the human images where babies (M=4.00, SD=2.03) were less preferred than adult images (M=6.00, SD=2.03), t(46)=-3.73, p=0.002. For animal images the preference for babies compared to adults was true for the silhouettes (Baby: =3.43, SD=1.08; Adult: M=1.57, SD=1.08), t(46)=5.88, p=0.001 as well as for the photos (Baby: M=3.96, SD=1.18; Adult: M=1.04, SD=1.18), t(46)=8.48, p=0.001.

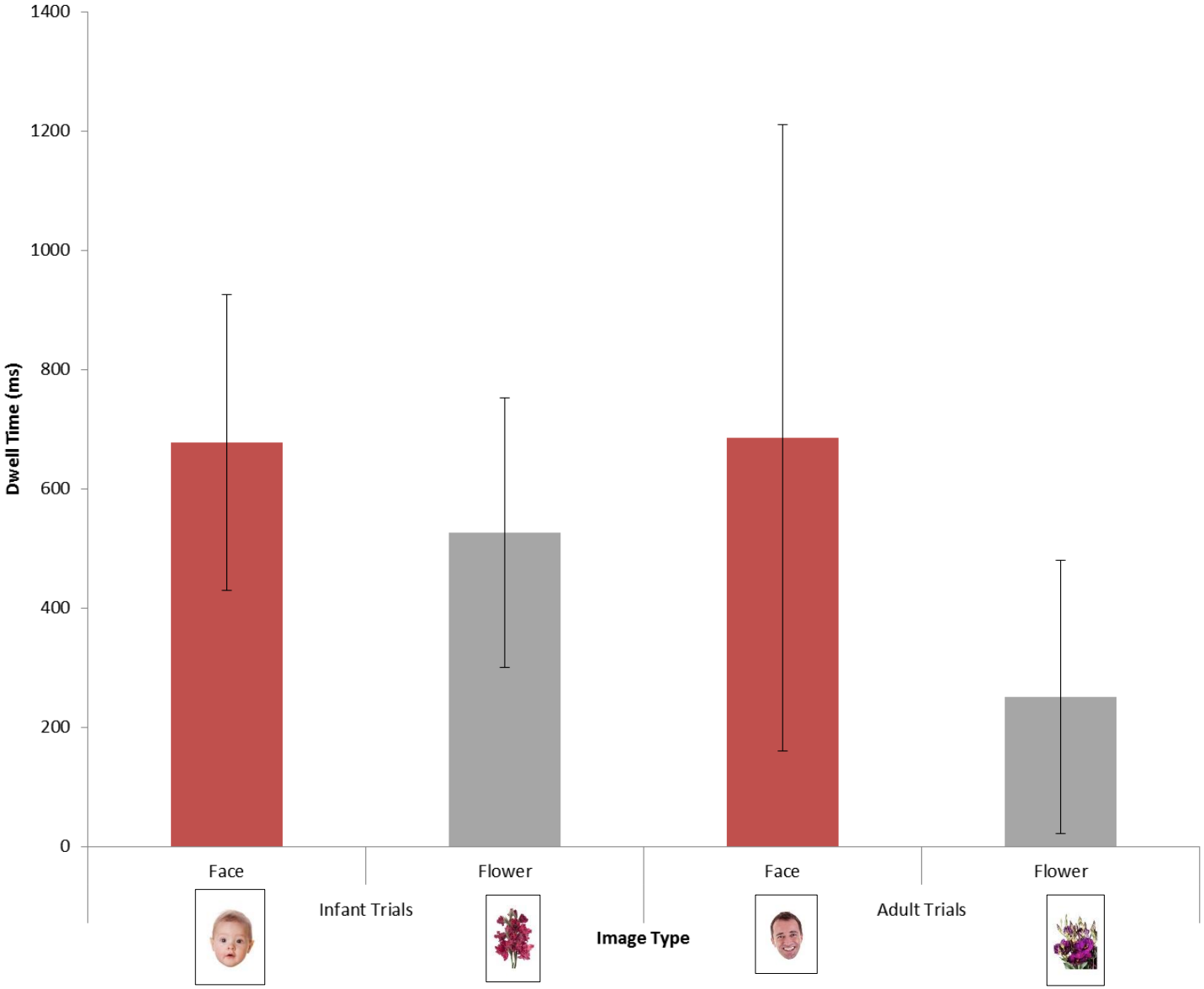

Figure 3.3 Study 1 ETT: Mean Dwell Time for Face and Neutral Stimuli.

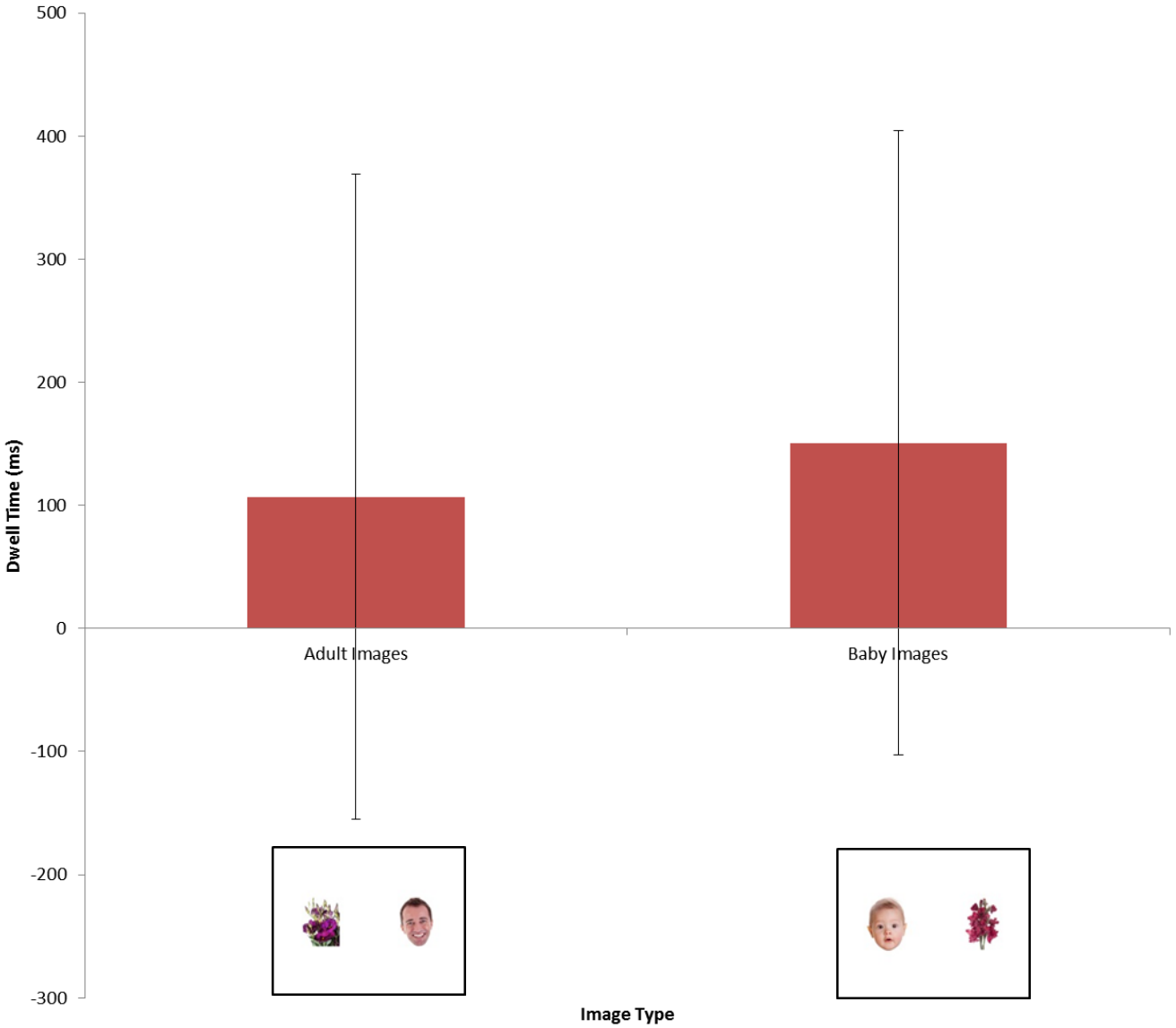

Figure 3.4 Study 1 ETT: Mean Dwell Time for Adult and Infant Stimuli.

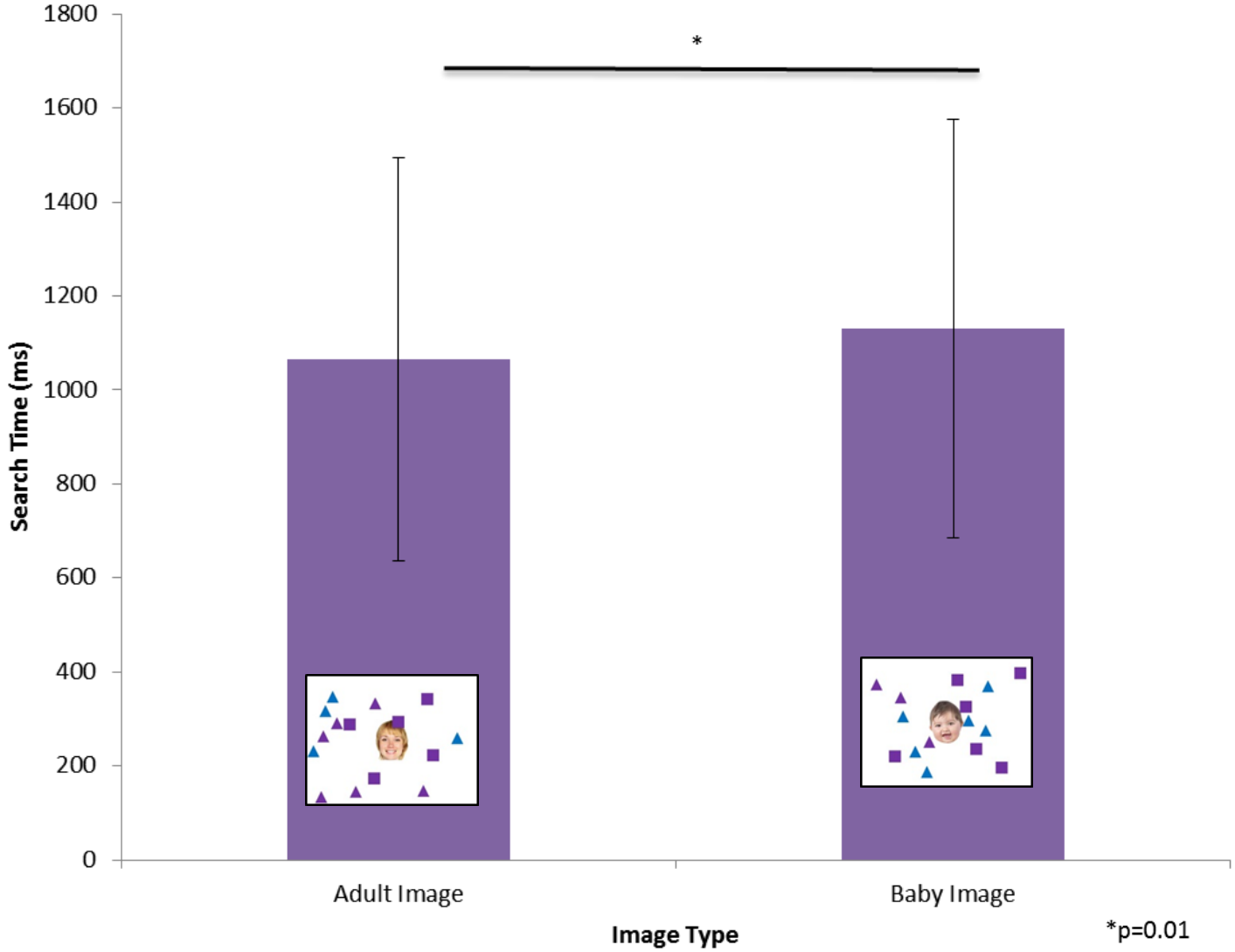

Figure 3.5 Study 1 CPTT: Mean Search Time for Trials with Adult and Infant Images.

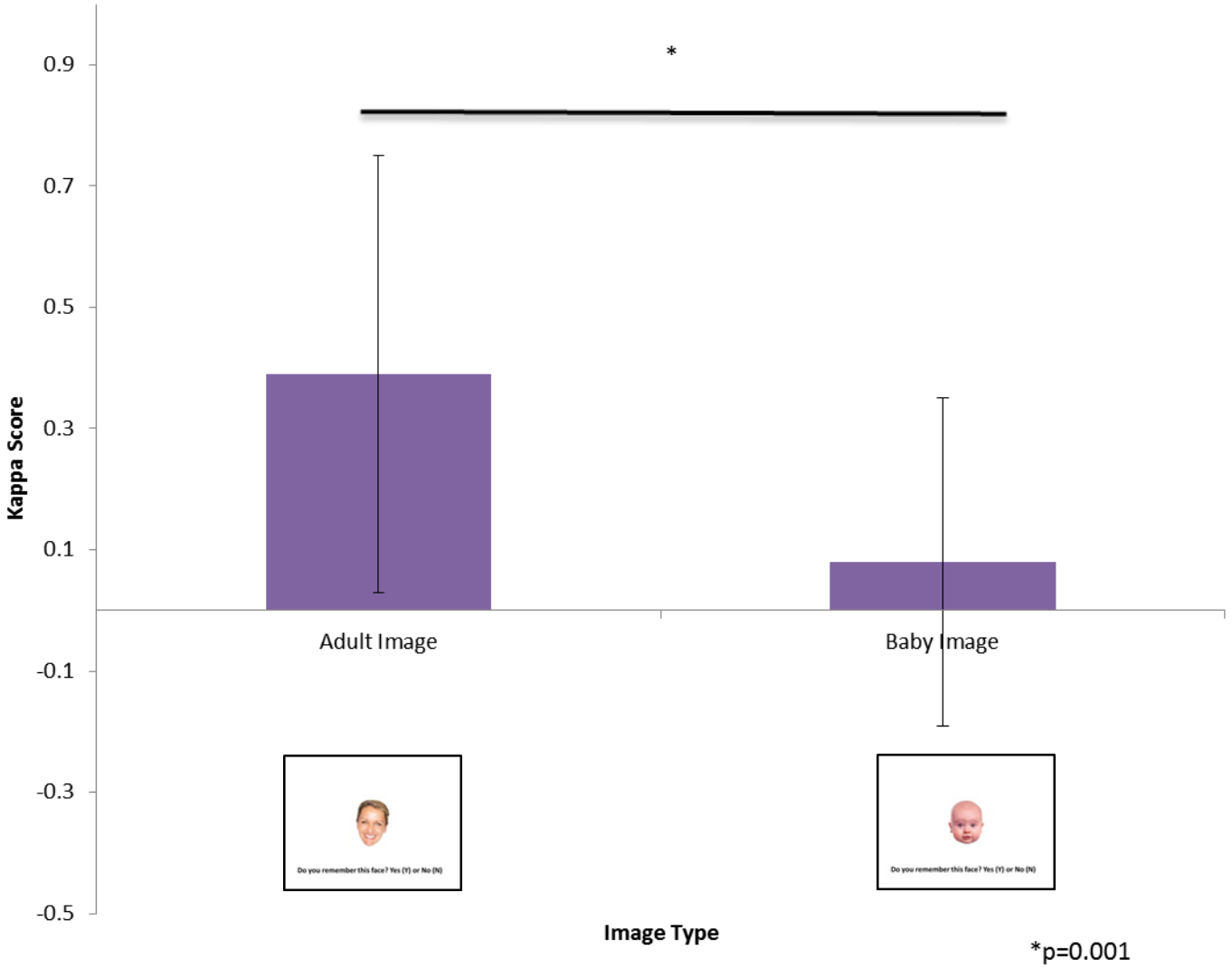

Figure 3.6 Study 1 CPTT: Mean Kappa Scores for Accuracy at Recognising Adult and Infant Images.

However, for the human images a significant difference was found in favour of the adult silhouettes (M=3.17, SD=1.51), compared to the infant silhouettes (M=1.83, SD=1.51), t(46)= -3.05, p=0.004, but there was no significant difference between the human photo images (Baby: M=2.17, SD=1.36; Adult: M=2.83, SD=1.36), t(46)=-1.67, p=0.10, (see Figure 3.7). Participants preferred animal infant silhouettes over human infant silhouettes, t(46)=6.53, p=0.001 and they preferred animal infant photos over human infant photos, t(46)=7.86, p=0.001 (see Figure 3.8).

3.3.5.2.4 Correlations between Interest in Infants Measures

Table 3.3 shows the correlations between the seven measures of interest in infants. Participants who preferred animal infant silhouettes tended to also prefer animal infant photos, r(47)=0.43, p=0.003. Also participants who showed better accuracy at remembering baby images compared to adult images were more likely to prefer human infant photos, r(47)=0.34, p=0.02. It is worth nothing that all other correlations were close to zero or non-significant.

3.3.5.3 Correlations between Childhood Adversity, Menarche and Intended Reproductive timing

Age was related to father absence in the first five years of life, r(45)=0.38, p=0.01, having more half/stepbrothers, r(46)=0.37, p=0.01 and reporting doing less activities with parents during childhood, r(45)=-0.34, p=0.02. Participants with more experience taking care of babies also had more brothers, r(46)=0.45, p=0.002. Most of the significant relationships between the childhood adversity variables were related to family structure. Father absence at zero to five years was related to father absence at six to 10, r(46)=0.56, p=0.001 and at 11 to 16 years, r(46)=0.35, p=0.02 and a higher incidence of half/stepsister, r(46)=0.37, p=0.01 as well as a report of fewer activities with parents in childhood, r(46)=-0.41, p=0.004. Father absence at six to 10 years was related to father absence at 11 to 16 years, r(46)=0.62, p=0.001. Father absence in this middle age group (six to 10 years) as well as in the older age group (11 to 16 years) were both related to stepfather presence at six to 10 years, r(46)=0.56, p=0.001 (middle), r(46)=0.35, p=0.02 (older) and at 11 to 16 years, r(46)=0.38, p=0.01 (middle), r(46)=0.50, p=0.001 (older). Additionally father absence at 11 to 16 years was related to an increase in number of half/stepsisters, r(46)=0.38, p=0.01. Stepfather presence at six to 10 years was related to stepfather presence at 11 to 16 years, r(46)=0.70, p=0.001.

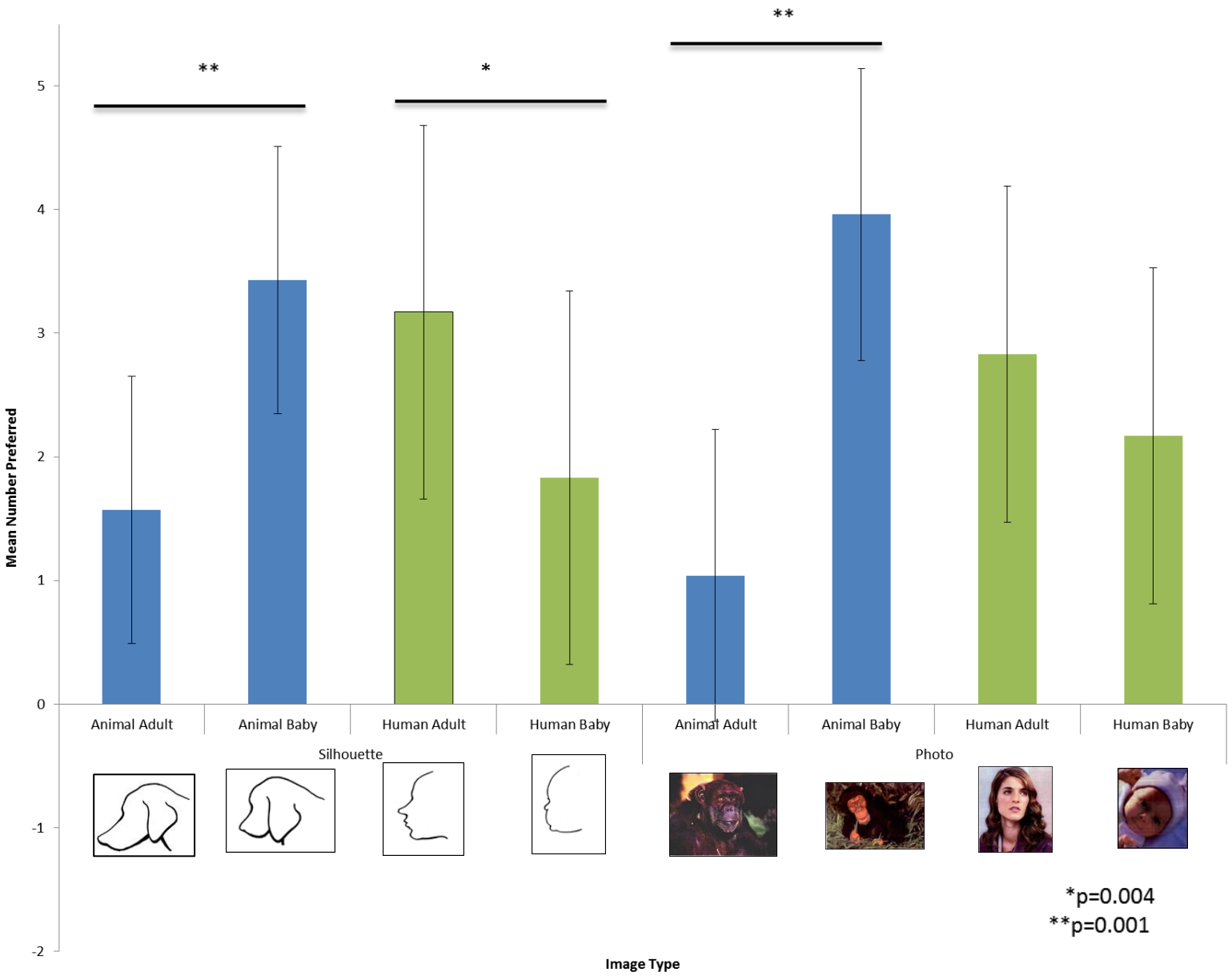

Figure 3.7 Study 1 PT: Mean Number of Adult and Infant Images Chosen as Preferred.

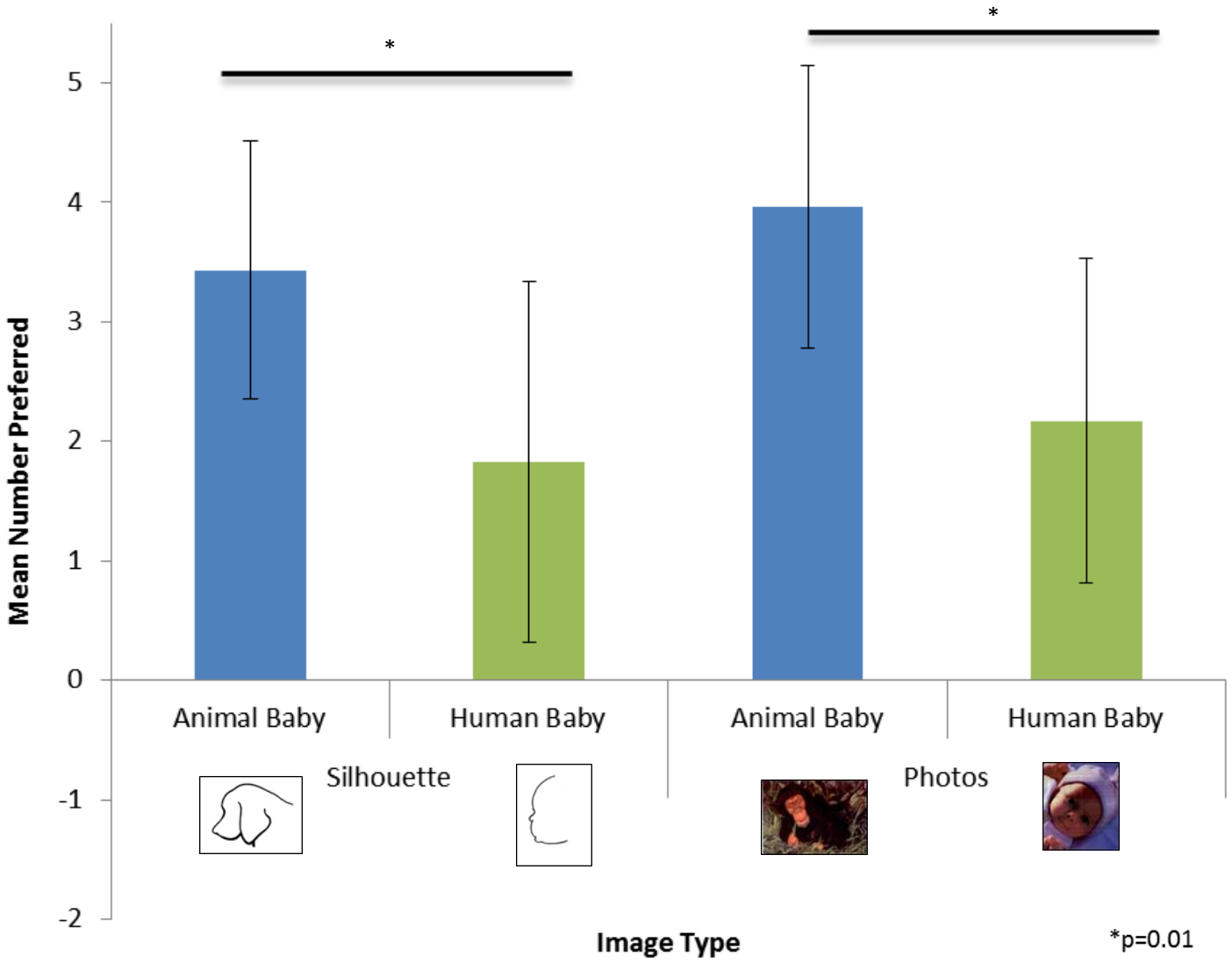

Figure 3.8 Study 1 PT: Mean Number of Animal and Human Infant Images Chosen as Preferred.

Table 3.3 Correlations between the Interest in Infants Measures for Study 1.

	PT Human Infant Sil	PT Animal Infant Sil	PT Human Infant Pho	PT Animal Infant Pho	CPTT Accuracy	CPTT Time
[1]PT Animal Infant Sil	0.19					
[1]PT Human Infant Pho	0.00	0.26				
[1]PT Animal Infant Pho	-0.07	0.43**	0.25			
[2]CPTT Accuracy	-0.12	0.03	0.34*	0.19		
[2]CPTT Time	0.07	-0.01	0.06	0.14	-0.16	
[3]ET Dwell Time	0.05	0.25	0.22	0.20	-0.06	-0.26

*p<0.05
**p<0.01
[1]PT refers to Preference Task. [2]CPTT refers to Count the Purple Triangles Task. [3]ET refers to Eye-Tracking Task.

Stepfather presence at 11 to 16 years was related to an increased number of half/stepbrothers, r(46)=0.30, p=0.04 and an increase in half/stepsisters r(46)=0.53, p=0.001. Having more stepbrothers was related to having more stepsisters, r(47)=0.37, p=0.01. Taking part in fewer activities with parents during childhood was related to an earlier age at menarche, r(46)=0.35, p=0.02. Finally there was a non-significant trend toward earlier menarche in participant with more half/stepsisters (47)=-0.30, p=0.05. There was no relationship between menarche and ideal age at parenthood, r(38)=-0.052, p=0.76.

The participants had no difficulty in answering the questionnaire items. However, because the questionnaire would subsequently be used in a younger sample (in Study 3 & 4) some of the questions were modified to reflect the age of the participant. As well additional items measuring childhood adversity were added. These items were based on those previously used in the literature to measure similar constructs. These changes are outlined in detail in the Methods section Study 3, section 3.5.3.2.2..

3.3.5.4 Correlations between Interest in Infants, Childhood Adversity, Menarche and Intended Reproductive Timing

Table 3.4 shows the relationships between interest in infants, childhood adversity, menarche and intended reproductive timing as well as two control variables, age (in months) and experience taking care of babies. Interest in infants was related to age, experience taking care of babies, as well as father absence between six and 10 years. Women who were younger in age at the time of data collection showed higher preference for animal infant photos, r (46)= -0.38, p=0.01 and had longer dwell time for infant images in the Eye Tracking Task, r(41)=-034, p=0.03. Women with more experience of taking care of babies showed a higher preference for human infant photos r(46)=0.39, p=0.01. As well women who had experienced father absence between the ages of six to 10 years spent longer counting purple triangles during infant trials in the CPTT , r(46)=0.34, p=0.02.

3.3.6 Discussion

The aims of Study 1 were to explore the intercorrelations between and the usability of the three different methods for measuring interest in infants, to pilot questionnaire items for measuring relationships between childhood adversity, reproductive and menarcheal timing as well as exploring possible relationships between these variables and interest in

Table 3.4 Correlations between the Interest in Infants Measures, Childhood Adversity, Intended Reproductive Timing and Menarche for Study 1.

	[1]PT Human Infant Sil	[1]PT Animal Infant Sil	[1]PT Human Infant Pho	[1]PT Animal Infant Pho	[2]CPTT Accuracy	[2]CPTT Time	[3]ET Dwell Time
Age	0.01	-0.22	0.01	-0.40**	0.17	-0.16	-0.34*
[4]Exp with Babies	-0.05	0.23	0.39**	-0.17	0.10	-0.18	0.30
Neighbourhood Deprivation [5]LSOA	-0.12	0.06	-0.05	-0.01	0.03	0.20	0.16
Father Absence (0-5years)	0.21	-0.22	0.09	-0.28	-0.08	0.12	-0.01
Father Absence (6-10years)	-0.03	-0.12	0.29	-0.01	-0.15	0.34*	0.02
Father Absence (11-16years)	0.04	0.04	0.02	-0.06	-0.27	0.18	-0.07
Stepfather Presence (6-10years)	-0.08	0.08	0.09	0.13	-0.12	-0.01	0.03
Stepfather Presence (11-16years)	-0.12	0.21	0.05	0.00	-0.03	-0.10	-0.01
Biological Brothers	-0.10	0.00	0.25	-0.02	0.02	-0.04	0.04
Biological Sisters	0.03	0.11	0.04	-0.02	0.22	0.04	-0.01
Half/Stepbrother	0.10	-0.06	-0.05	0.02	-0.03	0.03	-0.17
Half/Stepsister	-0.04	0.00	-0.02	-0.23	0.09	-0.02	-0.13
Activities with Parents	-0.12	0.01	-0.16	0.07	-0.17	-0.03	0.01
Feelings about Neighbourhood	-0.01	-0.05	0.08	-0.17	0.02	-0.03	0.12
Ideal Age at Parenthood	-0.16	-0.20	-0.16	0.02	0.04	0.09	-0.17
Age at Menarche	-0.14	0.10	-0.11	-0.01	-0.03	-0.12	0.05

*p<0.05
**p≤0.01
[1]PT refers to Preference Task. [2]CPTT refers to Count the Purple Triangles Task. [3]ET refers to Eye-Tracking Task. [4]Exp with Babies is the variable 'Experience Taking Care of Babies'. [5]LSOA: Lower Super Output Area. It is an Index of Multiple Deprivation ranking small areas in England and Wales on a scale from 1 (most deprived) to 32,482 (least deprived).

infants. There were few correlations between and within the interest in infants measures. Participants' accuracy for remembering infant faces in the Count the Purple Triangles Task was positively related to their preference for human infant photos in the Preference Task. Within the Preference Task participants who preferred images of animal infant silhouettes also preferred images of animal infant photos. Younger women in the sample showed higher interest in infants compared to older women. Specifically they preferred animal infant photos to animal adult photos and they had longer dwell time for infant stimuli during the Eye Tracking Task. Participants who had more experience taking care of babies showed higher preference for human infant photos in the Preference Task compared to participants with less infant caretaking experience. Participants who experienced father absence in late childhood (six to 10 years) took longer to count purple triangles, during the Count the Purple Triangles Task, while an infant image was presented on the screen compared to when an adult image was presented. Few relationships were found between childhood adversity variables. Father absence was stable across childhood, such that if father absence occurred in one age group it tended to also occur in subsequent age groups. Unsurprisingly, father absence was also related to stepfather and half/stepsibling presence. Participants who reported father absence in the first five years of life also reported doing fewer childhood activities with family. Taking part in fewer childhood activities was also related to early menarche.

Despite including many of the same childhood adversity factors as studies investigating similar relationships with menarche and reproductive timing (for references see literature review, Chapter 2) only one variable, fewer childhood activities with parents, was related to earlier menarcheal timing. It is possible this lack of relationship between childhood adversity and reproductive timing could be because previous studies (see Chapter 2 for references) investigating antecedents of reproductive timing, with the exception of Nettle et al. (2010a), were retrospective. Because of the age group and current life circumstances in my sample (i.e. most were university students in their early twenties) none of the participants were mothers and therefore reproductive timing had to be treated as prospective with participant's stating an ideal age at parenthood. Although fairly good accuracy has been found between intended and actual reproductive timing (Nettle et al. 2010a) it is not a perfect measure of future behaviour. Similar to Maestripieri et al.'s (2004) findings participants in our sample with father absence showed increased interest in infants. However, this relationship was found using the

Count the Purple Triangles Task and not Maestripieri et al.'s Preference Task. As well, this relationship was only found for participants who had experienced father absence in late childhood. Maestripieri et al.'s (2004) study does not specify the timing of father absence, which could be important.

In measuring interest in infants I attempted to tap into the conscious pleasure, 'liking', and incentive salience, 'wanting', facets of reward as outlined by Berridge and Robinson (2003). To measure 'liking' I used the Preference Task which has been used previously by Maestripieri et al.(2004) and Maestripieri and Pelka (2002) to measure participant's preference for infant or adult stimuli. Overall participants preferred infant stimuli to adult stimuli but this was specifically the case for animal silhouettes, animal photos and human silhouettes. There was no difference in preference when it came to human photos. To measure 'wanting' I used two tasks created for this study. The first was the Count the Purple Triangles Task where participants were given an unexpected recognition task for adult and infant faces viewed previously during an object search task. Participants took longer to count purple triangles when an infant face was presented on the screen, however, they showed better accuracy for remembering adult faces in the unexpected recognition part of the task. The second was the Eye Tracking Task where participants performed an unrelated reaction time task between viewing images of adult or infant faces paired with a neutral object (flowers) displayed on a computer screen while their eye gaze duration was measured. During the Eye Tracking task participants showed no difference in time spent looking at images of infants or adults, although they spent longer looking at face images compared to the neutral flower image.

Deconstructing interest into its proposed features of reward, (i.e. 'liking' and 'wanting'), is becoming more popular in the interest in infants literature (Parsons, Young, Kumari, et al., 2011; Sprengelmeyer et al., 2013; Yamamoto et al., 2009). When trying to isolate 'wanting' these studies have used key-press tasks to measure motivation to view an image. However, it is debateable whether this method is actually implicit. In this type of task participants are told that images will appear on the screen and they can extend or decrease the viewing time of images by pressing specific keys on a computer keyboard. Thus participants are aware that their actions are not only representative of their preference for certain images but that they are also being measured via key-presses. Just as rating scales are vulnerable to social desirability bias so too is the key-press task, although perhaps not as overtly. Therefore, in Study 1 I

attempted to design tools that were implicitly measuring 'wanting'. Study 1 was the first time these tools have been used. The Count the Purple Triangles Task had somewhat conflicting results with participants spending longer searching for and counting purple triangles during infant trials but showing increased accuracy for adult trials. Nonetheless, this indicated that the tool was measuring some form of interest in, or at the very least distractibility of, the target images. However, this was not the case with the Eye Tracking Task. This tool showed no difference between eye gaze duration for adult or infant images. It is possible that this was a true reflection of participants' interest in the images, i.e. that they were equally interested infant and adult images. . However, it was possible that the eye tracking data was biased by participants employing a saccade strategy in order to perform better on the letter identification part of the task. Participants thought the aim of the Eye Tracking Task was to accurately identify which letter was presented during a trial. The letter was presented very briefly (150ms) in the screen space previously occupied by either the adult/infant image or the neutral image on the left and right side of the screen. Thus it is possible that participants were quickly and repeatedly moving their eyes from the left to right side of the screen in an attempt to see the letter before it disappeared. Because of this potential bias I modified the Eye Tracking Task and tested the original and a modified version on a new sample of participants. The methods and results of this study are outlined in Study 2.

Measuring interest in infants using the three methods outlined above appears to be feasible, at least in this adult population. Participants were able to complete all the tasks by following the instructions and without help from myself. There were few correlations between the measures, however these did at least go in the expected directions (i.e. increased interest in infants in one measure was related to increased interest in infants in another measure). The Eye Tracking Task did not show any differences in interest in infant or adult stimuli. As outlined above this could be due to the design of the task. As such I have modified this task in Study 2. Participants had no problems in completing the questionnaire however some of the items were modified for use with a younger sample in Study 3.

3.4 Study 2: Pilot Study to Test Two Designs for the Eye-Tracking

3.4.1 Introduction

I was concerned that the design of the eye-tracking task was not ensuring that interest in the target images (infant/adult faces and flower) was being accurately captured. The participants were told the purpose of the task was to indicate which letter appeared on the screen (i.e. the letter 'z' or 'm'). The letter in each trial was presented in the place previously occupied by one of the images (i.e. adult/infant/flower) immediately after the disappearance of the target image from the screen. It is possible that in an attempt to correctly identify the letters at the end of each trial, participants were employing strategies of rapid saccades between the two images. Therefore the eye gaze data might not be an accurate measurement of interest in the target images but may instead be a by-product of this strategy. As a solution to this problem the Eye Tracking Task was redesigned with a fixation cross appearing for 1500ms after the disappearance of the target images. The extra fixation cross was added to allow the participants a break between looking at the images (the behaviour I was actually interested in measuring) and seeing/responding to the letter presentation. I hoped that this would increase the likelihood that any eye gaze data collected during the image presentation was indicative of interest in the images rather than a by-product of a strategy. As well I decided that the length of presentation of the images should be increased from 2500ms to 3000ms accord with other eye tracking studies.

Because this was a small modification to the Eye Tracking Task and I wanted to quickly determine if the modification was appropriate I again used an opportunity sample of adult females.

I predicted that the participants would spend a larger proportion of the potential viewing time for stimuli looking at the images (adult, infant or flower) in the new version of the Eye Tracking Task compared to the original version. This was because less time in the new version of the task should be taken up by saccades between the two images. Also because the new version of the task should be a truer measure of attention paid to the different target images and because females tend to have a high interest in infants (see Chapter 2 for references), I predicted that participants would have longer average gaze duration for infants in the new version of the task compared to the original version of the task.

This study only focused on testing the new and original versions of the Eye Tracking Task. As such the other interest in infants measures were not included nor did the participants fill out the questionnaire.

3.4.2 Aims

The aim of this study was to trial a new version of the eye-tracking task, which included an extra fixation cross, and a longer presentation time of the target images.

3.4.3 Methods

3.4.3.1 Sample

Sixteen female participants, aged 21- 35, were recruited from Newcastle University. This study received ethical approval from the Newcastle University Ethics Committee (see Appendices A & B).

3.4.3.2 Materials and Stimuli

The materials and stimuli were the same used in the initial study for the Eye Tracking Task (for details see Methods section of Study 1).

3.4.3.3 Design

Each participant completed the original version of the eye tracking task which had only one fixation cross as well as the new version of the eye tracking task which included an extra fixations cross and a longer image presentation time (3000ms instead of 2500ms). The order of completion of the eye tracking tasks was counter balanced across participants.

3.4.3.4 Procedure

The procedure for completing the original Eye Tracking Task was the same as the procedure for completing the Eye Tracking Task outlined in the Study1. The procedure for completing the new eye tracking task differed from the original eye tracking task in two ways, 1: the presentation of the target images was increased from 2500ms for 3000ms, and 2: a second fixation cross was presented for 1500ms after the disappearance of the target images form the screen but before the letter presentation. See Figure 3.9.

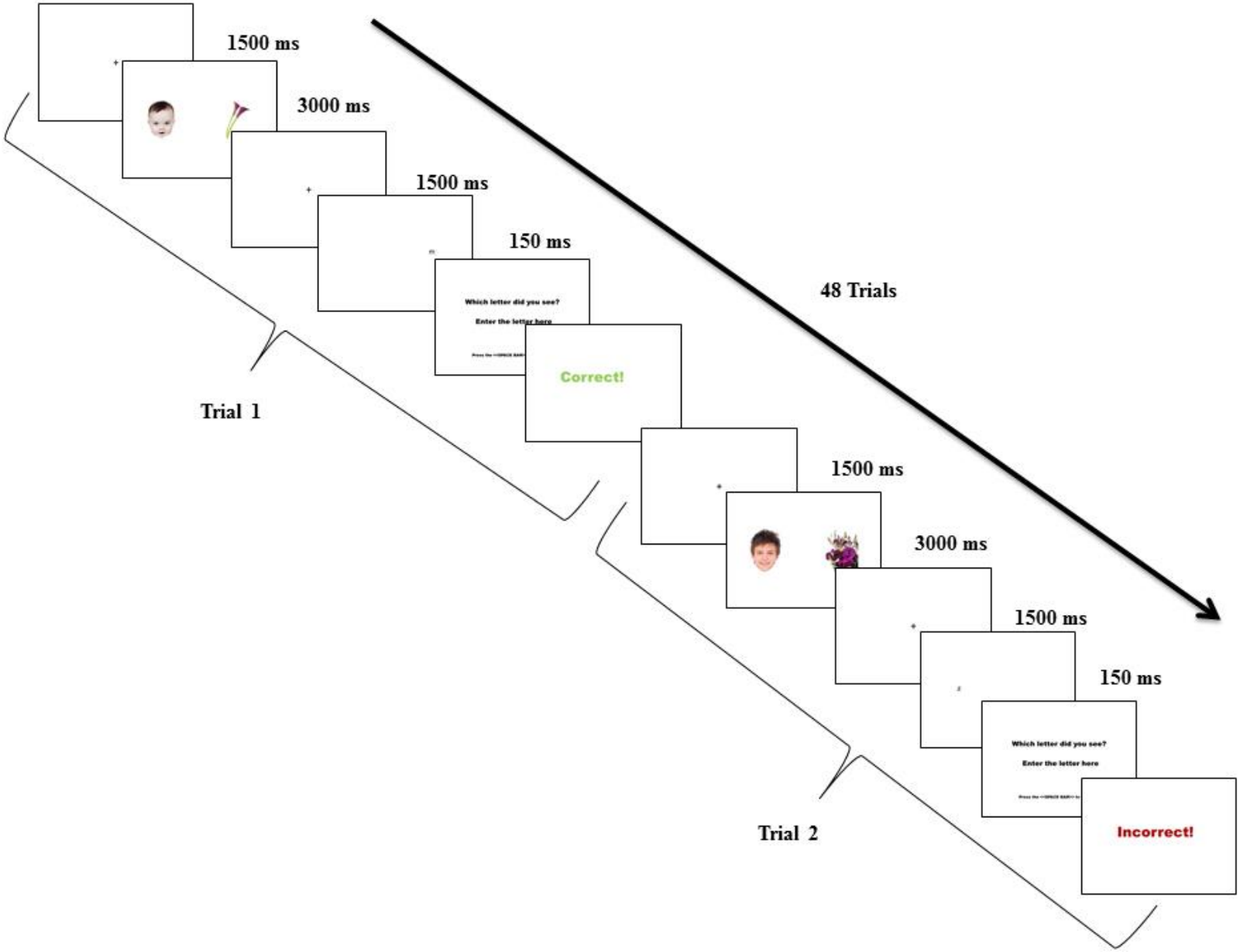

Figure 3.9 Example Modified Eye Tracking Task.

3.4.3.5 Data Analysis

The proportion of total time spent looking (dwell time) at the images (infant, adult and flowers) was calculated for the original and new versions of the Eye Tracking Tasks. A proportion of time equal to one would indicate the participant only looked at one of the images and nothing else during its presentation on the screen. The total proportion of dwell time on images in the original Eye Tracking Task was compared to the total proportion of dwell time on images in the new Eye Tracking Task using a paired samples t-test. The average time in milliseconds (ms) spent looking at infant versus adult images was calculated for both the original and new versions of the Eye Tracking Task. Because the 3000ms of image presentation included not only attention paid to images but also attention paid to random points on the screen, saccades between images as well as loss of contact with the eye tracker, I wanted to ensure the dwell time data was dependent only on the time spent looking at an image (either the face or the flower). As such in order to get a measure of interest in looking at the face images, baby or adult, the time spent looking at the flowers in each trial was subtracted from the time spent looking at the faces. This resulted in a baby dwell time variable and an adult dwell time variable. A paired samples t-test was then used to determine if participants spent more time looking at infant versus adult images in the original or new Eye Tracking Task. Within image category dwell time was tested by comparing the average time (ms) spent looking at adult images in the original Eye Tracking Task versus the average time (ms) spent looking at adult images in the new Eye Tracking Task using a paired samples t-test. The same test was also performed to compare the average time (ms) spent looking at baby images in both versions of the Eye Tracking Task. Finally between image category dwell time was tested by comparing the average time (ms) spent looking at infant/adult versus flower images in the original and the new Eye Tracking Tasks using paired samples t-tests.

As described in the Study 1 (see Study 1 Data Analysis, section 3.3.4.5) the first 250ms of eye gaze fixation points during the stimuli presentation was discarded if the participant failed to look at the preceding fixation cross for the final 250ms of its presentation. Also, as in Study 1 any participants missing more than one third of their eye gaze fixation point data for either the infant or adult trials were omitted from the analysis.

In all instances a $p < 0.05$ was considered significant.

3.4.4 Results

Of the 16 participants three were excluded from the analysis because two did not meet the criteria for having eye tracking data for at least two thirds of their trials due to the eye tracker losing their pupil coordinates and one had revealed after completing both the original and new versions of the pilot study that she thought the purpose of the experiment was to try and avoid looking at the images thus she consciously focused her gaze in the centre of the screen for the entire experiment.

For the original Eye Tracking Task there were two instances where the first 250ms of dwell time was omitted from the analysis due to the participant's failure to look at the fixation cross in the final 250ms of the fixation cross presentation. For the new version of the eye tracking task there were seven instances where the first 250ms of dwell time data was omitted from the final analysis for this reason.

3.4.4.1 Comparison of the Proportion of Time Spent Viewing Images

There was a non-significant trend towards participants spending a larger proportion of the time looking at the images during the new version of the Eye Tracking Task (M=0.51, SD=0.17) compared to the original version of the Eye Tracking Task (M=0.44, SD=0.12), t(12)= 2.06, p=0.06.

3.4.4.2 Comparisons of the Time Spent Looking at Images within Categories

There was no difference in time spent viewing infant (M=132.03, SD=267.81) versus adult (M=85.29, SD=249.38) images during the original version of the Eye Tracking Task, t(12)=1.31, p=0.22. For the new version of the Eye Tracking Task there was a non-significant trend towards viewing images of infants (M=203.71, SD=380.02) longer than images of adults (M=68.87, SD=299.78), t(12)=2.02, p=0.07. There was no difference in time spent looking at adult images in the original version of the Eye Tracking Task compared to the new version, t(12)=-0.31, p=0.77. Likewise there was no difference in time spent looking at baby images in the original version of the Eye Tracking Task compared to the new version, t(12)=1.06, p=0.31.

3.4.4.3 Comparisons of the Time Spent Looking at Images between Categories

In the original version of the Eye Tracking Task there was no difference in time spent looking at infant images (M=625.12, SD=280.12) compared to flower images (M=493.09, SD=75.01), t(12)1.78, p=0.10. There was also no difference in time spent

looking at adult images (M=590.28, SD=270.36), compared to flower images (M=504.98, SD=88.89), t(12)=1.23, p=0.24.

In the new version of the Eye Tracking Task there was no difference in time spent looking at infant images (M=886.69, SD=461.12) compared to flower images (M=682.98, SD=193.89), t(12), 1.93 p=0.08. There was also no difference in time spent looking at adult images (M=769.29, SD=304.46), compared to flower images (M=700.42, SD=194.31), t(12)=0.83, p=0.42.

3.4.5 Discussion

Although it did not meet the cut off (p=0.05) for statistical significance the inclusion of the second fixation cross did appear to increase the proportion of time participants spent looking at the images in general (i.e. infant, adult or flowers). It is possible that this was due to less time being spent in saccade between images in an attempt to correctly identify the subsequent letter before it disappeared. Also this finding was based on data from just 12 participants thus a larger sample might have produced a significant result. The second analysis comparing time spent looking at infant versus adult faces in both the original and the new version of the Eye Tracking task provided additional support for the new version. Participants showed no difference in time spent looking at adult versus infant images in the original Eye Tracking Task but there was a difference, albeit non-significant (p=0.07), for an increase in time spent looking at infant compared to adult images in the new task. There was also no difference in time spent looking at infant/adult versus flower images in either the original or the new Eye Tracking Task. Again it could be argued that these findings are largely due to the small sample size.

Despite only modest support for the new version of the Eye Tracking Task I felt it was still best to use this new version of the task in Study 3. Had the sample size been larger there would have been greater power to find significant results. Also it made intuitive sense to isolate the image presentations between two fixation crosses (as in the new version). This would both enable the participant to freely view the images without employing a saccade strategy as well as provide a warning (i.e. fixation cross) that the letter identification task was about to commence. Thus the original version of the Eye Tracking Task was replaced with the new version in Study 3.

3.5 Study 3: Investigating Methods for Measuring Interest in Infants in a Female Adolescent Sample

3.5.1 Introduction

The purpose of this study was to investigate different methods for measuring interest in infants in an adolescent female sample. I felt it was important to use this sample, as it would match the sample of participants in my main school school study, in terms of age. For this study participants completed the same Preference Task and Count the Purple Triangles Task used in Study 1. However, this Study 3y varied from Study 1 in three ways : it used the new version of the Eye Tracking Task (for reasons outlined in the discussion of Study 2), it included an additional measure of interest in infants, namely a single questionnaire scale item measuring self-report Fondness for Babies and it used a modified version of the original questionnaire.

The additional measure of interest in infants was added because it was a very simple way to measure participants' conscious pleasure, or 'liking', of infant stimuli as discussed in this chapter's introduction. As such it meant that this study now included an equal number of measures (two each) attempting to isolate the 'wanting' and 'liking' facets of reward, in relation to interest in infants.

The modified questionnaire contained many of the same variables used in the original questionnaire with some of the wording or structure changed. The wording for the measures of neighbourhood deprivation, menarche timing and intended reproductive timing were changed slightly to reflect the age group of the sample, for example participants were asked about current postcode rather than the postcode for their 'non term time' residence. To accommodate the young age of participants in the sample the family structure questions were simplified and no longer included time categories for parental absence but instead asked the participant to indicate, if applicable, her age at parental absence. The feelings about family and childhood neighbourhood items were replaced with two more comprehensive scales used by others (Nettle & Cockerill 2010; Elliott et al. 1985). Because there has been some evidence linking early sexual initiation (South et al. 2005) and early childbearing (Crowder & Teachman, 2004; as reviewed in Ellis, Figueredo, Brumbach, & Schlomer, 2009; Nettle et al., 2010b) with residential instability a frequency of residential relocations item was also included on the questionnaire.

3.5.2 Aims

The aims of this study were:1) to explore intercorrelations between different measures of interest in infants, which included the use of the new Eye Tracking Task and a self-reported fondness for babies scale in a population similar to the main study population ,2) to pilot use of the modified questionnaire, 3) to explore the relationships between childhood adversity, intended reproductive timing, menarche and interest in infants,

3.5.3 Methods

3.5.3.1 Sample

Girls aged nine to 14 years were recruited from primary and secondary schools in North Tyneside as well as through the Institute of Neuroscience, Newcastle University volunteer database. In total 48 girls participated in the study. This study received ethical approval from the Newcastle University Ethics Committee (see Appendices A & B). Prior to commencing this research I obtained an Enhanced Criminal Records Certificate from the Enhanced Criminal Records Bureau (see Appendix D). Because of the young age the participant they were required to be accompanied to the lab with a parent or guardian. Once in the lab the parent/guardian and participant were given written and verbal information on the study. Written parental/guardian consent and participant assent was obtained prior to participation in the study.

3.5.3.2 Materials and Stimuli

3.5.3.2.1 Interest in Infants

The Count the Purple Triangles Task and the Preference Task were the same used in Study 1. The Eye Tracking Task was the new version of the Eye Tracking Task outlined in Study 2. A self-reported Fondness for Babies item was added to the questionnaire. This question asked participants to rate, ‘How much do you like babies?’ from 1 (not at all) to 7 (very much).

3.5.3.2.2 Questionnaire

For example of this questionnaire please see Appendix I.

Neighbourhood Deprivation.

Neighbourhood deprivation was measured as the rank of the Index of Multiple Deprivation score of area of residence, identified using postcode of residence. Index of

Multiple Deprivation is a small-area based marker of deprivation calculated using a range of measures in seven domains (income; employment; health and disability; education, skills, and training; barriers to housing and services; crime; and the living environment) and is the UK government's preferred marker of deprivation (DCLG, 2011). All small areas, referred to as Lower Super Output Areas (LSOA), in England and Wales are ranked from 1 (most deprived) to 32,482 (least deprived).

Residential Relocations.

Participants reported the number of times they had moved house.

Family Structure.

Parental and stepparental residence in the home was reported along with age, if applicable, at parental separation. In line with Draper and Harpending (1982), who proposed that the first five years of life were particularly sensitive to father absence, I created the Timing of Father Absence variable. For consistency I also created the Timing of Mother Absence variable. Stepfather presence was derived indirectly, such that those participants who reported father absence as well as stepparent presence in the home were recorded as having a stepfather living at the same residence. Total number of biological brothers and sisters as well as half/stepbrothers and half/stepsisters were also reported.

Family Support.

This scale captured the extent to which participants felt their parent(s) cared for their well-being. The scale was modified from the Family Stress Scale (Mikach 1999) as used by Nettle and Cockerill (2010) with a scale reliability of α=0.78. It included five questions (e.g. 'My father is always there when I need him') measured on a seven-point scale ('1 Strongly Disagree' to '7 Strongly Agree'). Scores were summed for analysis and higher scores indicated stronger feelings of family support.

Perceived Neighbourhood Safety and Quality.

The perceived neighbourhood safety and quality scale measured feelings of safety and exposure to delinquent behaviours in the neighbourhood (e.g. 'Most adults in my neighbourhood respect the law') using eight items from the 18 item Neighbourhood Environment Scale (Elliott et al. 1985). Participants indicated how true each statement was for them (e.g. 'Not at all true', 'A little true', 'Sort of true', 'Very true'). Responses were summed, with higher scores indicative of better perception of neighbourhood. These eight items were the same used by Bass and Lambert (2004) who originally modified the 18 item Neighbourhood Environment Scale to study perceptions of

neighbourhood disorder and disadvantage in an adolescent population. Bass and Lambert's scale included two additional items relating to drug use in the neighbourhood but I chose not to include these items because of the young age of the participants in my studies.

Intended Reproductive timing

Participants were asked to circle 'Yes' or 'No' to the following questions: 'Would you like to have children one day?' then, 'If you answered yes, How old would you like to be when you have your first child? Participants wrote down their desired age at first birth in the space provided. Reported ideal age at parenthood has been shown to be an accurate prospective measure of actual age at parenthood in a sample of 16 year old females (O.R. 5.39; 95% CI 3.71 to 7.83) (Nettle et al. 2010a).

Measure of Menarcheal Timing

Participants reported if they had begun menstruating. If so they reported either the month and year or their age in years and months at first menstruation.

A summary of the study measures can be found in Table 3.5.

3.5.3.3 Design

As in Study 1 participants filled out the three tasks in a counterbalanced order with the questionnaire always being filled out at the end.

3.5.3.4 Procedure

The procedure for this study was the same as that used in Study 1.

3.5.3.5 Data Analysis

All the data were analysed according to the same criteria outlined in Study 1.

3.5.4 Results

3.5.4.1 Descriptive Data

The descriptive statistics along with ideal age at parenthood and menarcheal status can be found in Table 3.6. One quarter of the participants lived in the 10% most deprived areas in England and Wales with half of the participants living in areas that were categorised as within the 30% most deprived.. The final quarter of participants lived in the 14% most affluent neighbourhoods. Participants had moved house anywhere from

Table 3.5 Summary Table of the Study Measures for Study 3.

Interest in Infants	**Childhood Adversity**	**Intended Reproductive Timing**	**Puberty Timing**
Self-Report fondness for babies.	Neighbourhood Deprivation [4]LSOA	Ideal Age at Parenthood	Age at Menarche
[1]PT:Animal Infant Silhouettes	Residential Relocations		
[1]PT:Human Infant Silhouettes	[5]Timing of Mother Absence		
[1]PT:Animal Infant Photographs	[6]Timing of Father Absence		
[1]PT: Human Infant Photographs	Stepfather Presence		
[2]CPTT: Accuracy	Biological Brothers		
[2]CPTT: Time	Biological Sisters		
[3]ET: Dwell Time	Half/Stepbrothers		
	Half/Stepsisters		
	Family Support		
	Perceived Neighbourhood Safety and Quality		

[1]PT refers to Preference Task. [2]CPTT refers to Count the Purple Triangles Task. [3]ET refers to Eye Tracking Task. [5]LSOA: Lower Super Output Area. It is an Index of Multiple Deprivation ranking small areas in England and Wales on a scale from 1 (most deprived) to 32,482 (least deprived). [5]Timing of Mother Absence was not used in the final analysis because only 4% (n=3) had experienced this event. [6]Timing of Father Absence has two categories, zero to five years and six to 14 years

Table 3.6 Descriptive Statistics for Demographics, Ideal Age at Parenthood, Menarche for Study 3.

			Range	
Study Measures		Mean (St. Dev)/ (N)	Min	Max
	Age (years)	11 (1.6)	9	14
[1]Childhood Adversity				
	Neighbourhood Deprivation	15005.36 (11928.56)	236	32282
	[2]LSOA Residential Moves	2.36 (2.48)	0	11
	[3]Age at Mother Absence	7.00 (6.25)	0	12
	[4]Age at Father Absence	4.38 (3.15)	0	10
	Biological Brother	[5](n=25)	0	3
	Biological Sister	[5](n=22)	0	4
	Half/Stepbrother	[5](n=9)	0	4
	Half/Stepsister	[5](n=10)	0	2
	[6]Family Support	28.52 (5.71)	8	35
	[7]Perceived Neighbourhood Safety and Quality	26.32 (3.80)	18	32
Intended Reproductive Timing				
	Ideal Age at Parenthood	25.86 (4.65)	18	39
Menarche				
	Age at Menarche (years)	11.59 (2.12)	8.06	14.41

[1]Childhood Adversity: Timing of Father Absence and Step Father Presence are not included in this table because they are categorical variables. They are discussed in the text of the Results section. [2]LSOA: Lower Super Output Area. It is an Index of Multiple Deprivation ranking small areas in England and Wales on a scale from 1 (most deprived) to 32,482 (least deprived).[3]Age at Mother Absence: the age at which mother stopped living in the same residence as participant (n=3).[4]Age at Father Absence: the age at which father stopped living in the same residence as participant (n=16).[5] n= the number of participants who have one or more of this type of sibling. [6]Family Support: the minimum possible score was 5 and the maximum was 35, higher scores indicate more positive feelings of family support. [7]Perceived Neighbourhood Safety and Quality: the minimum possible score was 8 and the maximum was 32, higher scores indicate more positive perceptions of neighbourhood.

zero to 11 times in their lives. Of those it was marginally most common for the participant to never have moved house in her life (25%, n=12). However 52% (n=25) had relocated anywhere from one to four times and 17% (n=8) had relocated five or more times. Only 4% (n=2) of the sample did not have a mother living in the same home as them. One participant was five years or younger at the time of mother absence and two participants were six to 14 years at the time of mother absence. (Please note that although two participants stated their mother no longer lived in the same house, three participants stated an age at mother absence). Father absence was more prevalent with 38% (n=18) of the sample living without their biological father in the same house.

Sixty-three per cent (n=10) of these fathers became absent from the home when their daughter was five years of age or younger with 37% (n=6) leaving when the girls were in the older age category. Almost a third (27%, n=5) of the sample whose fathers were absent had a stepfather living with them. Having at least one or more siblings was most often the case, 85% (n=41), for the participants. Of these more than three quarters (n=37) of the participants had at least one or more biological siblings with nearly a third (n=14) having at least one or more half/stepsibling. The majority, 79% (n=38), of the participants indicated that they would like to be a parent one day. Desired age of parenthood ranged from 18 to 39 years. Only 21% (n=10) of the sample had experienced menarche. Of the post menarcheal girls, onset occurred anytime between eight and 14 years of age.

3.5.4.2 Interest in Infants

3.5.4.2.1 Eye Tracking Task

Of the 48 participants seven were omitted from all analysis that included eye tracking data because they had more than one third of their eye tracking trials missing. In total 95 fixation points of data from the first 250ms of the target presentation were discarded in the trials because the participant failed to look at the fixation cross in the final 250ms of its presentation. There was no difference in time spent looking at baby images (M= 182.29, SD= 200.62) as compared to adult images (M=138.35, SD= 235.61), $t(40)=1.41$, $p=0.17$, (see Figure 3.10). There was a significant difference in time spent viewing infant images (M=865.31, SD=262.98) compared to flower images (M=684.37, SD=257.96), $t(40)=5.75$, $p=0.001$. There was also a significant difference in time spent viewing adult images (M=807.12, SD=279.19) compared to flower images (M=668.77, SD=251.92), $t(40)=3.76$, $p=0.001$(see Figure 3.11).

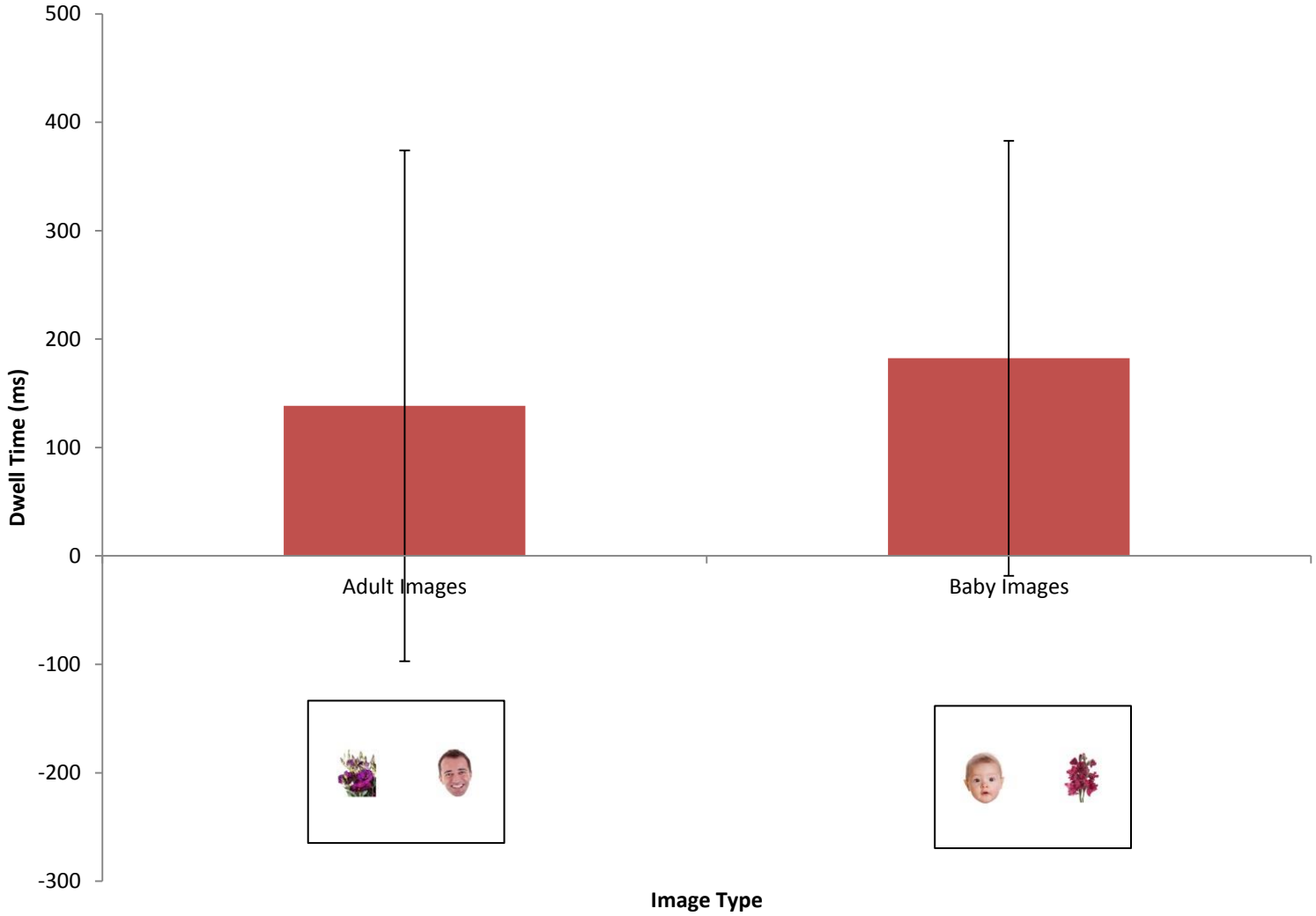

Figure 3.10 Study 3 ETT: Mean Dwell Time for Adult and Infant Stimuli.

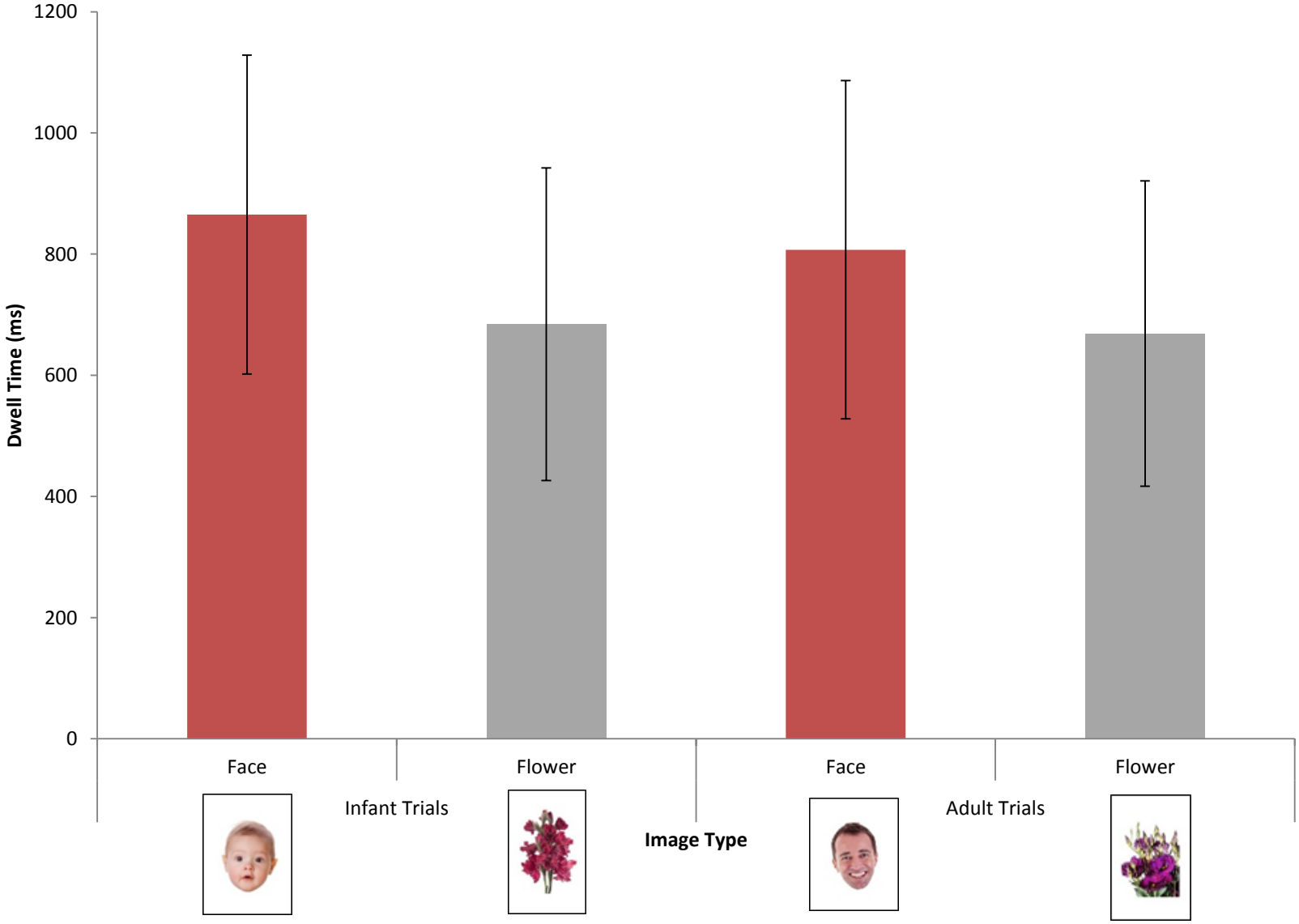

Figure 3.11 Study 3 ETT: Mean Dwell Time for Face and Neutral Stimuli.

3.5.4.2.2 Count the Purple Triangles Task

Participants spent longer searching for the purple triangles during infant trials (M=1236.59, SD=679.04) compared to the adult trials (M=1104.32, SD=460.51), t(47)=2.12, p=0.04, (see Figure 3.12). However, participants were more accurate at remembering the adult faces (M=0.37, SD=0.30) than they were at remembering the infant faces (M=0.18, SD=0.17), t(46)=4.37, p=0.001, (see Figure 3.13).

3.5.4.2.3 Preference Task

Overall participants indicated a higher preference for infant stimuli (M=12.39, SD=3.61) as compared to adult stimuli (M=7.61, SD=3.61) in the Preference Task, t(47)= 4.58, p=0.001. Indeed this was still the case for the animal images overall with a higher preference for infant animals (M=7.49, SD= 1.94) rather than adult animals (M=2.51, SD=1.94), t(47)=8.87, p=0.001. This was not the case for human images where there was no difference between preference overall for infant (M=4.90, SD=2.33) or adult (M=5.10, SD=2.33), t(47)=-0.31, p=0.76. This lack of significant difference for the human images was driven by the discrepancy in participants' preference between the silhouettes and the photos. Participants preferred images of human adults when it came to the silhouettes (baby: M=1.46, SD=1.52; adult: M=3.54, SD=1.52; t(47)=-4.76, p=0.001) but preferred images of human infants when it came to the photos (baby: M=3.44, SD=1.53; adult: M=1.56, SD=1.53; t(47)=4.25, p=0.001). In terms of the animal stimuli participants preferred the infants images over the adult images in both the silhouette trials (baby: M=3.44, SD=1.25; adult: M=1.56, SD=1.25; t(47)=5.18, p=0.001), and in the photo trials (baby: M=4.05, SD=1.09; adult: M=0.95, SD=1.09, t(47)=9.84, p=0.001, (see Figure 3.14). Participants preferred animal infant silhouettes over human infant silhouettes, t(47)=8.77, p=0.001 and they preferred animal infant photos over human infant photos, t(47)=2.45, p=0.02, (see Figure 3.15).

3.5.4.2.4 Self-Reported Fondness for Babies

Using the seven point scale from 1(not at all) to 7 (very much), participants reported high feelings of fondness for babies, M= 5.46 SD= 1.77.

3.5.4.2.5 Correlations between Interest in Infants Measures

The correlations between the measures of interest in infants can be seen in Table 3.7. Participants who preferred animal infant silhouettes tended to prefer animal infant

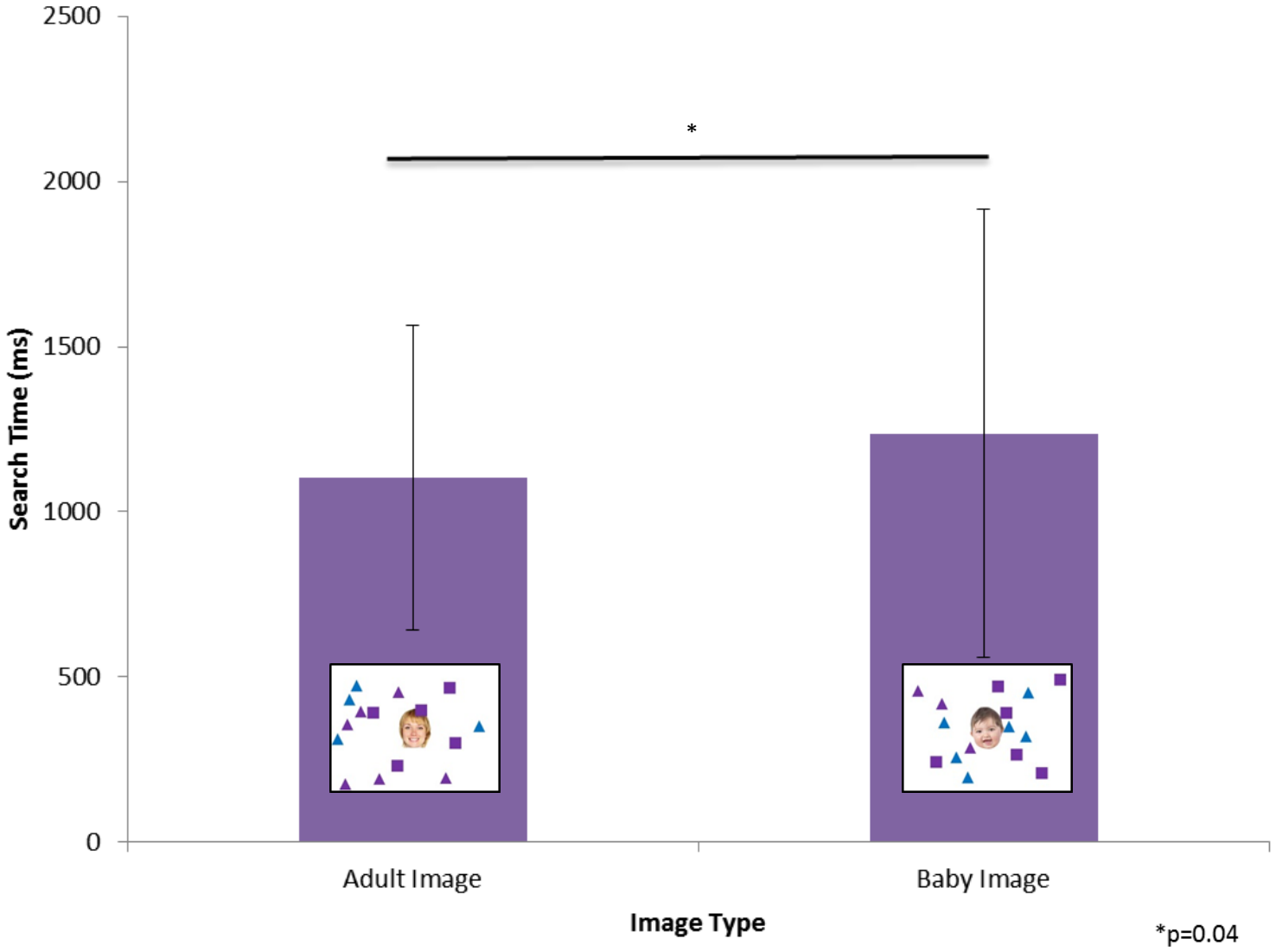

Figure 3.12 Study 3 CPTT: Mean Search Time for Trials with Adult and Infant Images.

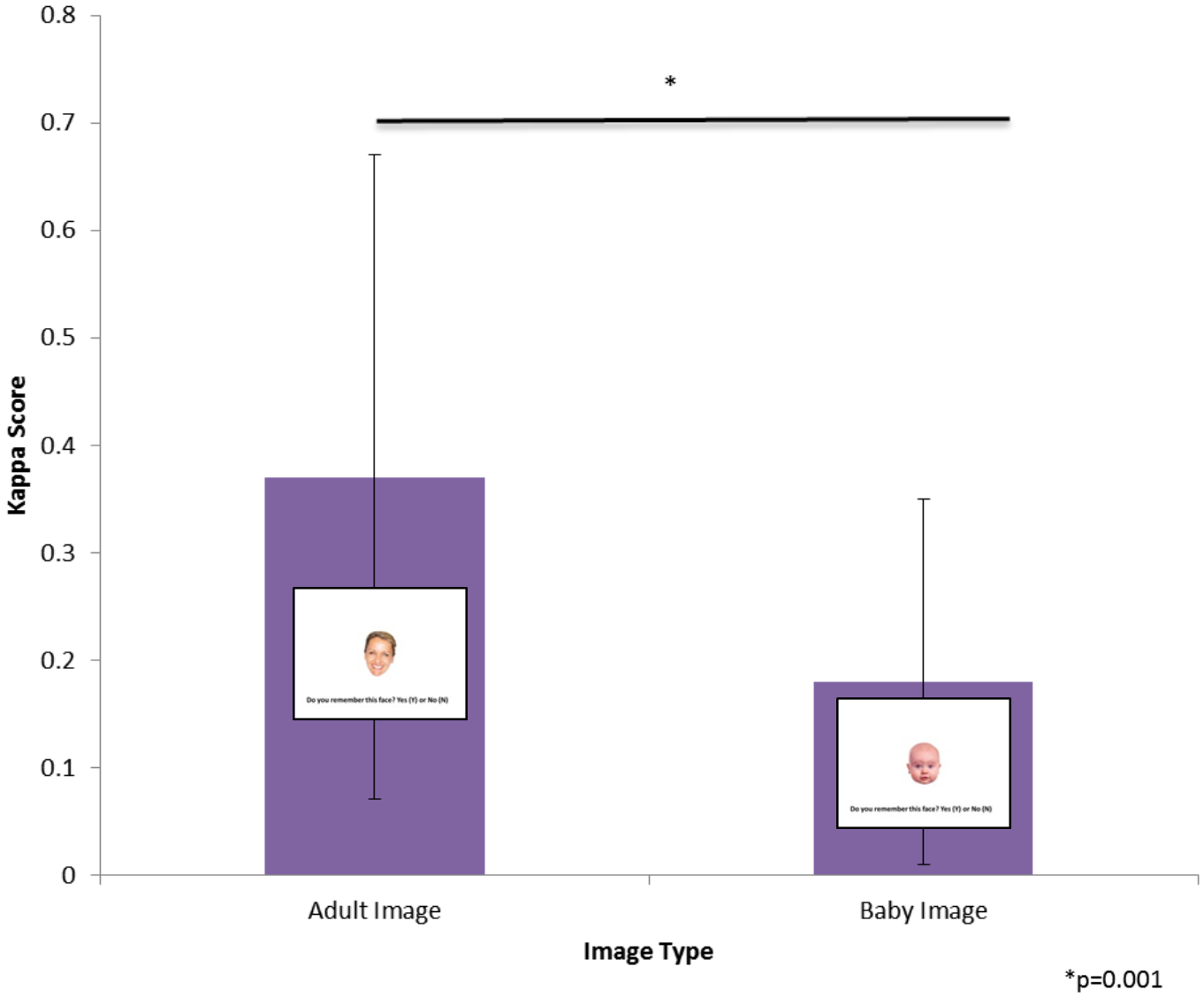

Figure 3.13 Study 3 CPTT: Mean Kappa Scores for Accuracy at Recognising Adult and Infant Images.

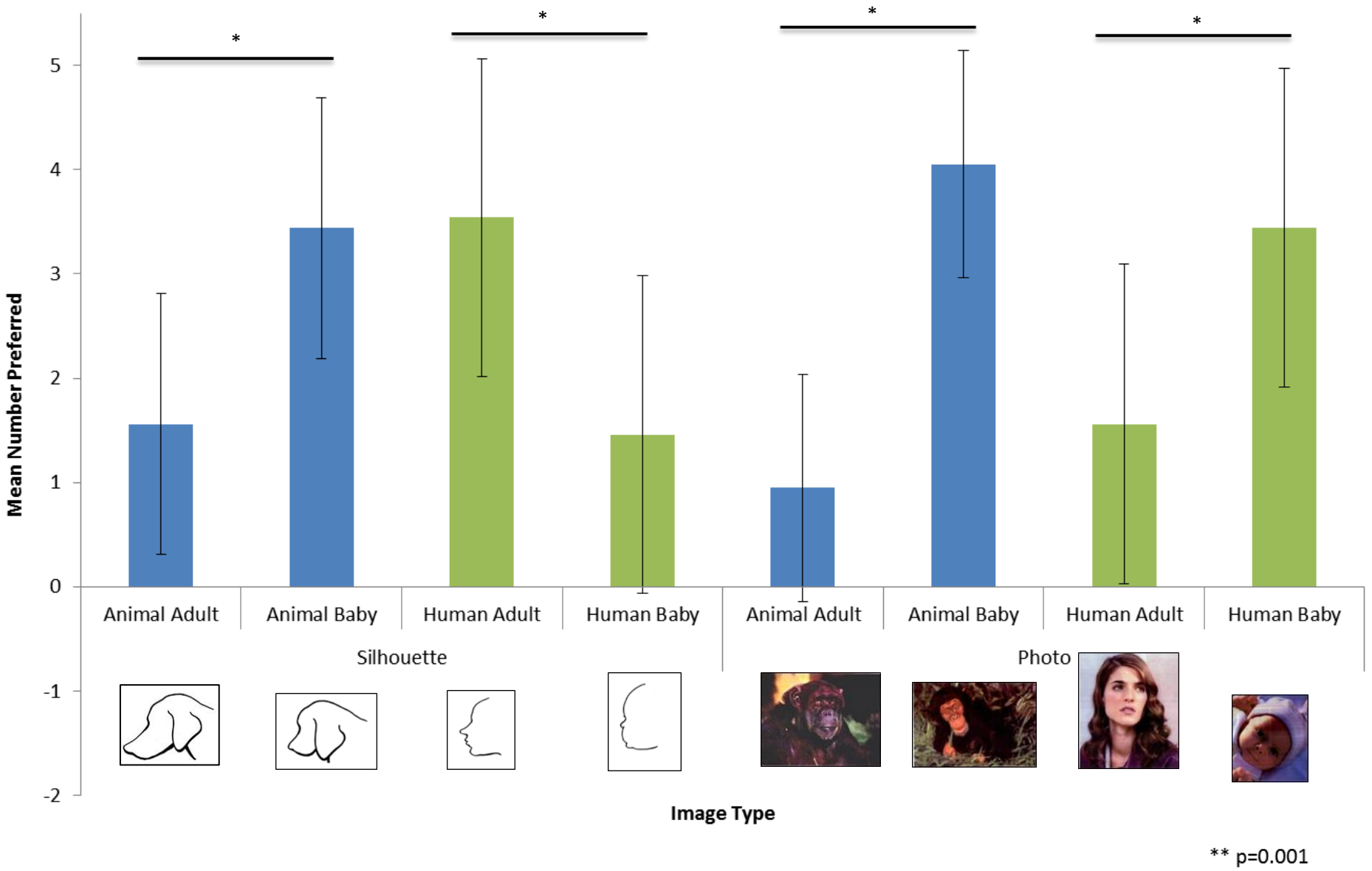

Figure 3.14 Study 3 PT: Mean Number of Adult and Infant Images Chosen as Preferred.

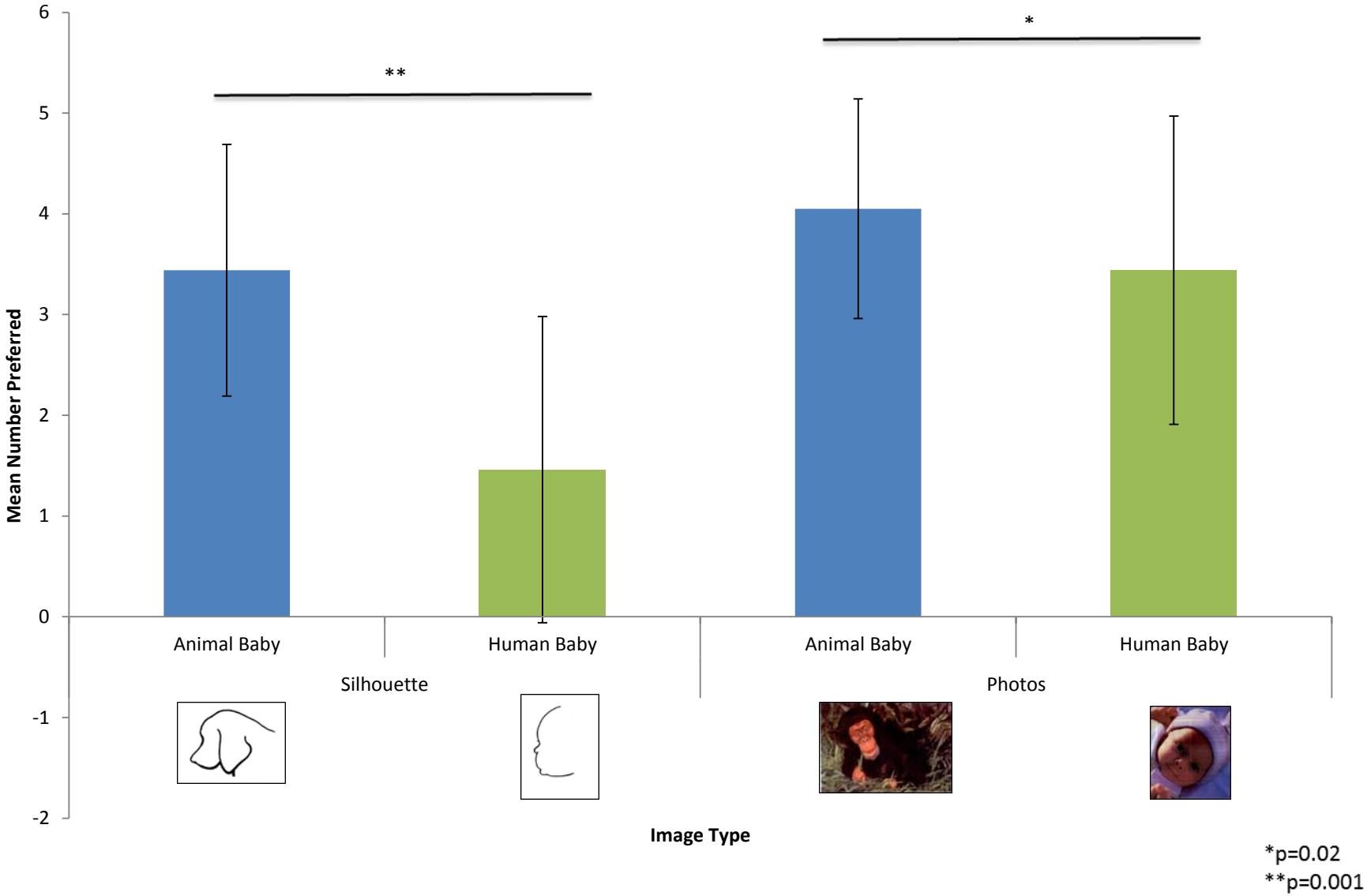

Figure 3.15 Study 3 PT: Mean Number of Animal and Human Infant Images Chosen as Preferred.

Table 3.7 Correlations between the Interest in Infants Measures for Study 3.

	Self-Reported Fondness for Babies	PT Human Infant Sil	PT Animal Infant Sil	PT Human Infant Pho	PT Animal Infant Pho	CPTT Accuracy	CPTT Time
[1]PT Human Infant Sil	0.27						
[1]PT Animal Infant Sil	0.08	.37**					
[1]PT Human Infant Pho	0.03	0.17	0.26				
[1]PT Animal Infant Pho	0.27	0.27	.37**	0.15			
[2]CPTT Accuracy	0.01	0.18	0.04	-0.21	-0.06		
[2]CPTT Time	-0.03	0.03	-0.22	-0.03	0.15	-0.21	
[3]ET Dwell Time	-0.39*	-0.34*	-0.10	0.13	-0.06	-0.34*	-0.12

[1]PT refers to Preference Task. [2]CPTT refers to Count the Purple Triangles Task. [3]ET refers to Eye Tracking Task.*p<0.05, **p<0.01.

photos, r(48)=0.37, p=0.01and human infant silhouettes, r(48)=0.37, p=0.01.Preference for human infant silhouettes was also associated with spending more time looking at adult face images in the Eye Tracking Task, r(41)=-0.34, p=0.03. Longer gaze time at adult face stimuli during the Eye Tracking Task was related to a higher self-reported Fondness for Babies score, r(39)=-0.39, p=0.01 as well as better accuracy for baby faces in the Count the Purple Triangles Task, r(40)=-0.34, p=0.03. However, other correlations between interest in infants measures were not significant.

3.5.4.3 Correlations between Childhood Adversity, Menarche and Intended Reproductive Timing

Living in a more deprived neighbourhood was related to stepfather presence, r(43)=-0.32, p=0.04, an increased number of half/stepsisters, r(44)=-0.40, p=0.01, a poorer perception of neighbourhood, r(43)=0.43, p=0.004 and an increased number of residential relocations, r(42)=-0.35, p=0.02. Moving house more times was related to stepfather presence, r(44)=0.44, p=0.003 as well as having more biological brothers, r(45)=0.33, p=0.03. Having more half/stepbrothers was related to having more half/stepsisters, r(48)=0.47, p=0.001. Stepfather presence was associated with an increased number of biological sisters, r(47)=0.30, p=0.04. Having more biological brothers was related to earlier menarche, r(9)=-0.72, p=0.03. A younger ideal age at parenthood was associated with living in a more deprived neighbourhood, r(32)=0.47, p=0.01, more residential relocations, r(34)=-0.45, p=0.01 and being older at father absence, r(13)=-0.59, p=0.03. Although not a measure of childhood adversity, age was also included in the correlation. Age was related to family support such that older girls tended to report lower feelings of family support, r(48)=-0.38, p=0.01.

3.5.4.4 Correlations between Interest in Infants, Childhood Adversity, Menarche and Intended Reproductive Timing

The correlations between interest in infants, childhood adversity, menarche and intended reproductive timing can be seen in Table 3.8. Of the childhood adversity variables only family support and perceived neighbourhood safety and quality were related to the interest in infants measures. Girls with higher feelings of family support reported higher levels of Fondness for Babies, r(46)=0.50, p=0.001 while girls with a better neighbourhood perception spent longer counting purple triangles during infant trials in the Count the Purple Triangles Task, r(47)=0.35, p=0.02. As well girls who were older at menarche also spent longer counting purple triangles during the infant

Table 3.8 Correlations between the Interest in Infants Measures, Childhood Adversity, Intended Reproductive Timing and Menarche for Study 3.

	Self-Reported Fondness for Babies	[1]PT Human Infant Sil	[1]PT Animal Infant Sil	[1]PT Human Infant Pho	[1]PT Animal Infant Pho	[2]CPTT Accuracy	[2]CPTT Time	[3]ET Dwell Time
Age	0.05	-0.09	0.26	0.01	0.01	0.00	-0.03	0.09
Neighbourhood Deprivation [4]LSOA	0.09	0.08	0.10	-0.01	-0.19	-0.16	0.08	0.07
Residential Relocations	0.03	-0.10	-0.25	0.22	0.07	-0.04	0.12	-0.17
[5]Timing of Father Absence	-0.40	-0.26	0.12	-0.12	-0.47	-0.07	-0.07	-0.14
Stepfather Presence	0.01	-0.11	-0.28	-0.09	0.15	-0.15	0.02	0.15
Biological Brothers	-0.07	-0.07	-0.03	0.20	-0.05	0.01	-0.04	-0.26
Biological Sisters	0.17	0.08	-0.07	-0.22	0.03	-0.06	0.11	-0.06
Half/Stepbrothers	0.02	-0.20	-0.06	-0.24	0.01	0.07	-0.03	-0.07
Half/Stepsisters	-0.05	0.04	0.19	0.07	0.04	0.07	-0.08	-0.17
Ideal Age at Parenthood	0.14	0.23	0.21	-0.12	0.02	-0.20	-0.09	0.17
Age at Menarche	0.24	0.43	0.76*	0.66	0.30	-0.12	0.72*	0.18
[6]Family Support	0.50**	0.03	-0.07	-0.03	0.22	-0.08	0.12	-0.20
[7]Perceived Neighbourhood Safety and Quality	0.11	-0.11	-0.06	-0.18	-0.07	-0.24	0.35*	0.01

*p<0.05
**p<0.01
[1]PT refers to Preference Task. [2]CPTT refers to Count the Purple Triangles Task. [3]ET refers to Eye-Tracking Task. [4]LSOA: Lower Super Output Area. It is an Index of Multiple Deprivation ranking small areas in England and Wales on a scale from 1 (most deprived) to 32,482 (least deprived). [5]Timing of Father Absence variable is coded as 1= father absence from zero to five years, 2= father absence from six to 14 years. [6]Family Support: the minimum possible score was 5 and the maximum was 35, higher scores indicate more positive feelings of family support. [7]Perceived Neighbourhood Safety and Quality: the minimum possible score was 8 and the maximum was 32, higher scores indicate more positive perceptions of neighbourhood.

trials, r(9)=0.72, p=0.03 and showed a higher preference for animal infant silhouettes, r(9)=0.76, p=0.02.

3.5.5 Discussion

The aims of this Study 3 were to explore the intercorrelations between different methods for measuring interest in infants, to pilot a modified version of the questionnaire used in Study 1 as well as explore relationships between childhood adversity, intended reproductive timing, menarcheal timing and interest in infants. In this study I replaced the original version of the Eye Tracking Task with the new version and added a second 'liking' measure in the form of a single questionnaire scale item of Fondness for Babies. There were few intercorrelations between the interest in infants measures with some of the relationships appearing to be contradictory. In this younger sample some of the childhood adversity variables were related to younger ideal age at parenthood, earlier menarche and decreased interest in infants. Similar to Study 1 there was no relationship between menarche and reproductive timing.

Longer dwell time for adult images during the Eye Tracking Task was related to higher levels of self-reported Fondness for Babies, a preference for human infant silhouettes and better accuracy for infant faces during the Count the Purple Triangles Task. Participants who preferred images of animal infant photos also preferred images of human infant silhouettes. Of the childhood adversity variables higher feelings of family support and neighbourhood perception were related to higher self-reported Fondness for Babies and longer counting time during infant trials in the Count the Purple Triangles Task, respectively. Later menarche was related to longer counting time during infant trials in the Count the Purple Triangles Task as well as a higher preference for animal infant silhouettes. Similar to Study 1 participants spent longer searching for objects in the Count the Purple Triangles Task when an infant was presented on the screen but were more accurate at remembering adult faces in the recognition portion of the task. Again similar to Study 1, participants preferred images of infants to adults overall in the Preference Task. Like Study 1 participants specifically preferred infant animal photos and silhouettes to the adult counterparts and they again preferred adult human silhouettes to infant human silhouettes. However, unlike Study 1 where no difference in preference was found for human photos, participants in Study 3 preferred infant human photos to the adult counterparts. On the self-report measure participants reported high feelings of Fondness for Babies.

Interestingly the only tool that did not show any difference in infant or adult outcomes was the Eye Tracking Task. I designed, and subsequently modified this tool, because measuring visual attention to stimuli seemed the most direct method of measuring implicit interest in stimuli. However, when given the option of looking at either an adult/infant face or the alternative neutral object, such as flowers, participants chose the former. Perhaps humans just prefer to look at other humans, rather than an alternative neutral object, when given the chance. One solution could be to pair the adult/infant face with an inverted or distorted version of itself instead of a neutral object. This method is often used and studied in the face perception literature (Valentine 1988). Arguably, this method would greatly decrease possible confounds because the paired stimulus would be identical in terms of features, brightness, contrast and colour with the only difference being that it was in the inverted position. However, I was concerned that using identical inverted faces, as the paired stimulus would be inadvertently distracting to the participant resulting in biased eye gaze data. Thus in designing the Eye Tracking Task I chose to use flowers as the paired stimulus for three reasons 1) they are a single category of object but with a variety of types, 2) like faces they have complexity varying in features, contrast, brightness and colour and 3) because of this complexity they are interesting without necessarily being distracting. It is debateable whether or not this was the correct decision but given more time to develop the Eye Tracking Task tool it could be informative to design and test two versions of the tool, one using flowers and one using inverted faces as the paired stimulus, in the same sample of participants.

Both Study 3 and Study 1 found a relationship between childhood adversity and interest in infants. However, not only were the interest in infants measures and childhood adversity variables different, the relationships were in the opposite direction. In Study 1 participants who experienced father absence in late childhood (six to 10 years) took longer counting purple triangles during infant trials where as in Study 3 participants who reported lower feelings of family support tended to report lower scores of Fondness for Babies. Only Study 3 found a relationship between menarche and interest in infants, such that girls who had an older age at menarche indicated a preference for animal infant stimuli and took longer to count triangles during infant trials of the Count the Purple Triangles Task.

In Study 3 childhood adversity was related to a faster reproductive trajectory. Girls with father absence (at aged six to 14 years), those living in deprived neighbourhoods and

those moving house more times desired a younger age at parenthood. This could be due to the prospective rather than retrospective nature of reproductive timing variable. Although, Nettle et al. (2010a) found that measuring reproductive timing in this way could be accurate in terms of subsequent reproductive behaviour the participants in their sample were 16 years old. Comparatively, the participants in Study 3 ranged in age from nine to 14 years old which means some of them were up to seven years younger than those in Nettle et al.'s (2010a) study. To investigate if age played a role in intended reproductive timing for participants in Study 3 a partial correlation controlling for age was run between above-mentioned variables (results not shown). Only timing of father absence remained significant.

Despite including many variables consistently found by others to be related to menarcheal timing (see Chapter 2 for references) only number of biological brothers was statistically significant in the Study 3 sample. It is unclear why having more biological brothers in particular would accelerate puberty. Indeed others have found the opposite effect with more brothers actually delaying menarche (Matchock & Susman 2006). Because of the young age of Study 3's participants relatively few of them had experienced menarche (n=10). What is more menarche was inherently confounded by the age of the participant since some girls were more likely to have experienced the event simply because they were older. Ideally survival analysis, such as Cox regression, would be run to investigate relationships with this variable; however, there was a lack of power due to the small sample size. Alternatively a partial correlation was run for number of biological brothers and menarche while controlling for age, which resulted in the effect disappearing (results not shown).

Despite relationships between childhood adversity, menarche, intended reproductive timing and interest in infants Study 3 was limited by its small sample size compared to other studies investigating similar relationships (Alvergne et al., 2008; Belsky, Steinberg, Houts, & Halpern-Felsher, 2010; Blell et al., 2008; Maestripieri et al., 2004; Nettle et al., 2010b). Often large samples are needed to produce even small to moderate effect sizes when investigating these relationships (Belsky et al. 2010; Nettle et al. 2010b). Because of the low power of Study 3 mainly correlations had to be used in the analysis. As such the findings allow us to only speculate on possible relationships between these variables rather than making more concrete conclusions or meaningful comparisons with other studies.

The primary aim of Study 3 was to develop and explore methods for measuring interest in infants, which included the modified version of the Eye Tracking Task. Secondary to this was to pilot the modified questionnaire items and explore potential relationships between interest in infants and individual differences in participants who were age matched to the sample used in the main study. Despite the low power of Study 3 some statistically significant relationships were found between and within these variables. What is more, three of the four measures of interest in infants indicated that participants had some increased level of interest in infants. However, one of these measures, Count the Purple Triangles Task, showed contradictory findings indicating an increased interest in adult stimuli as well. The fourth measure, the Eye Tracking Task, found no difference in interest in either infant or adult stimuli.

As in Study 1, there were few correlations between the methods for measuring interest in infants. Oddly, and unlike Study 1, some of the correlations that were present were in the opposite direction to those expected. That is, between some of the measures increased interest in adult stimuli was related to increased interest in infant stimuli. Again the modified version of the Eye Tracking Task did not find any difference in interest between infant and adult stimuli. The younger participants in this study were able to easily answer the questionnaire items on this modified questionnaire.

3.6 General Discussion

This chapter consisted of two studies (Study 1 and 3) that explored methods for measuring interest in infants, piloted questionnaire items for use in the main study and explored relationships between childhood adversity, menarche, intended reproductive timing and interest in infants. Study 1 and Study 3 investigated and explored these variables in different aged populations. This chapter also included a study (Study 2) describing an experiment to test the modifications made to the Eye Tracking Task. In this general discussion I will compare findings across Study 1 and 3 and discuss the strengths and limitations of all three studies.

3.6.1 Measuring Interest in Infants

Both the older (Study 1) and the younger (Study 3) sample of participants displayed at least some increased level of interest in infants and performed similarly on the Count the Purple Triangles Task and the Preference Task. Both spent longer counting purple triangles during infant trials. As well both preferred infant over adult stimuli in the

Preference Task and this was true for all sub-categories of stimuli (animal/human silhouettes/photos) except for human infant photos, which only the younger sample preferred. As well, in Study 3 participants had high ratings of self-reported of Fondness for Babies. However, both scored higher accuracy for adult faces in the recognition phase of the Count the Purple Triangles task. These seemingly contradictory findings of both an increased as well as a lack of interest in infant stimuli corroborate with those observed in other studies (Charles et al., 2013; Maestripieri & Pelka, 2002; Parsons, Young, Kumari, et al., 2011). Using the same Preference Task stimuli Maestripieri and Pelka (2002), found that although evidence for the phenomenon was present in girls and female adults preference for some of the infant stimuli reduced with age, a finding mirrored in my results where the younger sample preferred images of infants across all sub-categories, while the older sample did not. Despite the modification of the Eye Tracking Task to include an extra fixation cross and extend the image presentation time by 500ms neither Study 1 nor Study 3 showed differences in time spent viewing infant or adult stimuli. Although both groups did show a preference for viewing infant/adult stimuli over flower stimuli suggesting that human stimuli, regardless of age, is more interesting.

There were no similarities in intercorrelations for the interest in infants measures across Study 1 and 3. Furthermore, within the studies there were few intercorrelations between the measures. In Study 1 accuracy at recognising infant faces in the Count the Purple Triangles Task was related to preference for human infant photos in the Preference Task. Also preference for animal infant silhouettes was related to preference for animal infant photos. Although there were more intercorrelations between the interest in infants measures in Study 3 some were contradictory such that an increase in interest in infants on one measure was related to an increase in interest in adults on another measure. Specifically, an increase in animal infant photos was related to an increase in human infant silhouettes. However, an increase in dwell time on adult stimuli during the Eye Tracking Task was associated with an increase in self-reported Fondness for Babies, a preference for human infant silhouettes and better accuracy for recognising infant faces in the Count the Purple Triangles Task. This lack of consistency might be attributable to the small sample size and thus low power of the studies. However, those who have investigated interest in infants using other psychophysical methods have used similar or only slightly larger samples and found effects of increased interest in infant stimuli (Brosch et al., 2007; Golle et al., 2013; Sprengelmeyer et al., 2013; Thompson-

Booth et al., 2014; Yamamoto et al., 2009). Because the Count the Purple Triangles Task and the Eye Tracking Task were designed for use in my studies no directly comparable data exists. Nevertheless, amongst those who have investigated the 'liking' and 'wanting' of interest in infants using different tools some have found positive relationships between these tools (Charles et al., 2013; Sprengelmeyer et al., 2013) while others have found negative relationships (Parsons, Young, Kumari, et al. 2011; Yamamoto et al. 2009).

I have used different methods of measuring interest in infants in an attempt to tap into the different facets of reward, i.e. 'liking' and 'wanting'. Both the older and the younger sample demonstrated a liking and a desire for infant stimuli in the different measures. However, it was interesting that only the older sample, and the ones more likely to reproduce soon (as compared to the younger sample), showed a relationship between both liking and desiring infants. Whereas the younger age group showed no such correlation across 'liking' and 'wanting' tasks. Perhaps these two facets of interest in infants develop separately with one, 'wanting' or desire, developing more slowly and only reaching the levels of 'liking' as the likelihood of reproducing grows nearer.

The interpretation of 'liking' was not the same across studies in the literature. Berridge and Kringelbach (2008) define 'liking' as 'subjective hedonic reactions everyday sense of the word liking or pleasure, referring most directly to a conscious experience or subjective feeling of niceness'. Some have used attractiveness ratings as a proxy for 'liking' (Parsons, Young, Kumari, et al., 2011; Sprengelmeyer et al., 2013; Yamamoto et al., 2009). One exception was Charles et al. (2013) who used scales developed by Maestripieri and Pelka (2002) to measure self-reported liking of babies and self-reported interactions with babies in hypothetical situations. Similar to my studies, Charles et al. (2013) found no relationship between the 'liking' and 'wanting' measures of interest in infants. Conversely, those who used attractiveness as a proxy for 'liking' did find associations with the 'wanting' measures (Parsons, Young, Kumari, et al., 2011; Sprengelmeyer et al., 2013; Yamamoto et al., 2009). In one respect it seems sensible to use attractiveness as a proxy for 'liking' because studies have shown that baby schema is attractive and captures our attention (Sanefuji et al. 2007; Sternglanz et al. 1977; Power et al. 1982). Thus a stimulus that is rated as attractive in a 'liking' task is likely to be looked at longer during a 'wanting' task. My studies, and those of Charles et al. (2013) , instead considered 'liking' to be an admiration for infants. Although my studies found no relationship between the 'liking' and 'wanting' measures it does not

necessarily mean my interpretation of 'liking' was incorrect. Again it seems reasonable to assume that stimuli that is rated highly in terms of admiration in a 'liking' task will also be looked at longer, or in the case of the Count the Purple Triangles Task remembered better, in a 'wanting' task. Parsing interest in infants along the lines of the different facets of reward ('liking' and 'wanting') can only add to our understanding of the ultimate and proximate reasons for this behaviour, however, a more clear definition of the specific constructs being operationalised will be useful to interpreting the findings.

3.6.2 Childhood Adversity, Menarche, Intended Reproductive Timing and Interest in Infants

Although not identical the questionnaires from Study 1 and Study 3 did still target the same childhood adversity variables allowing at least informal comparisons between the two groups. I should highlight that due to the small sample size and low power of these studies investigating relationships between interest in infants, childhood adversity and reproductive trajectories was not one of my main aims. As such the analysis was only exploratory in nature. Both samples did exhibit some of the relationships commonly found between childhood adversity and reproductive trajectories (Belsky et al., 2010; Ellis & Garber, 2000; Kiernan, 1997; McCulloch, 2001) but menarcheal and intended reproductive timing were not related to the same childhood adversity variables across the two samples. For the younger sample in Study 3 having more biological brothers accelerated menarche where as for the older sample in Study 1 early menarche was related to doing fewer activities with parents during childhood. In terms of the younger sample these results differ from others who have found that brothers actually delay puberty (as reviewed by Matchock & Susman 2006). However, it is difficult to be as confident in my findings in the younger sample because only 11 of the participants had experienced menarche compared to the older sample who had all experienced the event. Furthermore, for the younger sample when a post-hoc partial correlation controlling for age of the participant was run the relationship between brothers and menarche disappeared.

Unlike previous research that has found relationships between childhood adversity and reproductive timing (Barber, 2001; Ellis et al., 2003; Johns, 2011; Nettle et al., 2010a, 2010b; Wellings et al., 1999) no such relationships were found in the older sample (Study 1). Admittedly, because Study 1's sample was made up of university students it

was more homogeneous than those used in the referenced samples. University students historically tend to come from the higher end of the socio economic spectrum, which in turn tends to have lower levels of adversity. In the younger sample (Study 3) father absence, increased neighbourhood deprivation and frequent residential relocations was related to an earlier ideal age at parenthood. However, similar to menarche when a post-hoc partial correlation controlling for age was run for the younger sample two of the three relationships disappeared, namely neighbourhood deprivation and residential relocations. It is not surprising that age played a role in intended reproductive timing. Regardless of individual differences in childhood adversity the sample in Study 1 all had one thing in common, they chose to come to university. Because of the commitment and constraints of completing a university degree most female students wait at least until graduation before reproducing meaning there will be inherently less variability in their reproductive trajectories. Indeed for this older sample the ideal age at parenthood had a range of nine years (24 to 33 years) whereas the younger sample of Study 3 had a range of 21 years (18 to 39 years).

Relationships between childhood adversity and interest in infants were found in both Study 1 and Study 3; however, these relationships were in the opposite direction. In the older sample (Study1) childhood adversity by way of father absence in late childhood was associated with spending more time counting purple triangles during infant trials in the Count the Purple Triangles Task. Conversely in the younger sample (Study 3) feeling less supported by one's family and having a poorer perception of one's neighbourhood were related to a decrease in self-reported Fondness for Babies and spending less time counting purple triangles during infant trials. In short, childhood adversity was related to increased interest in infants in the older group but decreased interest in infants in the younger group. To my knowledge there are no studies that have investigated childhood adversity and interest in infants in an adult sample. Maestripieri et al. (2004) have investigated these relationships in a an adolescent sample and found, similar to Study 3's adolescent sample, more positive experience with family, at least for father present girls, was related to higher preference for human infant photos. However, in this same sample, and similar to Study 1, Maestripieri et al. (2004) also found father absence was related to increased interest in infants via higher preference for human and animal infant photos. Although the interest in infants measures related to childhood adversity in Study 1 and 3 were different to those in Maestripieri et al.'s (2004) study it is interesting that the childhood adversity variables were the same. It

suggests that not only is there something salient about family structure and family support but also that they do not necessarily effect interest in infants in the same way.

3.6.3 Strengths and Limitations

The lab studies described in this chapter were novel in four ways: 1) they expanded on Maestripieri et al.'s (2004) study investigating similar relationships between childhood adversity, interest in infant and menarche by including a wider range of childhood adversity variables and an intended reproductive timing variable (Study1 and 3); 2) interest in infants was measured in an adolescent sample using both implicit ('wanting') and explicit ('liking') methods (Study 3). Although others have investigated interest in infants in an adolescent sample (Maestripieri et al., 2004) or by using implicit and explicit methods (Charles et al., 2013; Parsons, Young, Kumari, et al., 2011; Sprengelmeyer et al., 2013; Yamamoto et al., 2009), Study 3 was the first study to do both; 3) They included the use of two novel tools designed to measure implicit interest in infants (Study 1, 2 and 3); 4) Study 3 was the first to explore implicit methods for measuring interest in infants in an adolescent population.

A popular method for implicitly measuring interest in infants that is not resource intensive is the key-press task. Specifically, users of the key-press task propose that it measures motivation to view certain stimuli. I had reservations about using this type of task in a young sample because I was concerned the premise could be confusing leading to disengagement with the task. What is more I would argue that the key-press task is not truly implicit because the task consists solely of the participant increasing or decreasing viewing time of stimuli thus they are aware that this is the behaviour being measured. The drawback, however, of not using the key-press task and instead using novel tools was that there were no directly comparable tasks in the literature. Charles et al. (2013) did eye track participants whilst viewing infant and adult stimuli and found no difference in eye gaze duration. However, their stimuli varied greatly from my own consisting of computer generated outdoor scene and computer generated infant and adult stimuli with only vague facial features (characteristics that are arguably essential to the manifestation of the interest in infants behaviour according to Lorenz (1943)).

Both the Count the Purple Triangles Task and Eye Tracking Task were designed such that the behaviours actually being measured were concealed (i.e. the time taken to count purple triangles, the unexpected recognition task, eye gaze duration) within other tasks (i.e. inputting the number of purple triangles counted, correctly identifying a letter). As

such, they have the potential to be useful tools for more implicitly measuring the 'wanting' facet of interest in infants. However, that is not to say they are currently without their faults. Despite the modification of the Eye Tracking Task to include an extra fixation cross and a longer stimuli presentation time there were still no statistically significant difference in time spent looking at infant or adult stimuli in Study 2 and 3 and only a non-significant trend toward an increased proportion of time spent viewing any of the images in Study 2. As previously discussed this could be because humans might just prefer to look at other humans, infant or adult, rather than flowers. Still, I felt it made intuitive sense to include the new version of the Eye Tracking Task in Study 3. It is possible that participants benefited from the inclusion of the extra fixation cross as it acted to isolate the image presentation portion of the task and hopefully reduce unnecessary saccades between images in anticipation of the letter presentation. In terms of the Count the Purple Triangles Task, findings were somewhat contradictory such that, for both the older and the younger samples, that participants spent longer counting purple triangles during the infant trials but had better accuracy for recognising adult stimuli. It is possible that adult faces are more easily remembered than infant faces due to their distinctive features.

The data from Study 1 and 3 included samples from an adolescent and an adult population and some of the tasks (Preference Task, Count the Purple Triangles Task) and questionnaire items were the same, which allowed me to explore how the relationships between these variables might change over time. Unfortunately, extrapolations from the data were limited by the use of slightly different questionnaire items and different versions of the Eye Tracking Task. As well, the small sample size of both studies and the large number of variables being investigated meant that only correlational analysis could be performed. Nevertheless because Studies 1 and 3 were essentially piloting the various tools for use in the main school study they were still informative. The Count the Purple Triangle Task, the Preference Task and the self-reported Fondness for Babies questionnaire item not only showed variation in interest in infants but also were easily used by both the younger and older samples. The questionnaire items of the modified questionnaire were also easily completed by both samples. This ease of use in term of the tasks and the questionnaire was particularly important for the younger sample as the subsequent study in schools was done with similarly aged participants.

3.7 Conclusion

Investigating interest in infants has taken many forms over the last 50 years. Researchers have attempted to explain this phenomenon using behavioural, preference, self-report, psychophysics, physiological and non-human primate comparative studies. Despite this there is no gold standard for measuring interest in infants. In part this is due to a lack of focus on what we are trying to actually measure when we measure 'interest'. Recently some researchers (Charles et al., 2013; Parsons, Young, Kumari, et al., 2011; Parsons, Young, Parsons, et al., 2011; Sprengelmeyer et al., 2013; Yamamoto et al., 2009) have attempted to address this by turning to research investigating the neuropsychology of reward, which posits that reward is composed of multiple facets (Berridge & Robinson 2003).These facets do not always agree on what stimuli is rewarding which means measuring reward (in this case interest in infants) in humans and animals is not always straightforward. The primary aim of all three studies in this chapter was to explore different methods for measuring interest in infants via 'liking' (Preference Task and self-reported Fondness for Babies) and 'wanting' (Count the Purple Triangles Task and the Eye Tracking Task).

There were few intercorrelations between the interest in infants measures as well as few similarities in findings between the different samples in Study 1 and 3. This latter finding could be attributed to the difference in age of participants. Others have suggested these groups may have different levels of interest in infants (Maestripieri & Pelka, 2002). However, the former finding is somewhat more puzzling but perhaps enlightening. It suggests that 'liking' and 'wanting' are separate and what we say we like might not reflect any real underlying desire (or 'want'). One would expect 'wanting', considered as desire, to be more connected to reproductive timing than 'liking'. Desire is what motivates us as humans, or animals in general, to act. Indeed the older participants, those more likely to reproduce soon compared to the younger participants, were the only group who displayed relationships between 'liking' and 'wanting'.

The tasks and questionnaire were designed to be used by young participants. Indeed the sample in Study 3 was capable of completing the Preference Task, Count the Purple Triangles Task, Eye Tracking Task and questionnaire with little need of assistance. Unfortunately, due to time constraints the Eye Tracking Task could not be modified and tested further. As well, because the Eye Tracking Task was not mobile it could not be

brought into schools and therefore was not used to measure interest in infants in the subsequent main school study (Chapter 4).

The following chapter, 4, outlines the main school study, which took place in primary and secondary schools in North Tyneside. The focus of this study was to investigate the relationship between a broad range of childhood adversity variables, intended reproductive timing and interest in infants in a large more diverse sample. In the main study I employed the modified questionnaire (from Study 3) to measure childhood adversity, intended reproductive timing and menarche (analysed in Chapter 5) while interest in infants was measured using the Count the Purple Triangles Task, the Preference Task and the self-reported Fondness for Babies questionnaire item.

Chapter 4. Childhood Adversity Speeds up Reproductive Timing without Increasing Interest in Infants

The research described in this chapter has been published, (Clutterbuck et al. 2014a). The text has been largely unchanged except in instances where the reader is asked to refer to previous chapter regarding Methods information. This information has been omitted for the sake of brevity. Measures of self-esteem and perceived life chances, which have been linked to childhood adversity and reproductive timing, were included in this thesis chapter but not in the published article. The reason for their omission from the published article was to limit the focus and discussion to the relatively new and somewhat complex relationships between childhood adversity, intended reproductive timing and interest in infants Although the publication lists Jean Adams and Daniel Nettle as co-authors, I designed the study, collected the data, analysed the data and wrote the manuscript. The co-authors read and suggested changes to the initial drafts of the manuscript.

4.1 Introduction

A number of influential evolutionary theories have hypothesized that adversity experienced in childhood accelerates reproductive timing (Belsky et al., 1991; Chisholm et al., 1993; Draper & Harpending, 1982; Ellis et al., 2009).The adaptive basis of this acceleration is that when prospects are poor, it is adaptive to reproduce early to maximize the chances of producing at least some offspring who will themselves reach reproductive maturity. Empirical research, largely from US and UK populations, supports these theories: areas of high unemployment, poverty and male incarceration have increased rates of teenage pregnancy (Barber 2001). What is more, unpredictability within the family and low parental investment via maternal or paternal absence (Ellis et al., 2003; Nettle et al., 2010b; Wellings et al., 1999), negative subjective feelings about parental support (Nettle et al. 2010a), and frequent residential relocations in early childhood are more common in young mothers (Nettle et al. 2010b). The impact of low parental investment on reproductive timing can begin even at the perinatal stage: having a young mother (Seamark & Pereira Gray, 1997), experiencing reduced duration of breastfeeding, being born early for gestational age and of low birth weight (Nettle et al. 2010b) are all associated with earlier age at first birth in females. At the macro level, neighbourhoods with shorter life expectancy and increased homicide rates have younger ages at first birth (Nettle, 2011; Wilson & Daly, 1997). Additionally

reproductive timing mimics neighbourhood gradients of healthy life expectancy in the UK with an average decrease of seven years in age at first birth for those who can expect the fewest healthy years (Nettle 2011). Even perceptions of neighbourhood safety (Johns 2011) and personal disadvantage (McCulloch 2001) appear to be strongly associated with accelerated reproduction.

The psychological mechanisms facilitating the effects of these antecedents on reproductive timing have received less attention than the social (Nettle & Cockerill 2010) or hormonal mechanisms (Blell et al., 2008; Ellis & Garber, 2000; Kim & Smith, 1998; Romans et al., 2003). However, one psychological mechanism given some consideration is an increased level of interest in infants in girls who have experienced early adversity (Maestripieri et al., 2004). There is evidence in the human and non-human primate literature that interest in infants is an adaptation to acquire sufficient parenting skills for offspring survival and ultimately increase inclusive fitness (for review see Maestripieri & Roney, 2006). Evidence from non-human primates has found better survival outcomes for infants reared by mothers who showed higher interest in infants prior to reproducing (Fairbanks 1990). Interest in infants tends to be higher in females than males, peaking around adolescence and declining with age, mirroring the female reproductively viable years (Blakemore, 1981; Feldman et al., 1977; Frodi & Lamb, 1978; Fullard & Reiling, 1976; Maestripieri & Pelka, 2002). Lorenz (1943) proposed that it is the characteristic morphology of round face and forehead and large eyes, termed 'Kindchenschema' or 'baby schema', that makes an infant attractive and motivates nurturing behaviour. Physiological support for the motivational effect of baby schema is evident in the increased activation of the neural areas linked to the brain's reward centre when women view images of infants high in these distinctive features (Glocker, Langleben, Ruparel, Loughead, Valdez, et al. 2009). Increased sensitivity to infantile features is considered an adaptation important for mother-infant bonding and ultimately resource allocation amongst multiple offspring (Lobmaier et al. 2010).

Although Maestripieri et al. (2004) found evidence that interest in infants was associated with early adversity, their measurement of adversity was limited to family structure and the quality of the family environment. In their study, only father absence was associated with their proxy for reproductive timing (menarche), and, independently, with interest in infants. Maestripieri et al.(2004) were able to demonstrate a weak direct link between reproductive timing and interest in infants, such that girls with early

menarche preferred images of infant stimuli more than girls with later menarche. However, they argued this relationship arose from the strong associations of both early menarcheal timing and interest in infants to father absence. Similar to Maestripieri et al. (2004) I proposed that if acquisition of mothering skills is important before parenthood then girls experiencing more adversity will be on faster reproductive trajectories and consequently will display increased interest in infants for their age. The aim of this study was to investigate this hypothesis using a larger, more diverse population than Maestripieri et al. (2004), and a broader range of childhood adversity variables, encompassing both family-level and neighbourhood-level factors.

Unfortunately, there is no consensus on the best way to measure interest in infants. Methods have included interactions with unknown infants both whilst mothers were (Feldman et al., 1977; Feldman & Churnin Nash, 1978, 1979b; Frodi, Murray, Lamb, & Steinberg, 1984) and were not present (Blakemore 1981; Blakemore 1985); measurement of skin conductance, heart rate, facial muscle movements and neural activation when exposed to images of infants (Frodi & Lamb, 1978; Glocker, Langleben, Ruparel, Loughead, Valdez, et al., 2009; Leibenluft et al., 2004); preference for infant stimuli over adult stimuli and desire to view infant stimuli longer, rate them as more attractive, or pay more attention to them (Fullard & Reiling 1976; Berman et al. 1978; Berman et al. 1975; Glocker, Langleben, Ruparel, Loughead, Gur, et al. 2009; Brosch et al. 2007; Parsons, Young, Kumari, et al. 2011); and reported desire to spend time with infants and interact with them in hypothetical social situations (Maestripieri & Pelka, 2002).

Thus, I also sought to explore alternative approaches to measuring interest in infants. Because I was measuring similar hypotheses within a similar age group I used the same Preference Task as Maestripieri et al. (2004) and Maestripieri and Pelka (2002). However, this forced-choice paper and pencil task is an explicit measure that may introduce social desirability bias. Therefore, I wanted to also measure interest in infants implicitly via attention. Some popular methods for measuring attention include, but are not limited to, visual attention using eye tracking devices (Duchowski 2007), orienting paradigms such as dot probe tasks(Schmukle 2005) and motivation driven key-press tasks. Some of these methods have been used in relation to measuring interest in infants (Brosch et al. 2007; Parsons, Young, Kumari, et al. 2011; Yamamoto et al. 2009). However, eye tracking devices were not appropriate for non-laboratory settings such as the schools where I collected data, and reliability of dot-probe tasks in non-clinical

participants has been contested (Schmukle 2005). As well I was concerned a key-press task might confuse my participants, particularly those at the younger end of the age range, which could lead to disengagement with the task. I therefore, developed a novel tool based on the idea that participants who were highly interested in infants would have their attention more easily captured by infant images, as opposed to adult images, during an unrelated task and would later have better memory for those infant images. This tool combined a simple computer based object search task and an unexpected recognition task of infant and adult faces. Finally, my third method of measuring interest in infants was a self-reported Fondness for Babies questionnaire item.

4.2 Aims

This study had four aims: 1) To explore different methods of measuring interest in infants; 2) To establish whether interest in infants in young females is associated with earlier intended reproductive timing; 3) To investigate whether childhood adversity is associated with intended reproductive timing; and 4) To investigate whether childhood adversity predicts interest in infants.

4.3 Methods

4.3.1 Study Overview

Girls aged nine to 14 years were recruited via schools in one local authority area in the North East of England. Information letters and consent forms were sent home to parents inviting their daughter to take part in the study. This was a cross-sectional study completed in schools via self-report questionnaires, and paper-based and computer-based tasks. Information on participant's menarcheal status was also collected. However, menarche was not related to interest in infants or ideal age at parenthood and was only related to two of the childhood adversity measures. As such I felt the variable did not add significantly to the findings of the paper and was not included in the current analysis. I have also included measures of perceived life chances and self-esteem in the questionnaire because there is evidence, largely indirect through behaviours such as substance abuse and risky sexual activity, that these factors are related to childhood adversity and early reproductive timing (Farrell et al. 2009; Wild et al. 2004; Scheier et al. 2000; Wickrama et al. 2013; Griffin et al. 2004; Kiernan 1997). As such I wanted to investigate the potential for these related factors to act as mediators between childhood

adversity and intended reproductive timing in this sample. The measures gathered in the study are summarised in Table 4.1.

4.3.2 Ethics Statement

Ethical approval for the study was obtained from Newcastle University's Faculty of Medical Sciences Ethics Committee (see Appendices B & C)Written parental consent was required for participation in the study.

4.3.3 Measures of Interest in Infants

To measure interest in infants I used the Fondness for Babies self-report item, the Preference Task (PT) and the Count the Purple Triangles Task (CPTT). A description of these tools and the method for use can be found in the Methods section of Study 1 (Preference Task, Count the Purple Triangles Task) and Study 3 (Fondness for Babies) in Chapter 3, (see sections, 3.3.4.4.2, 3.3.4.4.3, 3.5.3.2.1).

4.3.4 Measures of Childhood Adversity

Measures of childhood adversity included: Neighbourhood Deprivation, Residential Instability, Family Structure, Family Support and Perceived Neighbourhood Safety and Quality. A description of these measures and how they were collected can be found in the Methods section of Study 3 in Chapter 3 (see section, 3.5.3.2.2).

4.3.5 Measure of Intended Reproductive Timing

Measure of intended reproductive timing was collected via two self-report questionnaire items. A description of these items can be found in the Methods section of Study 3 in Chapter 3 (see section, 3.5.3.2.2).

4.3.6 Measures of Related Factors

4.3.6.1 Self-Esteem

Self-esteem was measured using the revised version of the school short-form Coopersmith Self-Esteem Inventory (Hills et al. 2011). This inventory included 19 items giving a global measure of self-esteem made up of three types of self-esteem: personal self-esteem as well as parental and peer related self-esteem, (e.g. 'I often wish I were someone else', 'My parents expect too much of me', 'I often get discouraged in school'). Participants were asked to read each of the 19 statements and

Table 4.1 Summary Table of the Study Measures.

Interest in Infants	Childhood Adversity	Intended Reproductive Timing	Related Factors
Fondness for Babies	Neighbourhood Deprivation	Ideal Age at Parenthood	Perceived Life Chances
[1]PT: Animal Infant Silhouettes	Residential Instability		Self-Esteem
[1]PT: Human Infant Silhouettes	[3]Mother Absence		
[1]PT: Animal Infant Photographs	[3]Timing of Mother Absence		
[1]PT: Human Infant Photographs	Father Absence		
[2]CPTT: Accuracy	[4]Timing of Father Absence		
[2]CPTT: Time	Step-father presence		
	Biological Brothers		
	Biological Sisters		
	Half/Step Brothers		
	Half/Step Sisters		
	Family Support		
	Perceived Neighbourhood Safety and Quality		

[1]PT refers to Preference Task.[2]CPTT refers to Count the Purple Triangles Task.[3]Mother Absence and Timing of Mother absence were not used in the analysis because only 5% of the participants had experienced this event. [4]This consisted of two categories for Timing of Father Absence: 1) 0 to 5 years, 2) 6 years to 14 years.

indicate if they agreed or disagreed by circling ‘yes’ or ‘no’. Positive responses were given a score of one and negative responses were given a score of zero. Responses were summed with higher scores indicating higher self-esteem. For the purpose of this thesis I only included the measure of global self-esteem in the analysis. To see the full set of items in the measure please see the ‘Just You’ section of the questionnaire in Appendix I.

4.3.6.2 Perceived Life Chances

The Perceived Life Chances Scale consisted of 10 items, developed by Jessor, Donovan and Costa (1990) to measure how young people envisage their future in terms of education, family, friends, health, finances, well-being and career. The scale included a series of questions related to the future (i.e. what are the chances: You will have a job that you enjoy doing’?). Participants were asked to circle what they think their chances are of the outcome occurring (e.g. ‘Very high’, ‘High’, ‘About fifty-fifty’, ‘Low’ or ‘Very low’). These responses were ranked on a five point scale from ‘Very high’=5 to ‘Very –low’=1. Responses were summed with higher scores indicating a more positive perception of life chances. To see the full set of items in the measure please see the ‘You and Your Future’ section of Appendix I.

4.3.7 Procedure

Participants took part in groups of two to four during school hours in a quiet room and were given verbal and written instructions. Participants first completed the PT or the CPTT, with the order of completion counterbalanced. All participants completed the questionnaire after the PT and CPTT were completed. For the CPTT the laptops were positioned such that other participants and the researcher could not see the screen while the participants completed the task.

4.3.8 Data Analysis

If any answer on the PT or the questionnaire was left blank a mid-point was imputed. If participants put an age range for intended reproductive timing the midpoint was also imputed. However, if multiple ages for intended reproductive timing were given the mean was taken. Overall there were 164 (2%) instances when participants indicated they felt somewhere between ‘yes’ or ‘no’ on the self-esteem measure. Because positive responses on the self-esteem measure received a score of one and negative responses received a score of zero, these mid-point responses were given a score of 0.5. Univariate

general linear models (GLMs) determined the relationship between childhood adversity, perceived life chances and self-esteem independently. The perceived life chances and the self-esteem variables were entered into a multiple regression analysis to investigate their potential as mediating variables using the bootstrapping method (5000 samples) in the PROCESS macro in SPSS (as outlined in Hayes 2013). Univariate GLMs determined which childhood adversity factors and related factors (i.e. perceived life chances and self-esteem) were associated with intended reproductive timing. A multivariate general linear model (GLM) determined which childhood adversity factors were related to interest in infants. Paired t-tests determined infant preference and accuracy during the PT and the CPTT as well as time to complete object search during CPTT. Data was analysed using SPSS version 19 and all tests were two-tailed with a p value of <0.05 regarded as statistically significant.

4.4 Results

4.4.1 Descriptive Statistics

In total, 357 girls took part in the study. Three girls were omitted from the final analysis because one was older than the cut off age and two had previously taken part in a similar study run by the research team. This left 354 girls whose data were included in the final analysis, though the computer-based data from one further participant was omitted from the relevant analysis as she required the aid of the researcher to complete the task. The distributions of ages in the final samples were as follows: 9 (n=45), 10 (n=103), 11 (n=76), 12 (n=71), 13 (n=42), 14 (n=17).

Descriptive data on demographics, family structure and intended reproductive timing are summarised in Table 4.2. One quarter of participants resided in the 20% most deprived areas in England and Wales, with a further one quarter living within the 27% most affluent. Over a third of participants (37%) had never moved house with almost half (48%) moving anywhere from one to three times. A further 12% had moved house from four to six times and only 4% had relocated more than six times. Five percent of the participants had experienced mother absence from the home compared to 36% who had experienced father absence. Father absence occurred at age five or younger for 60% of the father absent girls with 40% reporting ages of six or older at the time of the event. One participant stated her father currently lives in the same house as her but that she was five when he stopped living in the same house. Although this seems contradictory it is possible that the participant's father was seperated from her mother sometime during

Table 4.2 Descriptive Statistics for the Study Measures.

			Range	
Study Measures		Mean (St. Dev)	Min	Max
Interest in Infants				
	Fondness for Babies	5.47 (1.70)	1	7
	[1]PT: Animal Infant Silhouettes	1.82 (1.62)	0	5
	[1]PT: Human Infant Silhouettes	3.52 (1.22)	0	5
	[1]PT: Animal Infant Photographs	4.25 (0.89)	1	5
	[1]PT: Human Infant Photographs	3.77 (1.26)	0	5
	[2]CPTTAcc	-0.14 (0.35)	-1.40	0.83
	[3]CPTTTime	71.70 (426.37)	-3299.17	2268.75
[9]Childhood Adversity				
	Neighbourhood Deprivation [4]LSOA	15091.08 (9876.85)	507	31911
	Residential Moves	1.76 (2.28)	0	18
	[5]Age at Mother Absence	5.66 (4.21)	0	13
	[6]Age at Father Absence	4.68 (3.95)	0	14
	Biological Brothers	0.68 (0.79)	0	4
	Biological Sisters	0.63 (0.78)	0	4
	Half/Step Brothers	0.36 (0.82)	0	6
	Half/Step Sisters	0.37 (0.72)	0	4
	[7]Family Support	29.02 (5.48)	10	35
	[8]Perceived Neighbourhood Safety and Quality	26.82 (4.05)	10	32
Intended Reproductive Timing				
	Ideal Age at Parenthood	24.97 (3.90)	14	36
Related Factors				
	[10]Perceived Life Chances	42.35 (4.91)	23	50
	[11]Self-Esteem	13.28 (4.09)	1	19

[1]PT: Preference Task.[2]CPTTAcc: the difference in accuracy of remembering infant versus adult faces during the unexpected recognition part of the Count the Purple Triangles Task. Positive value indicates better accuracy for infants.[3]CPTTTime: the difference in time (milliseconds) spent searching for purple triangles when a baby is on the screen compared to when an adult is on the screen during the Count the Purple Triangles Task. Positive value indicates more time spent searching while infants were on the screen.[4]LSOA: Lower Super Output Area. It is an Index of Multiple Deprivation ranking small areas in England and Wales on a scale from 1 (most deprived) to 32,482 (least deprived).[5]Age at Mother Absence: the age at which mother stopped living in the same residence as participant (n=17).[6]Age at Father Absence: the age at which father stopped living in the same residence as participant (n=127).[7]Family Support: the minimum possible score was 5 and the maximum was 35, higher scores indicate more positive feelings of family support. [8]Perceived Neighbourhood Safety and Quality: the minimum possible score was 8 and the maximum was 32, higher scores indicate more positive perceptions of neighbourhood.[9]Childhood Adversity: Timing of Father Absence and Step Father Presence are not included in this table because they are categorical variables. They are discussed in the text of the Results section. [10]Perceived Life Chances: the minimum possible score was 10 and the maximum was 50. [11]Sef-Esteem: the minimum possible score was 0 and the maximum was 19.

the ages of zero to five years and subsequently reconciled. For the purposes of the analysis this participant was categorised as currently 'father present' but with 'father absence' between 0 to 5 years'. Of those whose father no longer lived in the same house 38% had a stepfather living in the same house. The majority of participants (91%) had one or more biological (80%) or non-biological sibling (35%). In this sample nearly all participants (91%) stated a desire to have children one day.

On the whole participants percieved their future to be very positive and responded that their chances were 'high' or 'very high' in regards to: finishing their GSCEs (80%), going to university (70%), having a job that they enjoy doing (87%) and that pays them well (81%), owning their own home (83%), having a happy family life (89%), being in good health (89%), living whereever they want in the country (60%), being respected in their community (80%) and having friends they can count on (89%). Participants scored high on the global self-esteem (M=13.28, SD=4.09, out of a possible 19). Participants also scored highly on the personal self esteem (M=5.88, SD=2.46, out of a possible nine), self-esteem dervided from parents (M=4.20,SD=1.23, out of a possible five) and self-esteem derived from peers (M=3.19, SD=1.32, out of a possible five).

4.4.2 Interest in Infants

Table 4.2 shows the descriptive statistics for the interest in infants measures. In the PT, participants demonstrated a higher preference for infant images (M=13.36, SD=3.07) as compared to adult images (M=6.53, SD= 2.99) t(353)= 21.30, p=0.001. They preferred infant photos (M=8.02, SD= 1.70) more than infant silhouettes (M=5.34, SD=2.12), t(353)= 21.96, p=0.001. Within the categories of images human infant photos were preferred more than human infant silhouettes, t(353)=2.99, p=0.003 and likewise animal infant photos were preferred more than animal infant silhouettes, t(353)=26.10, p=0.001.

Infant images were preferred over adult images for all categories of images: human silhouettes: baby: M=3.52, SD=1.22; adult: M=1.45, SD=1.20, t(353)=16.16, p=0.001; human photos: baby: M=3.77, SD=1.26; adult M=1.19, SD=1.24, t(353)=19.63, p=0.001; animal photos: baby: M=4.25, SD=0.89; adult: M=0.72, SD=0.86, t(353)=38.05, p=0.001 with the exception of animal silhouettes: baby: M=1.82, SD=1.62; adult: M=3.17, SD=1.61, t(353)=-7.87, p=0.001, (see Figure 4.1). Participants showed higher preference for the human infant images (M=7.29, SD=1.89) than anima

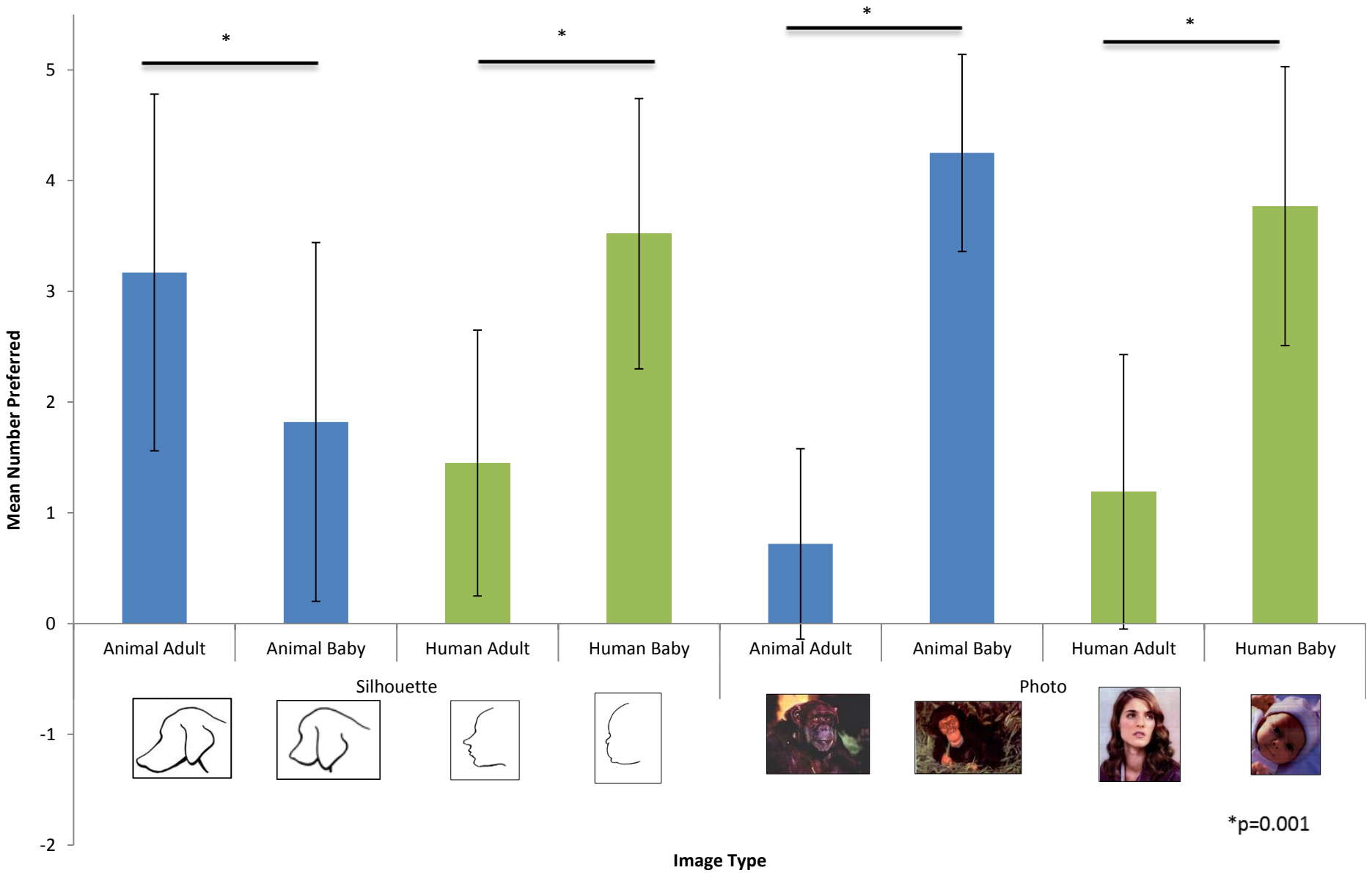

Figure 4.1 Study 4 PT: Mean Number of Adult and Infant Images Chosen as Preferred.

infant images (M=6.07, SD=1.93), t(353)=10.03, p=0.001. This preference for human infant images was only evident for the silhouettes, with human infant silhouettes being preferred more than animal infant silhouettes, t=(353)=16.55, p=0.001. In contrast animal infant photos were preferred more than human infant photos t(353)=6.62, p=0.001, (see Figure 4.2).

In the CPTT, participants were more accurate at recognising adult images (M=0.28, SD=0.29) than they were at recognising infant images (M=0.14, SD=0.27), t(342)=7.50, p=0.001, (see Figure 4.3). However, time spent searching and counting the purples triangles was longer during the infant stimuli trials (M=1231.13, SD=585.99) than the adult stimuli trials (M=1159.43, SD=570.85), t(351)= 3.16, p=0.002, (see Figure 4.4).

4.4.3 Relationships between Measures of Interest in Infants and Intended Reproductive Timing

As seen in Table 4.3, none of the correlations between interest in infant measures reached traditional cut-offs for moderate or strong effect sizes. Fondness for Babies was weakly but significantly positively correlated with three of the four PT scores (human infant silhouette, animal infant photo and human infant photo). Scores on the CPTT were not significantly correlated with those from any of the other tasks. Within the CPTT, time spent searching (CPTT Time) was not correlated to participant's accuracy (CPTTAcc). There were no statistically significant correlations between intended reproductive timing and any of the measures of interest in infants.

4.4.4 Childhood Adversity and Intended Reproductive Timing

The childhood adversity variables plus age were added into a univariate GLM as predictor variables with intended reproductive timing as the outcome variable (see Table 4.4, Model 1). Higher neighbourhood deprivation, more frequent residential relocation, having more half/step brothers, feeling less supported by family and having lower perception of their neighbourhood were associated with a younger ideal age at parenthood. There was a borderline significant result between age and the outcome variable (p=0.05). However, it should be noted that these factors only explained a small proportion of the variation not accounted for by the other variables. Interactions between age and childhood adversity variables were also explored but none were statistically significant.

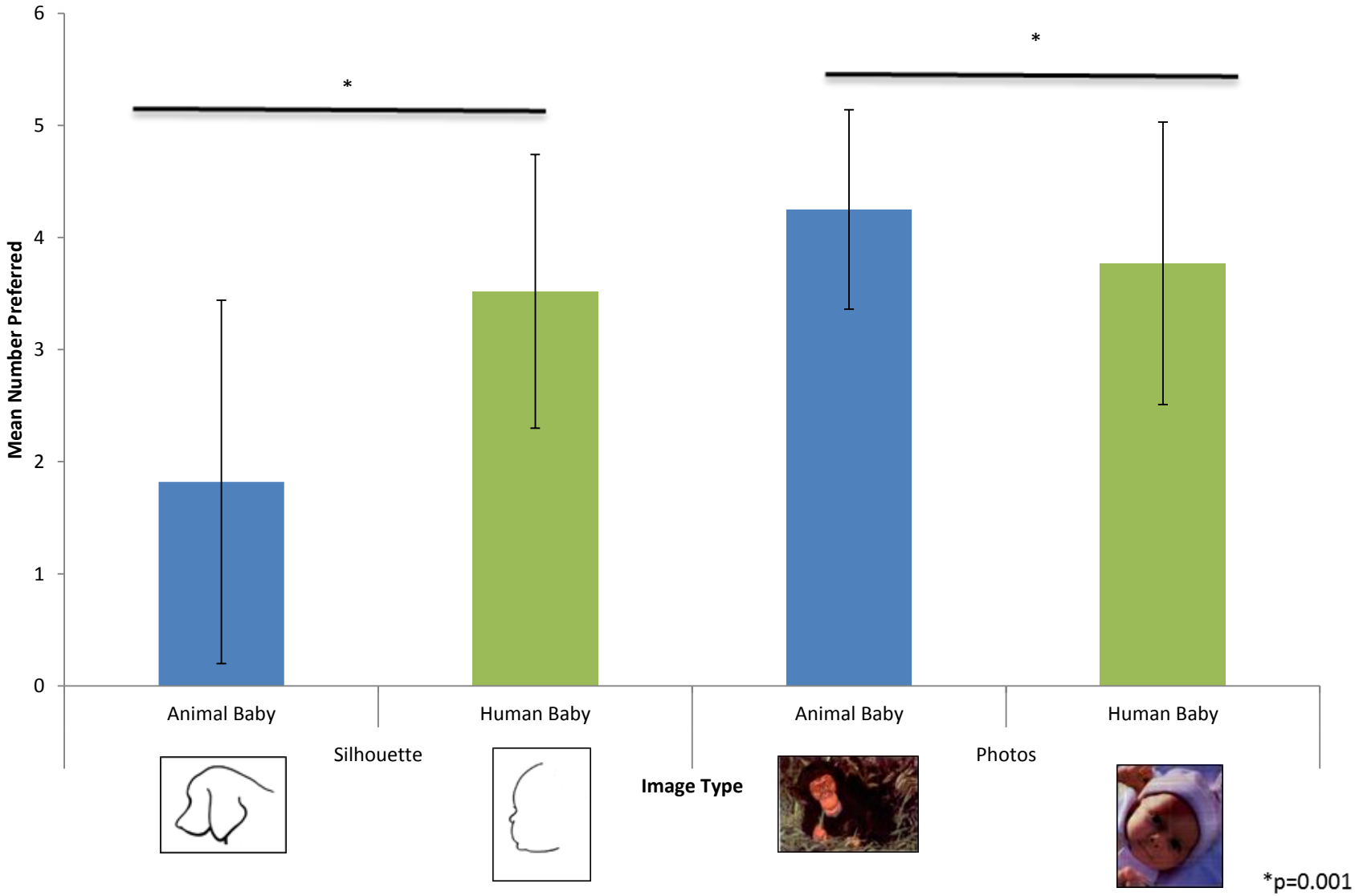

Figure 4.2 Study 4 PT: Mean Number of Animal and Human Infant Images Chosen as Preferred.

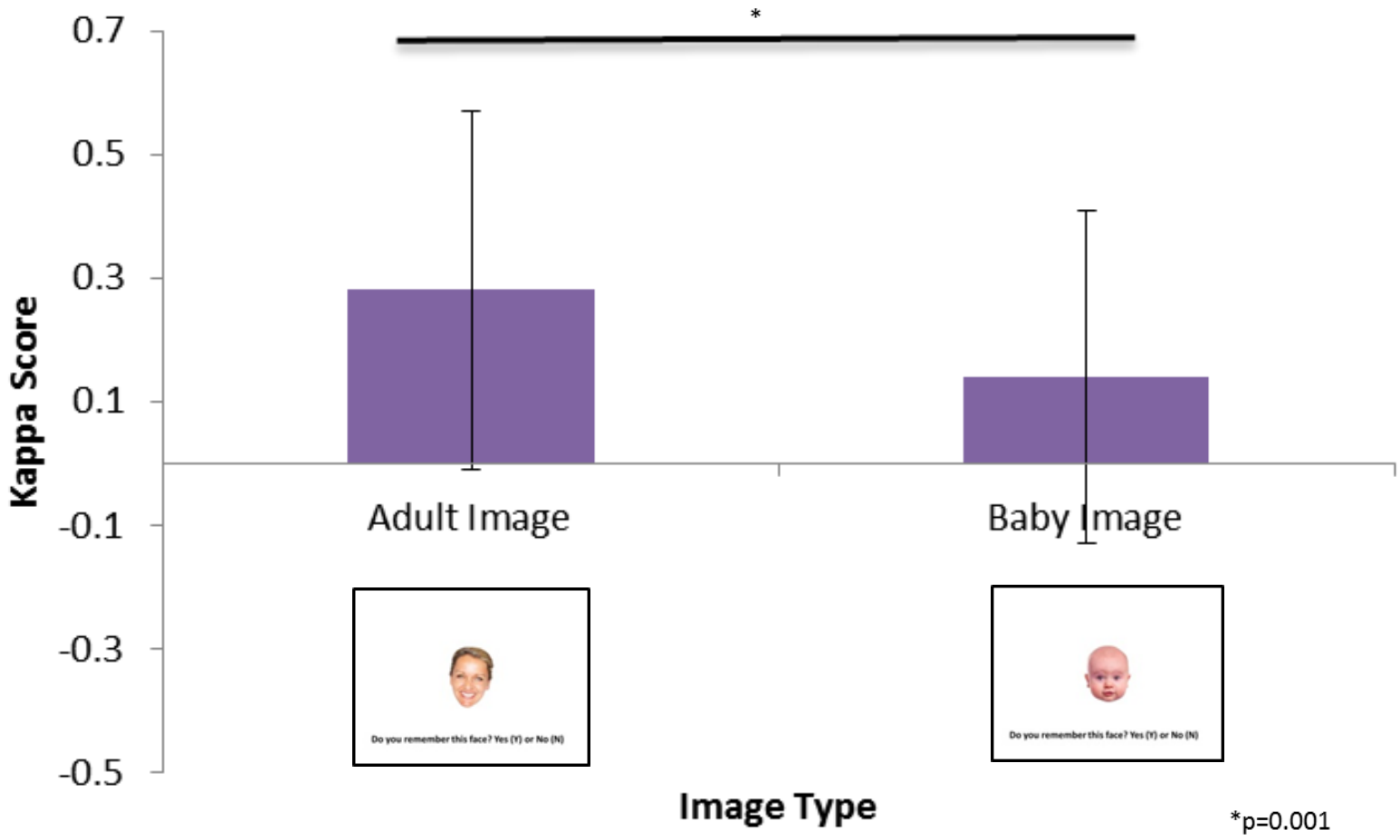

Figure 4.3 Study 4 CPTT: Mean Kappa Scores for Accuracy at Recognising Adult and Infant Images.

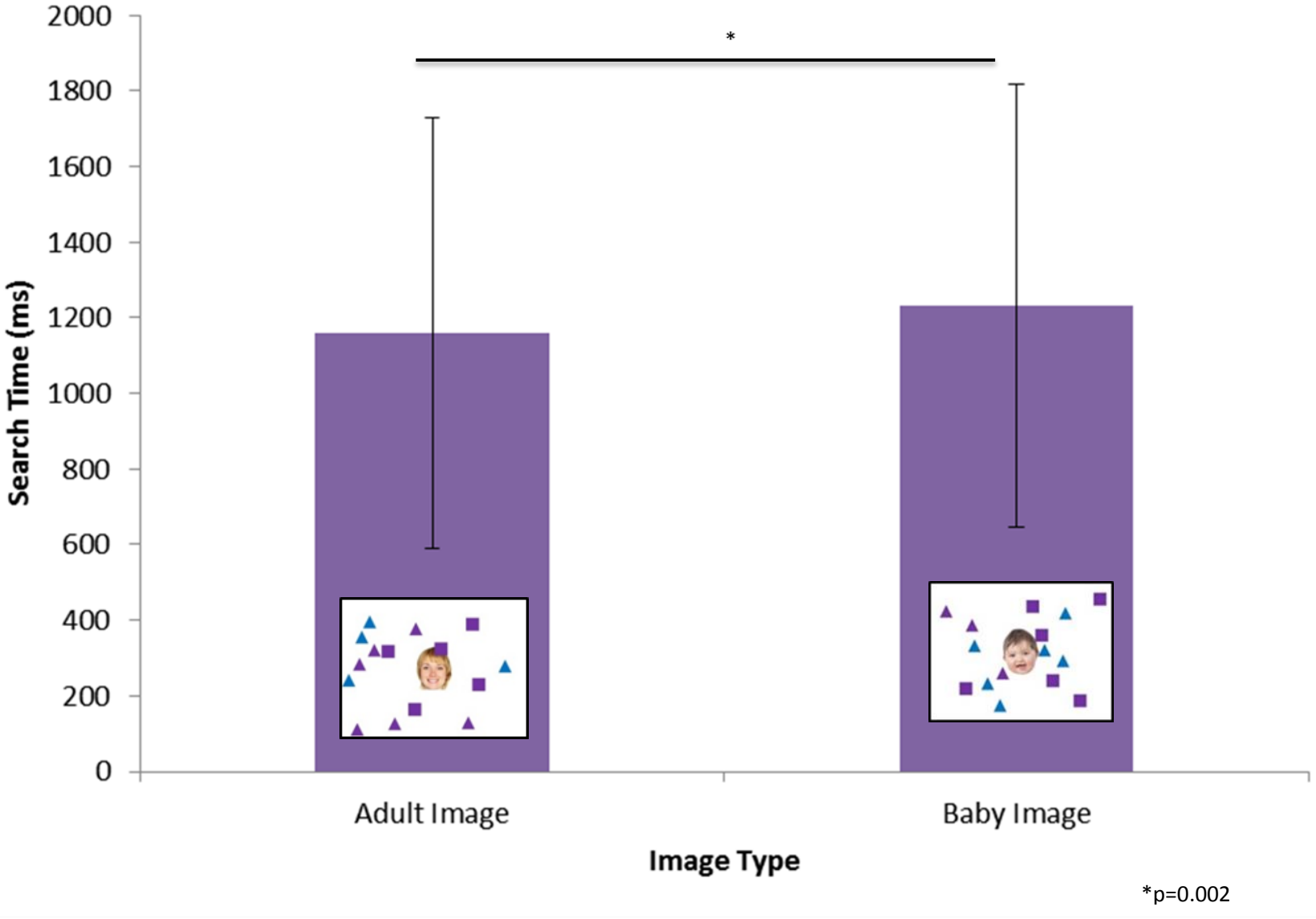

Figure 4.4 Study 4 CPTT: Mean Search Time for Trials with Adult and Infant Images.

Table 4.3 Correlation Coefficients between Measures of Interest in Infants and Intended Reproductive Timing.

	Fondness for Babies	[1]PT: Animal Infant Silhouettes	[1]PT: Human Infant Silhouettes	[1]PT: Animal Infant Photos	[1]PT: Human Infant Photos	[2]CPTTAcc	[3]CPTTTime
Fondness for Babies							
[1]PT: Animal Infant Silhouettes	0.08						
[1]PT: Human Infant Silhouettes	0.15*	0.10					
[1]PT: Animal Infant Photos	0.11*	0.12*	0.15*				
[1]PT: Human Infant Photos	0.12*	0.22*	0.17*	0.23			
[2]CPTTAcc	0.05	-0.04	0.00	0.04	0.02		
[3]CPTTTime	-0.03	-0.02	-0.02	0.02	0.07	0.05	
Ideal Age at Parenthood	-0.05	-0.03	0.03	-0.04	-0.04	-0.02	0.01

*p<0.05

[1]PT: Preference Task.[2]CPTTAcc: the difference in accuracy of remembering infant versus adult faces during the unexpected recognition part of the Count the Purple Triangles Task. [3]CPTTTime: the difference in time (milliseconds) spent searching for purple triangles when a baby is on the screen compared to when an adult is on the screen during the Count the Purple Triangles Task.

Table 4.4 Results of a Univariate GLM for the Childhood Adversity Variables plus Age on Intended Reproductive Timing.

	[1]Model 1				95% Confidence Interval for β		[2]Model 2				95% Confidence Interval for β		[3]Model 3				95% Confidence Interval for β	
	F	**Sig**	**$^4\eta p^2$**	**β**	**LB**	**UB**	**F**	**Sig**	**$^4\eta p^2$**	**β**	**LB**	**UB**	**F**	**Sig**	**$^4\eta p^2$**	**β**	**LB**	**UB**
Intercept	25.24	0.00	0.08	12.49	6.44	18.53	21.16	0.00	0.07	13.74	6.82	20.65	25.03	0.00	0.08	12.45	6.41	18.49
Age	3.79	0.05	0.01	0.03	0.00	0.05	3.51	0.06	0.01	0.03	0.00	0.05	4.21	0.04	0.01	0.03	0.00	0.06
Neighbourhood Deprivation	5.36	0.02	0.02	0.00	0.00	0.00	5.04	0.03	0.02	0.00	0.00	0.00	5.73	0.02	0.02	0.00	0.00	0.00
Residential Instability	4.95	0.03	0.02	-0.22	-0.41	-0.03	4.35	0.04	0.02	-0.21	-0.40	-0.01	5.07	0.03	0.02	-0.22	-0.41	-0.03
Timing of Father Absence (0 to 14 years)	0.45	0.64	0.00				0.58	0.56	0.00				0.37	0.69	0.00			
Timing of Father Absence (0 to 5 years)				1.91	-0.91	4.73				2.02	-0.82	4.86				1.86	-0.97	4.68
Timing of Father Absence (6 to 14 years)				0.85	-0.53	2.24				0.88	-0.51	2.27				0.85	-0.54	2.23
Step-Father Presence	0.02	0.90	0.00	0.94	-1.47	3.35	0.03	0.86	0.00	0.98	-1.43	3.39	0.02	0.90	0.00	0.96	-1.45	3.37
Biological Brothers	0.34	0.56	0.00	-0.17	-0.75	0.41	0.50	0.48	0.00	-0.21	-0.80	0.38	0.29	0.59	0.00	-0.16	-0.74	0.42
Biological Sisters	1.01	0.32	0.00	-0.28	-0.83	0.27	0.99	0.32	0.00	-0.28	-0.83	0.27	0.74	0.39	0.00	-0.24	-0.80	0.31
Half/Step Brothers	4.47	0.04	0.02	-0.60	-1.16	-0.04	4.38	0.04	0.02	-0.59	-1.15	-0.04	4.14	0.04	0.01	-0.58	-1.14	-0.02
Half/Step Sisters	0.37	0.54	0.00	0.20	-0.44	0.83	0.21	0.65	0.00	0.15	-0.50	0.80	0.49	0.48	0.00	0.23	-0.41	0.86
Family Support	4.28	0.04	0.01	0.09	0.00	0.18	4.81	0.03	0.02	0.10	0.01	0.19	1.82	0.18	0.01	0.07	-0.03	0.17
Perceived Neighbourhood Safety and Quality	9.90	0.00	0.03	0.18	0.07	0.29	10.19	0.00	0.03	0.18	0.07	0.30	7.57	0.01	0.03	0.16	0.05	0.28
Perceived Life Chances	-	-	-	-	-	-	0.54	0.46	0.00	-0.04	-0.13	0.06	-	-	-	-	-	-
Self-Esteem	-	-	-	-	-	-	-	-	-	-	-	-	1.00	0.32	0.00	0.07	-0.06	0.19

[1]Model 1: GLM with childhood adversity and age as the predictor variables and intended reproductive timing as the outcome variable. [2]Model 2: GLM with childhood adversity, perceived life chances and age as the predictor variables and intended reproductive timing as the outcome variable. [3]Model 3: GLM with childhood adversity, self-esteem and age as the predictor variables and intended reproductive timing as the outcome variable. [4]ηp^2 : Partial eta squared. This is the proportion of variation not accounted for by other variables captured by the named variable.

4.4.5 Childhood Adversity, Perceived Life Chances and Self-Esteem

The childhood adversity variables plus age were entered into univariate GLMs as predictor variables with perceived life chances as an outcome variable (see Table 4.5). The process was repeated substituting self-esteem as the outcome variable (see Table 4.6).In terms of perceived life chances, the more times a participant had moved house and the more supportive they felt their family was the more positive they perceived their future life chances. There was a significant effect of timing of father absence such that girls who had experienced father absence in the first five years of life had more positive feelings about their future compared to father present girls, $t(325)=2.03$, $p=0.04$. There was no relationship between father absence and perceived life chances for girls whose father left when they were six to 14 years of age, $t(325)=0.91$, $p=0.29$. Conversely those girls with more biological brothers and half/stepsisters perceived their life chances to be more negative. In terms of self- esteem, increased feelings of family support and more positive perceptions of neighbourhood were related to higher feelings of self-esteem. Low self-esteem was related to more biological sisters.

4.4.6 Childhood Adversity, Perceived Life Chances, Self-Esteem and Intended Reproductive Timing

I ran two univariate GLMs that both included the childhood adversity variables and age entered as predictor variables with ideal age at parenthood entered as the outcome variable. One of the GLMs also included the perceived life chances variable entered as a predictor variable and the other GLM included the self-esteem variable entered as a predictor variable (see Table 4.4, Models 2 and 3). The addition of perceived life chances variable to the GLM did not change the relationship between the childhood adversity variables and intended reproductive timing, however it did make the control variable of age non-significant ($p=0.06$). The addition of the self-esteem variable to the GLM rendered the relationship between family support and intended reproductive timing non-significant. However, it did not change the relationship between the other childhood adversity variables and intended reproductive timing.

Because perceived life chances and self-esteem rendered age and family support non-significant in the GLMs I decided to test for possible indirect effects of these variables (i.e. perceived life chances and self-esteem) on intended reproductive timing using mediation analysis. I first ran multiple regression analysis to determine the relationships between age, perceived future chances and ideal age at parenthood. There was a

Table 4.5 Results of a Univariate GLM for the Childhood Adversity Variables plus Age on Perceived Life Chances.

					95% Confidence Interval for β	
	F	**Sig**	**$^{1}\eta p^{2}$**	**β**	**Lower Bound**	**Upper bound**
Intercept	104.10	0.00	0.25	30.65	23.52	37.78
Age	0.44	0.51	0.00	-0.01	-0.04	0.02
Neighbourhood Deprivation	1.25	0.27	0.00	0.00	0.00	0.00
Residential Instability	7.22	0.01	0.02	0.30	0.08	0.52
Timing of Father Absence (0 to 14 years)	9.12	0.00	0.06			
Timing of Father Absence (0 to 5 years)				3.51	0.11	6.91
Timing of Father Absence (6 to 14 years)				0.91	-0.77	2.59
Step-Father Presence	1.65	0.20	0.01	1.11	-1.82	4.04
Biological Brothers	8.23	0.00	0.03	-0.99	-1.67	-0.31
Biological Sisters	0.10	0.75	0.00	0.11	-0.54	0.75
Half/Step Brothers	0.40	0.53	0.00	0.22	-0.46	0.89
Half/Step Sisters	8.72	0.00	0.03	-1.14	-1.90	-0.38
Family Support	40.88	0.00	0.12	0.33	0.23	0.43
Perceived Neighbourhood Safety and Quality	2.28	0.13	0.01	0.10	-0.03	0.23

$^{1}\eta p^{2}$: Partial eta squared. This is the proportion of variation not accounted for by other variables captured by the named variable.

Table 4.6 Results of a Univariate GLM for the Childhood Adversity Variables plus Age on Self-Esteem.

					95% Confidence Interval for β	
	F	**Sig**	**[1]ηp2**	**β**	**Lower Bound**	**Upper bound**
Intercept	0.00	0.96	0.00	-0.47	-5.73	4.78
Age	3.28	0.07	0.01	-0.02	-0.05	0.00
Neighbourhood Deprivation	2.94	0.09	0.01	0.00	0.00	0.00
Residential Instability	0.01	0.93	0.00	0.01	-0.15	0.17
Timing of Father Absence (0 to 14 years)	1.28	0.28	0.01			
Timing of Father Absence (0 to 5 years)				0.96	-1.54	3.46
Timing of Father Absence (6 to 14 years)				0.19	-1.05	1.42
Step-Father Presence	0.03	0.87	0.00	-0.13	-2.29	2.02
Biological Brothers	0.55	0.46	0.00	-0.19	-0.69	0.31
Biological Sisters	4.26	0.04	0.01	-0.50	-0.98	-0.02
Half/Step Brothers	1.53	0.22	0.01	-0.31	-0.81	0.18
Half/Step Sisters	2.08	0.15	0.01	-0.41	-0.97	0.15
Family Support	93.35	0.00	0.23	0.36	0.29	0.44
Perceived Neighbourhood Safety and Quality	30.21	0.00	0.09	0.27	0.17	0.37

[1]ηp^2: Partial eta squared. This is the proportion of variation not accounted for by other variables captured by the named variable.

significant positive relationship between age and ideal age at parenthood, β=0.03, t(325)= 2.02, p=0.04, a non-significant relationship between age and perceived future life chances, β=-0.03, t(325)= -1.92, p=0.06, and a non-significant relationship between perceived future chances and ideal age at parenthood, β= -0.01, t(325)=-0.23, p=0.82. Because there were no significant relationship between the predictor variable (age) and the potential mediation variable (perceived life chances) nor was there a significant relationship between the potential mediating variable and the outcome variable (ideal age at parenthood) mediation analysis was not performed.

Next I ran multiple regression analysis to determine the relationship between family support, self-esteem and ideal age at parenthood. There was a non-significant relationship between family support and ideal age at parenthood, β=0.07, t(325)= 1.41, p=0.16, a significant positive relationship between family support and self-esteem, β=0.41, t(325)= 11.69, p=0.001 and a non-significant relationship between self-esteem and ideal age at parenthood, β=0.11, t(325)=1.85, p=0.07. Because there were no significant relationship between the predictor variable (family support) and the outcome variable (ideal age at parenthood) and there was no significant relationship between the potential mediation variable (self-esteem) and the outcome variable mediation analysis was not performed.

4.4.7 Childhood Adversity and Interest in Infants

We used a multivariate GLM with the seven measures of interest in infants as the outcome variables and childhood adversity factors plus age as the predictor variables. As seen in Table 4.7, there was only a significant effect of family support on interest in infants such that feeling more supported increased participants interest in infants F(7, 301)= 2.64, p=0.01. Specifically, higher family support was related to an increased interest in animal infant photos F(1,307)=4.36, p=0.04, human infant photos F(1,307)= 5.89, p=0.02 and human infant silhouettes F(1,307)=6.24, p=0.01. There was also a borderline significant effect of CPTT Accuracy such that increased feelings of family support was related to better accuracy at remembering adult faces in the CPTT, F(1, 307)= 3.88, p=0.05) . When interactions between age and each of the independent variables were added, only age and biological brothers was statistically significant, F(7, 291)= 2.99, p=.005. The negative parameter value of the biological brothers variable indicated that as participants get older the effect of brothers on interest in infants becomes weaker.

Table 4.7 Results of a Multivariate GLM for the Childhood Adversity Variables plus Age on the Interest in Infants Measures.

	F	Sig	$^{1}\eta p^{2}$
Intercept	7.33	0.00	0.15
Age	1.06	0.39	0.02
Neighbourhood Deprivation	1.40	0.21	0.03
Residential Moves	1.50	0.17	0.03
Timing of Father Absence	1.32	0.19	0.03
Step-Father Presence	0.39	0.91	0.01
Biological Brothers	1.12	0.35	0.03
Biological Sisters	0.72	0.65	0.02
Half/Step Brothers	0.48	0.85	0.01
Half/Step Sisters	1.22	0.29	0.03
Family Support	2.64	0.01	0.06
Perceived Neighbourhood Safety and Quality	0.82	0.57	0.02

$^{1}\eta p^{2}$: Partial eta squared. This is the proportion of variation not accounted for by other variables that is captured by the named variable.

4.5 Discussion

I measured interest in infants, childhood adversity and intended reproductive timing in a large sample of English adolescent girls. I also measured the relationship between childhood adversity, perceived life chances, self-esteem and intended reproductive timing in this sample I used several different measures of interest in infants, including a self-report rating item, a previously used preference task, and a novel implicit attentional computer-based measure. I found that these different measures were at best very weakly correlated with one another, highlighting the complexity of the interest in infants construct and the possibility that different measures may not be capturing the same thing. Moreover, none of the interest in infants measures were significantly associated with intended reproductive timing. I found that greater childhood adversity was associated with earlier intended reproduction. However, the control variable (age) was borderline significant suggesting that it is also a factor in intended reproductive timing. I found that greater family support was a significant predictor of increased interest in infants.

I found that girls with greater family support as well as those who had fewer biological brothers and half/stepsisters perceived their life chances to be more positive. A more supportive family environment and fewer siblings indicate good availability of current resources, which could instil more positive expectations for the future. Interestingly, there were positive relationships between perceived life chances and both frequent residential relocations and father absence. A correlation between the individual questions on the perceived life chances scale and residential relocations (details not shown) found a positive relationship between frequency of residential relocations and scale items regarding a well-paid job, owning a house and living anywhere in the country. These events are either directly related to moving house (e.g. moving to a new geographic location, buying and selling a house) or indirectly related to moving house (e.g. moving for promotion). Thus it might not necessarily be the case that frequent residential relocations has increased girls positive perception of their life chances rather it has exposed them to the possibilities/realities of life, more so than less residentially mobile girls. In terms of father absence, it is probable that its occurrence necessitates reliance on social and kin support networks, particularly in the first five years of life when mothers need more help with young children. Indeed Sear and Mace ‘s (2008) review of the effect of kin on child survival found that maternal grandmothers were less variable than fathers when it came to child survival rates.

In terms of self-esteem, higher self-esteem was related to having higher feelings of family support and more positive perceptions of neighbourhood safety and quality. Interestingly lower self-esteem was related to having more biological sisters. Lawson and Mace (2009) found that biological sisters were a source of competition for maternal investment. It is conceivable that consistently feeling one needs to vie for attention and resources from one's mother could reduce self-esteem.

In this study neither perceived life chances nor self-esteem acted as mediating variables. However family support was a strong predictor of self-esteem suggesting that these two variables were measuring similar constructs. Considering the self-esteem measurement included a sub-scale of self-esteem derived from parents this is likely. Failure to find mediation of perceived life chances and self-esteem on childhood adversity and intended reproductive timing was not unsurprising given that evidence for their relationships from the literature are largely indirect. For example Wild et al. (2004) found a relationship between low self-esteem and risky sexual behaviours in adolescents, which has in turn been linked to early childbearing by others (Deardorff et al. 2005).

In the introduction, I discussed the hypothesis that interest in infants might be a psychological mechanism activated early in girls who have experienced childhood adversity as a component of their accelerated life history schedules (Maestripieri et al., 2004). This hypothesis predicts that interest in infants should be increased by childhood adversity, and greater interest in infants should be associated with earlier intended reproduction. Neither of these predictions was met in our study. I confirmed previous findings that deprivation, residential instability, more half/step brothers, less family support and perceptions of a poor environment are all associated with an intention to reproduce younger (Nettle et al. 2010a; Johns 2011; McCulloch 2001; Nettle & Cockerill 2010; Harden et al. 2009; Russell 2002). However, not only was the intention to reproduce younger not associated with interest in infants, but the one significant predictor, family support, was in the opposite direction to the prediction of the hypothesis. That is, greater family support, which has also been found in a previous study in the same population to be associated with desire for *later* reproduction (Nettle & Cockerill 2010), was here associated with *increased* interest in infants.

My results thus differ somewhat from those of Maestripieri et al. (2004), who found that father absence reduced age at menarche and increased interest in infants, and that there

was a weak direct association between interest in infants and markers of reproductive timing. However, similar to my findings Maestripieri et al. (2004) did find increased preference to infant stimuli amongst father present girls with more positive family experiences. Still, the reason for the discrepancy with the results of Maestripieri et al.(2004) is not clear, since my set of interest in infants measures included the PT that they used, my sample size was much larger and my set of childhood adversity measures more comprehensive. I should note however that in my sample correlations between father absence, stepfather presence and intended reproductive timing, whilst in the expected directions, were not significant. These findings were contrary to a large body of previous literature in which father absence has been found to be a predictor of early reproduction (Ellis et al., 2003; Quinlan, 2003).

Because I used stated age at first birth as a proxy for potential future reproductive behaviour caution is advised when interpreting the relationships I found between intended reproductive timing and childhood adversity. Although Nettle et al. (2010a), found stated intentions to be an accurate indication of future reproductive behaviour in a cohort of young British women their sample was in late adolescence at the time of response where as my sample was in early adolescence. Time perspective is thought to be weak during late childhood and early adolescence (Steinberg et al. 2009). I found that older girls in my sample tended to state an older desired age at parenthood. However, age was controlled in all analyses. Moreover our participant's responses were not at all implausible, ranging from 14 to 36 years with a mean of age 25 years.

There is evidence to suggest that reproductive timing is partly heritable (Kiernan 1997). However, childhood adversity tends to be intergenerational making it unclear to what extent the mother-daughter relationship in reproductive timing is the result of genetics or environment. The young age of my participants meant that asking about mother's age at first reproduction might not have produced reliable responses. As such I decided not to include that measure in my questionnaire.

The weak correlations both between and within the interest in infants measures highlight that, despite the long-established literature on this topic, measuring the construct is actually a complex task. It raises the question, what is 'interest'? An emerging distinction in the literature (Parsons, Young, Kumari, et al., 2011; Sprengelmeyer et al., 2013; Yamamoto et al., 2009) based on the neural classification of reward (Berridge & Kringelbach 2008), suggests that interest in infants could be

comprised of the motivation-centred 'wanting' and the appraisal-centred 'liking'. I attempted to isolate and measure these two facets of reward using the CPTT and the PT, respectively, but it is not clear whether my measures successfully captured this distinction. Ultimately, interest in infants as an adaptation for learning mothering skills should at the very least require 'interest' to be an attraction to infant stimuli regardless of how that attraction is operationalised. As Buss and Schmitt (1993) argued, albeit while discussing theories of sexual strategies, 'psychological preferences could not have evolved unless they have consequences for actual behaviour'. Interest merely needs to be sufficient at motivating the individual to interact with an infant thus increasing the chances of acquiring caretaking skills. However, until a consensus method for measuring interest in infants is found it will be difficult to compare across study results.

One possibility for future research could be to modify the PT by replacing the infant versus adult forced choice element with a neutral object versus infant/adult forced choice element. Currently it is unclear whether the PT measures interest in infants or just dislike of the alternative adult images, an issue Maestripieri et al. (2004) have addressed. Additionally, with some modification the CPTT has potential to be a reliable tool for measuring interest in infants in early adolescents. Findings in this sample, as well as the samples in Study 1 and 3,have shown that accuracy is better for adult faces compared to infant faces despite participants taking longer to count the purple triangles during the infant trials. This suggests not only that adult faces could be easier to recognise because of their distinctive features but also that infant faces appear to be more distracting. Therefore the CPTT could be more informative when focusing on the timing rather than the accuracy variable. As well, because of the possible importance of interest in infants in acquiring caretaking skills it might be useful to manipulate emotional salience. Mothers have been found to be particularly sensitive to this manipulation (Nishitani et al. 2011; Thompson-Booth et al. 2014).

My findings suggest that although early childhood adversity speeds up reproductive timing, it does not at the same time increase interest in infants. On the contrary, experiencing greater feelings of family support is indicative of displaying more interest in babies but not necessarily wanting them sooner. In hindsight, this perhaps makes intuitive sense if we consider variations in reproductive strategies. In their seminal paper, Belsky et al. (1991) theorised that children growing up in supportive early environments should go on to invest more in their offspring because such environments are conducive to an individual's growth and development. Adverse early environments,

on the other hand, induce a strategy of early attempts at reproduction with relatively little parental investment in each child. Measures of interest in infants may capture something about intended parental investment in offspring, rather than intended timing of reproduction. This is potentially important because women who become mothers young, despite often reporting a desire for early motherhood (Nettle et al. 2010a) are also statistically less likely to breast-feed (Nettle 2010), and to experience post-natal depression, causing a disengagement from their babies (Bottino et al. 2012).

Chapter 5. Frequent Residential Relocations Cumulatively Accelerate Menarcheal Timing

The research described in this chapter has been published, (Clutterbuck et al. 2014b). The text has been largely unchanged except in instances where the reader is asked to refer to previous chapter regarding Methods information. This information has been omitted for the sake of brevity. Although the publication lists Jean Adams and Daniel Nettle as co-authors, I designed the study, collected the data, analysed the data and wrote the manuscript. The co-authors read and suggested changes to the initial drafts of the manuscript.

5.1 Introduction

Life history theory proposes that growing up in unpredictable environments with higher mortality risks makes it adaptive for an individual to accelerate reproductive timing ensuring at least some offspring will survive and continue the genetic lineage (Chisholm et al. 1993). For females reproductive viability begins with menarche. As such, acceleration in menarcheal timing has been studied extensively from a life history perspective with a plethora of factors identified as potential antecedents. Belsky et al. (1991) theorised that early family environment provides a template for future expectations of reproductive opportunities, mate choice and ultimately resource availability. Specifically they proposed that stressful family environments would lead to early puberty, early reproduction, unstable pair bonds and low parental investment in offspring.

This theory has received much empirical support particularly in respect to menarcheal and reproductive timing. Parental absence, stepfather co-residence, sibling presence, stressful intra-family relationships, poor child-parent bonds, maternal harshness and lower socioeconomic position have all been associated with early menarche (Alvergne et al., 2008; Belsky et al., 2007; Bogaert, 2008; Ellis & Garber, 2000; Graber, Brooks-Gunn, & Warren, 1995; Hoier, 2003; Kim et al., 1997; Matchock & Susman, 2006; Moffitt, Caspi, Belsky, & Silva, 1992; Padez, 2003; Quinlan, 2003; Romans et al., 2003). Likewise there is evidence for relationships between low parental investment, parental absence (Ellis et al., 2003; Nettle et al., 2010a; Wellings & Kane, 1999), poverty (Barber 2001), reduced feelings of family support (Nettle & Cockerill 2010), early familial stress (Chisholm et al. 2005) and frequent residential relocations (Nettle et

al. 2010b) with early reproduction, or, in the case of Nettle and Cockerill (2010), with early *intended* reproduction.

Although relationships between family level adversity and both menarcheal and reproductive timing have been extensively studied, the same is not true for neighbourhood level adversity. In terms of menarche, neighbourhood level adversity has been largely ignored. However, there is compelling evidence that these factors play a role in reproductive timing. Women living in neighbourhoods with higher levels of disadvantage (McCulloch 2001; Nettle et al. 2010b) and mortality rates (Wilson & Daly, 1997), decreased life expectancies, fewer healthy years (Nettle 2011) and lower perceptions of safety (Johns 2011) tend to have younger ages at first birth. Geronimus (1987) and more recently Johns et al. (2011), argued that these types of harsh environmental cues accelerate reproductive trajectories in females by signalling a threat to future reproductive opportunity. If one considers that associations between early menarche and early child bearing in females have been directly (Dunbar et al. 2008) and indirectly (Andersson-Ellström et al. 1996; Deardorff et al. 2005; Helm & Lidegaard 1989; Savolainen et al. 2012; Udry 1979) found in the literature it is plausible that neighbourhood level factors could also play a role in menarche.

The primary aim of this study was to explore the relationships between menarcheal timing and a wide set of measures of childhood adversity, including both family level and neighbourhood level factors, in a cohort of adolescent girls from an English urban area. Because Clutterbuck et al. (2014a) found that increased family and neighbourhood level adversity in this sample was associated with a desire to have children at a younger age the secondary aim of this study was to investigate the relationship between menarche and intended reproductive timing.

5.2 Methods

5.2.1 Overview

The data was obtained from a large cross sectional study investigating the effect of childhood adversity on intended reproductive timing and interest in infants in English adolescent females, described in detail in Chapter 4. Ethical approval was obtained from Newcastle University's Faculty of Medical Sciences Ethics Committee (see Appendices B & C).

5.2.2 Sample

This sample was the same sample of participants outlined in Chapter 4 (see section, 4.3.1).

5.2.3 Materials

Participants completed a written questionnaire containing a number of measures relating to childhood adversity, menarcheal timing and intended reproductive timing. The childhood adversity measures included: neighbourhood deprivation, residential relocations, family structure, family support and perceived neighbourhood safety and quality. The menarcheal timing and intended reproductive timing measures were collected via self-report questionnaire items. A description of these items can be found in the Methods section of Study 3 in Chapter 3 (see section, 3.5.3.2.2).

5.2.4 Procedure

Participants took part in groups of two to four during school hours in a quiet room and were given verbal and written instructions on completing the questionnaire.

5.2.5 Data Analysis

Any answers on the questionnaire that were left blank were imputed using the mid-point. If participants put an age range for ideal age at parenthood the midpoint was also imputed. However, if multiple ages for ideal age at parenthood were given the mean was taken. Bivariate correlations were used to explore the relationships between the childhood adversity measures. Because of the age range in this sample only a quarter of the participants (n=90) had reached menarche. However, excluding pre-menarcheal participants from the analysis ignores useful information regarding potential effects of the predictor variables on menarcheal timing. In order to circumvent this issue Cox regressions were used to analyse relationships between childhood adversity, ideal age at parenthood and menarche. Data was censored at the reported date of menarche or the date of data collection if menarche had not yet occurred. Relationships between childhood adversity and ideal age at parenthood were analysed in detail elsewhere (Chapter 4; Clutterbuck et al. 2014a) but are discussed briefly in the results. All analysis was conducted in SPSS v 19.0. All tests were two tailed with $p<0.05$ deemed statistically significant.

5.3 Results

5.3.1 Descriptive Statistics

Descriptive statistics for all questionnaire measures are shown in Table 5.1. For those who had reached menarche, age at menarche ranged from 8.92 years to 13.58 years. Participants who wished to have children one day reported an ideal age at parenthood from 14 to 36 years. IMD rankings for participant's residence ranged from 507 to 31911. Half of the sample lived in the 39% most deprived areas in England and Wales with a quarter residing in areas categorised as the 20% most deprived. Another quarter of the participants lived in the 27% least deprived areas in England and Wales. Participants reported moving house anywhere from zero to 18 times. The majority (91%) of participants had at least one or more biological (81%) or half/step sibling (35%). Because only around 5% of participants had experienced mother absence from the home at some point in their life the 'Timing of Mother Absence' variable was excluded from subsequent analysis.

5.3.2 Childhood Adversity, Menarche and Intended Reproductive Timing

Table 5.2 shows correlations among the measures of childhood adversity, menarche and intended reproductive timing as well as age. Although most were correlated in the expected directions, many associations were weak and not all achieved statistical significance. Father absence in later childhood was associated with higher feelings of family support and fewer numbers of half/stepbrothers. Conversely, stepfather co-residence was associated with decreased feelings of family support and increased numbers of half/stepsiblings. Girls from more deprived neighbourhoods were more likely to have, a stepfather living in the home, more biological and half/stepsiblings as well as a poorer perception of their neighbourhoods. Moving house more times was related to disruption within the home such as stepfather presence, more half/stepsiblings and lower feelings of family support. Having more half/stepsiblings was associated with reduced feelings of family support, but only half/stepbrothers was related to poorer neighbourhood perceptions. Girls with poor neighbourhood perception tended to also report lower feelings of family support.

Table 5.1 Descriptive Statistics of all Questionnaire Measures.

		Frequencies (%)/ Mean (SD)
Participant Age	9 years	n=45 (13)
	10 years	n=103 (29)
	11 years	n=76 (21)
	12 years	n=71 (20)
	13 years	n=42 (12)
	14 years	n=17 (5)
Menarche	Reached Menarche	n=98 (30)
	Age (years)	Mean 11.80 (SD=1.02)
Ideal Age at Parenthood	Would Like to be a Parent	n=321 (94)
	Age (years)	Mean 24.97 (SD=3.90)
Childhood Adversity	[1]Timing of Mother Absence(0-5 years)	n=11 (3)
	Timing of Mother Absence(6-14 years)	n=9 (3)
	[2]Timing of Father Absence(0-5 years)	n=73 (21)
	Timing of Father Absence(6-14 years)	n=48 (14)
	[3]Age at Mother Absence	Mean 5.66 (SD=4.21)
	[4]Age at Father Absence	Mean 4.68 (SD=3.95)
	Stepfather Presence	n=48 (14)
	Biological Siblings	Mean 1.31 (SD=1.11)
	Half/Stepsiblings	Mean 0.71 (SD=1.24)
	Total Siblings	Mean 2.01 (SD=1.64)
	Biological Brothers (one or more)	n= 183 (52)
	Biological Sisters (one or more)	n= 171 (48)
	Half/Stepbrothers (one or more)	n= 79 (22)
	Half/Stepsisters (one or more)	n= 91 (26)
	[5]Neighbourhood Deprivation	Mean 15091.08 (SD=9876.85)
	Residential Moves	Mean 1.76 (SD=2.28)
	No Residential Relocations	n= 128 (37)
	One Residential Relocation	n= 80 (23)
	Two Residential Relocations	n= 43 (13)
	Three Residential Relocations	n= 44 (13)
	Four Residential Relocations	n= 21 (6)
	Five+ Residential Relocations	n= 34 (9)
	[6]Family Support	Mean 29.02 (SD=5.48)
	[7]Percieved Neighbourhood Safety and Quality (PNSQ)	Mean 26.82 (SD=4.05)

[1] Timing of Mother Absence: the age group of participant when mother stopped living in the same residence. Percentage includes those with continual mother presence. [2] Timing of Father Absence: the age group of the participant when father stopped living in the same residence. Percentage includes those with continual father presence. [3]Age at Mother Absence: the age at which mother stopped living in the same residence as participant (n=20).[4]Age at Father Absence: the age at which father stopped living in the same residence as participant (n=121). [5]LSOA: Lower Super Output Area. It is an Index of Multiple Deprivation ranking small areas in England and Wales on a scale from 1 (most deprived) to 32,482 (least deprived).[6]Family Support: the minimum possible score was 5 and the maximum was 35, higher scores indicate more positive feelings of family support. [7]Perceived Neighbourhood Safety and Quality: the minimum possible score was 8 and the maximum was 32, higher scores indicate more positive perceptions of neighbourhood

Table 5.2 Correlations between Age, Childhood Adversity, Menarche and Ideal Age at Parenthood.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Age												
2. [1]Neighbourhood Deprivation	0.21*											
3. Residential Moves	0.04	-0.08										
4. [2]Timing of Father Absence	0.08	0.12	-0.08									
5. Stepfather Presence	0.04	-0.12*	0.11*	-0.16								
6. Biological Brother	-0.12*	-0.13*	0.05	0.12	-0.06							
7. Biological Sister	-0.12*	-0.12*	0.04	-0.05	0.03	0.01						
8. Half/Stepbrother	-0.03	-0.19*	0.20*	-0.22*	0.25*	0.03	0.00					
9. Half/Stepsister	0.00	-0.19*	0.15*	-0.16	0.27*	-0.07	0.02	0.38*				
10. [3]Family Support	-0.17*	0.09	-0.17*	0.21*	-0.20*	-0.06	0.05	-0.17*	-0.25*			
11. [4]Perceived Neighbourhood Safety & Quality	0.05	0.38*	-0.08	0.16	-0.08	-0.10	-0.03	-0.12*	-0.06	0.26*		
12. [5]Menarche	0.63*	0.24*	-0.09	0.20	-0.17	-0.01	-0.16	-0.19	-0.23*	0.13	-0.01	
13. Ideal Age at Parenthood	0.11*	0.27*	-0.15*	0.08	-0.07	-0.08	-0.10	-0.17*	-0.07	0.16*	0.29*	0.26*

*p<0.05.

[1]LSOA: Lower Super Output Area. It is an Index of Multiple Deprivation ranking small areas in England and Wales on a scale from 1 (most deprived) to 32,482 (least deprived).[2] Timing of Father Absence: a categorical variable of the age group of the participant (1= 0-5years, 2=6-14years) when father stopped living in the same residence. For the purposes of this correlation table those with continual father presence were removed from this variable. [3]Family Support: the minimum possible score was 5 and the maximum was 35, higher scores indicate more positive feelings of family support. [4]Perceived Neighbourhood Safety and Quality: the minimum possible score was 8 and the maximum was 32, higher scores indicate more positive perceptions of neighbourhood. [5]Menarche: a continuous variable of age at menarche.

All ten childhood adversity variables were entered into a Cox regression with menarche as the outcome. In total 87 (25%) participants were included as events (having reached menarche) and 217 (61%) participants were censored (having not yet reached menarche). The remainder were treated as missing due to missing values in either the outcome or predictor variables. As Table 5.3 shows, only residential relocations (HR 1.11; 95%CI 1.02 to 1.22) and number of half/stepsisters (HR 1.63; 95%CI 1.16 to 2.29) were significantly associated with timing of menarche such that moving house more often and having more half/stepsisters was associated with accelerated menarcheal timing. The effect of moving house was cumulative in nature even when controlling for the other nine childhood adversity variables. Compared to never moving house, moving house one to four times more than doubled the likelihood of reaching menarche at a given time point (HR 2.14; 95%CI 1.23 to 3.73) and moving house five or more times more than tripled the likelihood of the event occurring (HR 3.20; 95%CI 1.44 to 7.10; see Figure 5.1). After controlling for the other nine childhood adversity variables, participants who had one or more half/stepsister compared to those who had none were twice as likely to reach menarche at a given time point (HR 2.10; 95%CI 1.16 to 3.79 see Figure 5.2).

Previous analysis of this sample revealed that increased levels of both family level and neighbourhood level childhood adversity were related to earlier ideal age at parenthood (Chapter 4; Clutterbuck et al. 2014a). Ideal age at parenthood and the ten childhood adversity variables were entered into a Cox regression with menarche as the outcome, however, there was no relationship between these two variables (HR 1.00; 95%CI 0.94 to 1.07).

5.4 Discussion

The relationship between multiple measures of childhood adversity and menarcheal timing, as well as the relationship between menarcheal timing and intended age of reproduction, was investigated in a cohort of urban English adolescent girls. Of the ten childhood adversity measures, only frequency of residential relocations and number of half/stepsisters was associated with accelerated menarche. Girls who had moved house more times were more likely to experience menarche at a given age than those who had never moved. The effect of residential relocations on menarcheal timing was cumulative. Compared to those who had never moved, relocating one to four or five or

Table 5.3 Results from a Cox Regression of Menarcheal Timing on the Ten Measures of Childhood Adversity. Exp(β) Represents the Relative Risk of Reaching Menarche at a Given Age for Each Additional Unit of Predictor Variable[1].

		95% CI for Exp (β)		
	Exp(**β**)	Lower	Upper	Sig
[2]**Neighbourhood Deprivation**	1.00	1.00	1.00	0.60
Residential Relocations	1.11	1.02	1.22	0.02
[3]**Timing of Father Absence**				0.76
[4]**Timing of Father Absence**	0.80	0.40	1.60	0.52
[5]**Timing of Father Absence**	1.02	0.55	1.92	0.94
[6]**Stepfather Presence**	1.15	0.58	2.28	0.68
Biological Brother	1.37	0.97	1.93	0.08
Biological Sister	1.08	0.79	1.47	0.62
Half/stepbrother	0.97	0.67	1.41	0.88
Half/Stepsister	1.63	1.16	2.29	0.01
[7]**Family Support**	0.99	0.95	1.02	0.46
[8]**Percieved Neighbourhood Safety and Quality (PNSQ)**	01.03	0.97	1.09	0.35

[1]In total 87 (25%) participants were included in the analysis as having reached menarche with 217 (61%) participants censored. [2]LSOA: Lower Super Output Area. It is an Index of Multiple Deprivation ranking small areas in England and Wales on a scale from 1 (most deprived) to 32,482 (least deprived).[3]Timing of Father Absence: this variable had three categories- 1= father absence during zero to five years, 2= father absence during six to 14 years, 3= father present. [4]Timing of Father Absence: father absence during zero to five years of age compared to reference category ('father present'). [5]Timing of Father Absence: father absence during six to 14 years of age compared to reference category ('father present'). [6]Stepfather Presence: stepfather presence compared to the reference category of 'no stepfather present'. [7]Family Support: the minimum possible score was 5 and the maximum was 35, higher scores indicate more positive feelings of family support. [8]Perceived Neighbourhood Safety and Quality: the minimum possible score was 8 and the maximum was 32, higher scores indicate more positive perceptions of neighbourhood.

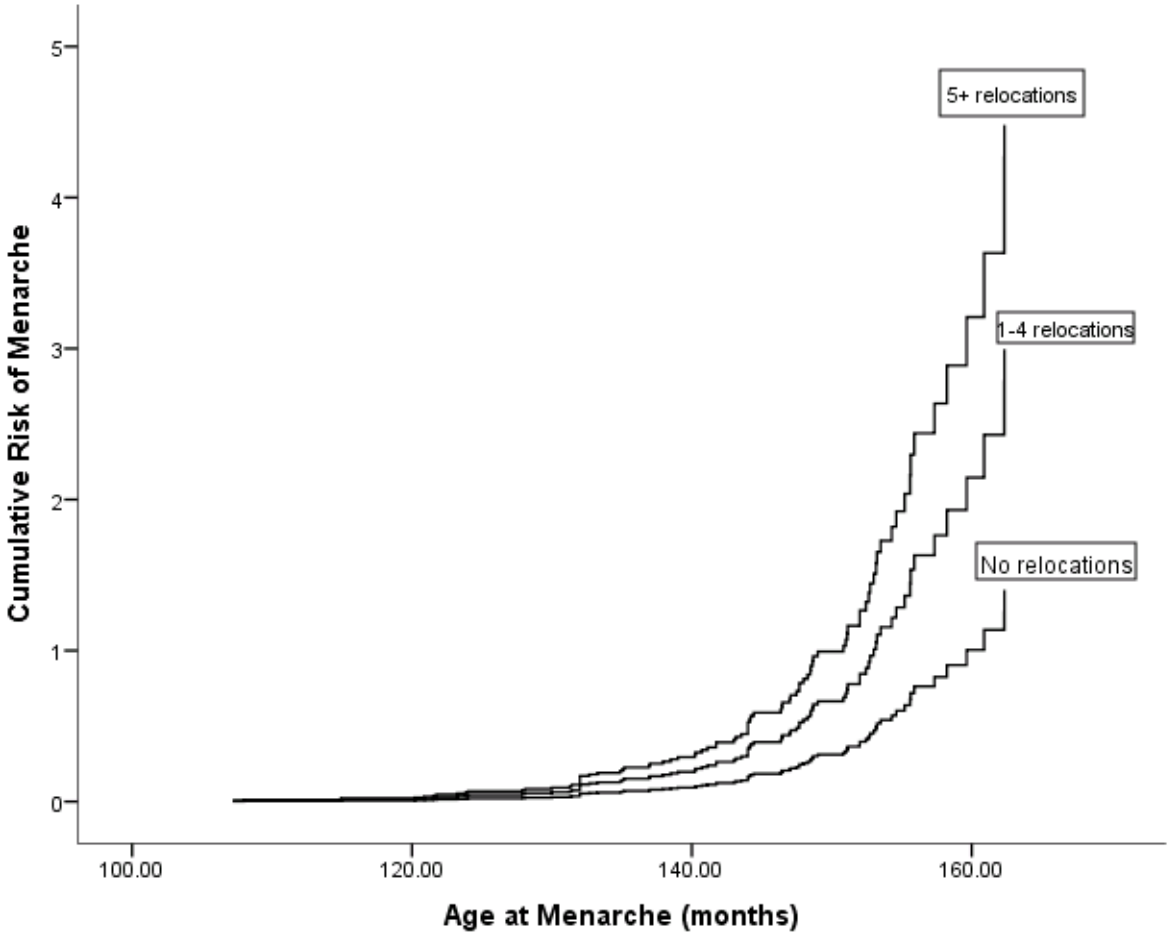

Figure 5.1. The Cumulative Risk of Menarche at a Given Age for Each One Unit Increase in Residential Relocations, Adjusted for all other Childhood Adversity Variables.

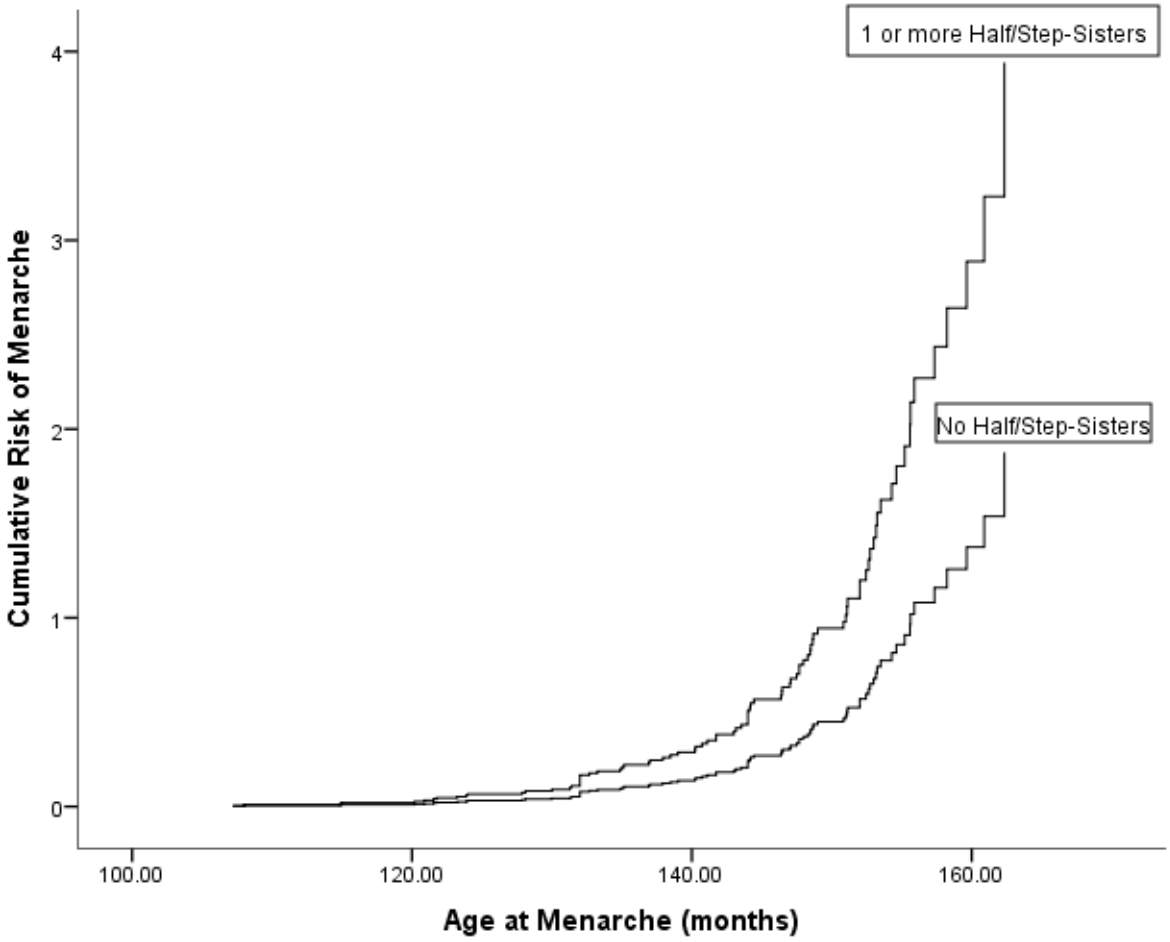

Figure 5.2. The Cumulative Risk of Menarche at a Given Age for Each One Unit Increase in Number of Half/Stepsisters, Adjusted for all other Childhood Adversity Variables.

more times doubled or tripled the chance of reaching menarche, respectively. In addition, the more half/stepsisters a participant had the more likely she was to have reached menarche. This accelerating effect of half/stepsisters on menarche was present even when comparing those participants with no half/stepsisters to those with one or more. There was no association between intended reproductive timing and menarcheal timing.

The family and neighbourhood level childhood adversity factors that have previously been associated with menarcheal and reproductive timing were not associated with menarcheal age in this sample (see Chapter 5 introduction for references). However, the sample size in this study was smaller than previous studies investigating antecedents of these reproductive life events (Alvergne et al., 2008; Belsky et al., 2007; Blell et al., 2008; Bogaert, 2008; Hoier, 2003; Johns, 2011; Matchock & Susman, 2006; McCulloch, 2001; Moffitt et al., 1992; Padez, 2003; Quinlan, 2003; Romans et al., 2003; Wilson & Daly, 1997). Furthermore, some studies have found that it is the duration of father absence or stepfather presence that matters most (Alvergne et al., 2008; Ellis & Garber, 2000; Hoier, 2003; Moffitt et al., 1992; Quinlan, 2003). To determine if duration of father absence had an effect on menarche in this sample a Cox regression was run including the ten childhood adversity variables but replacing the 'Timing of Father Absence' variable with a 'Duration of Father Absence' variable (duration of stepfather presence was not collected in this sample). However, the substitution of father duration made no difference to the model (details not shown).

Surprisingly, the only family structure variable that had a significant accelerating effect on menarche was the number of half/stepsisters. In this sample 57 (63%) of the participants with half/stepsister(s) (n=91) also had a half/stepbrother(s), a stepfather or both. These three variables were significantly positively correlated with each other. Thus it is possible the presence of half/stepsister(s) was acting as a proxy for exposure to unrelated males, a phenomenon observed by others to be related to early menarche (Ellis & Garber, 2000; Matchock & Susman, 2006). It is important to bear in mind that although participants were asked explicitly if a stepparent co-resided with them this was not the case for siblings, where in the interest of brevity participants were only asked about the number and type of sibling. Alternatively it is possible that having genetically dissimilar females present, such as half/stepsisters, increases intrasexual competition

activating early reproductive development. Recently intrasexual competition between females has garnered attention in the animal literature for the role it plays in reproductive success (Clutton-Brock & Huchard 2013). The result observed here, that is an acceleration of menarche in the presence of half/stepsisters, is in contrast to a previous finding in this sample of a decrease in ideal age at parenthood in the presence of half/stepbrothers (Chapter 4; Clutterbuck et al. 2014a). It should be noted that birth order was not collected in this sample. However, it is unclear how useful this information would have been as there is little consensus within the literature of the effect of birth order on menarcheal timing (Bogaert 2008; Hoier 2003; Padez 2003; as reviewed in Matchock & Susman 2006).

To my knowledge no previous studies investigating childhood adversity factors on menarcheal timing have explored the role of frequency of residential relocations. However, associations have been reported between residential relocations and both early sexual initiation and early childbearing (Crowder & Teachman, 2004; Ellis et al., 2009; Nettle et al., 2010b; South et al., 2005). Relocating indicates instability within the family and is likely to cause disruption to a child's social networks, which are essential in buffering against life's stressors (Cohen & Wills 1985). The social networks of mothers and/or fathers are likewise potentially disrupted when relocating, increasing parental stress levels and potentially decreasing support available for the child. Certainly, in this sample, frequent residential relocation was associated with presence of a stepfather (indicating absence of at least one biological parent), increased number of half/stepsiblings and reduced feelings of family support. What is more, the effects of residential relocations on children are far reaching including negative health outcomes, higher adult mortality rates, increased substance abuse, internalising and externalising symptoms and poor educational performance (Astone & McLanahan 1994; Jelleyman & Spencer 2008; Oishi & Schimmack 2010; Tucker et al. 1998). Many of these outcomes, it should be noted, are also associated with outcomes of early puberty and menarche (Copeland et al. 2010; van Jaarsveld et al. 2007; Prentice & Viner 2012).

The absence of an association between menarche and intended reproductive timing in this sample is perhaps not surprising given that this relationship tends to be indirect and mediated by sexual initiation (Udry 1979; Andersson-Ellström et al. 1996; Deardorff et al. 2005; Dunbar et al. 2008; Savolainen et al. 2012). Although, it is possible that some of the sample were sexually active it is likely to be only a small proportion. In addition, although intended age at reproduction has been found to be well correlated with actual

age at first birth (Nettle et al. 2010a), these variables are not interchangeable and intended age at reproduction tends to change with age and maturity. This was the case in this sample where older participants tended to state an older ideal age at first birth.

To my knowledge this study was the first to explore relationships between family level and neighbourhood level child adversity as well as intended reproductive timing on menarcheal age. In addition, this study was relatively unique in using a cohort of peripubescent participants rather than adults. Compared to study designs using retrospective recall with adults, participants in this study were reporting on current, or relatively recent, life events and circumstances allowing for potentially more reliable recall.

This study was part of a larger study that focused on recruiting girls within a specific age range and not by pubertal stage (Chapter 4; Clutterbuck et al. 2014a). Thus the proportion of post-menarcheal participants was small. The larger study included two 'interest in infants tasks' as well as the questionnaire. As such I was conscious to limit the number of questionnaire items to ensure participation did not prove too onerous for the young participants. Unfortunately, this meant the omission of possibly useful family structure information such as duration of stepfather presence, sibling co-residence and birth order as discussed above. Other factors known to correlate with menarcheal timing, such as body mass index or maternal age at menarche, might also have explained some of the variation in menarcheal timing in this sample (Posner 2006). However, obtaining these measures was beyond the scope of this study. Additionally, it is not clear how much mother's menarcheal age would add to the overall picture of adversity and menarcheal timing because it is difficult to determine if the mother-daughter menarcheal relationship is truly genetic or due instead to intergenerational similarities in developmental environments.

Due to the age of the cohort, socioeconomic position was also omitted from the questionnaire because I could not be confident in the reliability of responses to questions about parental income, educational attainment or employment. However, there is support for the utility of neighbourhood socioeconomic position as a proxy for individual socioeconomic position (Adams et al. 2004). Furthermore, investigating relationships between neighbourhood environment and physical development could have positive implications for real life. Lessons on pubertal development could be brought forward in schools where early development might be more likely in female

pupils. As well, because early menarche is often associated with early childbearing (see Chapter 5 introduction for references) it could add valuable information to the emerging debate (Johns et al. 2011) that the route to reducing teenage pregnancy rates is through reducing disadvantage and inequality.

Future research should explore the circumstances that strengthen the relationship between residential relocations and menarche. Two possible avenues are critical age of exposure, outlined as important in Belsky et al.'s (1991) theory, and type of relocation such as just home, just school or both. For a child or adolescent, moving house can come with a host of uncertainty and stress. It requires the establishment of new social networks and adjustment to a new environment with all its potential risks. It often indicates disruption to home life possibly through the break up and/or the merging of families. Rather than a benign event in a young female's life, residential relocations, in this sample, appears to be an important factor in menarche exhibiting a cumulative impact on its timing.

Chapter 6. Discussion

The literature suggests that there is a positive relationship between childhood adversity and reproductive trajectory, such that greater adversity speeds up menarcheal and reproductive timing. One psychological mechanism between these events that has received some attention in the literature is interest in infants. Interest in infants is important for learning caretaking skills, prior to reproduction. This thesis set out to test the hypothesis that interest in infants would mediate the relationship between early childhood adversity and reproductive trajectory. In order to address this hypothesis the research outlined in this thesis had two main aims: 1) to investigate the relationship between childhood adversity, reproductive timing and interest in infants in females and 2) to explore different methods for measuring interest in infants.

6.1 Summary of Findings

6.1.1 Measuring Interest in Infants

In Chapter 3 I reviewed the methods for measuring the construct of interest in infants. Interest in infants has been studied using a wide variety of methods including: behavioural, preference, self-report, psychophysics, physiology and non-human primate comparative studies. Despite the fact that this phenomenon has been researched for over fifty decades there is little consensus on the best method to use. As such I wanted to explore different methods of measuring this construct.

Interest in any stimuli relies on feelings of reward for the observer. Berridge and Kringlebach (2008) have proposed that reward is multifaceted broadly involving: liking, wanting and learning. Each of these facets can be expressed explicitly or implicitly. Interest in infants research is seeing a trend toward tools that operationalise the explicit 'liking' and an implicit 'wanting' (Brosch, Pourtois, & Sander, 2010; Charles et al., 2013; Hahn et al., 2013; Parsons, Young, Kumari, et al., 2011; Parsons, Young, Parsons, et al., 2011; Sprengelmeyer et al., 2013; Yamamoto et al., 2009). The 'liking' tasks most often involve self-reported fondness for infants or ratings of attractiveness while the 'wanting' tasks commonly include 'motivation to view' tasks. In a motivation to view task the participant can increase or decrease the length of time it views stimuli by pressing a computer key. In exploring different methods for measuring interest in infants I also wanted to include implicit and explicit tasks. As outlined in Chapter 3 I

designed two implicit tasks that would be engaging for young participants, they were the Count the Purple Triangles Task and the Eye Tracking Task. I also measured interest in infants explicitly using the Preference Task and a Fondness for Babies self-report questionnaire item.

6.1.2 Lab Studies

6.1.2.1 Studies 1 & 3

Study 1 and 3 tested the usability of the interest in infants tools (Count the Purple Triangles Task, Eye Tracking Task, Preference Task, Fondness for Babies) and the intercorrelation between them in a sample of adult and adolescent females respectively. These studies also piloted the childhood adversity questionnaires (including menarche and reproductive timing) as such I also explored the relationship between these variables, and interest in infants. In both samples participants showed no difference in time spent looking at adult versus infant images in the Eye Tracking Task. However, both samples did have greater dwell times for infant/adult stimuli compared to flower stimuli. Also in both samples participants took longer to count triangles while an infant face was present on the screen but were more accurate at recognizing adult faces in the Count the Purple Triangles Task. The Preference Task participants preferred images of infants more than adults. However, this preference was driven by the animal images only in the adult sample. The adolescent sample preferred images of infants to adults in all but the human silhouettes. The adolescent sample gave high ratings of Fondness for Babies. Of the seven measures of interest in infants (Eye Tracking Task: time spent looking at infants; Count the Purple Triangles Task: time spent searching for triangles during infant trials, accuracy for recognizing infant faces; Preference Task: preference for animal infant photos, animal infant silhouettes, human infant photos, human infant silhouettes) only two correlations were found in the adult sample. Women who preferred images of animal infant photos tended to prefer animal infant silhouettes (over their respective adult counterparts) in the Preference Task and women who were more accurate at remembering infant faces in the Count the Purple Triangles Task tended to prefer images of human infant photos in the Preference Task. There were more correlations between the interest in infants measures in the adolescent sample but they were somewhat contradictory. All of the Preference Task measures were positively correlated with the exception of human infant photos. Longer gaze time during adult

trials of the Eye Tracking Task was positively related to a preference for human infant silhouettes, a higher self-reported fondness for babies and better accuracy for recognising infant faces in the Count the Purple Triangles Task.

Because of the small sample sizes and the relatively large number of variables collected only exploratory analysis could be performed to look at relationships between childhood adversity, menarche, intended reproductive timing and interest in infants in both samples. In the adult sample earlier menarche was related to less family support and having more half/stepsisters. Females who experienced father absence in late childhood/early adolescence showed an increase interest in infants during the Count the Purple Triangles Task. However, interest in infants in the adolescent sample was related to less childhood adversity. Specifically girls who reported higher feelings of family support and who had better perceptions of their neighbourhood respectively reported higher Fondness for Babies and took longer counting purple triangles during infant trials in the Count the Purple Triangles Task. Girls with later menarche also took longer to count for triangles during infant trials of the Count the Purple Triangles Task and had a higher preference for infant silhouettes in the Preference Task. Childhood adversity and reproductive trajectories were also related. Girls with more biological brothers were younger at menarche and those moving house more often, experiencing father absence and living in more deprived neighbourhood tended to state a younger ideal age at parenthood.

6.1.2.2 Study 2

In Study 2 I modified the Eye Tracking Task to include an extra fixation cross because I was concerned any potential attentional capture of the stimuli was being masked anticipatory saccades. The new fixation cross appeared after the presentation of the face/flower stimuli and prior to the target letter presentation. The addition of this fixation cross acted as a cue for the target letter presentation which allowed the participant to look at the face/flower stimuli more freely. I also increased the duration of the face/flower stimuli to 3000ms from 2500ms in line with other eye tracking studies. I tested the modified version of the Eye Tracking Task on a small group of adult females. Compared to the original Eye Tracking Task participants spent a larger proportion of time viewing either face or flowers in the new Eye Tracking Task, however this was only a non-significant trend. There was also a non-significant trend toward longer dwell

time for infant stimuli versus adult stimuli in the new Eye Tracking Task. This was not the case for the original version of the Eye Tracking Task. Across the two versions of the task there was no difference in time spent viewing infant or time spent viewing adult images. It is possible with a larger sample size the differences would have reached statistical significance. Despite only modest support for the new version of the Eye Tracking Task I decided to still use it in the subsequent study (Study 3) because 1) it was less likely that potential target image dwell time would be lost in saccades and 2) it was more likely any dwell time spent on target images would be interest in that stimuli rather than an artefact of a saccade strategy.

6.1.3 School Study

In Chapters 4 and 5 I outlined a study I conducted in schools exploring the relationships between childhood adversity, reproductive trajectories and interest in infants in a large sample of English adolescent girls. To investigate interest in infants I used the Preference Task, the Count the Purple Triangles Task and the Fondness for Babies questionnaire item. Because the Eye Tracking Task could not be used easily outside of the lab this tool was not included. To investigate childhood adversity, intended reproductive timing and menarche the questionnaire trialled in Study 3 was used.

This schools sample also showed a higher preference for infant images compared to adult images in the Preference Task. This preference was specific to human infant silhouettes. As with the samples in Study 1 and 3 participants in this study were more accurate at recognising adult faces but spent more time counting triangles during the infant trials of the Count the Purple Triangles Task. Again they gave high ratings for Fondness for Babies. Only Fondness for Babies and three of the Preference Task measures were related, however these were weak.

In the school sample interest in infants was only related to one of the childhood adversity variables, family support, such that girls reporting more family support showed higher preferences for infants in the Preference Task. This was similar to the finding in the adolescent sample of Study 3 where less adversity was related to increased interest in infants. Interest in infants was not related to ideal age at parenthood nor was it related to menarche. There was no relationship between intended reproductive timing and menarche however both of these variables were associated with

high childhood adversity. Specifically, an earlier ideal age at parenthood was associated with living in a more deprived neighbourhood, feeling the neighbourhood was off poor quality, feeling less supported by parents, having more half/stepbrother and moving house more often. Menarche was also related to moving house more often and having more half/stepsisters.

Although the adult and both adolescent samples showed relationships between childhood adversity and reproductive trajectories they differed in terms of how these variables related to interest in infants. Adult females who had experienced childhood adversity had earlier menarche and were more interested in infants than their peers. Conversely adolescent females who experienced childhood adversity had earlier menarche, earlier ideal ages at parenthood but were less interested in infants than their peers. As discussed in the school study (Chapter 4), it perhaps makes more sense to consider interest in infants as a reflection of future parental investment rather than a mechanism between childhood adversity and interest in infants. In line with Draper and Harpending's (1982) theory, young females learning that the environment is uncertain will benefit by maturing and reproducing young and investing less in each offspring, making the accrual of caretaking skills less necessary. However, the older females were all childless university students at the time of the study, with the majority wanting to have children one day. Thus even those in the sample who had experienced some form of early adversity chose a slower life history strategy. They chose to invest in their development, via educational attainment with, we can assume, the intention of accruing financial resources through better-paid employment. For this sample as a whole time spent searching purple triangles in the Count the Purple Triangles Task was longer in the infant trials with father absent females more likely to show the effect. Perhaps educational attainment is modifying the effect of father absence on interest in infants in these females. At a young age these females learned that male investment was not a certainty and subsequently chose a slower reproductive trajectory with opportunity for greater investment in offspring.

6.1.4 Strengths

The studies outlined in this thesis expanded on previous research by using both neighbourhood and family level adversity factors, using two measures of reproductive trajectories, using novel tools for measuring interest in infants and measuring implicit

interest in infants in an adolescent population. The adult and adolescent samples allowed me to explore the relationships between childhood adversity, reproductive trajectory and interest in infants in different aged populations. Unfortunately I could not make direct comparisons between the samples because of the use of different questionnaires and slightly different Eye Tracking Task.

The Count the Purple Triangles Task and the Eye Tracking Task were designed to implicitly measure interest in infants. Currently the trend in measuring this construct is to use a 'motivation to view' task, otherwise known as a 'key-press' task. However, I was not satisfied that this was a truly implicit measure as the participant is aware that the behaviour of pressing the key is being measured. In both the Count the Purple Triangles Task and the Eye Tracking Task the behaviours being measured were concealed within other tasks.

The vast majority of studies exploring childhood adversity and reproductive trajectories tend to use an adult sample with a retrospective design. However, my samples, with the exception of the adult sample, were adolescents at the time of study. This could increase the validity of their responses because childhood adversities and menarche will be either current or relatively recent events and therefore less likely to be distorted by time. Obviously in the context of these studies asking about intended reproductive timing was necessary because none of the participants were mothers. However, there may be merit in asking participants about their ideal age at parenthood rather than obtain actual age at first birth. Intended reproductive timing is based on an idealized time to reproduce whereas actual age at first birth is confounded by other factors such as fertility and availability of mates. Still this measure needs to be considered with caution. The large sample of adolescent girls in the school study showed a positive relationship between ideal age at parenthood and age. However, this was not the case for the lab study samples. Future research studying post-partum females' reproductive timing might benefit from asking about idealised age at first birth.

6.1.5 Limitations

One of the limitations of these studies was that they were correlational rather than longitudinal in design and therefore causation cannot be inferred. The Studies 1 and 3 were hindered by small sample sizes and slightly different methods. In the absence of

these issues the groups could have been compared providing some insight into interest in infants at different time points in the relation to childhood adversity and reproductive trajectories. In fact the small sample size of both groups hindered the analysis of relationships even within group as it allowed for only exploratory analysis. Following up the younger participants from the larger school study could prove informative. It would allow us to measure the accuracy for using ideal age at parenthood measures, i.e. do they end up having children around the age they stated as ideal. For those participants who do go on to become mothers it would be of interest to measure attachment style with infants and correlate that with their interest in infants scores in the peripubertal stage. This could provide support for interest in infants being an indicator of future parental investment.

There were arguably some factors, which if included, would provide valuable information. Mother's age at menarche and body mass index are known to correlate with menarche in daughters (Posner 2006). Furthermore, socioeconomic position, sibling co-residence, birth order, duration of stepfather presence and type of residential relocation (e.g. school, home or both) could have helped in teasing apart the effects of childhood adversity on intended reproductive timing, menarche and interest in infants. However, these measures were excluded for two reasons: 1) in order to not overburden the younger participants with an excess of questionnaire items and 2) answers to some of the questions, such as maternal menarche and socioeconomic position, were likely to be unreliable due to the young age of the participant. Indeed it is unclear how useful these questions would have been (Adams et al. 2004; Matchock & Susman 2006).

In designing tools to measure interest in infants we are sometimes guilty of interpreting 'interest in infants' as 'preferring infant stimuli more than X'. In my tools, as with many in the literature, infant stimuli are compared to adults and/or some neutral object and participant responses (behavioural, physiological, psychophysical, etc) are measured. Interest in infants does not need to be greater than interest in some other stimuli in order to be considered sufficient for accrual of caretaking skills, it merely needs to exist. Perhaps then measures such as my Fondness for Babies questionnaire item are adequate at indicating interest in infants. Indeed in both adolescent samples participants rating their liking of infants near the top of the scale. However, using these methods requires

trust in the participants' interpretation of such rating scales and is more susceptible to social desirability bias that often accompanies explicit measures.

6.1.6 Future Directions

In designing the Count the Purple Triangles Task I had intended to use the accuracy scores as the primary outcome measure of the task. The premise of the task was such that a participant would have better accuracy for the face type (i.e. infant or adult) that was better able to capture their attention during the counting phase. Infants appeared to be better able to capture participant attention because participants in all studies took longer to count triangles while infant faces were present on the screen. However, adult faces are more distinctive and thus easier to recognise, which is likely the reason participants had better accuracy in the adult trials. Additionally, the Count the Purple Triangles Task could be modified to improve its ability to measure the construct; for example it might have benefitted from greater consistency in the faces. The adult faces ranged in age from approximately early twenties to early forties. Although all the adult faces were smiling this was not the case for the infant faces. The majority of the infant faces were smiling but some had neutral or slightly negative expressions. I did intentionally ensure the adult faces were all smiling in an attempt to control for the power of the baby schema. In other words I treated smiling adult faces as comparable in terms of reward to the viewer as cute baby faces. As such, I treated all baby face expression as equal. However, studies have shown that infant expression can affect maternal response and behaviour (Donovan et al. 2007; Pearson et al. 2010). It would be interesting to systematically vary the infant and adult expressions to include trials with positive, negative and neutral expressions. As well the counting portion of the task appeared to be more useful in determining interest in infant and adult stimuli. The recognition phase of the task was likely confounded by the fact that adult faces are more distinctive and thus easier to recognize than infant faces. As such increasing the number of trials in the counting phase would increase the reliability of the task and bring it in line with other psychophysics experiments that tend to use large number of trials. However, the constraints of the age of the participant would still need to be considered.

One of the reasons for creating the Count the Purple Triangles Task was to be able to measure interest in infants implicitly in a younger sample of participants. To date implicit measurement of this construct had only been done in adults. A tool that is

increasing in use is the ‘key press task’, where participants can increase or decrease the viewing time of stimuli. I was concerned a ‘key press task’ would be confusing for younger participant leading to disengagement with the task. However, we cannot know for sure if this would be the case. It would be useful to test the usability of this task with young people and potentially allow for comparison in implicit interest in infants across the age spectrum.

In the Eye Tracking Task I used flowers as comparison stimuli because it was a single category of object and like faces have a lot of light/dark colour contrast, complexity of shape and are individual. However, the findings from the lab studies suggest that when given the choice participants prefer to look at faces, infant or adult, rather than flowers. One solution to this would be to use inverted faces as a comparison as others have done in the face perception literature (Valentine 1988). Yet, even inverted faces still have the baby schema, and thus the features that tend to capture our attention, would still be identifiable. Instead one option would be to include schematic face drawings which are devoid of expression and age but which include normal facial features arranged in the correct position. Schematic faces have been used in the face perception literature and tend to be preferred to inverted or scrambled faces as comparison stimuli (Homa et al. 1976).

In my interest in infants measures, with the exception of the Fondness for Babies questionnaire item, preference for infant stimuli was quantified directly (as in the Preference Task) or indirectly (as in the Count the Purple Triangles Task and the Eye Tracking Task) in comparison to preference for adult stimuli. It is possible that by designing the tasks in these ways participants’ level of interest in infants was somewhat biased. For example, in the Eye Tracking Task although there was no difference between interest in infant versus adult stimuli there was a difference between interest in infant or adult stimuli compared to flower stimuli. In other words participants preferred looking at human over neutral stimuli. Indeed, regardless of the interested in infants, interest in adults is also arguably an important behaviour. From infancy through to adolescence adults are important for access to resources, specifically, parents and other kin can be relied on for food, shelter and protection (Trivers 1974). After sexual maturity adults become important for reproduction and forming pair bonds (Buss & Schmitt 1993). Thus using adult interest as a comparison to infant interest might not be

entirely useful or, as outlined in the literature review of interest in infants (Chapter 3), even necessary.

Menarche is often used in studies as a proxy to reproductive timing. However menarche is one of the final stages of pubertal development and might not be as sensitive as other biological measures. Adrenarche is the initial stage of pubertal maturation. At six to eight years of age the zona reticularis in the female's adrenal gland will begin to develop and increase its production of androgen precursors dehydroepiandrosterone (DHEA) and dehydroepiandrosterone sulphate (DHEAs) (Zaidi et al. 2012). Increased DHEA has been associated with increased early adversity (Ellis & Essex 2007). Both DHEA and DHEAs are easy to measure though saliva samples. Perhaps exploring relationships between adrenarche, via DHEA(s) measurement, childhood adversity and interest in infants would provide us with a clearer picture of how early parental investment cues are being embedded in young females.

6.2 Conclusion

The studies detailed in this thesis have made novel contributions to both the interest in infants and the childhood adversity/life history literature. First I explored different methods for measuring interest in infants. I incorporated evidence from the neuroscience literature (Berridge & Robinson 2003) that reward, a proxy for interest, is multifaceted and therefore needs to be studied accordingly. I created two novel tools to measure interest in infants in a young sample via the reward facet of 'wanting'. Using these tools, along with the interest in infants tools that measured the 'liking' facet of reward my studies have helped to shape our understanding of how interest in infants develops over the life course. Outside of my studies interest in infants had only been studied via 'liking' in young people. By investigating these two facets of reward in terms of interest in infants my studies provide evidence that infant stimuli is not only consciously liked by young females but it is also implicitly desired. This evidence for implicit desire is important as it suggests that there is an underlying motivation early on in a female's life to engage with infants.

Much of the interest in infants research to date has investigated sex and age differences and how these help to explain the phenomenon. The childhood adversity/life history research has largely investigated how adverse live events affect the timing of sexual

development and reproduction. Using the knowledge from both areas of research I attempted to elucidate how childhood adversity might accelerate life histories through the mechanism of interest in infants. To my knowledge this relationship was only investigated by one other group (Maestripieri et al., 2004). My studies differed from theirs in that I used broader measures of childhood adversity, including neighbourhood level factors, used a much larger sample size and measured interest in infants using both explicit and implicit methods. Unlike Maestripieri et al. 2004 my findings did not suggest that interest in infants was acting as a mechanism but instead that it could be acting as an indicator of future parental investment in offspring. My studies are the first to provide empirical evidence of future parental investment strategies being embedded early in life.

In order to make firm conclusions regarding the relationship between childhood adversity, reproductive trajectory and interest in infants the tools and questionnaires would need to be refined. However, the preliminary findings of these studies suggest that childhood adversity may manifest itself in ways other than just accelerated reproductive trajectories, such as future parental investment strategies. This information could be practically useful in terms of informing policy. Providing evidence that childhood adversity may be making significant changes to future parenting practices, and the knock on implications that has for society as a whole, might contribute to the impetus the government needs to improve social disadvantage.

This thesis began by reviewing the teenage pregnancy literature. Along with the literature outlining the role childhood adversity plays in teenage pregnancy, there is a large body of life history research suggesting that humans use these cues and adjust reproductive timing accordingly. My research adds to the life history literature by providing evidence for a potential adjustment of reproductive timing in adolescent females experiencing adversity as well as a biological impact of adversity by accelerating sexual development in some girls. Thus these studies provide further evidence that reproductive trajectories respond to external cues. Although interest in infants did not act as a mechanism between childhood adversity and reproductive trajectory as originally predicted, the outcome perhaps makes more intuitive sense. If the purpose of interest in infants is to motivate the individual to accrue care taking skills

to invest in future offspring, then being less likely to invest in future offspring should be related to being less interested in infants, as found in this research.

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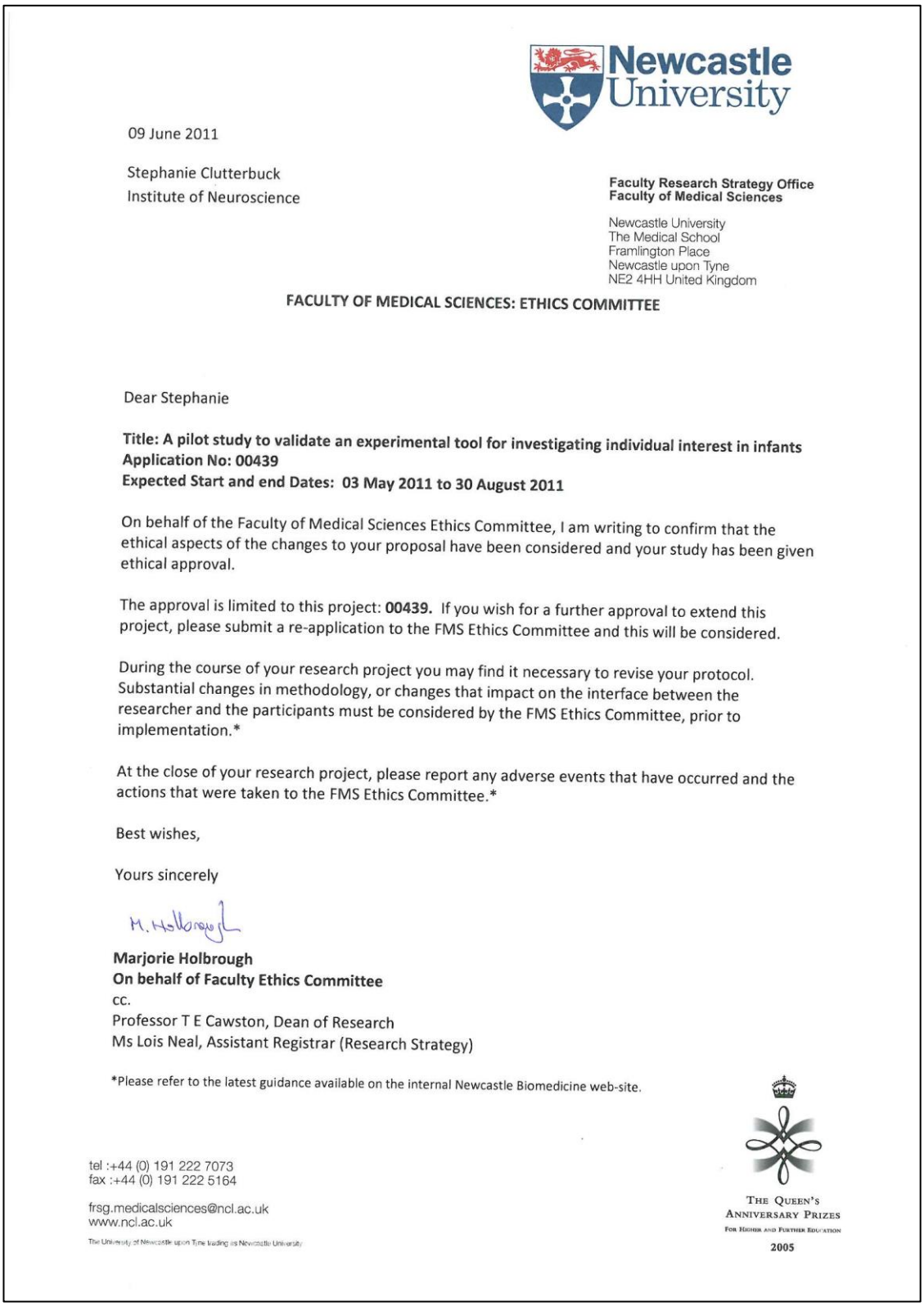
Appendices

APPENDIX A. Ethical Approval Letters for Studies 1-3.



Newcastle University

09 June 2011

Stephanie Clutterbuck
Institute of Neuroscience

Faculty Research Strategy Office
Faculty of Medical Sciences

Newcastle University
The Medical School
Framlington Place
Newcastle upon Tyne
NE2 4HH United Kingdom

FACULTY OF MEDICAL SCIENCES: ETHICS COMMITTEE

Dear Stephanie

Title: A pilot study to validate an experimental tool for investigating individual interest in infants
Application No: 00439
Expected Start and end Dates: 03 May 2011 to 30 August 2011

On behalf of the Faculty of Medical Sciences Ethics Committee, I am writing to confirm that the ethical aspects of the changes to your proposal have been considered and your study has been given ethical approval.

The approval is limited to this project: **00439.** If you wish for a further approval to extend this project, please submit a re-application to the FMS Ethics Committee and this will be considered.

During the course of your research project you may find it necessary to revise your protocol. Substantial changes in methodology, or changes that impact on the interface between the researcher and the participants must be considered by the FMS Ethics Committee, prior to implementation.*

At the close of your research project, please report any adverse events that have occurred and the actions that were taken to the FMS Ethics Committee.*

Best wishes,

Yours sincerely

M. Holbrough

Marjorie Holbrough
On behalf of Faculty Ethics Committee
cc.
Professor T E Cawston, Dean of Research
Ms Lois Neal, Assistant Registrar (Research Strategy)

*Please refer to the latest guidance available on the internal Newcastle Biomedicine web-site.

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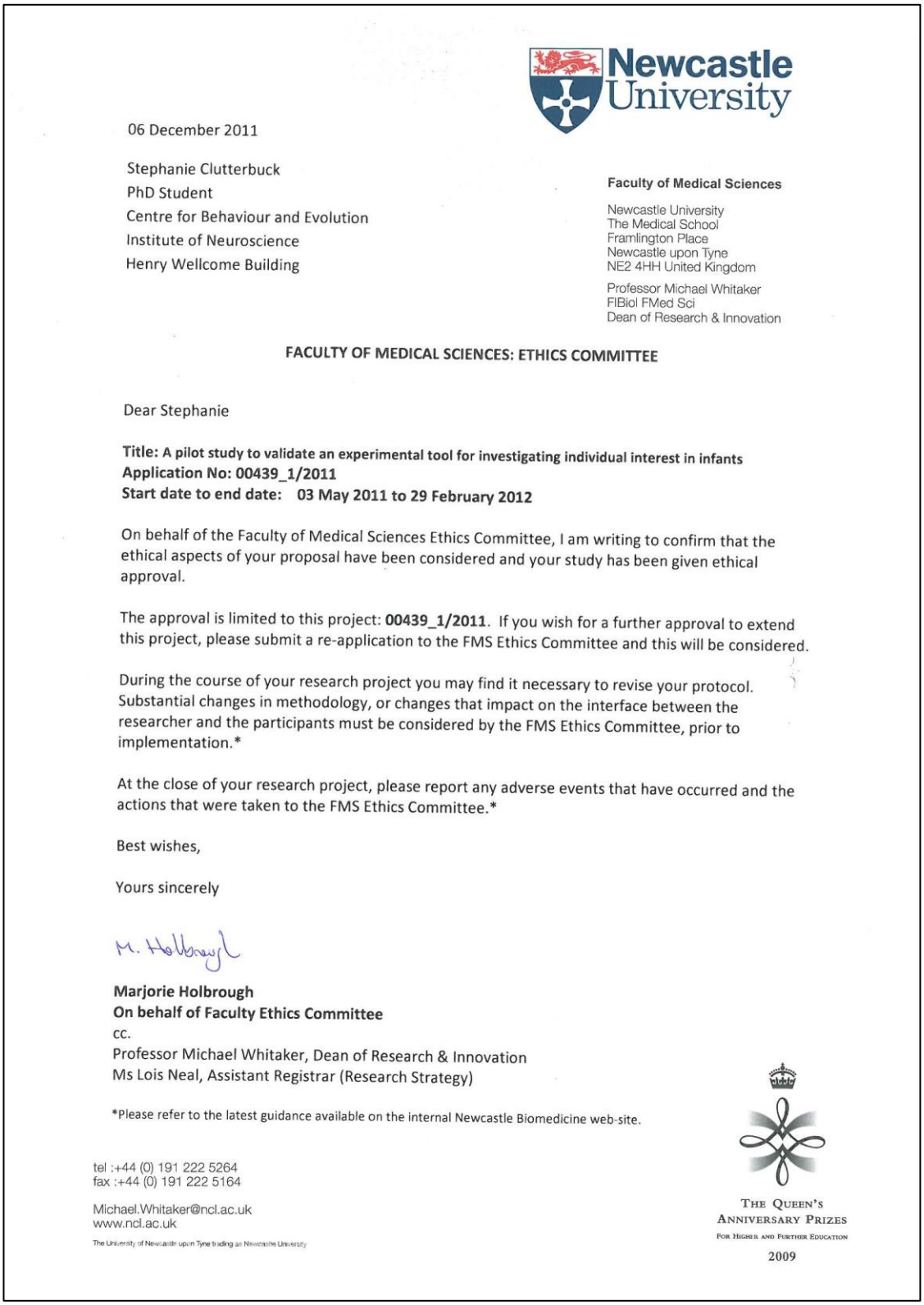
Figure A.1. Study 1-3 Ethics Approval June 2011.



Newcastle University

06 December 2011

Stephanie Clutterbuck
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Professor Michael Whitaker
FIBiol FMed Sci
Dean of Research & Innovation

FACULTY OF MEDICAL SCIENCES: ETHICS COMMITTEE

Dear Stephanie

Title: A pilot study to validate an experimental tool for investigating individual interest in infants
Application No: 00439_1/2011
Start date to end date: 03 May 2011 to 29 February 2012

On behalf of the Faculty of Medical Sciences Ethics Committee, I am writing to confirm that the ethical aspects of your proposal have been considered and your study has been given ethical approval.

The approval is limited to this project: **00439_1/2011**. If you wish for a further approval to extend this project, please submit a re-application to the FMS Ethics Committee and this will be considered.

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At the close of your research project, please report any adverse events that have occurred and the actions that were taken to the FMS Ethics Committee.*

Best wishes,

Yours sincerely

M. Holbrough

Marjorie Holbrough
On behalf of Faculty Ethics Committee
cc.
Professor Michael Whitaker, Dean of Research & Innovation
Ms Lois Neal, Assistant Registrar (Research Strategy)

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THE QUEEN'S ANNIVERSARY PRIZES
FOR HIGHER AND FURTHER EDUCATION
2009

Figure A.2. Study 1-3 Ethics Approval December 2011.

Newcastle University

04 January 2012

Stephanie Clutterbuck
PhD Student
Centre for Behaviour and Evolution
Institute of Neuroscience
Henry Wellcome Building

Faculty of Medical Sciences

Newcastle University
The Medical School
Framlington Place
Newcastle upon Tyne
NE2 4HH United Kingdom

Professor Michael Whitaker
FIBiol FMed Sci
Dean of Research & Innovation

FACULTY OF MEDICAL SCIENCES: ETHICS COMMITTEE

Dear Stephanie

Title: A pilot study to validate an experimental tool for investigating individual interest in infants
Application No: 00439_2/2011 (Amendment)
Start date to end date: 03 May 2011 to 31 January 2013

On behalf of the Faculty of Medical Sciences Ethics Committee, I am writing to confirm that the ethical aspects of your proposal have been considered and your study has been given ethical approval.

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THE QUEEN'S ANNIVERSARY PRIZES
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2009

Figure A.3. Study 1-3 Ethics Approval January 2012.

Newcastle University

09 May 2012

Stephanie Clutterbuck
Institute of Neuroscience
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Newcastle upon Tyne
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Professor Michael Whitaker
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Dean of Research & Innovation

FACULTY OF MEDICAL SCIENCES: ETHICS COMMITTEE

Dear Stephanie

Title: A pilot study to validate an experimental tool for investigation individual interest in infants
Application No: 00439_3/2012 (Amendment)

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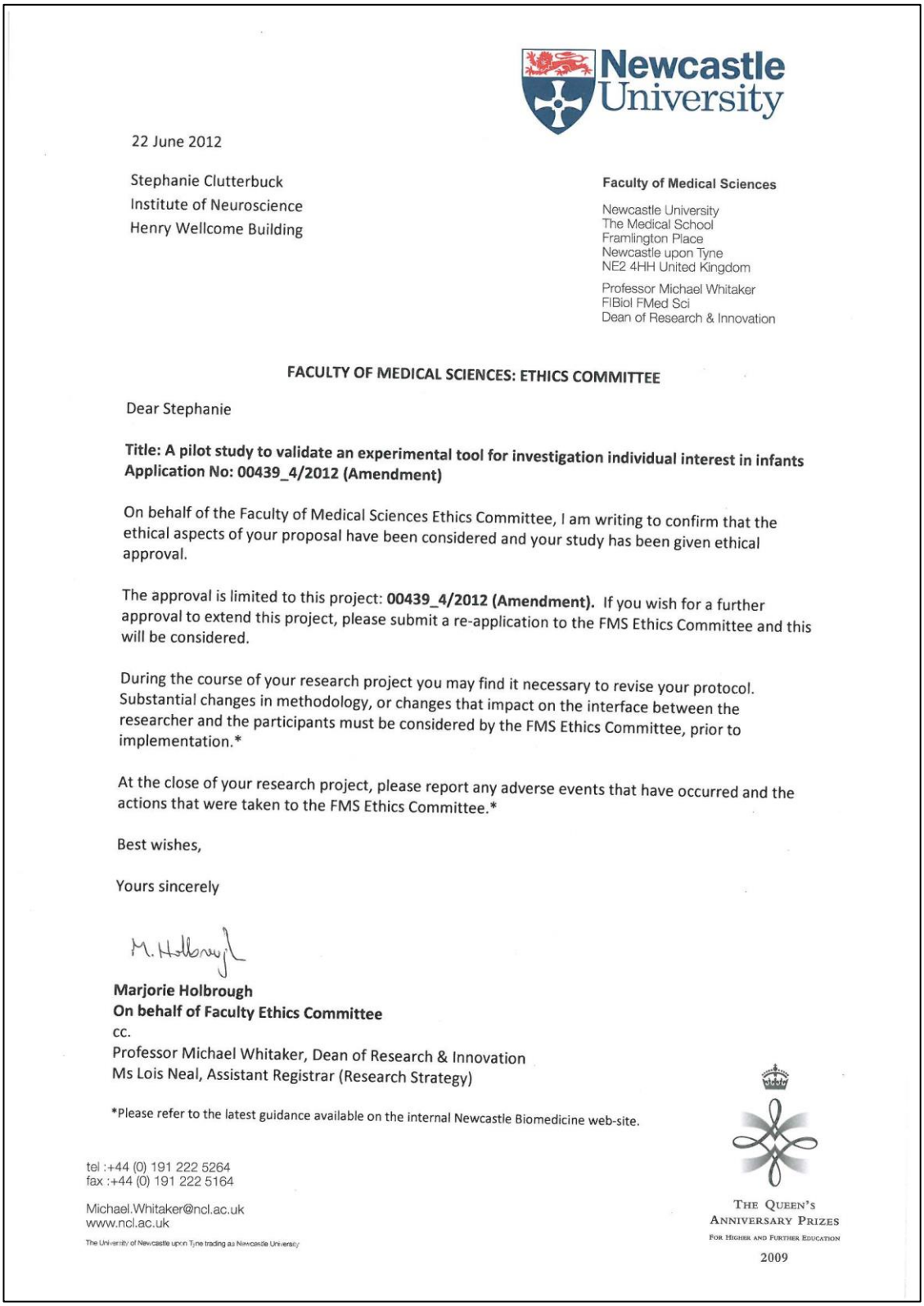
Figure A.4. Study 1-3 Ethics Approval May 2012.



Newcastle University

22 June 2012

Stephanie Clutterbuck
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Henry Wellcome Building

Faculty of Medical Sciences

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Framlington Place
Newcastle upon Tyne
NE2 4HH United Kingdom

Professor Michael Whitaker
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Dean of Research & Innovation

FACULTY OF MEDICAL SCIENCES: ETHICS COMMITTEE

Dear Stephanie

Title: A pilot study to validate an experimental tool for investigation individual interest in infants
Application No: 00439_4/2012 (Amendment)

On behalf of the Faculty of Medical Sciences Ethics Committee, I am writing to confirm that the ethical aspects of your proposal have been considered and your study has been given ethical approval.

The approval is limited to this project: **00439_4/2012 (Amendment).** If you wish for a further approval to extend this project, please submit a re-application to the FMS Ethics Committee and this will be considered.

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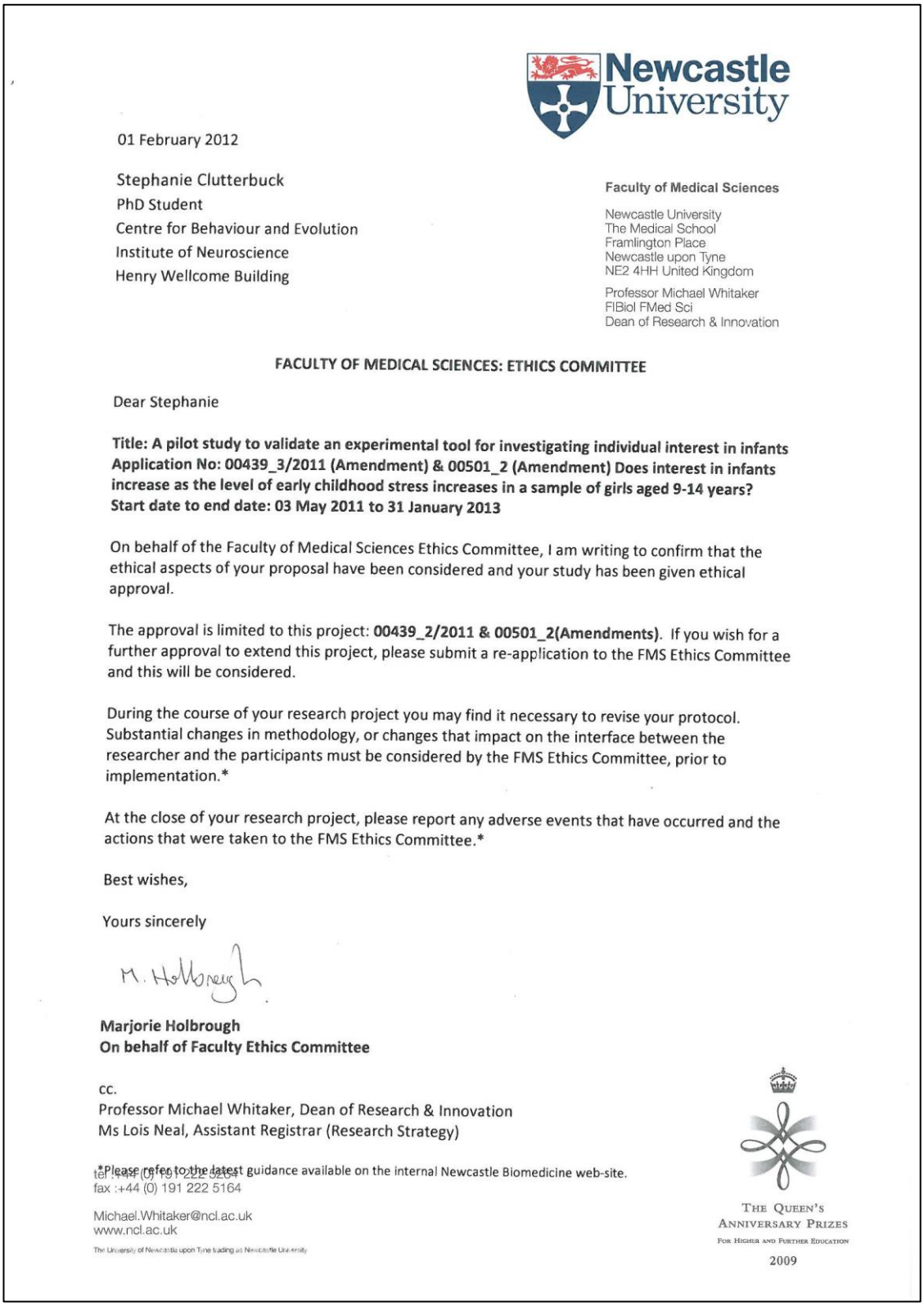
Figure A.5. Study 1-3 Ethics Approval June 2012.

APPENDIX B. Ethical Approval Letter for Studies 1-3 & 4.



Newcastle University

01 February 2012

Stephanie Clutterbuck
PhD Student
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Institute of Neuroscience
Henry Wellcome Building

Faculty of Medical Sciences
Newcastle University
The Medical School
Framlington Place
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NE2 4HH United Kingdom
Professor Michael Whitaker
FIBiol FMed Sci
Dean of Research & Innovation

FACULTY OF MEDICAL SCIENCES: ETHICS COMMITTEE

Dear Stephanie

Title: A pilot study to validate an experimental tool for investigating individual interest in infants
Application No: 00439_3/2011 (Amendment) & 00501_2 (Amendment) Does interest in infants increase as the level of early childhood stress increases in a sample of girls aged 9-14 years?
Start date to end date: 03 May 2011 to 31 January 2013

On behalf of the Faculty of Medical Sciences Ethics Committee, I am writing to confirm that the ethical aspects of your proposal have been considered and your study has been given ethical approval.

The approval is limited to this project: **00439_2/2011 & 00501_2(Amendments)**. If you wish for a further approval to extend this project, please submit a re-application to the FMS Ethics Committee and this will be considered.

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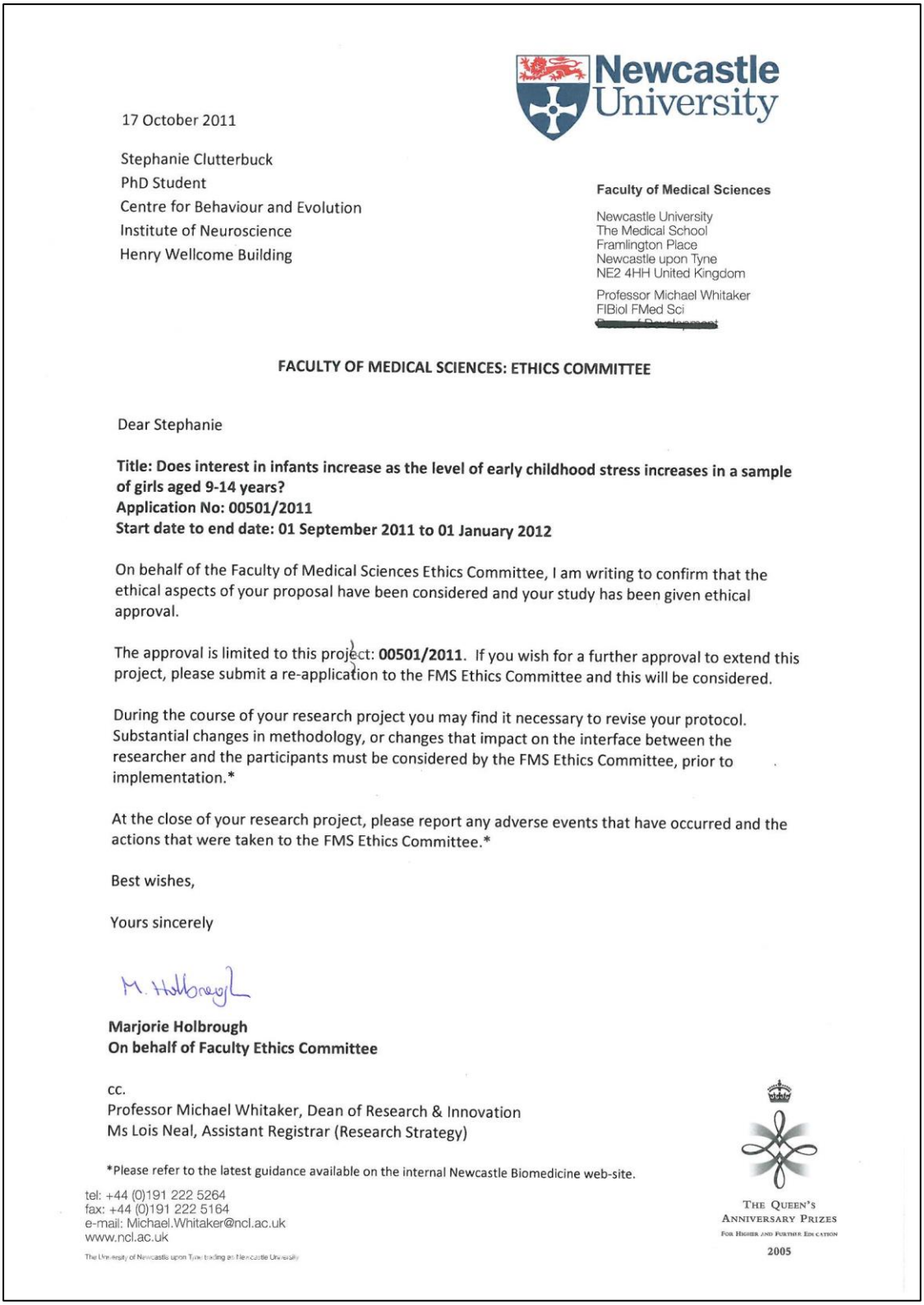
Figure B.1. Study 1-3 & 4 Ethics Approval February 2012.

APPENDIX C. Ethical Approval Letters for Study 4.



17 October 2011

Stephanie Clutterbuck
PhD Student
Centre for Behaviour and Evolution
Institute of Neuroscience
Henry Wellcome Building

Newcastle University

Faculty of Medical Sciences

Newcastle University
The Medical School
Framlington Place
Newcastle upon Tyne
NE2 4HH United Kingdom

Professor Michael Whitaker
FIBiol FMed Sci
[redacted]

FACULTY OF MEDICAL SCIENCES: ETHICS COMMITTEE

Dear Stephanie

Title: Does interest in infants increase as the level of early childhood stress increases in a sample of girls aged 9-14 years?
Application No: 00501/2011
Start date to end date: 01 September 2011 to 01 January 2012

On behalf of the Faculty of Medical Sciences Ethics Committee, I am writing to confirm that the ethical aspects of your proposal have been considered and your study has been given ethical approval.

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Ms Lois Neal, Assistant Registrar (Research Strategy)

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2005

Figure C.1. Study 4 Ethics Approval October 2011.

Newcastle University

04 January 2012

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Dean of Research & Innovation

FACULTY OF MEDICAL SCIENCES: ETHICS COMMITTEE

Dear Stephanie

Title: Does interest in infants increase as the level of early childhood stress increases in a sample of girls aged 9-14 years?
Application No: 00501_1/2011 (Amendment)
Start date to end date: 01 September 2011 to 31 January 2013

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Figure C.2. Study 4 Ethics Approval January 2012.

17 February 2012

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Dear Stephanie

Title: Does interest in infants increase as the level of early childhood stress increases in a sample of girls aged 9-14 years?
Application No: 00501_3/2011 (Amendment to questionnaire)
Start date to end date: 01 September 2011 to 31 January 2013

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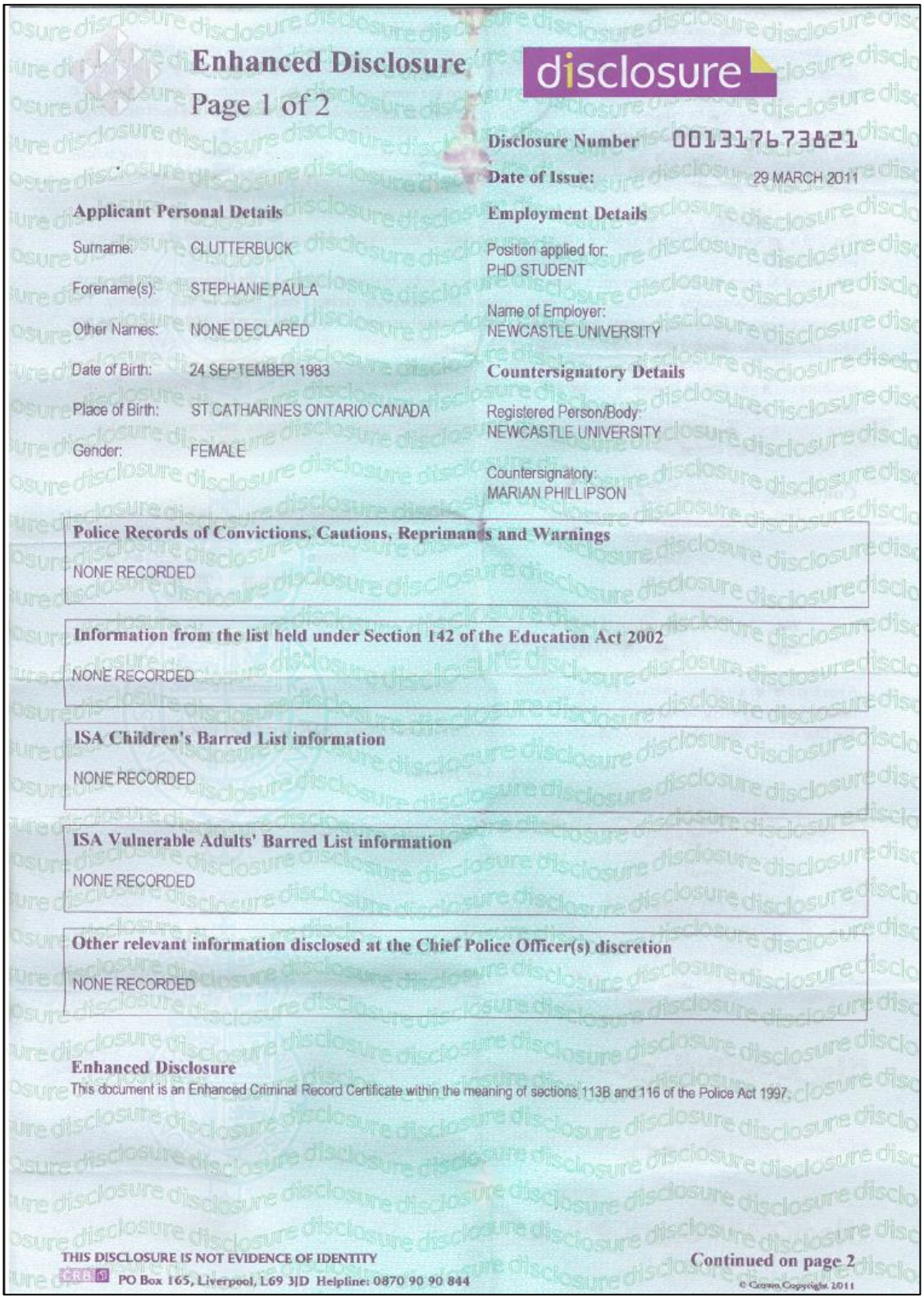
www.ncl.ac.uk

The University of Newcastle upon Tyne trading as Newcastle University

THE QUEEN'S ANNIVERSARY PRIZES
FOR HIGHER AND FURTHER EDUCATION
2009

Figure C.3. Study 4 Ethics Approval February 2012.

APPENDIX D. Enhanced Criminal Records Certificate.



Enhanced Disclosure

Page 1 of 2

disclosure

Disclosure Number 001317673821

Date of Issue: 29 MARCH 2011

Applicant Personal Details

Surname: CLUTTERBUCK

Forename(s): STEPHANIE PAULA

Other Names: NONE DECLARED

Date of Birth: 24 SEPTEMBER 1983

Place of Birth: ST CATHARINES ONTARIO CANADA

Gender: FEMALE

Employment Details

Position applied for:
PHD STUDENT

Name of Employer:
NEWCASTLE UNIVERSITY

Countersignatory Details

Registered Person/Body:
NEWCASTLE UNIVERSITY

Countersignatory:
MARIAN PHILLIPSON

Police Records of Convictions, Cautions, Reprimands and Warnings

NONE RECORDED

Information from the list held under Section 142 of the Education Act 2002

NONE RECORDED

ISA Children's Barred List information

NONE RECORDED

ISA Vulnerable Adults' Barred List information

NONE RECORDED

Other relevant information disclosed at the Chief Police Officer(s) discretion

NONE RECORDED

Enhanced Disclosure

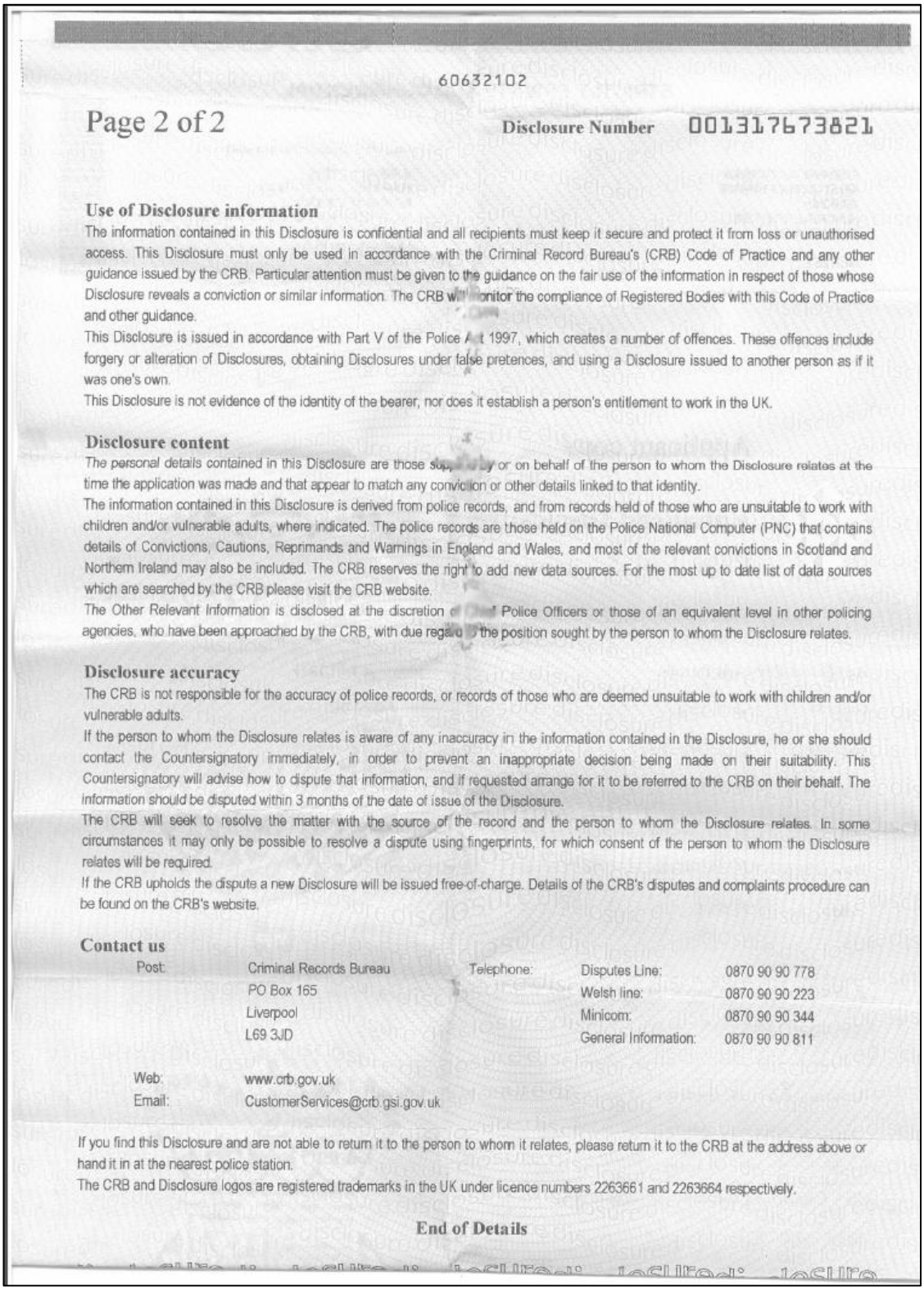
This document is an Enhanced Criminal Record Certificate within the meaning of sections 113B and 116 of the Police Act 1997.

THIS DISCLOSURE IS NOT EVIDENCE OF IDENTITY

CRB PO Box 165, Liverpool, L69 3JD Helpline: 0870 90 90 844

Continued on page 2

Figure D.1. Enhanced Criminal Records Certificate (front).



60632102

Page 2 of 2 **Disclosure Number** 001317673821

Use of Disclosure information

The information contained in this Disclosure is confidential and all recipients must keep it secure and protect it from loss or unauthorised access. This Disclosure must only be used in accordance with the Criminal Record Bureau's (CRB) Code of Practice and any other guidance issued by the CRB. Particular attention must be given to the guidance on the fair use of the information in respect of those whose Disclosure reveals a conviction or similar information. The CRB will monitor the compliance of Registered Bodies with this Code of Practice and other guidance.

This Disclosure is issued in accordance with Part V of the Police Act 1997, which creates a number of offences. These offences include forgery or alteration of Disclosures, obtaining Disclosures under false pretences, and using a Disclosure issued to another person as if it was one's own.

This Disclosure is not evidence of the identity of the bearer, nor does it establish a person's entitlement to work in the UK.

Disclosure content

The personal details contained in this Disclosure are those supplied by or on behalf of the person to whom the Disclosure relates at the time the application was made and that appear to match any conviction or other details linked to that identity.

The information contained in this Disclosure is derived from police records, and from records held of those who are unsuitable to work with children and/or vulnerable adults, where indicated. The police records are those held on the Police National Computer (PNC) that contains details of Convictions, Cautions, Reprimands and Warnings in England and Wales, and most of the relevant convictions in Scotland and Northern Ireland may also be included. The CRB reserves the right to add new data sources. For the most up to date list of data sources which are searched by the CRB please visit the CRB website.

The Other Relevant Information is disclosed at the discretion of Chief Police Officers or those of an equivalent level in other policing agencies, who have been approached by the CRB, with due regard to the position sought by the person to whom the Disclosure relates.

Disclosure accuracy

The CRB is not responsible for the accuracy of police records, or records of those who are deemed unsuitable to work with children and/or vulnerable adults.

If the person to whom the Disclosure relates is aware of any inaccuracy in the information contained in the Disclosure, he or she should contact the Countersignatory immediately, in order to prevent an inappropriate decision being made on their suitability. This Countersignatory will advise how to dispute that information, and if requested arrange for it to be referred to the CRB on their behalf. The information should be disputed within 3 months of the date of issue of the Disclosure.

The CRB will seek to resolve the matter with the source of the record and the person to whom the Disclosure relates. In some circumstances it may only be possible to resolve a dispute using fingerprints, for which consent of the person to whom the Disclosure relates will be required.

If the CRB upholds the dispute a new Disclosure will be issued free-of-charge. Details of the CRB's disputes and complaints procedure can be found on the CRB's website.

Contact us

Post:	Criminal Records Bureau PO Box 165 Liverpool L69 3JD	Telephone:	Disputes Line: Welsh line: Minicom: General Information:	0870 90 90 778 0870 90 90 223 0870 90 90 344 0870 90 90 811
Web:	www.crb.gov.uk			
Email:	CustomerServices@crb.gsi.gov.uk			

If you find this Disclosure and are not able to return it to the person to whom it relates, please return it to the CRB at the address above or hand it in at the nearest police station.

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End of Details

Figure D.2. Enhanced Criminal Records Certificate (back).

APPENDIX E. Questionnaire used in Study 1 (adult females).

- **Please circle your answer, fill in the blank or tick the box that applies.**
- **If you have any questions, remember to ask the researcher.**
- **If there are some questions you do not want to answer, you can leave them blank.**

1. When were you born? Month_____ Year_____
2. Where is your non-term time home? Street_____ Postcode_____
3. How long have you lived in this non-term time home? (Years)_____
4. Did your **mother** live in the same house as you when you were: (tick **all** that apply)
   0-5years ☐ 6-10 years ☐ 11-16 years ☐
5. Did your **father** live in the same house as you when you were: (tick **all** that apply)
   0-5years ☐ 6-10 years ☐ 11-16 years ☐
6. Did a **step-parent** live in the same house as you when you were: (tick **all** that apply)
   0-5years ☐ 6-10 years ☐ 11-16 years ☐
7. How many **full brothers and sisters** do you have? Brothers_____ Sisters_____
8. How many **step/half brothers and sisters** do you have? Brothers_____ Sisters_____

For questions 9-12 circle how much you agree or disagree with the statement:

9. Growing up, I often did activities with one or both of my parents.

Strongly Disagree | Disagree | Somewhat Disagree | Neither Agree or Disagree | Somewhat Agree | Agree | Strongly Agree

10. Growing up, I liked the neighbourhood I live in.

Strongly Disagree | Disagree | Somewhat Disagree | Neither Agree or Disagree | Somewhat Agree | Agree | Strongly Agree

11. Growing up, I felt the people in my neighbourhood could be trusted.

Strongly Disagree | Disagree | Somewhat Disagree | Neither Agree or Disagree | Somewhat Agree | Agree | Strongly Agree

12. I have a lot of experience taking care of babies.

Strongly Disagree | Disagree | Somewhat Disagree | Neither Agree or Disagree | Somewhat Agree | Agree | Strongly Agree

13. Are you a parent? Yes No
    a. If Yes, what is your child(ren)'s age(s)? Child 1___, Child 2____, Child 3_____
14. Would you like to be a parent one day? Yes No
    a. If Yes, at what age would you like to become a parent? _____
15. How old were you when you had your first period? Years_____ Months_____
(If you can't remember, please give your nearest guess)

Thank you for answering the questions! Please return to the researcher.

APPENDIX F. Eye Tracking Task Instructions and Stimuli.

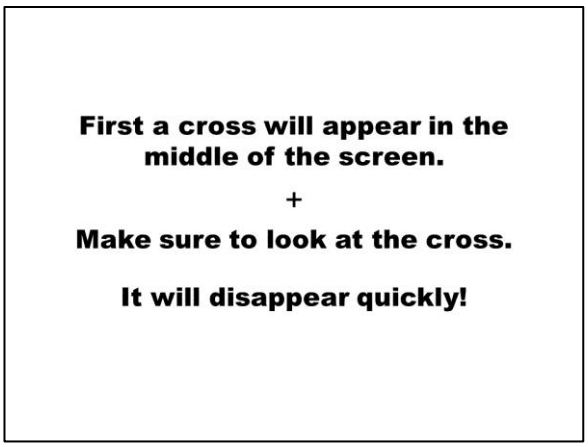


Figure F.1. ETT: Instructions Page 1.

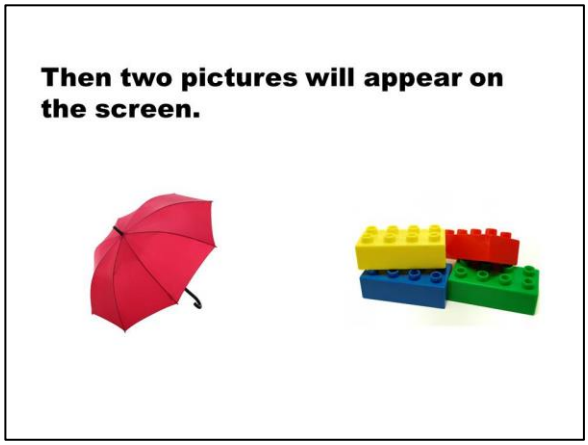


Figure F.2. ETT: Instructions Page 2.

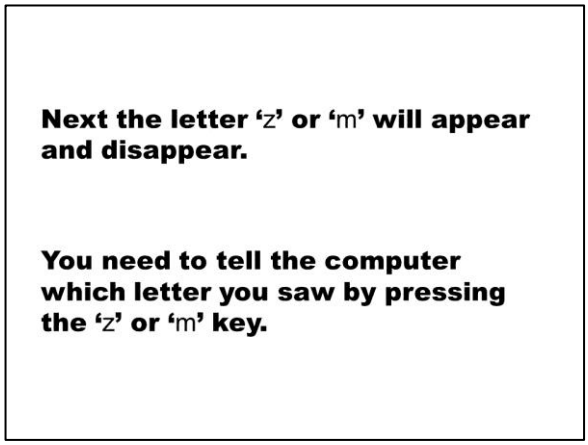


Figure F.3. ETT: Instructions Page 3.

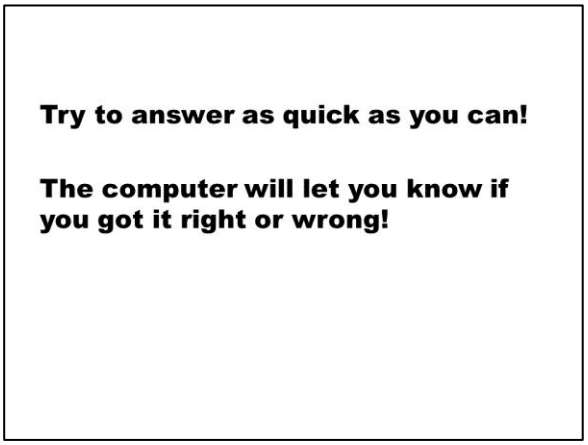


Figure F.4. ETT: Instructions Page 4.

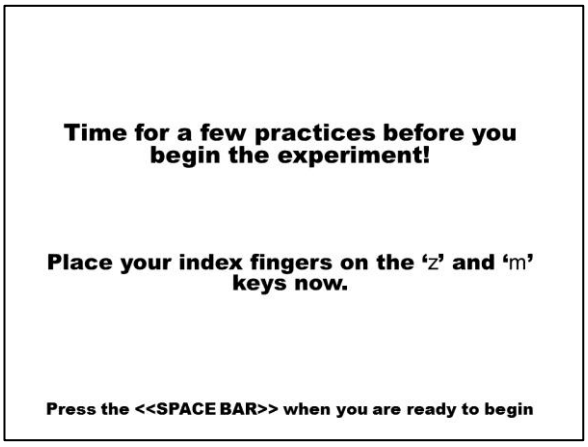


Figure F.5. ETT: Instructions Page 5.

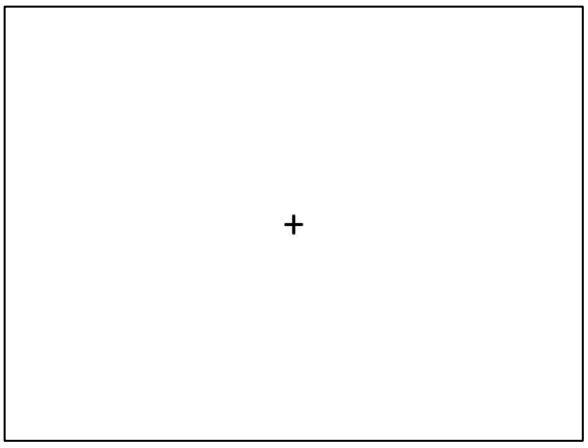


Figure F.6. ETT: Fixation Cross.

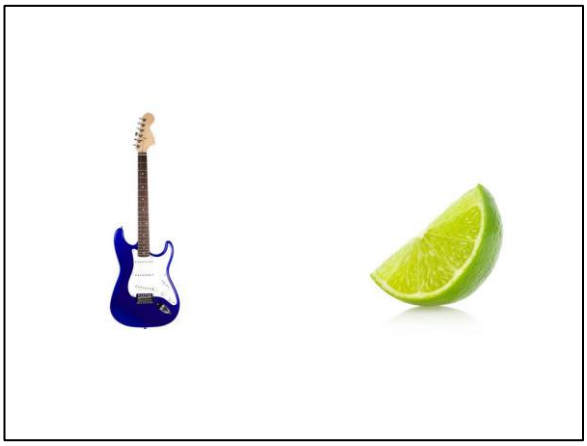


Figure F.7. ETT: Practice Stimuli 1.

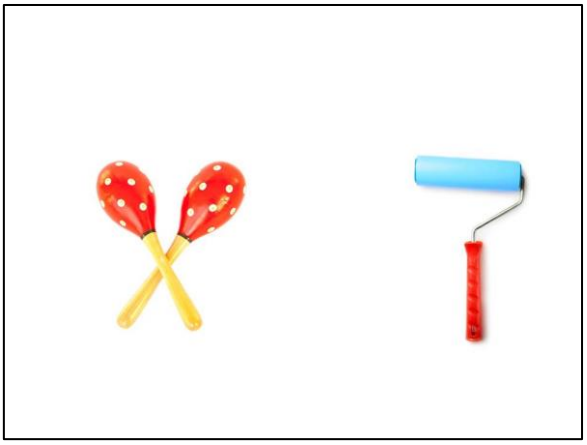


Figure F.8. ETT: Practice Stimuli 2.

Figure F.9. ETT: Practice Stimuli 3.

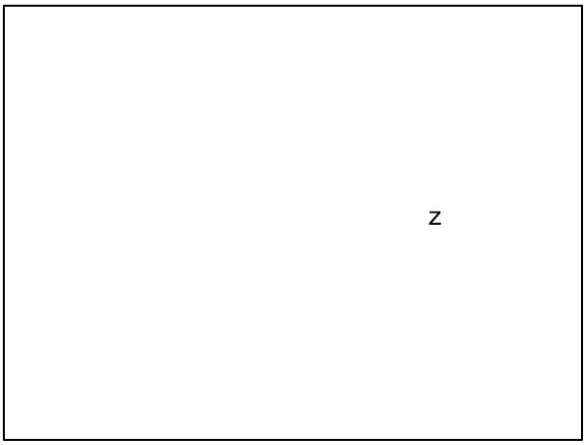


Figure F.10. ETT: Letter ‘z’ (right).

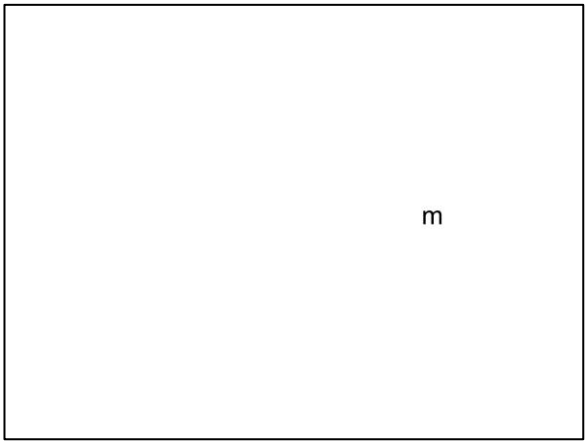


Figure F.11. ETT: Letter ‘m’ (right).

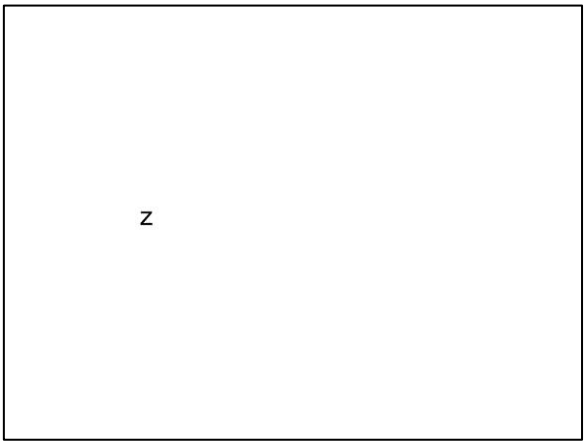


Figure F.12. ETT: Letter ‘z’ (left).

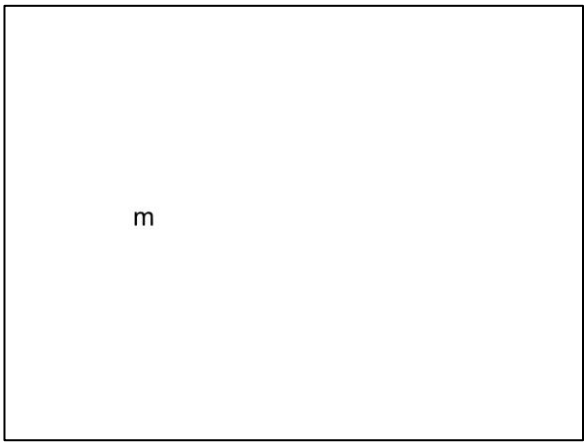


Figure F.13. ETT: Letter ‘m’ (left).

Figure F.14. ETT: Letter Prompt.

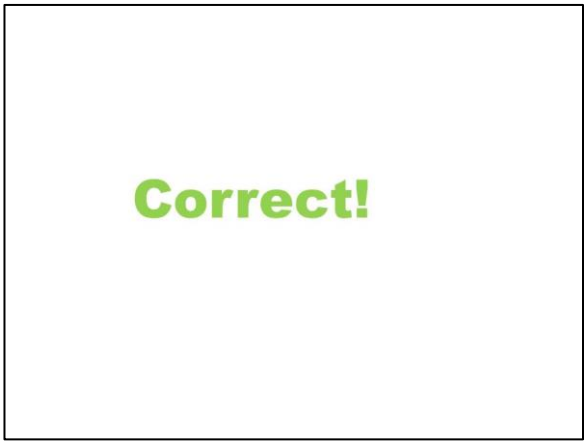


Figure F.15. ETT: Feedback ‘correct’.

Figure F.16. ETT: Feedback ‘incorrect’.

Figure F.17. ETT: End of Practice.

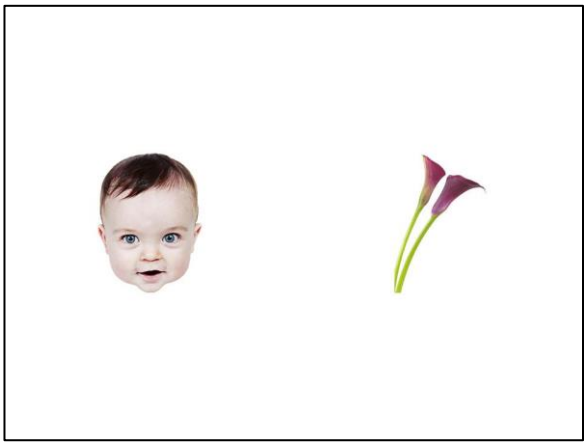


Figure F.18. ETT: Baby 1 (left).

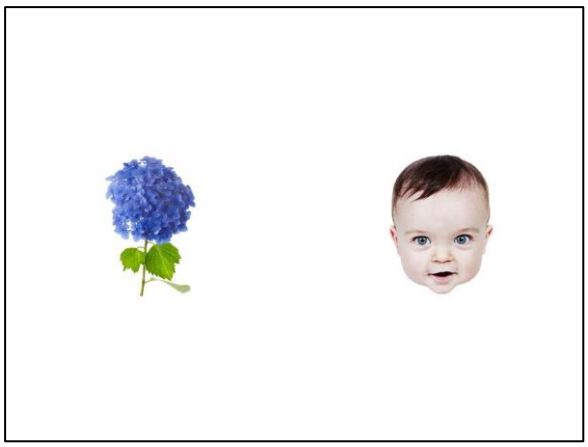


Figure F.19. ETT: Baby 1 (right).

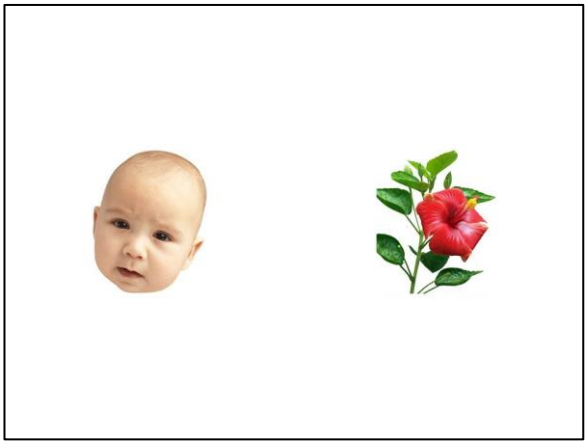


Figure F.20. ETT: Baby 2 (left).

Figure F.21. ETT: Baby 2 (right).

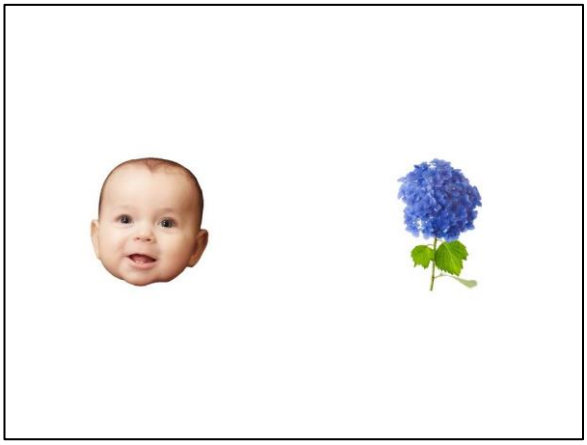


Figure F.22. ETT: Baby 3 (left).

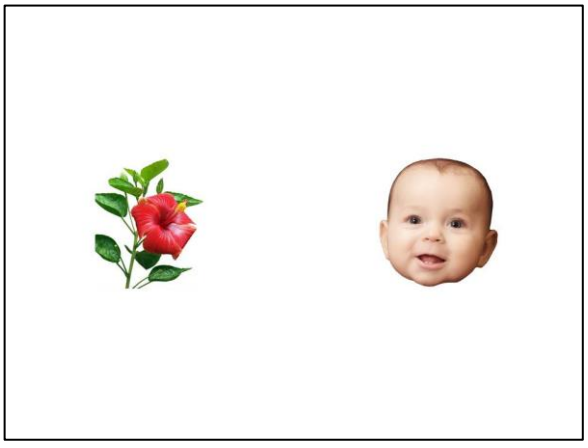


Figure F.23. ETT: Baby 3 (right).

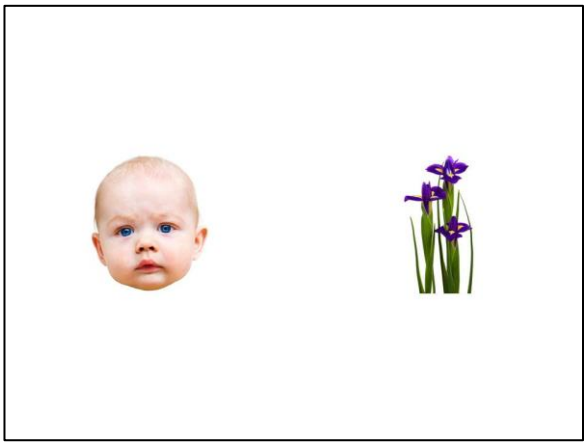


Figure F.24. ETT: Baby 4 (left).

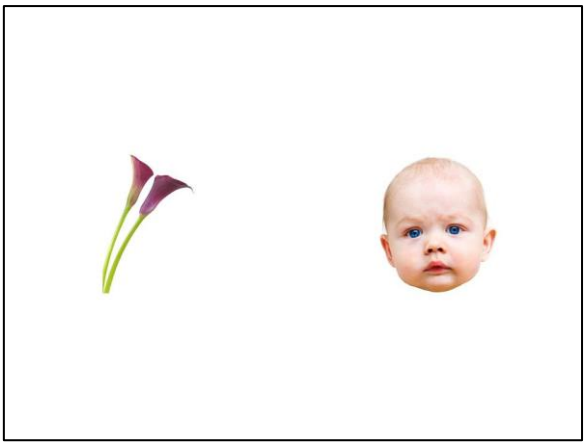


Figure F.25. ETT: Baby 4 (right).

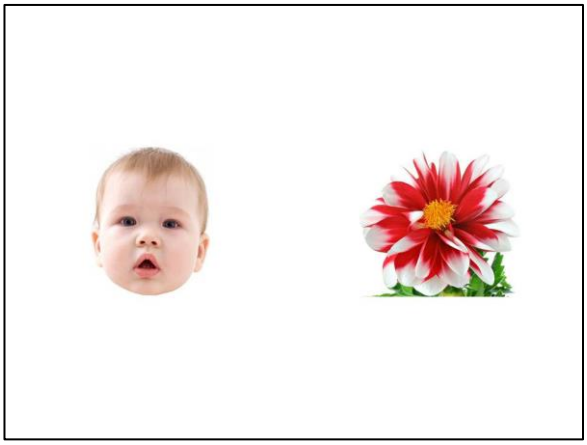


Figure F.26. ETT: Baby 5 (left).

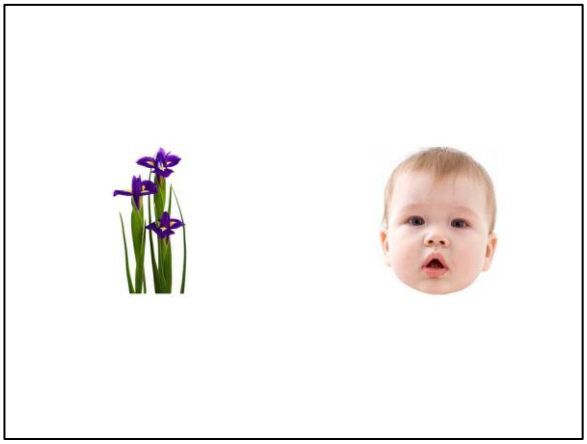


Figure F.27. ETT: Baby 5 (right).

Figure F.28. ETT: Baby 6 (left).

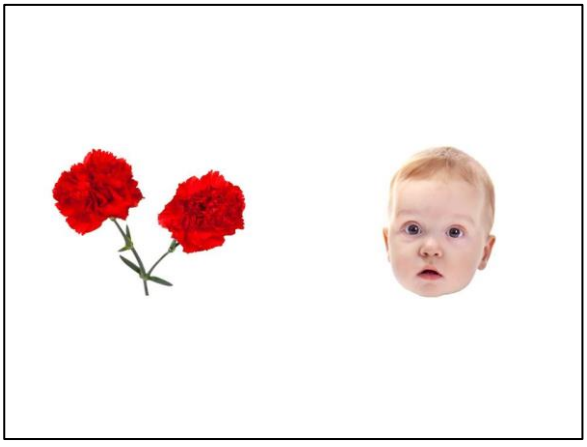


Figure F.29. ETT: Baby 6 (right).

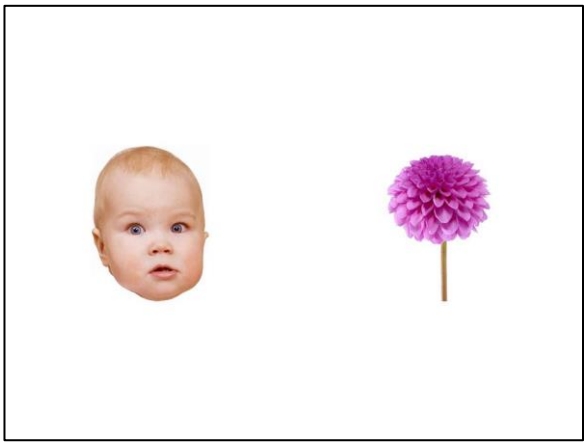


Figure F.30. ETT: Baby 7 (left).

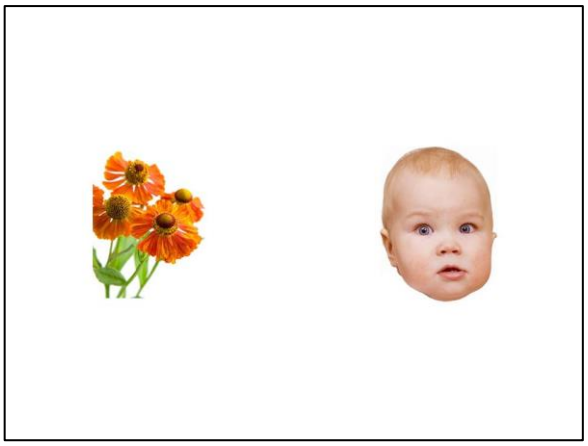


Figure F.31. ETT: Baby 7 (right).

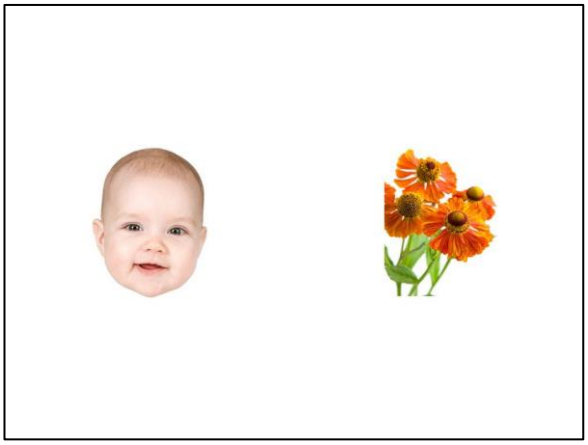


Figure F.32. ETT: Baby 8 (left).

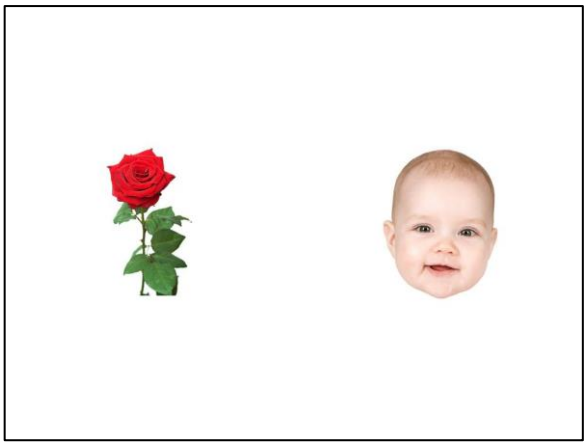


Figure F.33. ETT: Baby 8 (right).

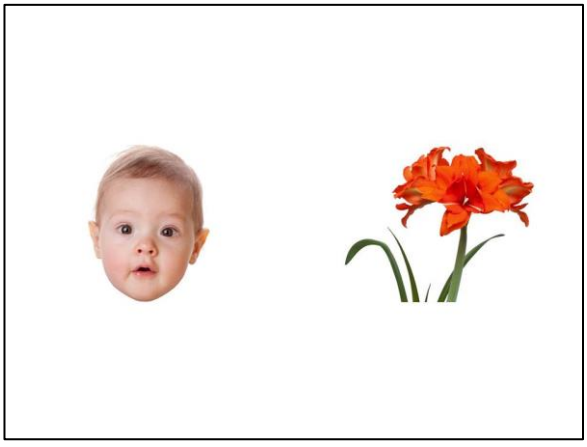


Figure F.34. ETT: Baby 9 (left).

Figure F.35. ETT: Baby 9 (right).

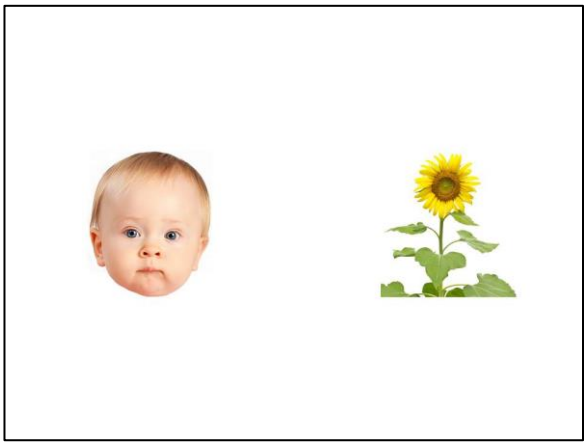


Figure F.36. ETT: Baby 10 (left).

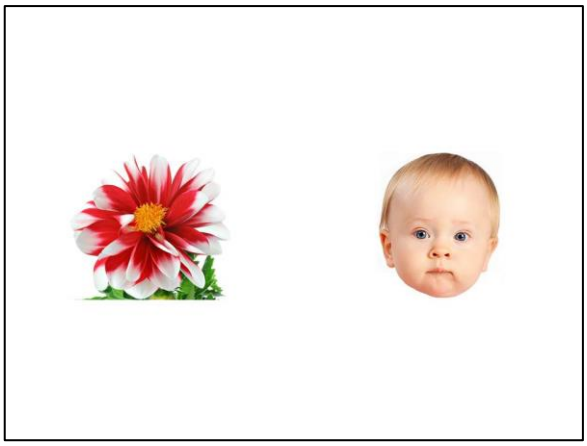


Figure F.37. ETT: Baby 10 (right).

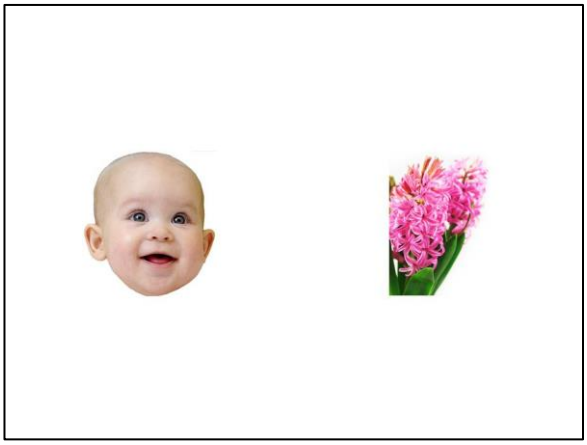


Figure F.38. ETT: Baby 11 (left).

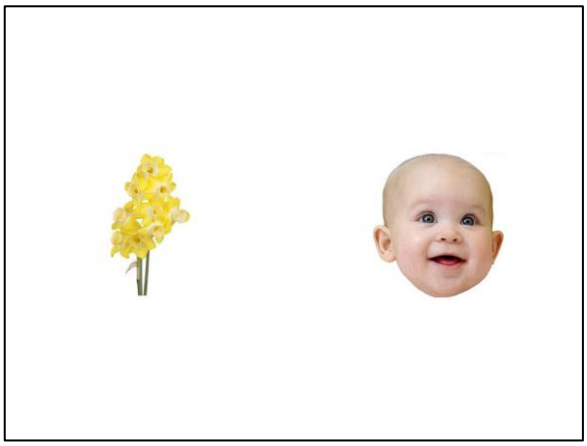


Figure F.39. ETT: Baby 11 (right).

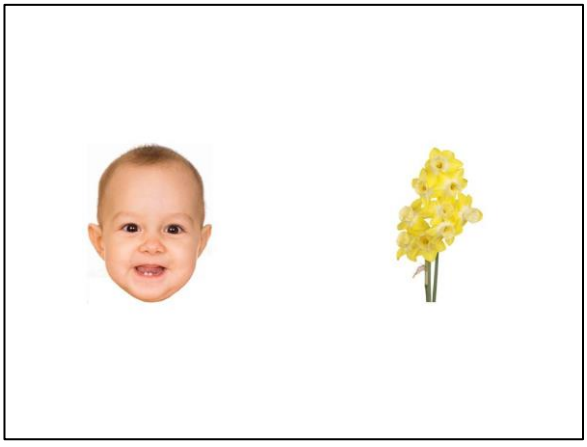


Figure F.40. ETT: Baby 12 (left).

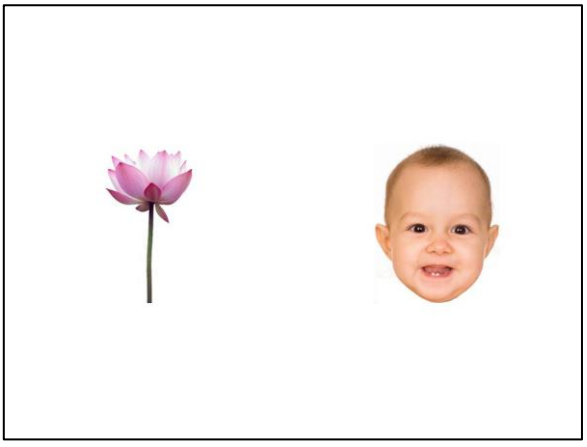


Figure F.41. ETT: Baby 12 (right).

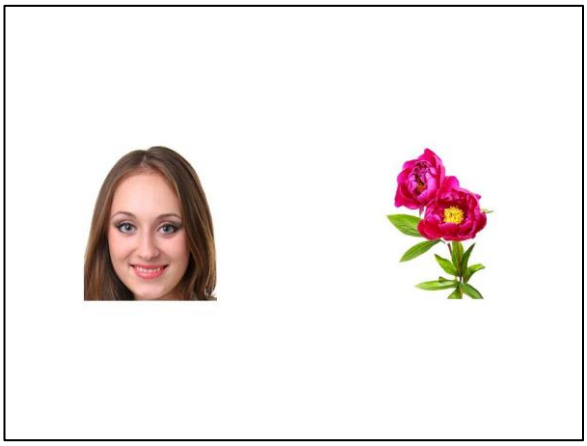


Figure F.42. ETT: Female 1 (left).

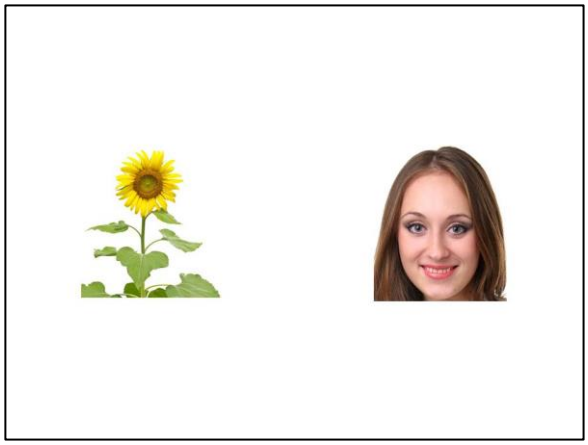


Figure F.43. ETT: Female 1 (right).

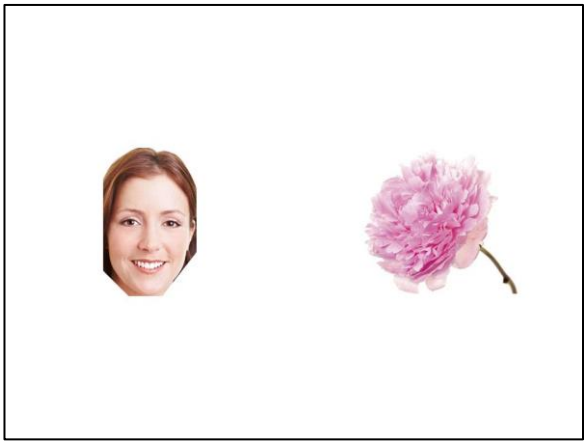


Figure F.44. ETT: Female 2 (left).

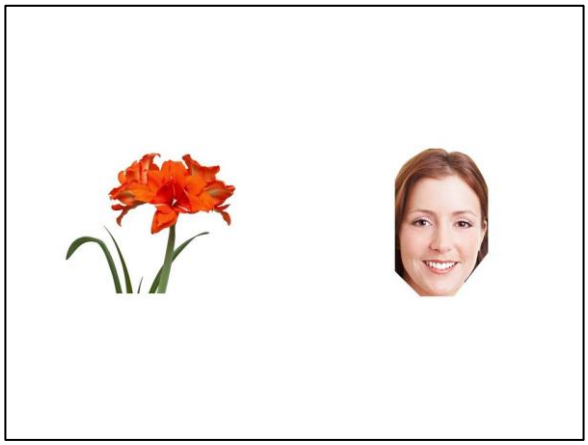


Figure F.45. ETT Female 2 (right).

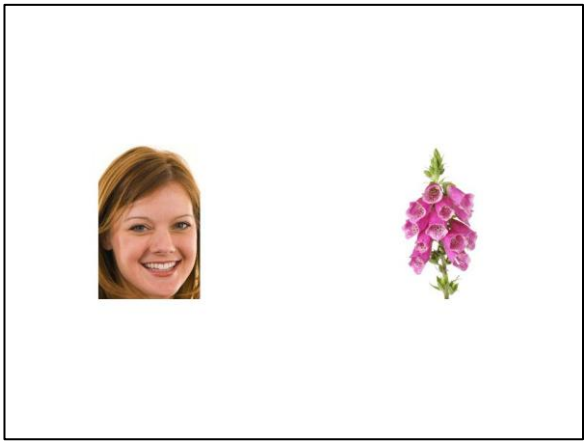


Figure F.46. ETT: Female 3 (left).

Figure F.47. ETT: Female 3 (right).

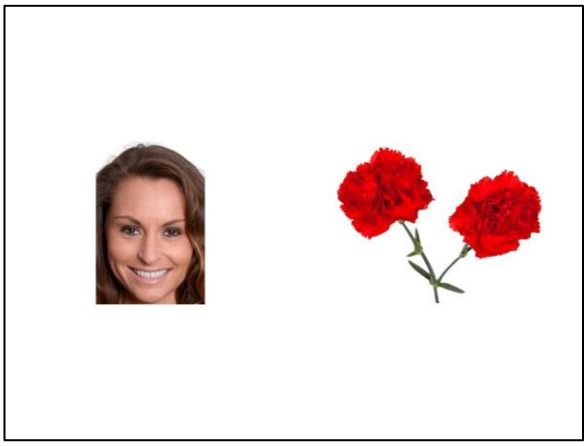


Figure F.48. ETT: Female 4 (left).

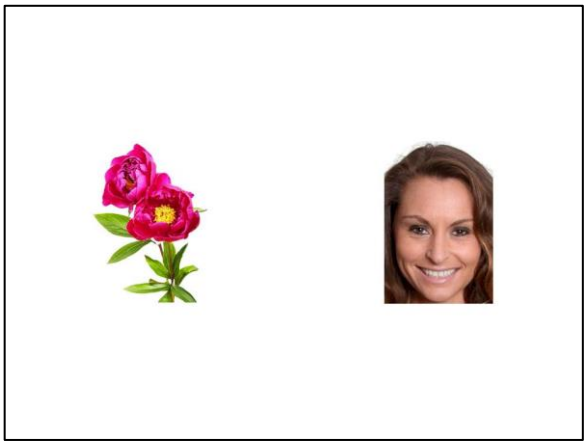


Figure F.49. ETT: Female 4 (right).

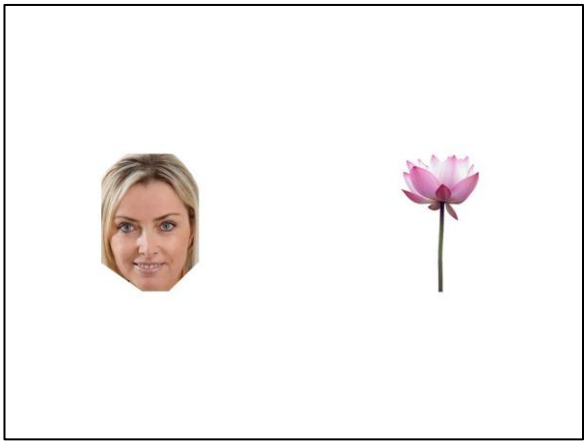


Figure F.50. ETT: Female 5 (left).

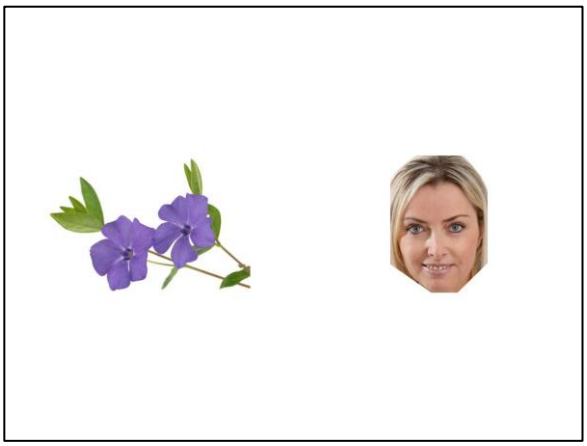


Figure F.51. ETT: Female 5 (right).

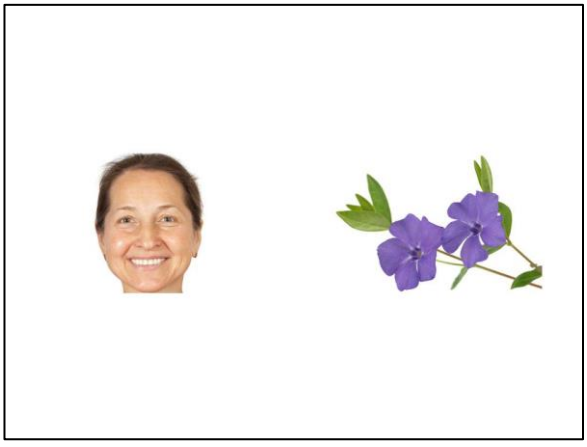


Figure F.52. ETT: Female 6 (left).

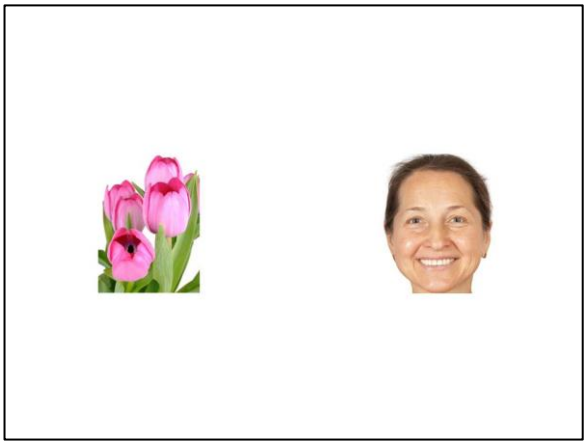


Figure F.53. ETT: Female 6 (right).

Figure F.54. ETT: Male 1 (left).

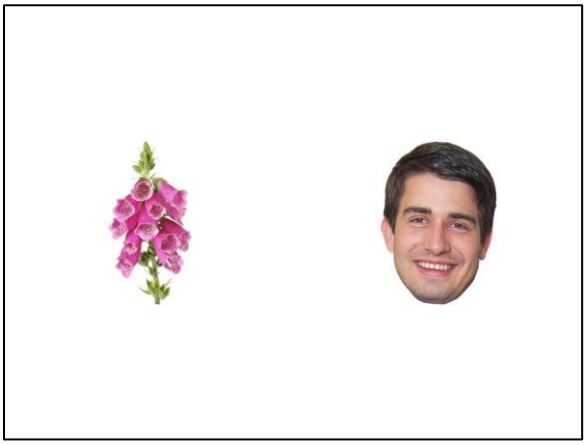


Figure F.55. ETT: Male 1 (right).

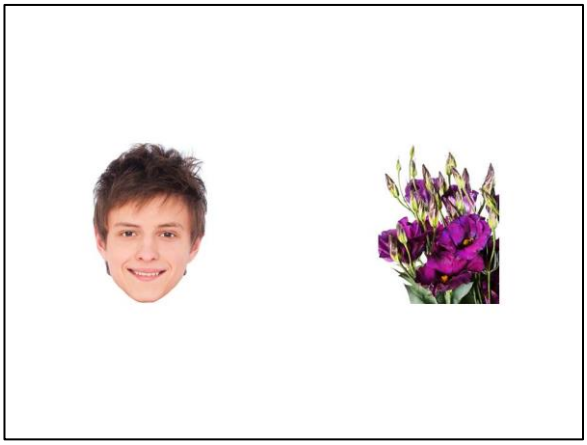


Figure F.56. ETT: Male 2 (left).

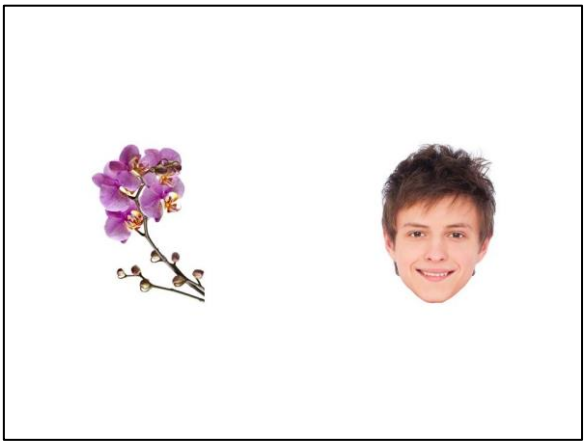


Figure F.57. ETT: Male 2 (right).

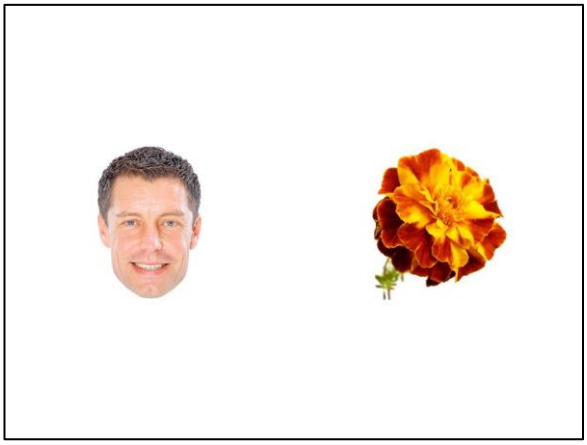


Figure F.58. ETT: Male 3 (left).

Figure F.59. ETT: Male 3 (right).

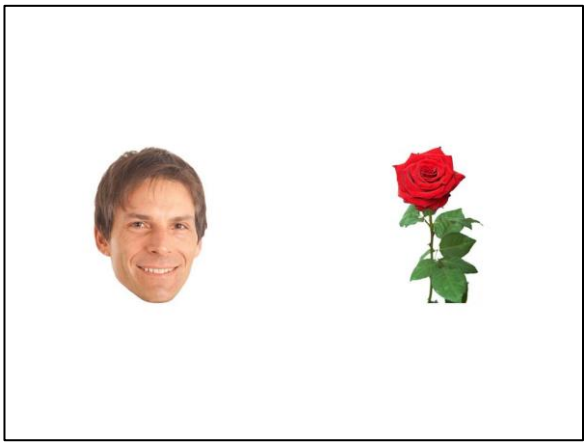


Figure F.60. ETT: Male 4 (left).

Figure F.61. ETT: Male 4 (right).

Figure F.62. ETT: Male 5 (left).

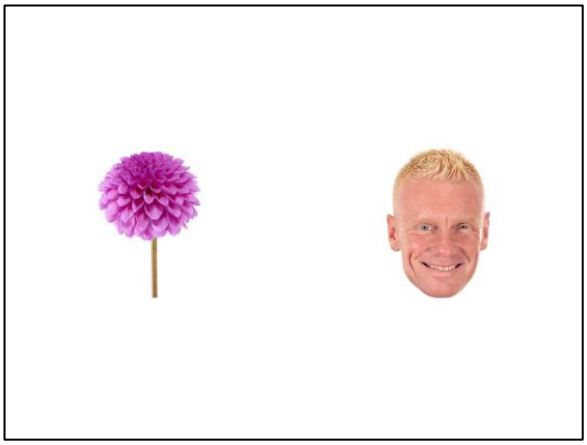


Figure F.63. ETT: Male 5 (right).

Figure F.64. ETT: Male 6 (left).

Figure F.65. ETT: Male 6 (right).

APPENDIX G. Count the Purple Triangles Instructions and Stimuli.

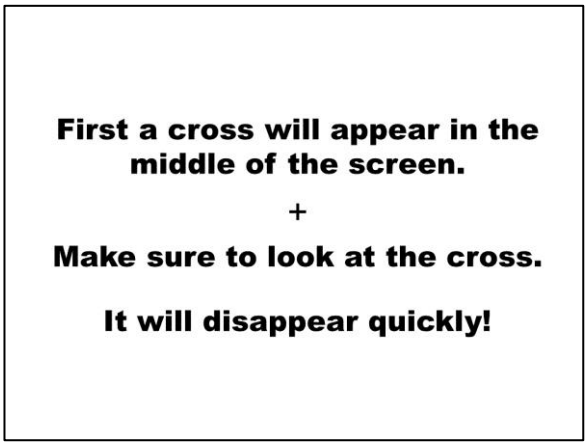


Figure G.1. CPTT: Instruction Page 1.

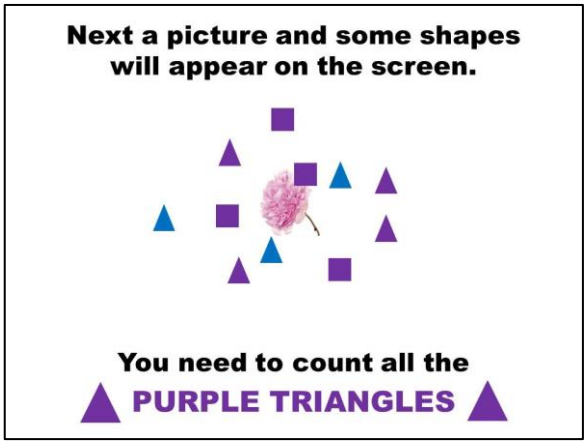


Figure G.2. CPTT: Instruction Page 2.

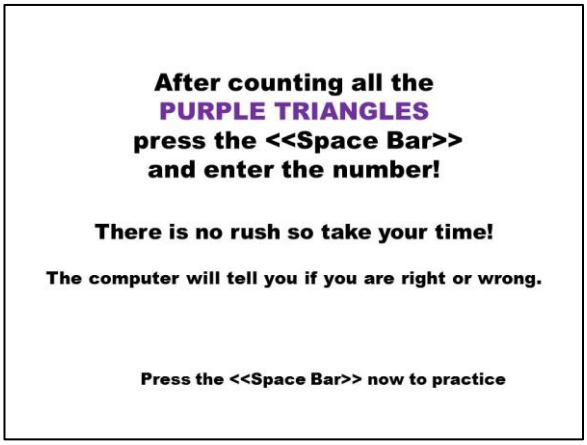


Figure G.3. CPTT: Instruction Page 3.

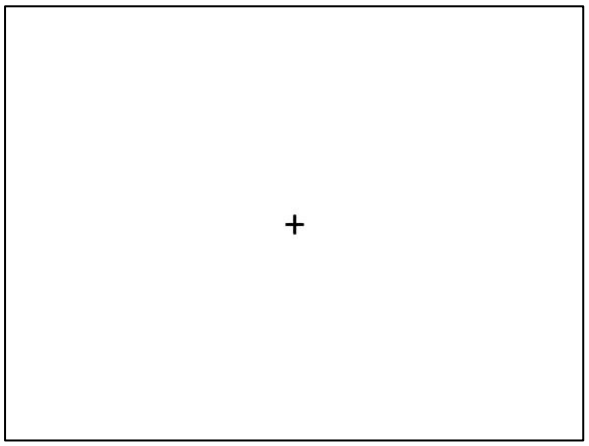


Figure G.4. CPTT: Fixation Cross.

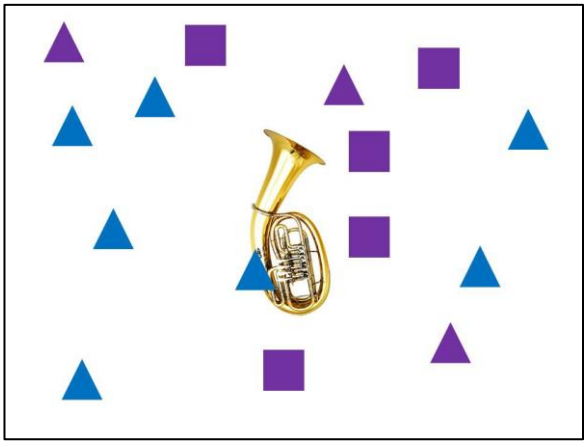


Figure G.5. CPTT: Practice Stimuli 1.

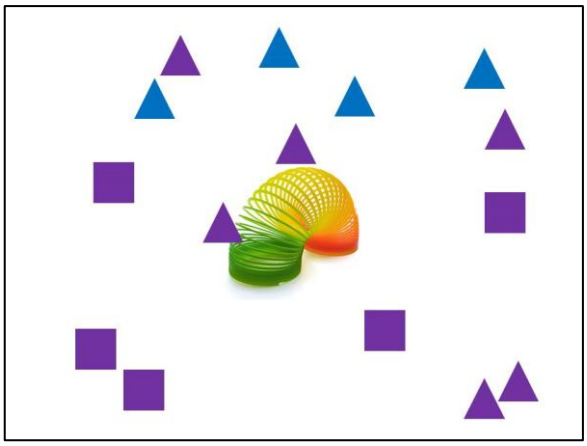


Figure G.6. CPTT: Practice Stimuli 2.

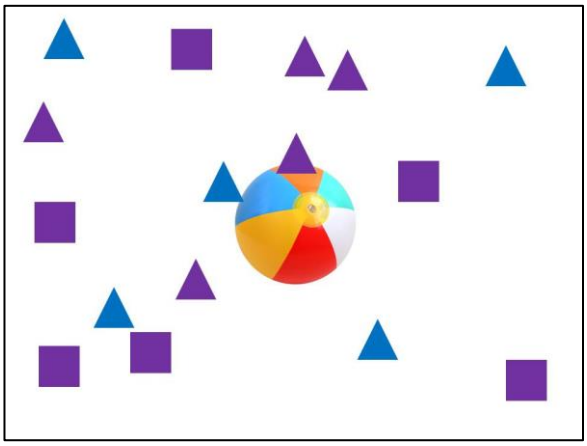


Figure G.7. CPTT: Practice Stimuli 3.

Figure G.8. CPTT: Count Prompt.

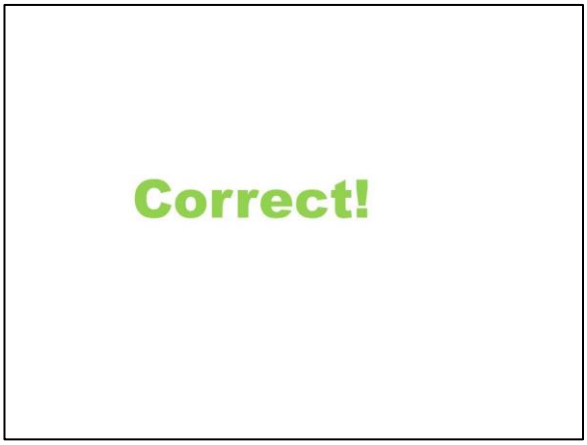


Figure G.9. CPTT: Feedback 'correct'.

Figure G.10. CPTT: Feedback 'incorrect'.

Figure G.11. CPTT: End of Practice.

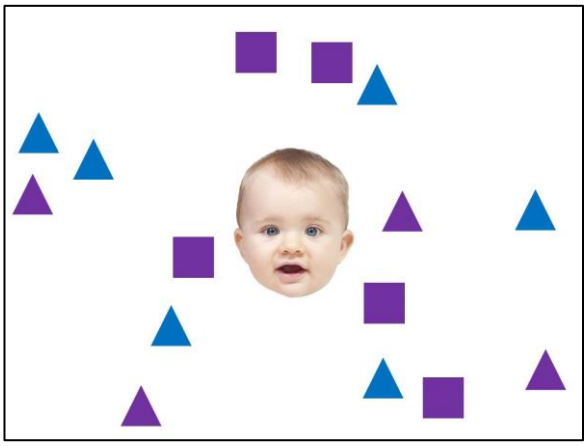


Figure G.12. CPTT: Count Phase Baby 1.

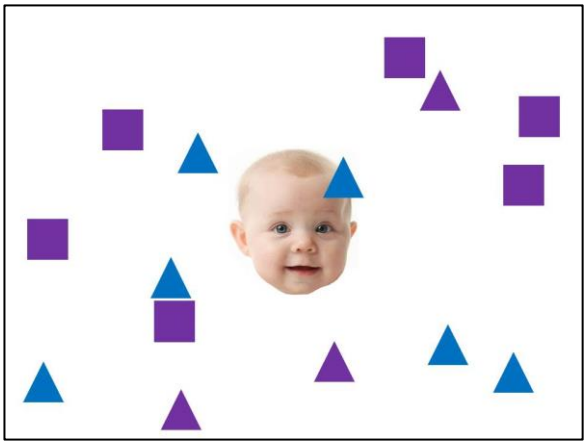


Figure G.13. CPTT: Count Phase Baby 2.

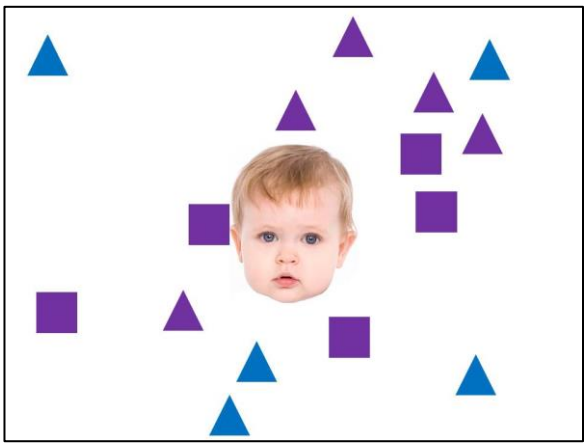


Figure G.14. CPTT: Count Phase Baby 3.

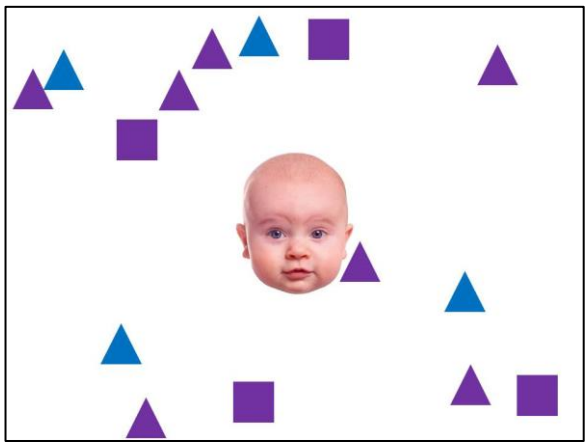


Figure G.15. CPTT: Count Phase Baby 4.

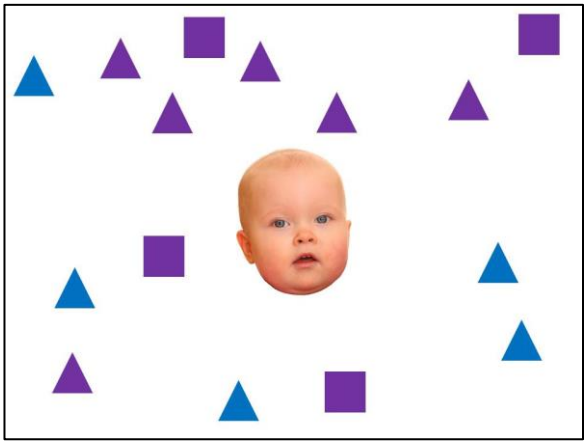


Figure G.16. CPTT: Count Phase Baby 5.

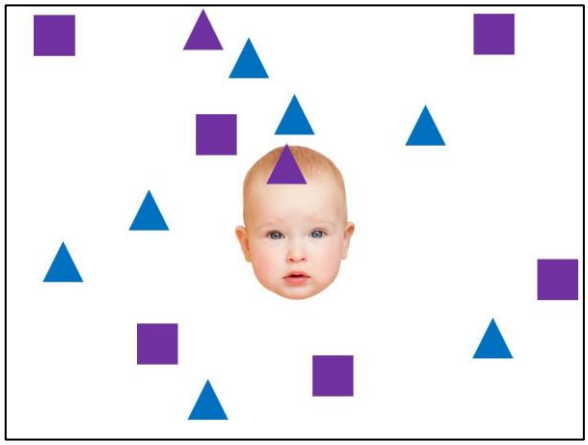


Figure G.17. CPTT: Count Phase Baby 6.

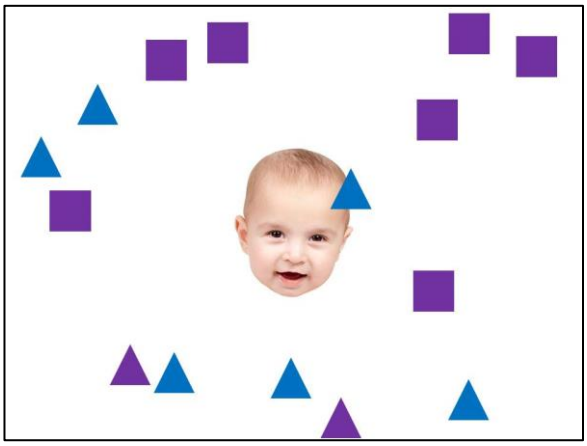


Figure G.18. CPTT: Count Phase Baby 7.

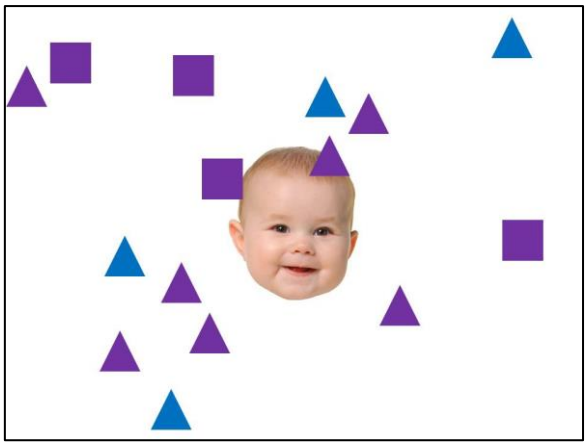


Figure G.19. CPTT: Count Phase Baby 8.

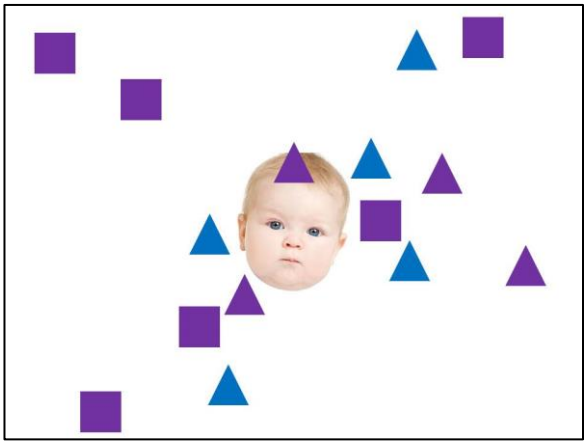


Figure G.20. CPTT: Count Phase Baby 9.

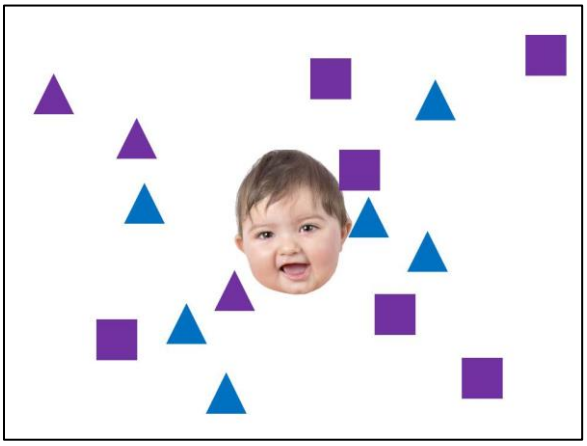


Figure G.21. CPTT: Count Phase Baby 10.

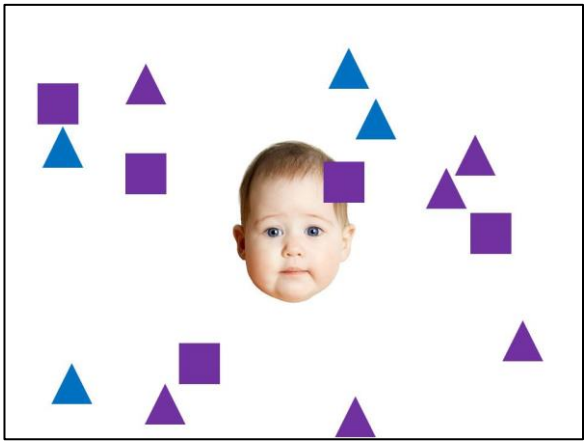


Figure G.22. CPTT: Count Phase Baby 11.

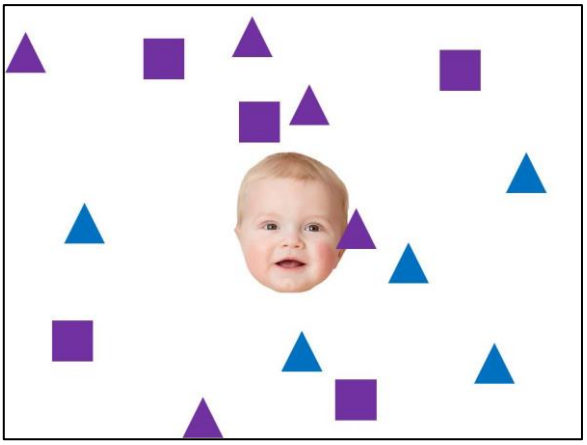


Figure G.23. CPTT: Count Phase Baby 12.

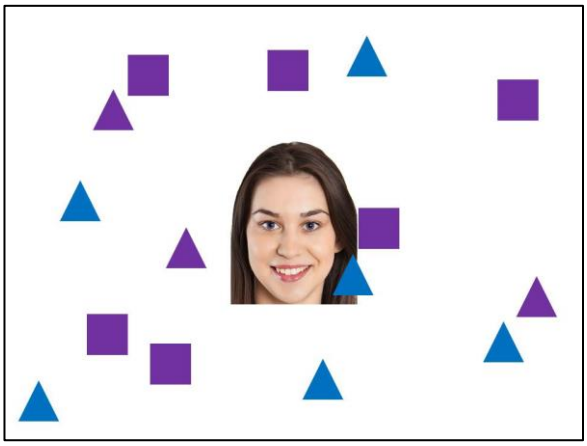


Figure G.24. CPTT: Count Phase Female

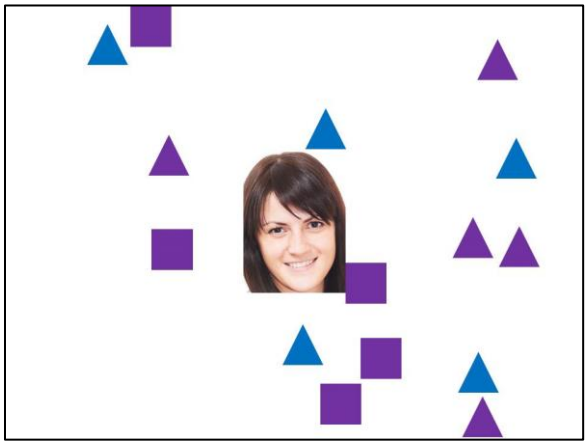


Figure G.25. CPTT: Count Phase Female

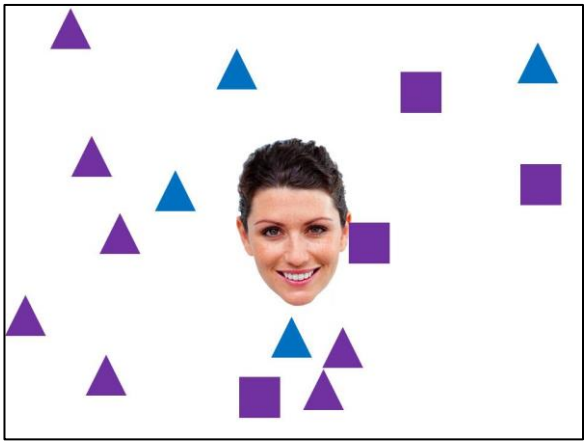


Figure G.26. CPTT: Count Phase Female

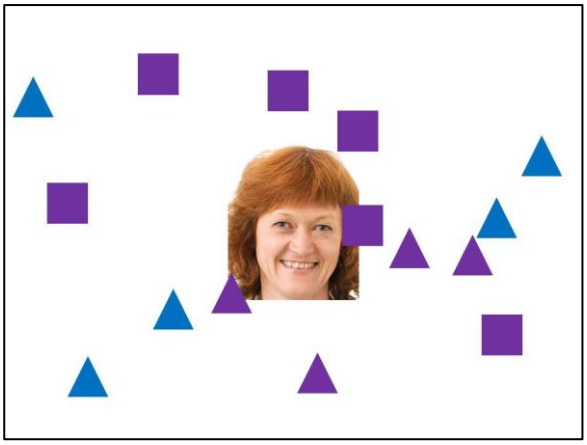


Figure G.27. CPTT: Count Phase Female

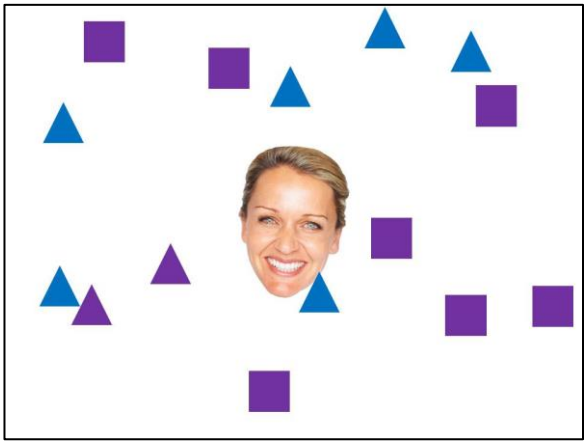


Figure G.28. CPTT: Count Phase Female

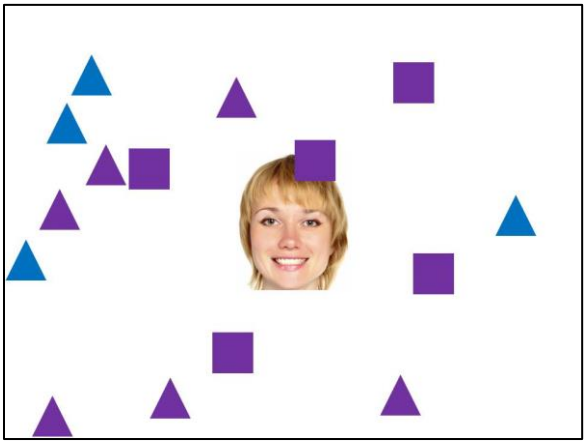


Figure G.29. CPTT: Count Phase Female

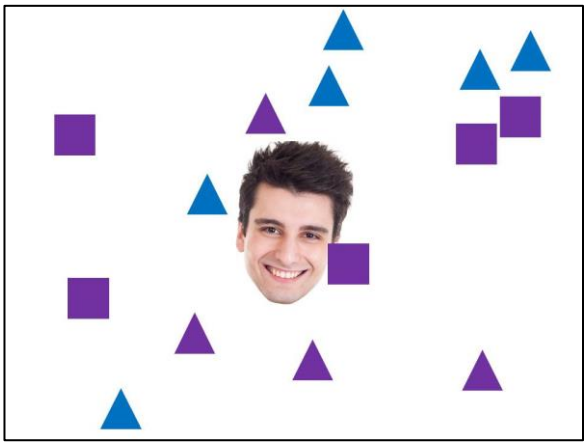


Figure G.30. CPTT: Count Phase Male 1.

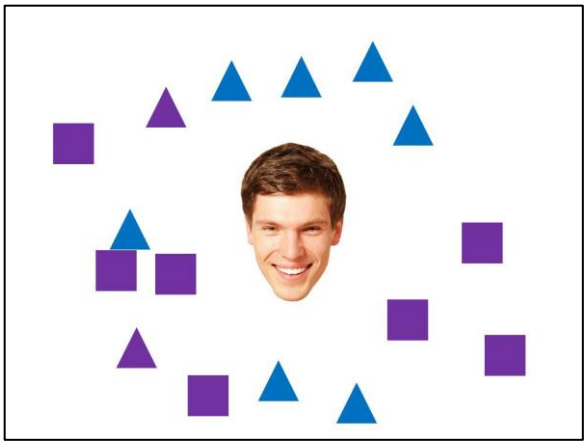


Figure G.31. CPTT: Count Phase Male 2.

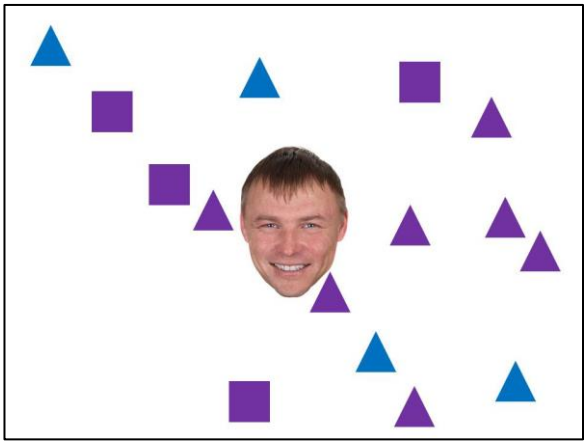


Figure G.32. CPTT: Count Phase Male 3.

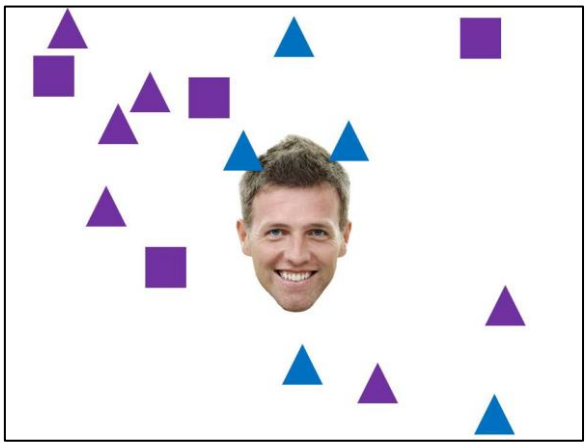


Figure G.33. CPTT: Count Phase Male 4.

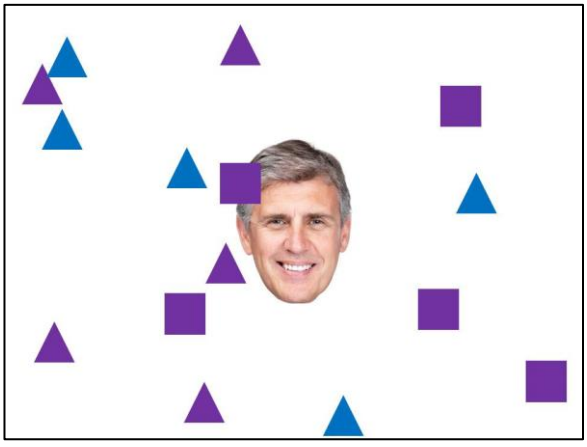


Figure G.34. CPTT: Count Phase Male 5.

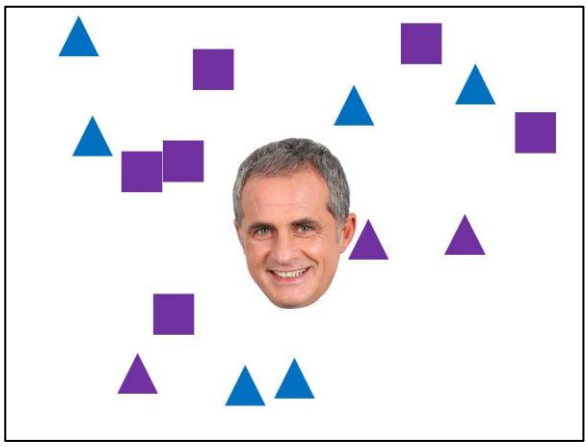


Figure G.35. CPTT: Count Phase Male 6.

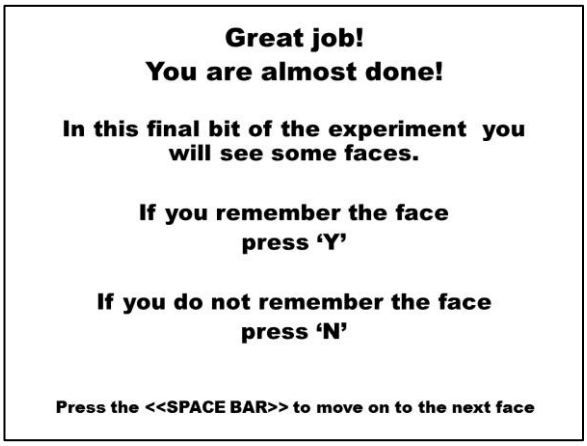


Figure G.36. CPTT: Recognition Phase Instructions.

Figure G.37. CPTT: Recognition Phase Baby 1.

Figure G.38. CPTT: Recognition Phase Baby 2.

Figure G.39. CPTT: Recognition Phase Baby 3.

Figure G.40. CPTT: Recognition Phase Baby 4.

Figure G.41. CPTT: Recognition Phase Baby 5.

Figure G.42. CPTT: Recognition Phase Baby 6.

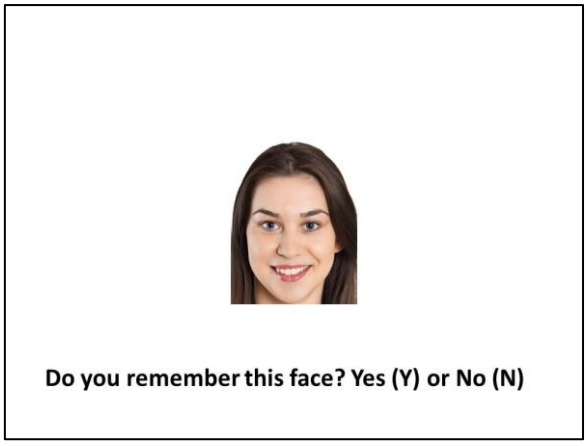


Figure G.43. CPTT: Recognition Phase Female 1.

Figure G.44. CPTT: Recognition Phase Female 2.

Figure G.45. CPTT: Recognition Phase Female 3.

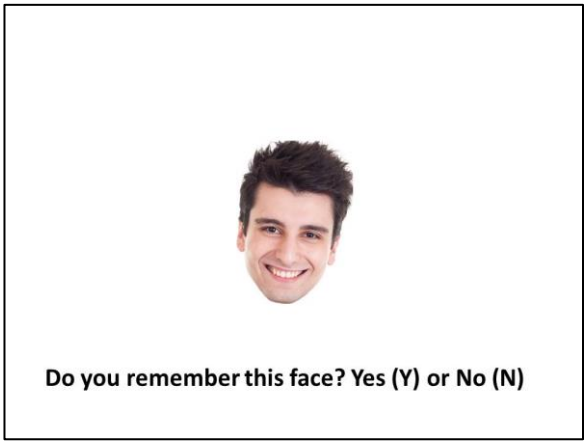


Figure G.46. CPTT: Recognition Phase Male 1.

Figure G.47. CPTT: Recognition Phase Male 2.

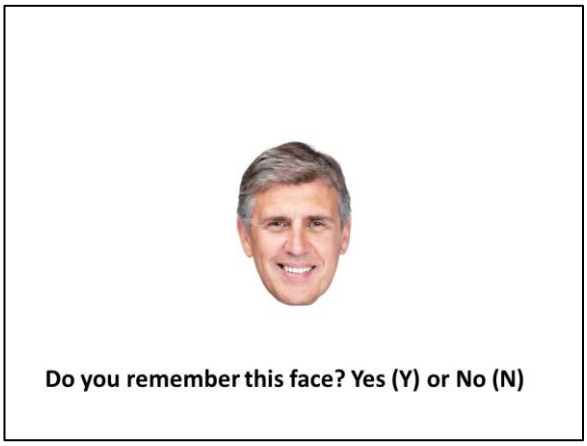


Figure G.48. CPTT: Recognition Phase Male 3.

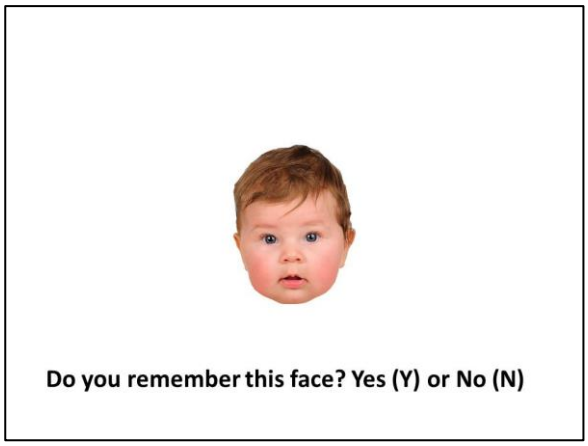


Figure G.49. CPTT: Recognition Phase Baby 1 (new).

Figure G.50. CPTT: Recognition Phase Baby 2 (new).

Figure G.51. CPTT: Recognition Phase Baby 3 (new).

Figure G.52. CPTT: Recognition Phase Baby 4 (new).

Figure G.53. CPTT: Recognition Phase Baby 5 (new).

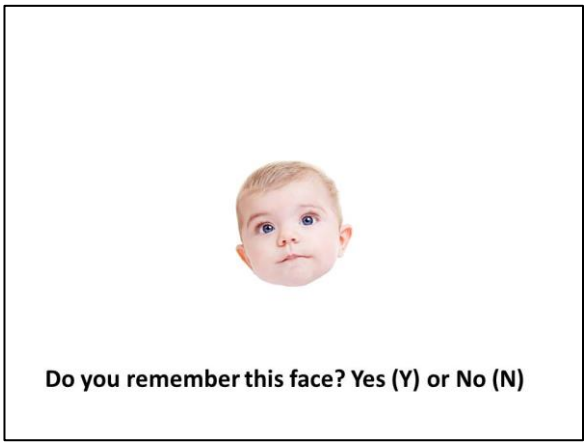


Figure G.54. CPTT: Recognition Phase Baby 6

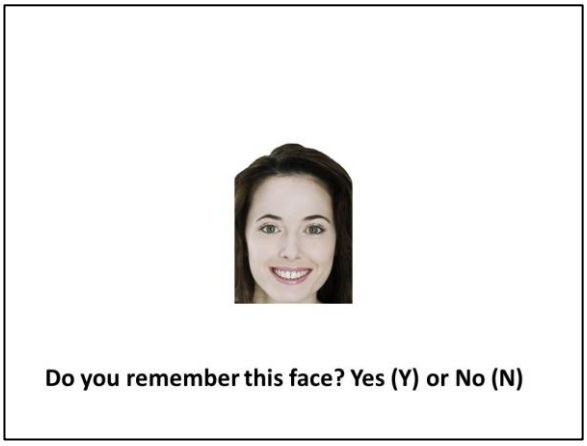


Figure G.55. CPTT: Recognition Phase Female 1 (new).

Figure G.56. CPTT: Recognition Phase Female 2 (new).

Figure G.57. CPTT: Recognition Phase Female 3 (new).

Figure G.58. CPTT: Recognition Phase Male 1 (new).

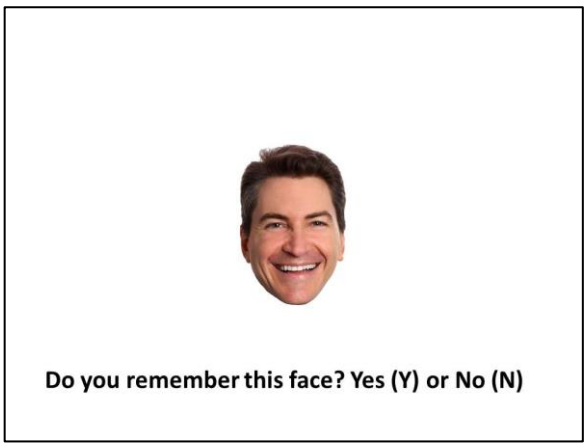


Figure G.59. CPTT: Recognition Phase Male 2 (new).

Figure G.60. CPTT: Recognition Phase Male 3 (new).

APPENDIX H. Preference Task Stimuli and Answer Sheet.

Source: (Maestripieri & Pelka, 2002; Maestripieri et al., 2004)

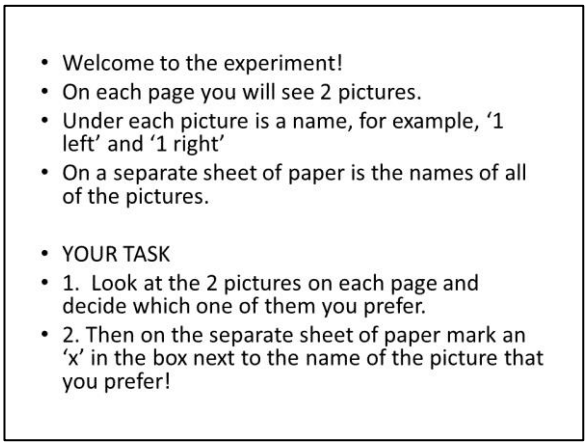


Figure H.1. PT: Instruction Page.

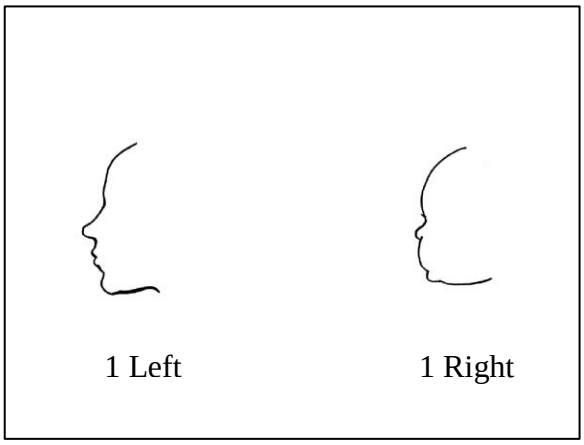


Figure H.2. PT: Human Silhouettes 1.

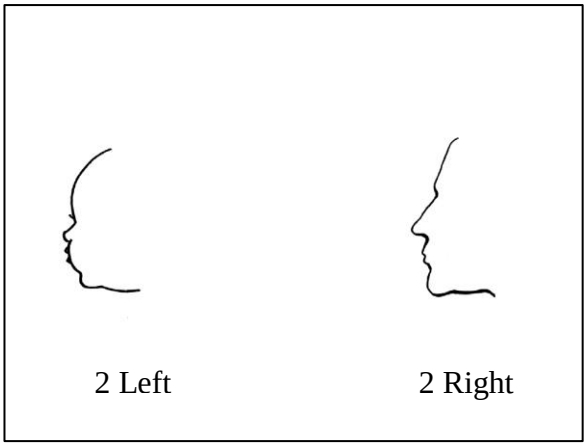


Figure H.3. PT: Human Silhouettes 2.

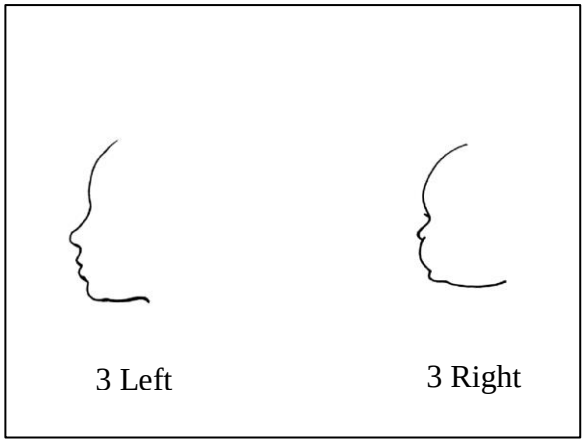


Figure H.4. PT: Human Silhouettes 3.

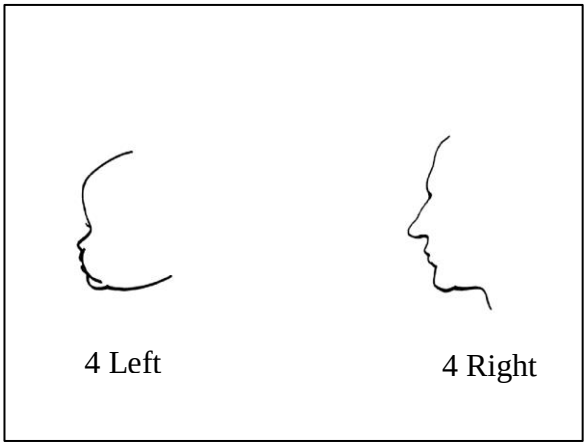


Figure H.5. PT: Human Silhouettes 4.

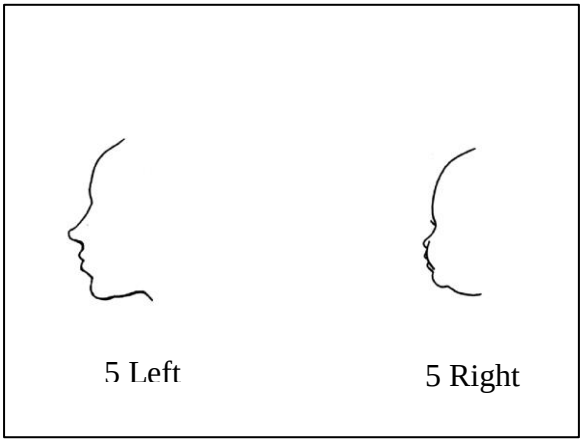


Figure H.6. PT: Human Silhouettes 5.

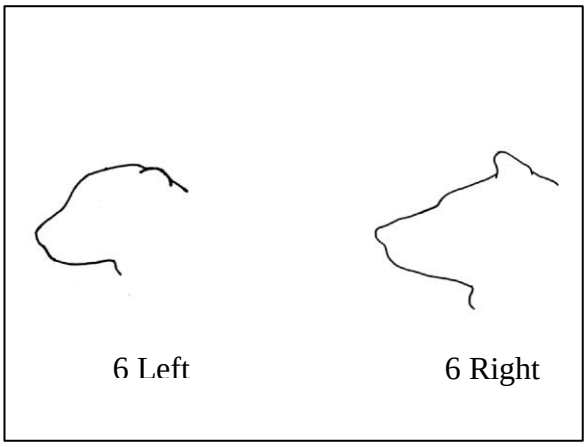


Figure H.7. PT: Animal Silhouettes 1.

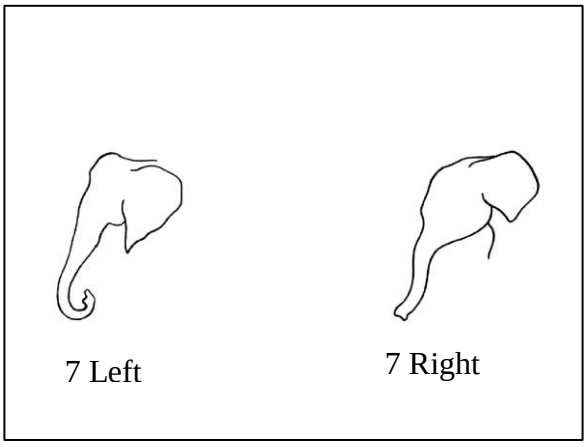


Figure H.8. PT: Animal Silhouettes 2.

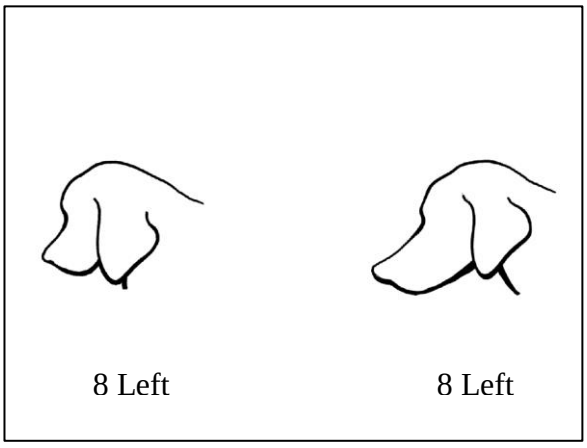


Figure H.9. PT: Animal Silhouettes 3.

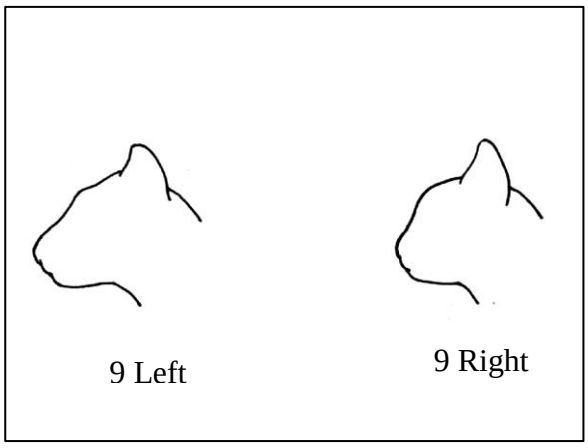


Figure H.10. PT: Animal Silhouettes 4.

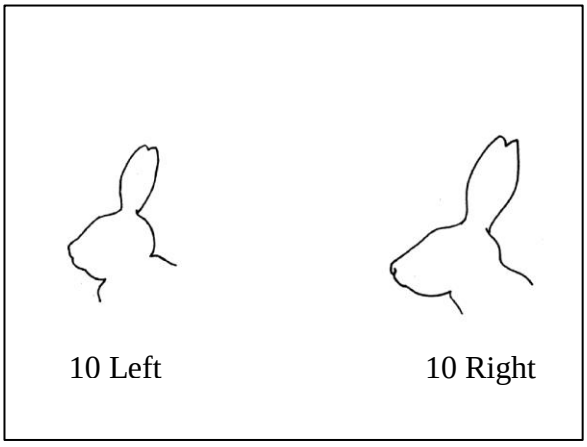


Figure H.11. PT: Animal Silhouettes 5.

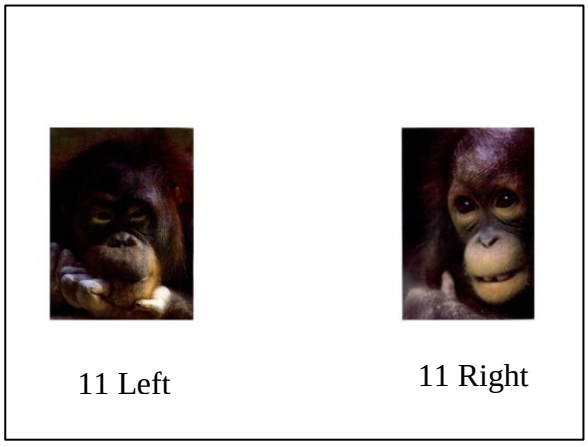


Figure H.12. PT: Animal Photos 1.

12 Left

12 Right

Figure H.13. PT: Animal Photos 2.

13 Left

13 Right

Figure H.14. PT: Animal Photos 3.

14 Left

14 Right

Figure H.15. PT: Animal Photos 4.

15 Left

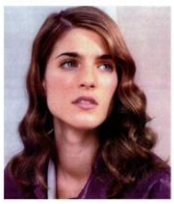
15 Right

Figure H.16. PT: Animal Photos 5.

16 Left

16 Right

Figure H.17. PT: Human Photos 1.



17 Left

17 Right

Figure H.18. PT: Human Photos 2.

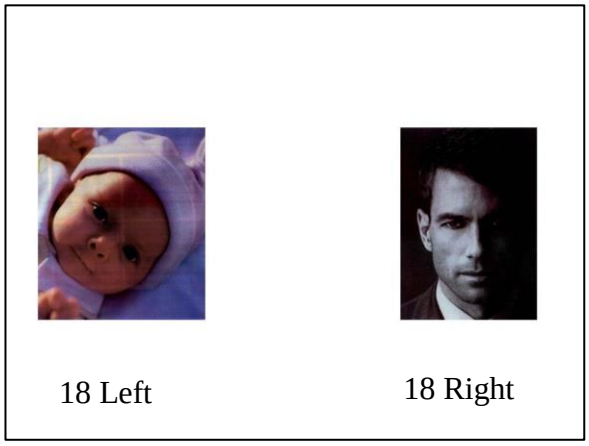


Figure H.19. PT: Human Photos 3.

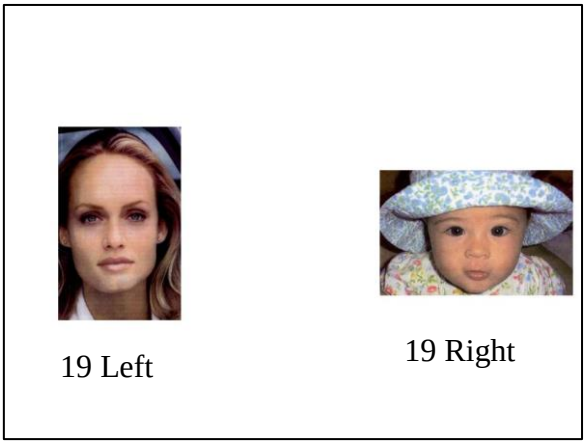


Figure H.20. PT: Human Photos 4.

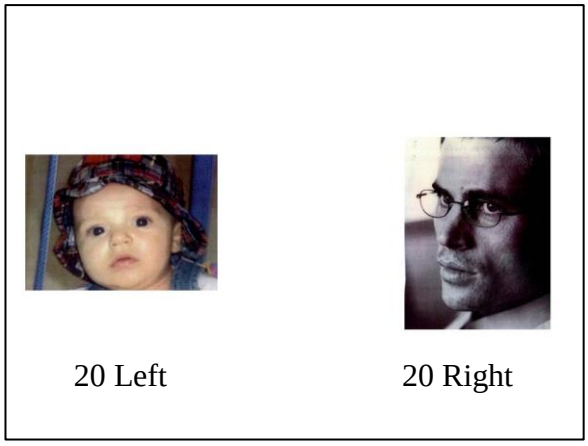


Figure H.21. PT: Human Photos 5.

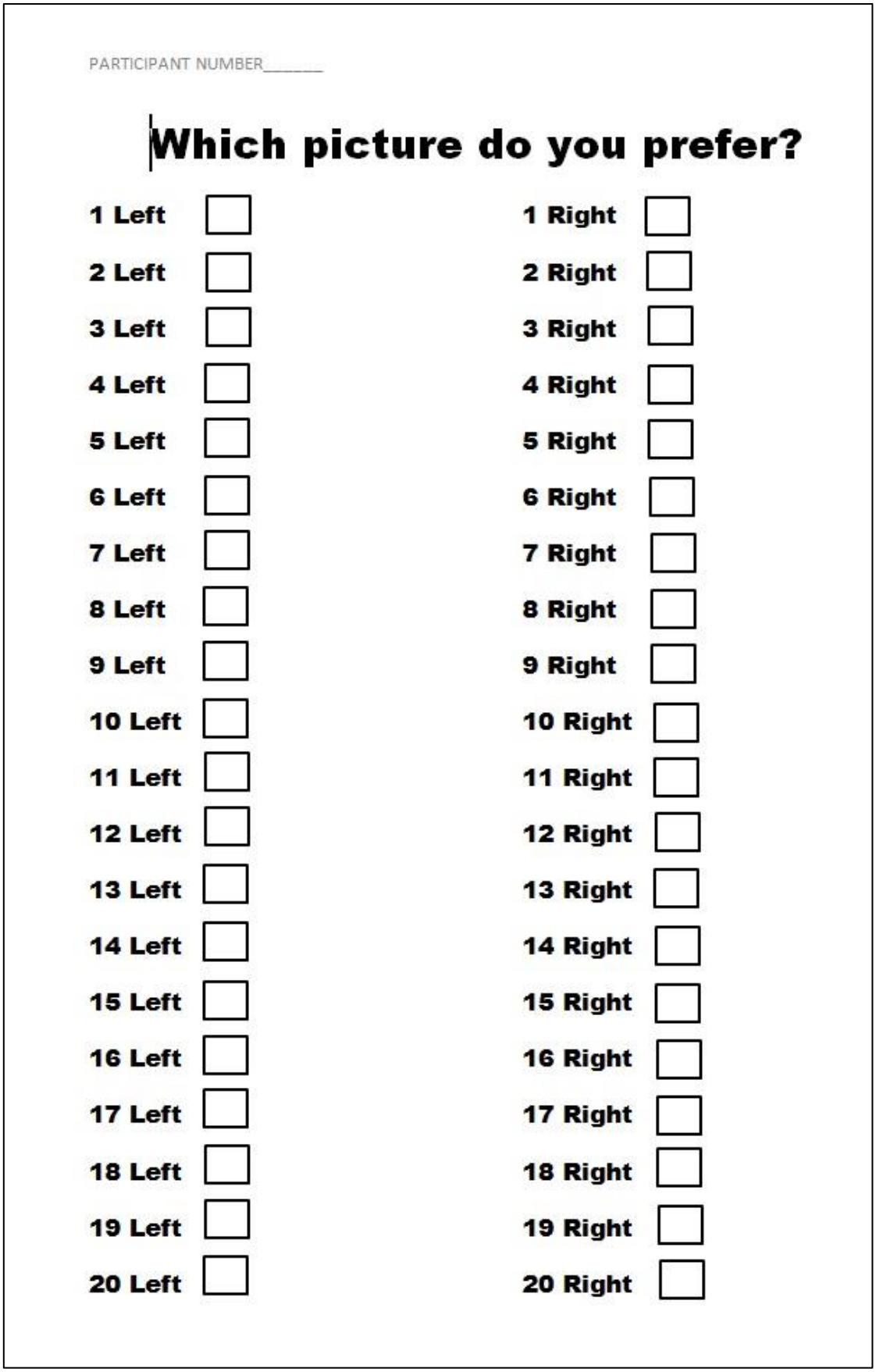


Figure H.22. PT: Answer Sheet.

APPENDIX I. Example of Questionnaire used in Study 3 & 4 (adolescent females).

- **Please answer all the questions the best you can.**
- **If there are any questions you don't want to answer, than just leave them blank.**
- **If you have any questions ask the researcher.**

1) What is your street and postcode?
   Street_____Postcode_____

2) How many **years** have you lived on this street? _____

3) In your life, how many **times** have you moved house? _____

4) Does your **mum** live in the same house as you now? Yes No

If you answered no,

How old were you when your mum **stopped** living in the same house?

_____

5) Does your **dad** live in the same house as you now? Yes No

If you answered no,

How old were you when your dad **stopped** living in the same house? _____

6) Does a **step-parent** live in the same house as you? Yes No

7) How many **full brothers and sisters** do you have? Brothers____
   Sisters____

8) How many **'step' or 'half' brothers and sisters**?
   Step/Half Brothers_____ Step/Half Sisters_____

9) Would you like to have children one day? (Circle one) Yes No

If you answered yes,

How old would you like to be when you have your first child?

_____

10) Have you had your first period? Yes No

If you answered yes,
When did your first period happen? Month _____ Year_____
(Example: Month October Year 2011)

OR

If you can't remember the Month and Year of your first period,
How old were you when you had your first period? _____ Years ____ Months
(Example: 11 Years 2 months)

11) How much do you like babies?

1 2 3 4 5 6 7
Not at all Very much

You and your Family

- **Read each sentence and tell us how much you agree or disagree by circling one of the numbers from 1 to 7.**

12) My father is always there when I need him.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

13) I want to raise my children in the way my parents raised me.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

14) My mother is always there when I need her.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

15) I do many activities with my family.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

16) My parents always seem to care what I am doing.

1 2 3 4 5 6 7
Strongly Disagree Strongly Agree

You and your Neighbourhood

- **Read each sentence and circle one of the answers to tell us <u>how true</u> the sentence is for your neighbourhood.**

17) There are plenty of safe places to walk or spend time outdoors in my neighbourhood.

Not at all true A little true Sort of True Very True

18) Every few weeks, some kid in my neighbourhood gets beaten up or mugged.

Not at all true A little true Sort of True Very True

19) Every few weeks, some adult gets beaten up or mugged in my neighbourhood.

Not at all true A little true Sort of True Very True

20) In the morning or later in the day, I often see drunk people on the street in my neighbourhood.

Not at all true A little true Sort of True Very True

21) Most adults in my neighbourhood respect the law.

Not at all true A little true Sort of True Very True

22) I feel safe when I walk around my neighbourhood by myself during the day.

Not at all true A little true Sort of True Very True

23) People who live in my neighbourhood often damage or steal each other's property.

Not at all true A little true Sort of True Very True

24) I feel safe when I walk around my neighbourhood by myself at night.

Not at all true A little true Sort of True Very True

You and your Future

- **For these next questions think about how you see the future.**
- **Read each question and then tell us <u>what you think your future chances are</u> by circling one of the answers.**

What are the chances that:	**I think the chances are:**				
25) You will finish your GSCEs?	Very high	High	About fifty-fifty	Low	Very low
26) You will go to university?	Very high	High	About fifty-fifty	Low	Very low
27) You will have a job that pays well?	Very high	High	About fifty-fifty	Low	Very low
28) You will be able to own your own home?	Very high	High	About fifty-fifty	Low	Very low
29) You will have a job that you enjoy doing?	Very high	High	About fifty-fifty	Low	Very low
30) You will have a happy family life?	Very high	High	About fifty-fifty	Low	Very low
31) You will stay in good health most of the time?	Very high	High	About fifty-fifty	Low	Very low
32) You will be able to live wherever you want to in the country?	Very high	High	About fifty-fifty	Low	Very low
33) You will be respected in your community?	Very high	High	About fifty-fifty	Low	Very low
34) You will have friends you can count on?					

Just You

- **Read each sentence and tell us if you <u>agree or disagree</u> with it by circling 'Yes' or 'No'.**

35) I often wish I were someone else	Yes	No
36) There are lots of things about myself I'd change if I could	Yes	No
37) I get easily upset at home	Yes	No
38) I am a lot of fun to be with	Yes	No
39) I am popular with kids my own age	Yes	No
40) My parents usually consider my feelings	Yes	No
41) My parent expect too much of me	Yes	No
42) It is pretty tough to be me	Yes	No
43) Things are all mixed up in my life	Yes	No
44) Kids usually follow my ideas	Yes	No
45) I have a low opinion of myself	Yes	No
46) There are many times when I would like to leave home	Yes	No
47) I often feel upset in school	Yes	No
48) I am not as nice looking as most people	Yes	No
49) If I have something to say I usually say it	Yes	No
50) My parents understand me	Yes	No
51) Most people are better liked than me	Yes	No
52) I usually feel as if my parents are pushing me	Yes	No
53) I often get discouraged in school	Yes	No

Thanks for filling out this questionnaire!