SEX DIFFERENCES IN 12, 18 AND 24-MONTH-OLD INFANTS' PREFERENCE FOR COLOUR, TOYS AND SHAPE

VASANTI JADVA

THESIS SUBMITTED IN FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPY
CITY UNIVERSITY, LONDON
DEPARTMENT OF PSYCHOLOGY
OCTOBER 2006

Table of Contents

List of Tables

List of Figures

ACKNOWLEDGEMENTS

Firstly, I would like to thank my supervisors, Professor Melissa Hines and Professor Susan Golombok for their advice, support and for keeping me going throughout the duration of this project.

I would also like to thank Kariofillis Zervoulis and James Hampton for their help with statistical analysis, and my colleagues at the Family and Child Psychology Research Centre, at City University, for their support.

My thanks are also due to the nurseries that helped with recruiting participants for this study, and to the parents and infants who took part. Their patience and enthusiasm was very much appreciated.

I would also like to thank my brother, sister, family and friends for their encouragement throughout the course of my PhD. In particular, I would like to thank my husband Harish for being there for me, and my daughter Keera who gave me light relief during the writing up stage of this thesis. Finally, I would like to thank my parents for teaching me to pursue my goals and for believing in me.

DECLARATION

I grant powers of discretion to the University Librarian to allow this thesis to be copied in whole or in part without further reference to me. This permission covers only single copies made for study purposes, subject to normal conditions of acknowledgement.

Vasanti Jadva

ABSTRACT

Introduction: A growing number of studies have found differences between boys' and girls' preferences for sex-typed toys during infancy. Toy preferences have been explained using biological, social and cognitive theories. More recently, focus has turned towards the low-level properties of toys that boys and girls find attractive. The present study was designed to assess the relationship between toy preference and toy colour, as well as to examine sex differences in infants' preferences for colour and shape. In addition, sex differences in the colours of infants' home environments, and in the colour and type of infants' toys, were examined.
Method: A total of 120 infants aged 12, 18 or 24 months took part in the study, with 20 males and 20 females in each age group. Colour, toy and shape preference were assessed using the preferential looking task, whereby two images were presented to each infant simultaneously and the infant's gaze was recorded onto videotape. These tapes were later coded to determine the length of time the infant looked at each image. In addition, parental interviews were conducted to obtain data about the colour of infants' home environments and their toy preferences.
Results: Sex and age differences in visual preferences for toys were found when the brightness of pink and blue were controlled. Boys looked longer at the car than girls and girls looked longer at the doll than boys. This preference for sex-typed toys was greatest when the infants looked at a same-sex-typed toy coloured in a same-sex-typed colour. Despite this overall sex difference, 12-month-olds, irrespective of their sex, looked at the doll more than the car. Infants were not found to show any sex differences in their visual preference for pink versus blue or for angular versus rounded shapes. Sex differences were not found in the colour of infants' bedrooms, bedcovers or bedroom curtains but sex differences were found in the colours of infant playrooms and clothing. With regard to reported toy play, boys played with more vehicles than girls, and girls played with more dolls than boys. A positive relationship was found between infants' reported play with vehicles and their looking time at the car on the preferential looking task.
Conclusions: Infants as young as 18 and 24 months show sex-typed visual preferences for toys which are strengthened when the toys are coloured in same sex-typed colours. Sex differences in shape preference and colour preference were not found in the present study. Instead, boys and girls were found to be similar in their preference for rounded shapes over angular shapes, and for red over blue.

INTRODUCTION

Boys and girls tend to play with different toys (O'Brien & Huston, 1985; Snow, Jacklin & Maccoby, 1983). Boys are more likely to play with tool sets, trains and trucks, whereas girls are more likely to play with dolls, tea-sets and doll houses (O'Brien & Huston, 1985). Children aged from 3 years clearly show sex-typed toy preferences (Golombok & Hines, 2002) and recent studies suggest that preferences for sex-typed toys appear before this age (Campbell, Shirley, Heywood & Crook, 2000; Serbin, Poulin-Dubois,Colburne, Sen & Eichstedt, 2001;Snow, Jacklin & Maccoby, 1983).

Research has moved from answering the general question of whether or not boys and girls display sex-typed toy preferences to more specific questions designed to examine why children consistently show a preference for particular toys. Explaining why sex-typed toy preferences exist is a complicated issue, and involves debate about nature versus nurture. Some have argued that children are innately predisposed to select same sex toys (Snow et al., 1983), whereas others believe that differential socialisation of boys and girls from parents and other individuals produces differences in toy preferences (Eisenberg, Wolchik, Hernandez & Pasternack, 1985). But even within these two approaches further issues arise, such as, if infants are being socialized to play with such toys, then who is doing the socialization? And if infants are biologically predisposed to play with same-sex toys, then what biological component is affecting toy play? In addition, research has also moved to examine the individual variability found within each sex.

This introduction begins by examining how sex-typed toy play has been measured and why sex–typed toy play is important. It then looks at what age sex-typed toy play is first displayed. Next, the different explanations of sex–typed toy play that have been put forward by psychologists are discussed. The final two sections examine the link between sex-typed toys and colour, and sex-typed toys and shape.

How has sex-typed toy play been studied?

Researchers have attempted to examine children's sex-typed toy preferences and to explain them using an array of research methodologies. These include observational studies of children's play, experimental studies and cataloguing children's toys using toy inventories.

Observational studies have commonly been used to study toy preferences in young children. They may take place in specially designed laboratories, at the child's home, or at the child's school/nursery. Many observational studies have been conducted to examine the role of parents in socialising infants. Studies have observed parent-child play in a laboratory (Caldera, et al., 1989; Rodgers, Fagot & Weinberger, 1998; Servin et al., 1999; Snow et al., 1983), nursery (Idle, Wood & Desmarais, 1993; Langlois and Downs, 1980) or home setting (Bradley & Gobbart, 1989; Jacklin et al., 1984; Leaper, 2000). Observational studies have also been conducted to examine children's play with sex-typed toys whilst on their own. Such observational studies have either taken place in a laboratory (Doering, Zucker, Bradley & MacIntyre, 1989; Rekers & Yates, 1976; Schau, Kahn, DiPold & Cherry, 1980; Zucker, Doering, Bradley & Finegan, 1983) or in a day care setting (Powlishta, Serbin & Moller, 1993). Finally, observational studies have also been conducted to examine children's play with same sex toys in the presence of peers (DiPietro, 1981; Fagot, 1977; Fridell, 2001; Lloyd, Duveen & Smith, 1988; Serbin, Connor, Burchardt & Citron, 1979).

Experimental studies cover a range of methodologies in which researchers have tested children's toy preferences. Some studies have involved interviews with children in order to assess their toy and playmate preferences (Alexander & Hines, 1994; Carter & Levy, 1988). Others have shown children pictures of toys and asked children to point to the one they prefer, or the one that is most suitable for a particular sex (Blakemore, et al., 1979; Guinn & Fitzgerald 1985). This technique of showing pictures to children to choose from has also been used with younger non-verbal infants using the preferential looking paradigm. This involves two images being shown to the infant and the infant's gaze being recorded and later coded to determine which picture s/he looked at more. From this, it is inferred that the image

looked at more is the one that the child prefers (Campbell et al., 2000; Serbin et al., 2001; Shirley, Campbell, Heywood & Crook, 2000; Vance & McCall, 1934).

Other studies have created inventories of children's toys by examining the number of particular toys that a child owns, or has been given (Cole, Zucker, & Bradley, 1982; Pomerleau, Bolduc, Malcuit & Cossette, 1990; Rheingold & Cook, 1975; Robinson & Morris, 1986). The advantage of examining the toys that children own is that researchers are able to assess what toys the child has available to them during play in everyday life.

Although many different methodological techniques have been used to determine children's toy preferences, each has its advantages and disadvantages. Observational studies allow children to behave as they would in the real world, particularly if observations are taking place in the home or a day care setting with which the child is familiar. However, it is very difficult to manipulate these environments, for example, to control the amount of physical space or the type of toys available to the child as well as the possible distractions in the room. In the case of home observations, findings between children who have very different home environments may not be comparable. The presence of the experimenter could also influence the children's behaviour.

Interviews allow children to respond to questions in a structured manner, and enable cross comparisons between subjects to be made with greater ease. However, it can be argued that they are not as valid as observational reports because subjects may distort their responses. The type of methodology used also depends on the age group that is studied. For example, the preferential looking paradigm allows toy preferences to be observed in very young infants. Despite the different methodologies that are available and that have been utilised by researchers, nearly all have found similar findings in that children over the age of 3 consistently display sex-typed toy preferences.

Why study toy play? The link between toy play and cognitive development

It has been argued that behavioural differences between males and females have their roots in childhood, and can be linked to the toys with which children play. Boys' toys tend to be more mechanical "...and provide more explicit feedback from the physical world. Girls' toys, on the other hand, tend to encourage imitation, are more often used in proximity to the caretaker, and provide less opportunity for variation and innovation" (Block, 1983, p.1342). According to Block (1983), the different kinds of toy preferences that boys and girls show may play an important role in later cognitive development. For example, male superiority in tasks of spatial ability (i.e. spatial orientation tasks such as the embedded figures test, and mental rotation tasks) may be related to playing with toys that encourage the use of such skills. Baennenger and Newcombe (1989) stated that boys are more likely to play with toys involving building and construction and are more likely to play outdoors. It has also been suggested that toy play provides children with the opportunity to practice behaviours through role rehearsal. Play with feminine toys encourages nurturance and proximity, and play with masculine toys encourages activity and manipulative play (Caldera, Huston & O'Brien, 1989). Thus, the toys a child plays with may contribute to the skills and behaviours they display as an adult, and may influence the differences found between the sexes in adulthood.

Eaton, Von Bargen, and Keats (1981) looked at whether toy choice of 34-74 month olds was related to the motor activity levels that masculine and feminine toys provided. They found that both boys and girls preferred high activity toys, but when given a choice between a same-sex-typed toy of low activity and an opposite sex typed toy of high activity, they chose the same-sex-typed toy of low activity. This suggests that the sex-appropriateness of the toy is more important than the motor activity level that it provides. O'Brien and Huston (1985) assessed the level of motor activity that sex-typed toys and neutral toys provided infants aged 14-28 months during a free-play situation. They too found that boys and girls preferred to play with toys stereotyped for their own gender and they also found, like Eaton et al. (1981), that both boys and girls played more with toys eliciting high activity compared to toys eliciting low activity. These studies show that both males and females prefer toys that elicit high motor activity, but also that children were most likely to play

with high motor activity toys when they were stereotyped for their own gender. However, masculine toys have been found to elicit more potential for motor activity compared to feminine toys (Masters & Wilkinson, 1976), and if children are selecting toys on their sex appropriateness, then this would result in females engaging less with activity eliciting toys (O'Brien & Huston, 1985).

To summarise, the link between toy play and cognitive abilities may not, therefore, be a clear causal relationship. Many other factors (genetic, hormonal, social) may influence the behavioural and cognitive differences observed between the sexes. Furthermore, differences in toy preferences found between the sexes may be a result of differences in cognitive abilities, and the relationship between the two may even be bi-directional.

At what age do same-sex toy preferences emerge? And does this differ between boys and girls?

An increasing amount of research has shown that a difference exists in the age at which sex-typed toy preferences begin to appear between boys and girls. Studies suggest that boys show sex-typed toy preferences earlier than girls. O'Brien and Huston (1985) studied the toy preferences of 52 children aged 14-35 months. They observed children playing with toys categorised as masculine (tools, train and truck), feminine (doll, tea-set and doll house) and neutral (stacking rings, hourglass, chiming toy). They found boys showed same sex toy preferences at 18-20 months whereas girls of this age showed no preference between masculine and feminine toys. They found that after 20 months, boys' play with sex-typed toys stayed consistent whereas for girls sex-typed toy play increased gradually. Girls aged 20-30 months played more with same sex-typed toys and less with cross sex-typed toys compared to younger girls.

Robinson and Morris (1986) asked 89 parents of 31 to 65 month-old children to list the toys they had given their child over Christmas, and to note whether or not the child had requested the toy. It was found that boys requested more sex-typed toys in comparison to girls. Separate analyses conducted for the three age groups of 3, 4 and 5 years found that boys did not differ significantly in the number of sex-typed toys

that they requested at each age group. Girls, however, requested more sex-typed toys at age 5 compared to age 3. By 5 years of age, girls were requesting a similar proportion (73%) of sex-typed toys to the boys (75%). These findings were consistent with a study conducted by Blakemore, La Rue and Olejnik (1979), in which 60 children aged either 2, 4 or 6 years old were shown a picture of a feminine typed toy and a masculine typed toy and were asked to say which toy they 'liked best'. They found that boys' preferences for sex typed toys was strong at all three ages and did not differ significantly between the ages. For girls, 2 year olds showed no preference for sex typed toys whereas 4 and 6-year-old girls did show a preference.

More recently, Campbell et al. (2000) assessed the toy preferences of 48 infants using a preferential looking task, where infants were shown images of feminine (doll, oven, dustpan and brush, pram and toaster) and masculine toys (ball, steering wheel, train, cars and blocks). The infants were tested at 3, 9 and 18 months of age. They found that boys aged 9 and 18 months showed a significant preference for sex-typed toys whereas girls were not found to show any preference at these ages.

All these studies suggest boys' preferences for sex-typed toys are present earlier than girls'. The studies by Robinson and Morris (1986) and Blakemore et al. (1979) both suggest that, by age 2, boys show sex-typed preferences, which do not appear in girls until after the age of 3. For girls, the process of acquiring sex-typed toy preferences may be more gradual (O'Brien & Huston, 1985). The study of infants conducted by Campbell et al. (2000) suggests that boys showed a preference for sex-typed toys from 9 months of age. However, only one of the studies (O'Brien & Huston, 1985) assessed children's actual play with toys, and because of the differing methodologies adopted by each study, it is difficult to draw any general conclusions. Furthermore, the different ways of analysing the findings could have given different results. For example, some researchers compared girls' toy play to boys' toy play, whereas other researchers looked within each sex to examine preference for same-sex toys over cross sex toys. Different methods of analysing data could have led to some of the discrepancies found in the results of the studies.

Other studies have found contradictory results. Some have found no difference in the age at which boys and girls display sex-typed toy preferences and others have found that girls' preference for sex-typed toys increases with age. Serbin et al. (2001) examined the toy preferences of 77 children aged 12, 18 and 24 months. They used a method similar to that employed by Campbell et al. (2000). Pictures of vehicles and dolls were shown to infants, and the length of time the infant looked at each image was used to determine their preferences. It was found that both boys and girls displayed a preference for sex-typed toys at 18-months. At 24 months, this preference for sex-typed toys was still apparent, but girls at this age had also started to show an interest in vehicles.

Studies of older children have found that girls' preferences for sex-typed toys may decrease with age. In a study conducted by Etaugh and Liss (1992), 245 children aged 5, 8, 11 and 13, were asked to complete questionnaires about the toys they had requested and the toys they had received for Christmas. They found that, for girls, requests for sex-typed toys decreased with age, but for boys it did not differ. This is contradictory to the findings of the studies mentioned above (Blakemore et al., 1979; Campbell et al., 2000; O'Brien & Huston, 1985; Robinson & Morris, 1986) which have found girls' same sex toy play increases with age. With regards to the toys actually received, it was found that boys received more male-typed toys in comparison to girls, and that girls received more female-typed toys in comparison to boys. Interestingly, this study revealed that boys and girls who requested toys stereotyped for the other gender did not receive them, suggesting that adults were reluctant to buy toys stereotyped for the other gender for their children, even if the child had requested them. In addition, it was also found that the requests for gender-neutral toys increased with age. The children studied by Etaugh and Liss (1992) were older than in the other studies, and it may be possible that older girls' interest in female-typed toys is replaced with interest in more neutral toys. It is also possible that the gradual increase in female-typed toy preference found in younger girls may not continue into the middle childhood years.

A more recent study conducted on younger children also found similar findings to Etaugh and Liss's (1992) finding that girls' interest in sex-typed toys decreased with age. Servin, Bohlin, and Berlin (1999) observed 106 children aged 1, 3 and 5 years of

age during a semi-structured play session in a laboratory. Children were provided with ten toys: masculine (bus, garage, construction toy, and X-men figures), feminine (doll, Barbie and Ken dolls, tea-set and beauty set) or neutral (view-master and playing cards). It was found that as age increased, boys and girls played less with female-typed toys. By age 5, the boys were playing significantly more with the male-typed toys compared to the female-typed toys but girls at each age group showed no preference. The researchers explained their findings in terms of a possible change in the cultural norms, such that girls in today's society are reinforced for displaying less stereotypically feminine interests.

Explanations of sex-typed toy play: Biological theory

Research has looked at the influence of hormones on sex-typed behaviour. It has been suggested that sex differences in hormone levels present prenatally lead to differences in the organisation of neural substrates in the brain such that high levels of prenatal androgens lead to brain masculinization resulting in male-typical behaviour (Ehrhardt, 1987). It is thought that hormones affect sensitivity to sex-typed stimuli, which in turn produces sex-typed behaviour. One of the ways in which the effect of hormones on sex-typed behaviour has been researched is by studying children with congenital adrenal hyperplasia (CAH), a condition where individuals are exposed to high levels of androgens (masculinizing hormones) prenatally.

Berenbaum and Hines (1992) compared the toy preferences of 11 CAH boys and 26 CAH girls to a control group of unaffected siblings or relatives. All children were aged between 3-8 years. They observed the children playing with toys stereotyped as masculine (transportation toys and construction toys), feminine (dolls, kitchen supplies, telephone, crayons and paper) and neutral (books, board games and jigsaw puzzles). It was found that CAH girls spent more time playing with masculine toys and less time playing with feminine toys compared to control group girls. CAH girls spent more time playing with masculine toys compared to feminine toys. CAH boys showed no significant difference from control group boys. Thus, it appears that raised levels of prenatal androgen exposure in females result in an increase in masculine toy play.

However, it has been suggested that the differences observed between CAH girls and unaffected girls could be explained by factors unrelated to the prenatal hormone environment. For example, some have argued that parents of CAH girls may treat their child differently from parents of unaffected girls. Parents of CAH girls may treat their daughters more like boys as CAH girls often display more masculine behaviour (Quadagno, Briscoe & Quadagno, 1977). In order to address this issue, Pasterski, Geffner, Brain, Hindmarsh, Brook and Hines (2005) compared 65 children with CAH playing with their parents to 52 unaffected siblings playing with their parents. The children were between 3-10 years and the study had similar numbers of CAH boys and girls (34 females and 31 males). Children were videotaped playing alone, playing with their parent, and, when available, playing with their other parent. The toys made available to the child included stereotypically masculine (car, fire truck, Lego airplane, tool set, helicopter and gun), feminine (set of dishes, Barbie doll, infant doll, rag doll and cosmetic kit), and neutral toys (puzzle, board game, books, crayons and a sketchpad). It was found that CAH girls exhibited male typical toy play during play with their mothers and their fathers, and furthermore, that neither parent was found to encourage male-typical toy choice in their daughters with CAH. CAH boys were not found to differ significantly in their toy play from the unaffected boys, although mothers of CAH boys were found to be more encouraging of sex-typed play with their CAH sons compared to their unaffected sons. This study, therefore, found no support for the notion that the male-typical toy choices observed by CAH girls might be a result of parental socialisation. Further support for the link between prenatal androgens and toy play in girls comes from a study by Nordenstrom, Servin, Bohlin, Larsson and Wedell (2002). The study observed the toy play of 31 CAH girls and correlated their male-typical toy play to the level of prenatal androgen exposure. They found that girls with a higher degree of prenatal androgen exposure displayed more masculine toy play. The study also looked at the effect of parental influence on toy play of girls with CAH, and it too found no support for the idea that parental treatment of CAH girls leads to their preference for male typical toys.

Findings from studies of the effects of androgenic progestins on children of mothers exposed to such hormones (due to problem pregnancies) have provided further support for the notion that prenatal androgenization predisposes girls towards male

sex role behaviour (Money and Ehrhardt, 1972). In addition, girls exposed to nonandrogenic progesterones, which act as an antiandrogen, tend to be more interested in doll play and child care (Ehrhardt, Meyer-Bahlburg, Feldman and Ince, 1984).

Another way in which researchers have attempted to examine the effect of hormones on sex-typed toy play is by studying twins. Henderson and Berenbaum (1997) compared girls to their female or male co-twins. The assumption here is that females with a male twin may be more masculinised than females with a female twin due to the transfer of testosterone from their male twin in utero. Thirty-five girls with a boy co-twin, 36 girls with a girl co-twin and 20 singleton girls with an older brother were observed playing for 10 minutes with sex-typed and neutral toys in a screened off area within the child's home. The children were aged between 3-8 years. The results gave no support to the prediction that girls with a boy co-twin would differ from girls with a girl co-twin. There are a number of possible reasons why an effect was not observed. In particular, it has been suggested that hormones transferred pre-natally are so small in quantity that they do not have an effect on later behaviour (Henderson & Berenbaum, 1997). Also, studies of toy preferences have shown that boys show a more marked preference for same-sex toys compared to girls (Blakemore et al., 1979; Robinson and Morris, 1986; Servin et al., 1999). The study by Henderson and Berenbaum (1997) focused on girls' preference for sex-typed toys. It may be possible that comparing the toy play of boys with a girl co-twin to boys with a boy co-twin may result in different findings. Iervolino, Hines, Golombok, Rust and Plomin (2005) assessed the genetic and environmental influences on gender role behaviour in 3990 3-4-year-old twin and nontwin sibling pairs. The Pre-School Activities Inventory (PSAI) was completed by parents to assess gender role behaviour. It was found that both genetic and environmental influences were important in explaining individual differences in gender-role behaviour. Environmental influences were found to be more important for boys than for girls.

More recently, Knickmeyer, Wheelwright, Taylor, Raggatt, Hackett and Baron Cohen (2005) conducted the first study to correlate the levels of amniotic testosterone with sex-typed play in a normative sample. They asked the mothers of 53 children aged between 4-6 years to complete the Children's Play Questionnaire –

a questionnaire designed to assess the masculinity and femininity of children's play. The researchers failed to find any relationship between the levels of amniotic testosterone and the sex-typed nature of children's play. A number of possible explanations were put forward to explain the findings, including the possibility that questionnaire measures of play may not be as accurate as observational measures of play, and that amniotic testosterone levels may not accurately determine the amount of testosterone exposed to the brain. In addition the timing of exposure may also be important.

This study together with the study by Henderson and Berenbaum (1997) demonstrates that, unlike studying individuals exposed to unusually high levels of prenatal masculinising hormones, studies of children exposed to normal levels of such hormones, may not show a direct relationship between prenatal hormone exposure and sex-typed toy play. However, Hines, Golombok, Rust, Johnston, Golding and the ALSPAC team (2002) did find a positive relationship between levels of testosterone in pregnant women and later gender role behaviour in girls but not boys. However, maternal T accounted for only approximately 2% of the variance in the gender role behaviour of girls. The significant finding by Hines et al. (2002) compared to the non-significant finding by Knickmeyer et al (2005) could be attributed to the way in which gender role was assessed. The study by Hines et al. (2000) used the PSAI to measure gender role behaviour. The PSAI was designed to examine within sex variation, enabling researchers to distinguish, for example, between masculine boys and very masculine boys. Thus, it is possible that the PSAI could have been a more sensitive measure of gender role behaviour compared to the Children's Play Questionnaire used by Knickmeyer et al. (2005), and that this could have contributed to the different findings.

Research on the behaviour of animals (in particular non-human primates) has also lent support to the biological explanation of sex differences in toy play. Alexander and Hines (2002) found that monkeys (Cercopithecus Eathiops Sabaeus) displayed sex differences similar to those observed in children. Male monkeys showed more interest in a car and a ball, compared to female monkeys, and female monkeys showed a greater preference for a doll and a pot compared to the male monkeys. Such findings suggest that sex differences in toy preferences may be explained from

an evolutionary perspective, where preferences for certain objects arise as a result of differences in the behavioural roles of males and females (Alexander & Hines, 2002; Alexander, 2003). Importantly, by demonstrating that monkeys display sex-typed toy preferences despite not having the cognitive and social influences used to explain toy preference in humans, this study suggests that factors other than social and cognitive need to be considered when explaining children's sex-typed toy play.

The emergence of toy preferences early in life lends further support to biological theories. Servin et al. (1999) found sex-typed toy play in infants as young as 12 months of age. They proposed that toy preferences observed at such a young age strengthen the argument for a biological influence. Interestingly, their study observed that 12-month-old children showed patterns of play that were inconsistent with their own sex with relation to one of the toys – an X-Men figure. They found that 12-month-old girls played with the figure and 12-month-old boys did not, arguing that this may have been due to both sexes seeing the figures as dolls and hence girls played with them and boys did not. However, by the age of three, girls no longer played with the figures and boys did. The researchers suggested that by age 3 the children "...may have come to realize the masculine aspect of this toy, thus making it more interesting to the boys. This is in line with the biological predisposition to certain behaviour, which in this case then yields to environmental influences" (Servin et al., 1999, p 47).

In summary, hormones may play a part in the emergence of sex-typed toy preferences. Sex differences in toy preferences may also be a result of an evolutionary process, whereby males and females display object preferences that are related to their different roles. The younger the age at which sex-typed toy preferences are observed the more the biological approach is strengthened as the effects of socialisation are minimised. It is possible that the recognition of particular toys as belonging to a particular gender may have some innate basis, which is reinforced by the social environment, so that earlier ideas are either strengthened or, as in the case of the X-men figures in Servin et al.'s (1999) study, re-evaluated.

Explanations of sex-typed toy play: Social learning theory

The question of whether or not boys and girls are treated differently by others has triggered a great deal of research. According to social learning theory, boys are reinforced for engaging in male-typed activities, and girls for engaging in female-typed activities. Opposite sex-typed behaviour is punished or not rewarded which leads to extinction. Such selective reward and punishment, it is argued, encourages the child to engage in sex-typed behaviour.

Adults' toy play with male and female children

Early studies that examined whether adults treated boys and girls differently included the baby X studies (Seavy, Katz & Zalk, 1975; Sidorowicz & Lunney, 1980). These studies looked at adult interaction with an infant who was introduced as either a boy, a girl, or with no gender information. The original baby X study, conducted by Seavy et al. (1975), examined adult interactions with a 3-month-old female infant labelled as either male, female or with no gender label. A second study conducted by Sidorowicz and Lunney (1980) observed adult interactions with both male and female infants aged 3-11 months. Both studies were observational studies and participants were left in a room with the infant. The room also contained a football (male toy), a doll (female toy) and a teething ring (gender neutral). It was found that regardless of the 'real' gender of the child, the adults would assume a gender label for the infant and use stereotypically gender appropriate toys when interacting with them. This finding appears to support the claim that people treat children differently based on assumed gender.

These early baby X studies demonstrated that adults treat infants according to their gender (Huston, 1983). However, a study conducted by Lewis, Scully and Condor (1992) found that an infant's 'actual' gender might be related to adults' perceptions of their own gender-related behaviour. They conducted a study similar to that of the baby X studies, and also asked adults to rate themselves after having interacted with a 10-month-old infant. It was found that adults who had interacted with a male infant rated themselves as more masculine. This study demonstrated that adults might be reacting to both the gender label and the actual behaviour of the infant. This may also

be true of adult behaviour towards infants in everyday life (Golombok & Fivush, 1994).

Parents' toy play with male and female children

Studies looking at adult interactions with a 'strange' infant may result in more stereotyped behaviour from adults than from parents interacting with their own children (Huston, 1983). Some research has, therefore, focused on the behaviour of adults with their own children (Bradley & Gobbart, 1989; Caldera et al., 1989; Fagot & Hagan, 1991; Idle, Wood, & Desmarais, 1993; Snow et al, 1983). In an observational study, Fagot (1974) looked at 12 toddlers aged between 18 and 24 months, interacting at home with both their parents. It was found that parents responded favourably when their child displayed sex-stereotyped behaviours. That is, girls were rewarded for playing with dolls, whilst boys were encouraged to play with blocks.

Caldera et al. (1989) examined parents' interactions with their child. They observed 40 parent-child pairs, 20 mothers and 20 fathers. The children were aged between 18-23 months. Half of the mothers and fathers were observed with their son, and the other half with their daughter. The parents were observed with their child whilst playing with 6 sets of toys that were stereotyped as masculine (trucks and blocks), feminine (dolls and a kitchen set) or neutral (puzzles and shape sorters). They found that parents were more involved when their child played with opposite-sex-typed toys compared to same-sex-typed toys. Parents were also found to be more involved during play with toys that were stereotyped for their own gender, that is mothers were more involved in feminine toys compared to fathers and fathers were more involved in masculine toys compared to mothers. It was also found that masculine toys elicited fewer questions and teaching, and a lower proximity between the parent and child, when compared with feminine toys. The authors concluded that the type of toy had a greater influence on the way in which the parent and child interacted than the sex of the child.

Maccoby and Jacklin (1974) reviewed earlier research looking at parental socialisation practices. They concluded that few differences exist between parents'

treatment of boys and girls, except for very specific sex-typed behaviours such as toy and activity choice. However, they did find some evidence indicating that boys were more likely to be punished, and played with more roughly, in comparison to girls. Maccoby and Jacklin's review was criticised for focusing on preschool children and for not taking fathers into account (Block, 1978). In addition, the research failed to distinguish between the quality of studies being reviewed (Golombok and Fivush, 1994). In an attempt to address some of the methodological issues raised by the Maccoby and Jacklin (1974) review, Lytton and Romney (1991) conducted a meta-analysis of 172 studies that looked at parent socialisation of boys and girls. They found that parents on the whole did not treat boys differently to girls; however, differences were found for specific behaviours such as in the encouragement of sex-typed activities, which included toy play and household chores. The mean effect sizes for mothers, fathers and both parents were .34, .49, and .43 respectively.

Parents' toy play with male and female children: mothers vs. fathers

Block (1983) had suggested that fathers would show greater sex-differentiated socialisation in comparison to mothers. This was addressed by the Lytton and Romney (1991) meta-analysis that concluded that although differences were observed between mothers and fathers these were not found in relation to toy play. However, some studies have found differences between mothers and fathers interactions with their children during play with sex typed toys. Langloise and Downs (1980) looked at 48 children aged 3 years and 5 years playing with their mothers and fathers at their child's nursery. Two studies were conducted. In the first study, children were observed playing with sex-typed toys in an unoccupied room at their nursery either with their mother, their peer or alone. In the second study children were observed playing with their fathers. It was found that mothers rewarded their daughters, by giving praise and affection for playing with same-sex typed toys, and punished them for playing with cross-sex-typed toys. Mothers of boys were found to reward play with cross-sex typed toys and same-sex typed toys. Fathers were found to exhibit more positive reactions during play with their daughters, and more negative reactions during play with their sons. Such a study shows the importance of distinguishing between a male and female parent when trying to determine whether parents could be influencing sex-typed toy play.

Snow et al. (1983) looked at a total of 107 father–child pairs playing with sex-typed toys. The children were aged 12 months. The father and child were observed in a room with 6 toys placed on a shelf that was too high for the child to reach. They found that fathers were less likely to give dolls to their sons than to their daughters but were equally likely to give trucks to their sons and daughters. However they also found that for those children who were given a doll by their father, girls played with the dolls more than the boys. Boys and girls who were given a truck by their father were equally likely to play with them. It was suggested that by withholding the dolls from their sons, fathers maybe preventing their sons from engaging in play that is stereotypically feminine. Jacklin et al. (1984), in a study of home observations of 44 3-year-old infants, found that mother-son dyads engaged in both masculine and feminine play, whereas father-daughter dyads focused primarily on feminine-typed play. Jacklin et al. (1984) concluded that "fathers are doing the major share of differential socialisation of sex-typed toy play" (Jacklin et al., 1984, p. 424).

Bradley and Gobbart (1989) looked at whether mothers and fathers gave different toys to their infants during play at home. They looked at 10 parent-daughter dyads and 10 parent-son dyads where the children were aged between 1 and 3. They found that fathers gave more same sex-typed toys to their sons and daughters compared to opposite sex-typed toys but that mothers showed no significant difference in the number of sex-typed toys they gave to their sons and daughters. Although this study lends further support to the notion that fathers may be more influential than mothers, the study had a small sample size.

Roopnarine (1985) found that mothers and fathers were equally likely to offer sex-typed toys to their infants aged between 10-18 months. The sample consisted of a total of 32 children who were observed playing with their mother and then separately with their father in a laboratory. The study found that fathers were more likely to attend to the doll play of girls than boys. Mothers were not found to differ signikficantly in their play with their sons and daughters. This study also shows a similar trend in that fathers did differ from mothers in their play with young infants.

In a study that had a larger sample size, Fagot and Hagan (1991) conducted home observations of 92 12-month-olds, 82 18-month-olds and 172 5-year-olds. They did not find support for Block's hypothesis that fathers would be more involved in sex typing than mothers. However, they did observe that fathers gave fewer positive reactions than mothers, to 18 months-old boys engaging in female-typical play.

Idle et al. (1993), looked at the family play patterns of 20 two-parent families with a child aged 27-64 months. They found that although parents identified female toys as most desirable for girls, and masculine toys as most desirable for boys, when it came to actual play with the toys, feminine toys were not chosen for either boys or girls. Thus, although parents may hold traditional gender stereotyped beliefs, "...they acknowledge and reinforce a different set of values when directing play with their own child." (Idle et al., 1993, p. 688). Parents were more likely to see neutral toys as most appropriate for their child regardless of their child's gender. Idle et al. (1993) explained this in terms of social influence, arguing that when engaged in play with their own children, parents may be more prone to show egalitarian beliefs and values as opposed to the more stereotypic personal values that they may hold. A study designed to assess the gender stereotypes of 206 toys as evaluated by parents and non-parents, found that parents were more likely to rate toys as 'neutral' compared to non-parents (Campenni, 1999). It was suggested that this difference between parents and non-parents may be due to parents' interactions with their own children. Parents may have observed their own children playing with cross sex toys and may therefore be more likely to view some sex-typed toys (particularly masculine-typed toys) as gender neutral. This hypothesis needs further study (Campenni, 1999).

More recently, Caldera and Sciaraffa (1998) observed 42 parent-child pairs during play with either a doll or a clown. The children were aged between 18-23 months. They found that parents of boys called their attention to the clown more than the doll, and parents of girls called their attention to the doll more than the clown. They found that mothers of daughters encouraged more nurturing and care taking of the doll compared to mothers of sons. However they also found that fathers of sons were more encouraging of nurturing and taking care of the doll compared to fathers of daughters. It was argued that fathers may be important socialising agents for their sons, particularly during feminine-typed play. The difference in these findings to

those of previous studies may be due to a change in attitudes and roles of males in society, in that males are now more likely to engage in child care (Lamb, 1997).

In addition to viewing children playing with sex-typed toys either on their own or with their parents, some researchers have attempted to catalogue children's environments to assess whether parents provided boys and girls with different physical environments at home. Rheingold and Cook (1975) catalogued the content of 96 children's bedrooms. The children were aged between 1 and 6 years. The toys and furnishings were noted and later classified into 13 categories. It was found that boys had more vehicles, toy animals, sports equipment and educational art materials. Girls had more dolls, doll houses and domestic items. The appearance of rooms were also found to differ, with girls' rooms containing more floral furnishings and more items bearing ruffles, fringe or lace.

A similar study was conducted by Pomerleau et al. (1990). They compared the physical home environments of 60 boys and 60 girls aged 5 months, 13 months or 25 months. Infants' toys, clothing colour and room décor were recorded on a checklist during home visits. The toys were grouped into 19 categories and sex differences were found in 8 of these. Boys were found to have more sports equipment, tools, large vehicles and small vehicles. Girls were found to have more dolls, fictional characters, children's furniture and toys belonging to a category defined as 'other toys for manipulation'. The colour of infants' clothes also showed a sex difference with boys being reported by parents to wear more blue, red and white compared to girls. Girls wore more pink, and multicoloured clothing compared to boys. In addition, girls were found to have more yellow bedding compared to boys. Boys were more likely to have blue bedding and blue curtains compared to girls. The study illustrates that even for very young infants the physical environment for boys and girls is different. As many of these infants are too young to impose their likes and dislikes on their environment, these differences must arise from their parents' choices (Pomerleau et al., 1990). Thus, parental influences on sex-typed toy play and other behavioural sex differences may be taking place not only in the way in which they interact with their children, but also in the way they define their child's environment (Pomerleau et al., 1990).

In summary, the research into parental socialization of sex-typed toy play in children generally supports the idea that parents do treat their sons and daughters differently. Furthermore, studies have shown that differences may exist between the way in which mothers and fathers interact with their children during play with sex-typed toys. Much of the research conducted on the role of socialising agents in children's toy play has focused on parents. However, other groups such as teachers, peers and the media, may also be important. In a study designed to assess the link between peer interaction and toy preference in 51 4 to 5 year olds, Eisenberg, Tryon, and Cameron (1984) found a non-significant positive correlation between play with same-sex peers and play with same-sex toys. This relationship was found to be stronger in boys than in girls. Moller and Serbin (1996) failed to find any link between same-sex peer preference and sex-typed toy play in a group of 57 2 to 3 year old children. However, this may have been due to the age of the children tested, as research has shown that same-sex playmate preference may not become apparent until age 3 (Golombok & Hines, 2002).

Ruble, Balaban, and Cooper (1981) conducted a controlled experiment with 50 males and 50 females aged from 4 to 6 years. They found a direct link between television commercials of toys that were modelled by children of a particular sex, and sex-typed play with that toy. Children who displayed gender constancy avoided play with the toy if it was modelled by children of the opposite sex. Children who did not show gender constancy, played more with the advertised toy compared to toys that were not shown in the commercial, irrespective of the gender of the children who were advertising it. This study not only shows the power the media may have on a child's play behaviour, but that children will mimic play with toys if they are shown to be associated with their own gender, once they had attained gender constancy.

The social learning theory places great emphasis on children being socialised to adopt sex-typed preferences. However, the study carried out by Pasterski et al. (2005), summarised earlier, found that CAH girls received more encouragement of feminine-typed toy play compared to unaffected girls, suggesting that masculine toy preferences displayed by CAH girls are not a result of parental socialisation. It was proposed that the ineffectiveness of parents' encouragement of feminine-typed play in CAH girls might have been related to the increased levels of prenatal androgen

that CAH girls are exposed to, although the authors acknowledge that more research is required to draw this conclusion. What the study does suggest is that parental socialisation may not completely account for children's preference for sex-typed toys. Other factors, either biological, cognitive or a combination of both may play some role in the acquisition of toy–preferences.

Explanations of sex-typed toy play: Cognitive developmental theories

Rather then viewing children as passive beings socialised by the environment around them, the cognitive approach argues that children play an active role in constructing ideas about the world. One of the earliest cognitive theories of gender development was put forward by Kohlberg (1969) who argued that gender role acquisition undergoes three stages: gender labelling, gender stability and gender constancy. Gender labelling occurs between the age of 2-3.5 years. At this stage the child is able to label him/herself correctly and can also correctly use the terms man, woman, boy and girl. The next stage of gender stability occurs between 3.5 to 4.5 years. Once children reach this stage they are aware that gender stays the same over time. It is at the stage of gender constancy that children come to understand that gender remains the same across different situations, including dressing up in opposite-sex clothes. Most children would have gone through all 3 stages by the age of 6-7 years. According to Kohlberg, sex role behaviour develops after a child has reached gender constancy. Kohlberg (1966) argued that although modelling is important, it develops as a consequence of cognitive construction, i.e. once gender constancy has been established.

Another theory based upon the cognitive model is the idea that children form gender schemas to organise and structure information taken from their environment (Bem, 1981; Martin & Halverson, 1981; Martin, Ruble & Szkrybalo, 2002). An important developmental step for gender schema theorists is the child's ability to categorise themselves as belonging to a particular gender, as only then do they begin the process of gender-typing.

Both these cognitive theories of gender development suggest that gender-typed preferences develop as a result of children knowing their own gender as well as

being aware of the stereotypes already existing in the environment around them. Children can then learn which gender stereotypes belong to the same gender category as themselves, and thereby adopt behaviour and ideas consistent with their own gender. Studies in which children are shown pictures of males and females in typical and atypical activities have found that children display a 'memory bias'. That is, when asked to recall the pictures viewed, they tend to recall more pictures of adults engaged in gender typical activities than gender atypical activities (Martin and Halverson, 1983). Such research provides support for the notion that gender schemas are in operation.

Sex-typed toy play is a problematic issue for cognitive theorists because of the assumption that children must be able to identify their own gender before displaying sex-stereotyped behaviour and preferences. Campbell et al. (2000) conducted a longitudinal study using the preferential looking task to examine 3, 9 and 18 month old infants' same sex preferences for babies, children, toys and activities. A total of 60 infants participated. In addition, they assessed whether or not the infants were able to recognise themselves by showing them a photo of themselves alongside an image of a same-sex peer. The assumption was that infants who are able to recognise themselves in images would know which sex they are and only then should they be able to show sex-typed toy preferences. They found that infants showed no preference for the image of themselves at any of the age groups despite boys showing a preference for sex-typed toys from 9 months. It was concluded that "sex-typed toy preference and the greater male preference for masculine activities is unlikely to be a function of gender schematic processing..." (Campbell et al., 2000, p. 492). Thus, the early onset of toy preferences may be a result of what the toy can do and not a result of the gender labels attached to toys (Campbell et al., 2000).

Serbin et al. (2001) assessed the visual preference for sex-typed toys in 77 infants aged 12, 18 and 24 months. They also assessed infants' knowledge of sex-typed toys (vehicles and dolls). A male or female face coupled with a male or female voice was presented prior to each presentation of sex-typed toys. This was done to determine whether infants could match the face and voice to the appropriate toy. Specifically, whether they would look longer at the toy stereotyped for the same gender as the face. Infants did not display knowledge of sex-typing as they were not able to match

the faces and voices to the appropriate toy. However, infants from 18 months displayed sex-typed preferences, in that boys looked longer at vehicles compared to girls, and girls looked longer at dolls compared to boys. Thus, infants were displaying sex-typed toy preferences despite not being able to display knowledge of the gender appropriateness of sex-typed toys. Analyses of the methodology used by the study revealed that infants' strong attraction to sex-typed toys might have interfered with their cognitive processing. "In other words, strong interest and preferences for toys may have dominated the children's attention during the trials, reducing the memory trace of the preceding gender category cues (the faces and voices) to an ineffective level" (Serbin et al., 2001, p 12).

To rectify this issue, a second study was conducted with a new sample of 58 infants aged 18 and 24 months. A single sex-typed toy was shown first, followed by two faces (a male and a female). Infants were expected to look longer at the face that was consistent with the sex-typed nature of the toy previously displayed. It was found that girls at 18 months and 24 months displayed gender knowledge, by being able to match the male and female faces with the vehicles and dolls. Boys at these ages were not found to display gender knowledge. Thus, the study found that, for girls, sex-typed toy preferences and gender knowledge were present during infancy. The authors however, noted that the importance placed upon gender identity by cognitive theorists needs to be re-evaluated, as children below the age of 3 not only display sex-typed preferences, but also show signs of gender knowledge.

Explanations of sex-typed toy play: Social cognitive theory

Social cognitive theory aims to combine social learning theory with the cognitive approach (Bussey and Bandura, 1999). The theory suggests that gender concepts and gender role behaviour are created from a complex mix of experiences encountered in everyday life. These gender concepts work alongside motivational and self-regulatory mechanisms to result in sex-typed behaviour. The theory places importance on modelling but instead of this being viewed as a direct mechanism for learning same sex behaviour, the theory suggests that motivational and self regulatory mechanisms are involved. Motivational mechanisms include an individual's ability to assess whether they will be able to excel in certain behaviour,

and if by doing so they will benefit from the modelled behaviour in the same way as they observe others to be benefiting. Self-regulatory mechanisms include children's ability to adapt their behaviour based on their increasing knowledge about the possible consequences of adopting gender-linked behaviour. In addition, unlike the social learning approach and the cognitive approach to gender development, the social cognitive approach does not focus on childhood; instead, it looks at the entire life span.

What is it about toys that attract boys and girls to them?

Although it is now largely concluded that boys and girls are attracted to different toys, some researchers, instead of explaining these differences in terms of theoretical frameworks, have asked the question of what low level properties of the toys attract males and females to them (Campbell et al., 2000). For example are boys attracted to 'wheels' and motion, and girls to faces and imaginary role-play? Moller and Serbin (1996) argued that toy preferences might be a result of what the toy can do, rather than children knowing that a certain toy is appropriate for their own gender.

Furby and Wilke (1982) conducted a study of the characteristics of the favourite toys of 91 3-month-olds, 116 6-month-olds, 149 9-month-olds and 105 12-month-olds. Mothers were asked to complete questionnaires containing items related to their infant's behaviour during the previous week. Of the questions asked, two related to toy play. The first question asked the mother if the child had a favourite toy or toys, and the second question asked the mother what these toys were. In their response, mothers also noted what the child did with the toy. The toys were later coded to determine their material composition as well as the stimulation provided by the toy. It was found that both boys and girls had favourite toys that were made of hard material rather than soft material. Boys' preference for hard objects increased with age whereas girls' preference for hard objects decreased with age. With regard to toys made of soft materials, it was found that both boys' and girls' preference decreased between the ages of 3 and 9 months and did not change between the ages of 9 and 12 months. No significant sex differences were found in the type of stimulation provided by the toys that infants were reportedly playing with. The

researchers also found that boys and girls had similar numbers of dolls at ages 3 and 6 months, but for the age groups of 9 and 12 months girls had more dolls than boys.

This study, however, had a number of limitations. Firstly, the data were collected using questionnaires completed by mothers, which asked two very broad questions. Some mothers may have given more information than others. When coding the data, although inferences were avoided wherever possible, they were still made, particularly with regards to what the infant did with the object. Secondly, as the researchers themselves noted, the toys that infants played with were limited to what toys the child was given. Thus, the preferences for certain toys could be a reflection of the parent's toy choice and not necessarily the child's toy preference. Thirdly, findings were reported as percentages and no statistical analysis was conducted on the data.

Sex-typed toys and colour

Stereotyped toys for boys and girls tend to differ in many ways, one of which is the colour of the toy. Toy manufacturers usually colour code male and female toys. Boys' toys are coloured in bold primary colours, such as blue and red, and girls' toys are coloured in paler pastel shades, such as pink and lilac (Pennell, 1994). A UK toy store has attempted to bridge this gap by providing one of its leading toys (an interactive learning system appropriate for 6-36 month olds) in both pink and blue so as not to force a particular colour onto the child or parent.

Pennell (1994) conducted an analysis of how children are taught gender ideologies through toys, their packaging, catalogue listings and advertisements. She found that although boys' and girls' toys differed in a number of ways, one of the most obvious was toy colour. Girls' toys tended to be coloured in pastel shades, especially pink and lavender. In contrast, boys' toys tended to be coloured in 'intense colours' such as red, blue and black. Pennell (1994) concluded that children's toys send clear messages to boys and girls that reinforce traditional gender stereotypes. That is, girls' toys symbolise passivity, softness and femininity and boys' toys represent activity, boldness and masculinity.

Infants colour perception and colour preferences

Although toy manufacturers and advertisers are imposing these colours onto children, very little research has attempted to examine whether or not children do actually show sex-typed colour preferences.

Babies as young as 3 months can see colour (Bornstein, 1985; Cohen, DeLoache, and Strauss, 1979), and also begin to show preferences for certain colours. Staples (1932) found that 2-5 month olds looked longer at blue, green, yellow and red compared to grey. Bornstein (1975) looked at the colour preference of 4-5 month olds and found that infants looked longest at red followed by blue, yellow and then green. In a study of 1 and 3 month old infants, Adams (1987) found that 3 month olds preferred red followed by yellow, blue and then green. Such studies demonstrate that colour is a preference that is present early on in a child's life, and that young infants are particularly attracted to red.

Sex-typed colour preferences in children

Few studies have directly looked at sex differences in colour preference. In an early study of colour preferences, Katz and Breed (1922) asked over 2,500 subjects aged from 5–22 years to rank order their preferences for 6 colours (red, orange, yellow, green, blue and violet). Overall, the subjects ranked blue the highest and yellow the lowest. Adolescent boys preferred red, green, blue and violet more than pre-adolescent boys. Adolescent girls preferred red and green more than pre-adolescent girls who showed a greater preference for orange, yellow, blue and violet. The study however had a number of methodological flaws, primarily, the data were not analysed statistically.

Picariello, Greenberg and Pillemer (1990) conducted 4 studies to gain an understanding of children's sex-stereotyping of colours. The first study presented 33 3-7 year olds with 6 felt pigs. The pigs were coloured in stereotypically masculine colours (navy blue, brown and maroon) and stereotypically feminine colours (light pink, bright pink and lavender) as rated by adults prior to the study. Children were first asked which was their favourite pig and then they were asked to identify each

pig as either masculine or feminine. They found that children were more likely to choose a favourite pig that they later identified as being of the same sex as themselves. They also found that children showed colour-stereotypes that were consistent with adult stereotypes, that is they labelled the navy blue, brown and maroon toy pigs as male and the light pink, bright pink and lavender toy pigs as female.

In study two, 76 children aged from 4–8 years were shown pictures depicting sex-stereotyped characteristics (toys, attributes or future roles). The children were also presented with a picture of identical twins, one dressed in pink and the other dressed in blue. Children were asked to say which twin they thought would like to do each of the characteristics. For example, children were shown a picture of toy vehicles and asked, "Here are some toy cars and trucks. Do you think that Bobby or Jimmy likes to play with toy cars and trucks?" (Picariello et al., 1990, p. 1455). It was found that children stereotyped images of other children based on their clothing colour. The twin dressed in blue was assigned more masculine-typed characteristics, and the twin dressed in pink was assigned more feminine characteristics.

Study 3 was designed to assess the sex stereotypes of the children assessed in study 2 irrespective of colour, and study 4 was designed to assess both the colour stereotypes as well as the sex stereotypes of a single sample of children aged 4-7 years. These latter two studies showed that children's sex stereotypes were much stronger than children's colour stereotypes. The results of all four studies indicate that children display sex stereotyping of colours and that colour may influence children's perceptions and impressions of others (Picariello et al., 1990). However, the study relied on children's responses when shown images of male and female characters and such stereotypes may not be displayed when faced with real people dressed in opposite sex-stereotyped colours in everyday life.

A recent study by Chiu, Johnson, Owen-Anderson, Bradley, Gervan, Fairbrother and Zucker (2004) looked at the sex-stereotyped colour choices of children aged between 3-12 years. They compared the colour choices of 65 children with a Gender Identity Disorder (GID) to 100 clinical controls and 100 community controls. The children were asked to choose their top three favourite colours from a colour chart. It was

found that, in the control groups, boys preferred red and girls preferred pink and purple. Comparing the preferences for pink/purple and blue within each sex it was found that boys preferred blue to pink/purple, and girls preferred pink/purple to blue. Interestingly, the comparison with children with a gender identity disorder revealed that GID boys showed preferences similar to the control girls, and GID girls showed preferences similar to the control boys. Although boys did not show a significant preference for blue, when the luminance of the colours was taken into account it was found that boys showed a preference for the darker shades of blue and girls for the paler. This is consistent with previous findings (Boyatzis and Varghese, 1994) of boys preferring darker shades and girls preferring brighter pastel shades. This preference for different brightness levels also continues into adulthood. In a study of adults aged between 18-32 years, men were found to prefer higher saturation lower luminance colours and females were found to prefer lower saturation higher luminance colours (Hurlbert, Ling and Sweeting, 2003).

Colour and emotions

Some researchers have attempted to examine the relationship between colours and the emotions that they elicit. Differences between boys and girls in their association of emotions to colours may help explain the differences in their preference for certain colours. Boyatzis and Varghese (1994) found sex differences in their group of 60 5 and 6.5 year olds. The children were shown eight colours (pink, red, yellow, black, grey, green, blue, purple, and brown) presented on separate pieces of paper. The children were asked how they felt when they looked at each colour. Girls expressed more positive associations towards bright colours such as pink, red, yellow, green, purple and blue and more negative associations with dark colours such as black, brown and grey. Boys also associated positive emotions with bright colours but expressed positive reactions to the dark colours as well. In addition, the children were asked what their favourite colours were. The majority of boys preferred blue and red, and girls preferred pink and purple. These results are in contrast to the findings of Karp and Karp (1988) who found no sex differences in the colour associations of emotionally loaded stimuli in a group of 9-10 year olds. However, this may be due to the age of the children studied. As the researchers pointed out, 9-10 year old children may have been aware of the emotional associations of certain

colours used widely in society and hence with which both genders were familiar. For example, love = red, and fear = black. In Boysatzis and Varghese's (1994) study, the younger children may not yet have learnt these general colour associations and thus showed greater sex differences in their responses.

A more recent study of younger children aged 3-4 years showed that children do associate colours with facial expressions of emotions. Zentner (2001) asked 127 Swiss children attending day care to rank their preferences for 9 colours (red, yellow, light green, dark green, light blue, dark blue, pink, brown and black). Children who successfully completed a practice matching task were asked to match 6 colours (red, yellow, bright green, dark blue, brown and black) with 3 pictures of faces (happy, sad and angry). No significant sex differences were found in children's preference for pink and blue. However, girls were found to show a non-significant trend (p = .053) towards a preference for bright colours compared to boys. Children associated bright colours with the happy face and dark colours with the sad face. Boys were more likely to match red with the happy face than the sad face and were more likely to match brown with the sad face than the happy face. Girls did not show these associations.

Burkitt, Barrett and Davis (2003) asked 330 children (176 boys and 154 girls) aged between 4-11 years to colour in pictures of a man, a dog, or a tree. Children were also asked to rank ten colours in order of preference and to colour in three identical pictures of figures that were characterised as being nasty, nice or neutral. It was found that children used their favourite colour for the nice figure, their least favourite colour for the nasty figure, and the intermediately ranked colours for the neutral figure. Darker colours, such as black and brown, were more likely to be associated with the nasty figure and were also least preferred by children. No differences were found between boys and girls in their choice of colours. The study shows that children aged from 4 years are able to use colours symbolically.

Sex-typed toys and shape

In addition to colour, sex-typed toys differ in their shape. Cars and blocks tend to be angular, in comparison to dolls and tea sets, which have more round edges. Whether

or not males and females prefer different shaped toys has yet to be studied. However, research has been conducted on sex differences in preference for object forms in general. Recent research in this area is sparse, and many of the studies date back to the 1950's when psychoanalytic theories were used to explain any differences. These studies can be broadly segregated into two areas, shape production studies and shape preference studies. Shape production refers to the shapes or images males and females create from objects or drawings presented to them. Shape preference refers to the shapes males and females prefer when given a choice of images or objects to choose from.

Shape production studies

Erikson (1951) conducted a study in which he asked pre-adolescent boys and girls to build a scene using blocks, toy furniture, dolls, cars and animals. He found that boys built tall, elaborate configurations and included more moving objects around their scenes. Girls built quiet indoor scenes that included more static objects and people. Erikson's study was criticised for not taking into account children's preference for sex-typed toys, which would greatly determine the types of configurations that they could build (Caplan, 1979; Budd, Clance and Simerly, 1985). In a study designed to rectify this issue, Budd et al (1985) asked 90 11-19 year olds to construct a movie scene using blocks. They found that females built more tall structures compared to males and that, unlike in Erikson's study, males did not include more motion when they constructed their scenes using blocks alone. Furthermore, no developmental differences were found in their sample. The authors argued that the selection of sex-typed toys by boys and girls pre-determine the styles of scenes they can build.

A study of the images created by male and female adults when asked to complete simple line drawings also found sex differences in the resultant pictures (Franck and Rosen, 1949). Men were found to 'close off' stimuli, to enlarge the image (mainly by extending the image upwards), and to emphasise sharp or angular lines. Women were found to leave the stimulus areas 'open', to elaborate the drawing within the confines of the presented lines and to blunt or round off any angular lines. Men were also found to draw images of objects that "move under their own power" (Franck and Rosen, 1949, p. 252), such as cars and ships, whereas women chose to draw objects

that could only be moved by an external force (e.g., a rowing boat). Women also drew more flowers, animals and human figures. The authors put forward a Freudian explanation of these results, arguing that the resultant images were a measure of individuals' conscious or unconscious sex role. They also put forward a cultural explanation suggesting that subjects were drawing images with which they were most familiar. However, as the authors themselves pointed out, this does not take into account the fact that men were not drawing stereotypically familiar *rounded* objects such as circular saws, and women were not drawing stereotypically familiar *angular* images such as knives and candles.

Significant sex differences in children's drawings were also found by Iijima, Ariska, Minamoto and Arai (2001), in a sample of 124 boys and 128 girls. The study, conducted in Japan, found that girls were more likely than boys to use flowers, butterflies, the sun and human motifs in their drawings. Boys were more likely to draw mobile objects such as vehicles, trains, aircrafts and rockets. They also found sex differences in children's use of colour. Girls used more colour in their drawings compared to boys and preferred to use warm colours including pink. Boys used more 'cold' colours such as grey and blue compared to girls. The researchers then compared the drawings done by 8 girls with CAH to 12 unaffected boys and 17 unaffected girls. It was found that CAH girls produced drawings with more masculine characteristics and less feminine characteristics compared to the unaffected girls. CAH girls were not found to differ in the masculine characteristics from the unaffected boys.

In summary, a sex difference has been found in children's production of 3D objects from sex-typed toys (Erikson, 1951) and sex-neutral objects such as blocks (Budd et al., 1985) although the type of differences found may be largely affected by the objects made available to the children. Furthermore, studies looking at the characteristics of drawings by adults and children suggest that a sex difference may exist in the production of images by adults (Franck and Rosen, 1949) and children (Iijima et al., 2001).

Shape preference studies

Studies looking at sex-typed shape preference have found a reversed pattern from that found by Franck and Rosen (1949). In a study examining the shape preferences of 779 9-16 year olds (McElroy, 1954), two images (one angular and one rounded), were presented and subjects were asked which they liked better. Males chose more rounded shapes, and females chose more angular shapes and this pattern became more pronounced with age. This study was replicated by Jahoda (1956) on a culturally different sample of tribal children in Africa. Similar pictures to those used by McElroy (1954) were shown to 858 children aged 11-19 years, and children were asked to circle the image they preferred. Jahoda (1956) found that unlike McElroy's sample, boys and girls did not increase their preference for these shapes with age. Instead boys did not change their preference with age, and girls increased their preference for rounded objects. The differences found between these two studies may have been a result of the cultural difference between both samples, and the study illustrates that generalising findings cross-culturally needs to be done with caution.

Munroe, Munroe and Lansky (1976) aimed to test whether or not sex differences exist in 92 4-12 year olds' preference for differently shaped sweets. They presented children with two containers which held either spherical or cubed sweets. They found that although both sexes chose the spherical sweets more than the cubed sweets, girls chose significantly more spherical sweets compared to the cubed ones. Boys did not differ significantly in their choice of spherical to cubed sweets.

To summarise, it appears that studies of shape production, where subjects are asked to draw images, show that males prefer angular shapes and females prefer rounded shapes. Studies assessing children's shape preference for images have found that males choose rounded images and girls choose angular images, although these may be influenced by cultural factors. Finally, in relation to children's preference for sweets, girls choose more rounded sweets to angular sweets. There appear to be no clear pattern as to what shapes males and females prefer, and studies that are available are now somewhat dated. The recent study by Iijima et al. (2001) ahows that sex differences can be found in children's drawings, particularly in relation to

the images that the child chooses to draw. The different methods used for testing sex differences in shape production or shape preference further complicates the issue.

The present study

The literature that has been presented on children's toy preferences shows that a sex difference exists in the toys that boys and girls choose to play with. Girls prefer dolls and boys prefer vehicles. This sex difference has been found consistently from the age of 3 irrespective of the method employed to assess children's toy play. Increasingly, this preference has been found in early infancy. The presence of toy preferences so early has important implications for the way in which sex-typed toy play is explained. According to biological theory, sex-typed toy play may result from innate differences, either genetic or biochemical, that exist between the sexes. The presence of sex-typed toy play in infancy strengthens the argument for a possible biological determinant, as the socialisation experiences of infants would be limited. For socialisation theory, the presence of sex-typed toy play in infancy, suggests that differential treatment from others may occur at an early age. The early detection of sex-typed play is most problematic for the cognitive approach, which believes that sex-typed play results once a child is aware of his/her own sex. Infants aged 3–18 months have not been found to show cognitive awareness of their own sex (Campbell et al., 2000), and thus should not, according to cognitive theorists, be able to display sex-typed toy preferences.

In recent years, the emphasis has expanded from theoretical explanations, to looking at what low level properties attract males and females to different toys (Moller and Serbin, 1996; Campbell et al, 2000). Studies have found that stereotypically masculine and feminine toys differ in their colour and texture (Pennell, 1994). Despite the different characteristics of toys being imposed on children, it is not known if boys and girls do show a preference for toys of different colour or shape. Literature available on children's colour preference has shown that girls prefer pink and boys prefer blue (Chiu et al., 2004). Studies on shape preferences yield inconsistent findings, whereby studies assessing children's *production* of shapes suggest that girls produce rounded shapes and boys produce angular shapes. Studies assessing children's *preference* for shapes suggest the opposite pattern, whereby

boys prefer rounded images and girls prefer angular images, although the available literature is somewhat dated.

To date, no study has attempted to manipulate the colour of sex-typed toys to assess the influence of colour on sex-typed toy preference. Furthermore, no study has assessed sex differences in colour and shape preference of infants aged as young as 1 and 2 years.

The present study was the first designed to directly assess the relationship between toy preference and colour preference and also to examine sex differences in colour preference and shape preference of infants aged 12, 18 and 24 months.

The preferential looking task was utilised as the main method of data collection. Studying infant preferences are problematic because infants are not able to verbally express what their preferences are; instead, researchers have to interpret their behavioural responses to infer their preferences. The preferential looking task is a widely used method that allows researchers to examine young pre-verbal infants' preferences. Data collection usually takes places in a laboratory that has been specially designed for this purpose. Two images are presented simultaneously to the infants, and the infant's gaze is recorded. The image the infant spends the most time looking at is assumed to be the image that they 'prefer'. Despite the need to make this assumption, the preferential looking paradigm remains an important tool for examining pre-verbal children's preferences.

This methodology was first used to assess toy preferences by Vance and McCall (1934). They studied 32 3-6 year olds and compared children's preferences for toys (measured by presenting paired pictures of toys) with their actual play with toys. They used a preferential looking task that differed from the more technical methods employed in recent studies. They found that the preference for toys as determined using the paired comparison of pictures, correlated well (.59) with the amount of time spent playing with toys. However, due to their small sample size (n =32), this correlation did not reach statistical significance. Nonetheless, the study demonstrated that the preferential looking task can be used to assess children's toy preference. More recently, Campbell et al. (2000) used the preferential looking task to assess

infants' preferences for faces and toys. They found that 9-month-old boys favoured looking at pictures of same sex-typed toys more than opposite sex-typed toys. Serbin et al. (2001) also successfully used the preferential looking task to detect sex-typed toy preferences in 18 and 24 month old boys and girls. Boys looked longer at the car compared to girls, and girls looked longer at the doll compared to boys. The study by Campbell et al. (2000) and Serbin et al. (2001) demonstrate that the preferential looking task can detect significant differences between boys and girls with regard to their preference for sex-typed toys.

The preferential looking task was chosen as the method of data collection for the present study because, firstly, it has been used previously to successfully identify sex differences in infants' toy preference (Serbin et al., 2001; Campbell et al, 2000; Vance and McCall, 1934) and secondly, a number of trials can be shown to infants in any one session because pictures are shown for a few seconds only (5 seconds in the present study), although it is important to run pilot studies to assess the number of trials that can be used without the infant getting tired during testing. Thirdly, unlike observational studies, the preferential looking task is not dependent on an infant's level of mobility. When studying infants, there is great variability in what infants of the same age can do. Some infants have more advanced fine and gross motor skills compared to other infants, which would affect the way in which they manipulate objects or explore their environment. This is particularly true when comparing a 12-month-old to a 24-month-old. Because the preferential looking paradigm is not dependent on an infant's level of mobility these cross comparisons within and between different age groups may be more reliable than observational studies of infants' toy preferences. A few studies have assessed toy preferences using the preferential looking task; however, more studies are needed to address the relationship between the visual preference for toys and actual play with toys.

Research Questions

The research questions have been presented in three sections. The first section refers to research questions relating to information directly obtained from the infants using the preferential looking task. This section is further divided into three sub-sections named 'colour stimuli', 'toy stimuli' and 'shape stimuli'. The second section refers

to research questions relating to information obtained from the parents. This section is called 'Parental interview'. It has three sub-sections, 'environmental colour inventory', 'toy inventory' and 'opposite sex-typed toys'. The third section refers to research questions asked about the relationship between the data collected from the infants and the data collected from the parents and is called 'Relationship between preferential looking task and parental interview.'

Colour stimuli

The first research question was:

> **1a.** Do boys and girls aged 12, 18 and 24 months show preferences for pink or blue?

The preferential looking task assessed whether infants showed a preference for different colours. The colours compared were pink and blue, because studies of older children have found these two colours to be most consistently sex-typed. Girls' toys are often pink and boys' toys, blue (Pennell, 1994). Also, studies of children's preferences have found girls to prefer pink and boys to prefer blue (Picariello et al., 1990; Boyatzis and Varghese, 1994; Chiu et al., 2004). Thus, the hypothesis tested was that there is a sex difference in infants' preference for pink and blue. Girls will prefer pink and boys will prefer blue. Possible age related differences in preferences for pink and blue were also examined.

> **1b.** Do boys and girls aged 12, 18 and 24 months show preferences for pink or blue when brightness is controlled?

Pink and blue differ in brightness levels, with pink being brighter than blue. Differences in the brightness levels of different colours have been found to influence infants colour preferences (Cohen, DeLoache and Strauss, 1979). To control for this difference, two additional colours were studied, red and pale blue. The red matched the pink in hue and the blue in brightness; the pale blue matched the blue in hue and the pink in brightness. Thus, the hypothesis tested was that there is a sex difference

for infant's preference for pink and blue when the brightness of these colours is controlled. Again, possible age effects were also examined.

Toy stimuli

The second research question was:

> **2.** Do boys and girls aged 12, 18 and 24 months show a preference for a car or a doll and does this depend on whether the car and doll are coloured in sex-typed colours?

The preferential looking task assessed whether infants showed a preference for different toys, namely a car and doll, and whether this preference was influenced by the colour of the car and doll. The car and doll were chosen as they have most consistently been found to be sex-typed (O'Brien et al., 1985; Moller and Serbin, 1996). The car and doll were coloured in pink, blue, red and pale blue. These colours were chosen for the same reasons explained in the colour stimuli task (see above). By colouring the car and the doll in different colours, infants' preference for the car and doll could be assessed when it was coloured in either sex-typed or opposite sex-typed colours. The hypothesis tested was that preferences would be strongest for same sex-typed toys of same-sex-typed colours and weakest for opposite sex-typed toys of opposite sex-typed colours.

Because this question is very broad it was subdivided into 5 more specific research questions. These were:

> **2.a.** Do boys and girls differ in their looking times for the pink doll versus the blue car and does this change with age?

Research has shown that boys prefer cars and girls prefer dolls and that boys prefer blue and girls prefer pink. The study therefore tested the hypothesis that boys and girls would differ in their preference for the pink doll and blue car, and that within each sex, boys would look at the blue car longer than the pink doll and girls would look at the pink doll longer than the blue car. Since toy preference has been found to

increase with age, the study also tested the hypothesis that these preferences would grow stronger with age. Finally, the study tested the hypothesis that these preferences would be found earlier in boys than in girls, as research looking at similar age groups have found this preference in boys earlier than in girls (O'Brien and Huston, 1985, Robinson and Morris, 1986; Blakemore et al., 1979; Campbell et al., 2000).

2.b. Do infants show sex-typed toy preferences if the toys are coloured in 'opposite sex-typed colours'? i.e. pink car versus blue doll?

The study tested the hypothesis that, if the car and doll were coloured in opposite sex typed colours, then the preference for the same-sex toy would not be as strong as when the sex-typed colour of the toy was consistent with the toy.

2.c. If pink and blue are controlled for their differing brightness levels, do the same patterns of sex-typed toy preferences emerge?

Infants were shown pictures of the car and doll where the colours were either pink versus pale blue or red versus blue. This was done to control for the difference in brightness levels that occur between pink and blue. This approach tested the hypothesis that hue and not brightness, was the determinant of sex-typed preferences. This would be reflected in boys preferring the blue car to the red doll and girls preferring the pink doll to the pale blue car. Sex-typed toy preferences would be weaker when the sex-typed toy was coloured in an opposite sex-typed colour (i.e. pink car versus pale blue doll and red car versus blue doll).

2.d. Do sex differences in toy preference exist when colour is kept constant? If so, at what age do they emerge?

Infants were shown a pink car with a pink doll, a blue car with a blue doll or a neutral car with a neutral doll to assess if a sex-typed toy preference exists when the colour of the two stimuli is constant. The hypothesis tested was whether infants would look longer at the same-sex typed toy when it was paired with an opposite sex-typed toy of the same colour or of no colour.

2.e. Do sex differences in colour preference exist when the toy is kept constant? If so, at what age do they emerge?

Infants were shown a blue car versus a pink car and a blue doll versus a pink doll, to assess if a colour preference exists when the toy is held constant. The hypothesis tested was that infants would look longer at the toy of the same sex-typed colour compared to the same toy of the opposite sex-typed colour. That is, girls would look longer at the pink toy and boys would look longer at the blue toy.

Shape stimuli

The third research question was:

3.a. Do boys and girls differ in their preference for angular or rounded shapes and does this change with age?

The preferential looking task assessed the preference for rounded versus angular shapes. The images were chosen to reflect shapes that differed only in whether or not they were angular or rounded. Sex differences in infant's shape preference have not been assessed before. Findings from studies of children's shape preference have shown that boys prefer rounded figures and girls prefer angular figures (McElroy, 1954). However, these studies are somewhat dated, and more recent studies analysing children's constructions using toys and blocks, and analyses of their drawings, suggest that boys prefer angular objects and girls prefer rounded objects (Iijima et al., 2001). In line with these recent studies, the hypothesis tested by the present study was that boys would prefer angular images and girls would prefer rounded images.

3.b. Are shape preferences related to the colour of the shapes?

Infants were shown a rounded image versus an angular image of different colours (pink, blue, red or pale blue), to determine if preferences were influenced by interactions between colour and shape. This question was subdivided into two more specific questions.

3.b.a. Do boys and girls differ in their preference for an angular shape or a rounded shape, if the shapes are coloured in sex-typed colours (pink or blue)?

Because boys have been found to prefer blue and girls have been found to prefer pink, it was hypothesised that infant preferences would be strongest when shown a same-sex-typed shape (boys angular shape, girls rounded shape) coloured in a same sex-typed colour. For example, when shown a blue angular shape versus a pink rounded shape, boys will look at the blue angular shape more than the pink rounded shape, and girls will look at the pink rounded shape more than the blue angular shape.

3.b.b. Are sex differences in shape preferences found if pink and blue are controlled for their differing brightness levels?

As pink and blue are made up of different brightness levels, red and pale blue were used to control for this. Thus, red was shown with blue and pink was shown with pale blue. It was hypothesised that these findings would show a similar pattern to those found in response to question 4a. in that boys would prefer blue to red and girls would prefer pink to pale blue. If the brightness of the colours is confounding the results, then a stronger preference should be detected when the brightness is controlled. Thus, the hypothesis tested was that sex differences in shape preference would be stronger when the shape was of a same-sex-typed colour paired with a shape of an opposite sex-typed colour of equal brightness, and that this preference would be larger than the preference seen in response to 3.b.a.

Environmental Colour Inventory

Parents were interviewed to gain additional information about the infants and their environment. The infant's exposure to different colours in their environment was assessed by asking parents to name the colours of their infant's bedroom, bedcovers, curtains, and playroom as well as the colours in which they dress their child. This was done primarily to determine if sex differences existed in the colours with which children were surrounded. In addition, it also allowed any relationship between

colours preferred by infants on the preferential looking task, and the colours they are exposed to in their natural environment, to be assessed.

Studies looking at the environments of young children have found sex differences in the way in which boys' and girls' rooms are decorated (Rheingold and Cook, 1975; Pomerleau et al., 1990). Rheingold and Cook (1975) found boys' rooms were more likely to be decorated with animal motifs and girls' rooms were more likely to be decorated using lace and ruffles. Pomerleau et al. (1990) in an adaptation of the study by Rheingold and Cook (1975) found that boys and girls differed in the colours of the clothes they were dressed in, as well as the colour of their bedding and curtains. Boys were dressed in more blue and white compared to girls, and girls were dressed in more pink and multicoloured clothing compared to boys. The present study tested the hypothesis that there would be sex differences in the colour of infants' environments, namely their bedroom, bedcovers, curtains, playroom and clothes.

Toy Inventory

Parents were asked to list the three toys their child played with the most and the colour of these toys was also recorded. This was done to examine whether infants as young as 12-24 months of age played with sex-typed toys, and secondly to assess whether their play with cars and dolls was related to their preference for cars and dolls on the preferential looking task. Studies that have classified boys' and girls' toys during home observations have found significant sex differences in the types of toys that are available to boys and girls. Boys have been found to have more vehicles, sports equipment and tools compared to girls, and girls have been found to have more dolls, fictional characters and children's furniture compared to boys (Pomerleau et al., 1990). The present study was not assessing the toys that boys and girls had available to them, instead parents were being asked to report the three toys their child played with most. This was thought to be a more accurate measure of children's toy preference, as infants may not always play with toys that they have available to them. The hypothesis tested was that boys and girls would be reported to play with different sex-typed toys.

The colours of infants' favourite toys were also obtained from parents. It was hypothesised that in line with the findings from Pennell (1994), girls' favourite toys would be coloured in pastel shades such as pink and lavender, and boys' favourite toys would be coloured in darker shades, such as red, blue and black.

Opposite sex-typed toys

In addition to the colour and toy inventories, parents were asked if their infant had opposite sex-typed toys available to them, and if so, whether or not they played with them. This was done because research has shown that the sex-typing of boys is more rigid compared to girls (Maccoby and Jacklin, 1974). Parents have been found to play with opposite sex-typed toys more with their daughters than with their sons (Snow et al., 1983; Roopnarine, 1985; Fagot and Hagan, 1991). Boys' play with male peers leads to more same sex-typed toy play compared to girls play with female peers (Serbin, Connor, Burchardt and Citron, 1979). The study tested the hypothesis that girls would have more opposite sex-typed toys available to them than boys, and that girls would play with opposite sex-typed toys more than boys.

Relationship between preferential looking task and parental interview

The relationship between information from the preferential looking task and from parents was also examined. With the exception of the early study conducted by Vance and McCall (1934), no study has attempted to validate the preferential looking task as a measure of toy preference with infants' actual play with toys. The present study set out to do this by posing the following research questions.

> **4.a.** Does exposure to pink and blue in a child's environment relate to preferences for pink and blue on the preferential looking task?

It was hypothesised that a relationship would exist between infant preference for pink and blue, and exposure to pink and blue in the infants' environment. Specifically, the study tested the hypothesis that firstly, male and female infants who were exposed to pink in their environment would look longer at pink on the preferential looking task compared to male and female infants who were not exposed

to pink, and secondly, that male and female infants who were exposed to blue in their environment would look longer at blue on the preferential looking task compared to male and female infants who were not exposed to blue.

4.b. Is reported play with vehicles and dolls related to looking times at the car and doll on the preferential looking task?

The study tested the hypothesis that parental report of infants' play with cars and dolls correlated with the looking times at the car and doll on the preferential looking task. Specifically, the study tested the hypothesis that, firstly, playing with vehicles would correlate positively with percentage of time looking at the car, and secondly, that playing with dolls would correlate positively with percentage of time looking at dolls. The study also tested the hypothesis that male and female infants who played with cars would look longer at the car on the preferential looking task compared to infants who did not play with cars, and that male and female infants who played with dolls would look longer at the doll on the preferential looking task compared to infants who did not play with dolls.

METHOD

Overview

A total of 120 infants participated in the study at either 12, 18 or 24 months. Infants were tested in a laboratory using the preferential looking task. The task consisted of two images shown to the infant simultaneously. The infant's face was recorded onto videotape, which was coded at a later stage to determine the amount of time the infant looked at each image. The images shown were categorised into three groups; colour stimuli, toy stimuli and shape stimuli. The colour stimuli consisted of 4 pairs of images, the toy stimuli consisted of 11 pairs of images and the shape stimuli consisted of 18 pairs of images. Each pair was shown for 5 seconds. In addition to the preferential looking task, data were obtained from the parent about the colour of the infants' home environment (bedroom walls, bedroom curtains, bed covers, and play room) and the colour of the clothes infants were dressed in. The colour of the infants' clothes during their visit to the laboratory was also noted. In addition, parents were asked if their child had opposite sex-typed toys available to them and, if so, whether or not their child played with them. Finally, parents were asked to state what 3 toys their child played with the most, and what the colours of these toys were.

Participants

Parents of infants aged between 12 to 24 months were contacted through nurseries and playgroups in North London. Parents were recruited in one of three ways. Firstly, letters to parents (see Appendix A) were sent out to nurseries that had agreed to pass them on to parents on behalf of the experimenter. Parents wishing for their infants to take part were asked to fill in an attached slip with their contact details and return the slip to the University. Secondly, the experimenter visited a number of mother and baby groups where she was able to inform parents about the study in person and invite them to take part. The contact details of those parents wishing for their child to take part were taken, and leaflets (see Appendix B) were left with interested parents who wished to take more time over their decision. Thirdly, parents who had already participated in previous research at the University, and who had a

child within the appropriate age category, were contacted by telephone about the study. Appointments were made with parents when their child neared the target age of 12, 18 or 24 months. An effort was made to see the infants when their age matched as close as possible to each of the age categories. In the majority of cases, infants were brought to the laboratory by their mother. Four of the infants came with their fathers.

A total of 120 infants were recruited into three separate age categories: 12 months, 18 months and 24 months. Each age category consisted of 20 males and 20 females. The mean age in weeks for males and females at each age category is shown in table 1.

Age group in months	N	Sex	Mean age in weeks (sd)
12	20	Males	54.51 (5.20)
	20	Females	53.66 (4.76)
18	20	Males	80.45 (3.42)
	20	Females	81.26 (5.24)
24	20	Males	106.58 (6.36)
	20	Females	105.85 (5.28)

Table 1. Mean age in weeks for males and females at each age group

The demographic details for the mothers and fathers of the infants tested in this study are shown in table 2. The mothers' ages ranged from 23 to 43 years with a mean of 34.83 years (sd = 4.47) and the fathers' ages ranged from 26 to 59 years with a mean of 37 years (sd = 5.35). One hundred and ten (91.6%) mothers had a co-habiting partner, 10 (8.3%) did not. One hundred and seventeen (97.5) of the infants were in contact with their father. Fifty-four of the mothers (45.8%) were working at the time their child was tested and 13 (10.8%) of these worked full-time. The parents were asked to state their occupation in order to gain a measure of social class. Occupations were categorised into social class using a modified version of the Registrar Generals Classification (OPCS and employment department group, 1991) ranging from 1 (Professional/managerial) to 4 (Partly skilled or unskilled). For those mothers who were not currently employed, their previous occupation was noted. The occupation of

their partner was also obtained. The majority of the mothers and fathers of the infants in the current study had professional occupations (mothers 60%, fathers 68%).

The parents' level of education after the age of 16 (O-levels) was also obtained. The majority of parents held a University degree (mothers 78%, fathers 80%). Three of the mothers that took part in the study had no partner and hence their partner's occupation was not obtained.

		Mean age in years (sd)			
Mothers age		34.83 (4.47)			
Fathers age		37 (5.35)			
		No. of cases (%)			
Does mother have co-habiting partner?	Yes	110	(91.6)		
	No	10	(8.3)		
Is infant in contact with father?	Yes	117	(97.5)		
	No	3	(2.5)		
Mothers Working Status	Not working	66	(55)		
	Full-time	13	(10.8)		
	Part-time	41	(34.2)		
		No. of cases (%)			
		Mother		**Father**	
Social Class	Professional	72	(60)	81	(67.5)
	Managerial/technical	19	(15.8)	16	(13.3)
	Skilled non-manual	11	(9.1)	4	(3.3)
	Skilled manual	13	(10.8)	14	(11.7)
	Partly Skilled	2	(1.7)	1	(0.8)
	Unskilled	0	(0)	1	(0.8)
	Not-applicable	3	(2.5)	3	(2.5)
Education	None	12	(10)	12	(10)
	Apprenticeship	0	(0)	3	(2.5)
	Non-professional training	3	(2.5)	2	(1.7)
	Professional non-graduate	11	(9.1)	4	(3.3)
	University Graduate	94	(78.3)	96	(80)
	Not-applicable	0	(0)	3	(2.5)

Table 2. Demographic information for parents

The ethnic group of the infants was recorded using the CRE Classification (Commission for Racial Equality). Ninety-eight (81.7%) of the infants were Caucasian, 6 (5%) were Black, 2 (1.7%) were Chinese and 3 (2.5%) were Indian. The remaining 11 (9.2%) infants were classified as being of 'other' origin.

Fifty-two (43.3%) of the infants had a sibling that lived with them. Of these 41 (34.2%) had 1 sibling, 8 (6.7%) had 2 siblings and 3 (2.5%) of the infants had 3 siblings. Ten (8.3%) of the infants had siblings or stepsiblings that did not live with them.

Information on whether or not infants attended nursery or day care was also obtained from the parents. A total of 45 (37.5%) infants attended nursery. These included 26 boys (6 12-month olds, 8 18-month olds and 12 24 month-olds) and 19 girls (5 12-month olds, 6 18-month olds and 8 24 month-olds). Chi-square analysis revealed no significant difference between the number of infants attending day care at each age group (χ^2 (df = 2, N = 45) = 4.480, p =.106). In addition, no significant difference was found between the number of males and females attending day care (χ^2 (df = 1, N = 45) = 1.742, p =.187).

The laboratory

The laboratory had three separate rooms: the reception room, the test room, and the observation room. The reception room was where participants first arrived and were informed about the study, and where the parental interview was conducted. The test room and observation room were set up to assess the infant and were linked via a one-way mirror. See diagram below.

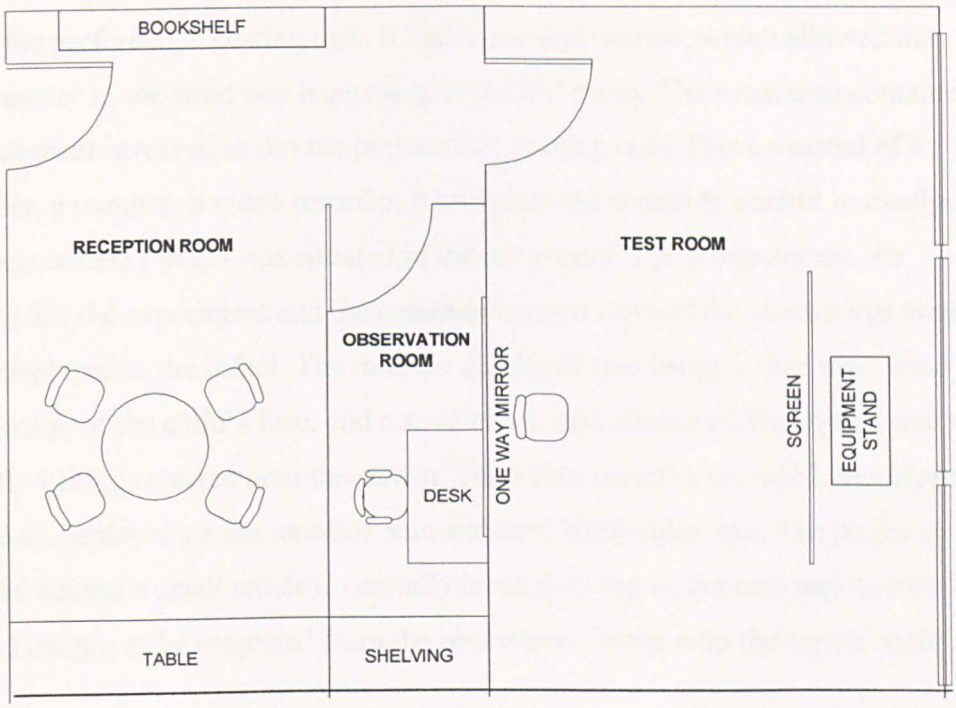

Fig. 1. Laboratory plan

The test room (see photograph in fig 2 below) was where infants were tested using the preferential looking task. A chair was placed against the wall where the one-way mirror was situated so that the parent and child had their back to the one-way mirror. In front of the chair, at a distance of 2 metres, was a large white screen onto which the prepared images were projected. Hidden behind the screen was a stand holding a video camera and speakers. Only the lens of the video camera was visible from the front of the screen as this was protruding from a hole cut out of the screen. The hole had a diameter of 7.5 cm.

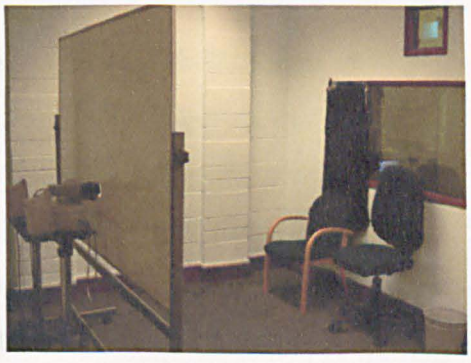

Fig. 2. The test room

The observation room (see photograph in fig. 3) was where the experimenter sat during the preferential looking task. It had a one-way mirror, which allowed the experimenter to see what was happening in the test room. The room also contained the equipment involved to run the preferential looking task. This consisted of a computer, a monitor, a video recorder, a projector and a remote control to manipulate the video camera (which was situated in the test room). The computer ran the software for the experiment and the computer screen showed the stimuli that were being displayed to the infant. The monitor displayed two images. One was of the video image of the child's face, and a smaller window displayed the stimuli that were currently being projected onto the screen. The video recorder recorded the output that was being displayed on the monitor onto standard VHS videotape. The projector was mounted behind a small window centrally located on top of the one-way mirror. This allowed images to be projected from the observation room onto the screen in the test room.

Fig. 3. The observation room

Stimuli

The stimuli used for the task all measured 45x45cms once projected onto the screen. The colour stimuli consisted of blocks of colour that covered the entire space of the stimuli (i.e. they measured 45x45cms). The toy stimuli and shape stimuli consisted of either a toy or a shape inset within a square that measured 45x45cms. The space surrounding the shape was coloured in grey. All images were created using the software package Microsoft Paint 1998, and their size was adjusted using the software package Adobe Photoshop 5.5.

Choice of colours for the stimuli

The two colours chosen for the stimuli were pink and blue as these colours have consistently been shown to be sex-typed. Girls have been shown to have a preference for pink and boys for blue (Picariello et al., 1990; Chiu et al., 2004). To ensure that the colour of the stimuli matched the shades of pink and blue of existing toys, two toys were scanned directly onto the computer and their shades of pink and blue were recorded. The pink colour was taken from a doll's dress, and the blue shade was taken from a building block.

Pink and blue are made up of different brightness (luminance) levels, with pink being brighter than blue. Differences in the brightness levels of colours have been shown to modify infants' colour preferences (Cohen et al., 1979). To control for the difference in brightness levels, two additional colours were introduced. The pink was matched for brightness with the blue to produce red, and the blue was matched to the brightness of the pink to produce a paler shade of blue. The characteristics of the four colours as recorded by the software package the images were created in, are shown in table 1.

Colour	Hue	Saturation	Luminance
Blue	146	240	115
Pink	234	235	191
Pale blue	146	240	191
Red	234	235	115

Table 3. Characteristics of colours used for the stimuli

The package allows the user to identify and adjust the properties of different colours in relation to their hue, saturation and luminance. The colour chart, shown in fig. 4 was taken from the package and it illustrates what each of the characteristics refers to.

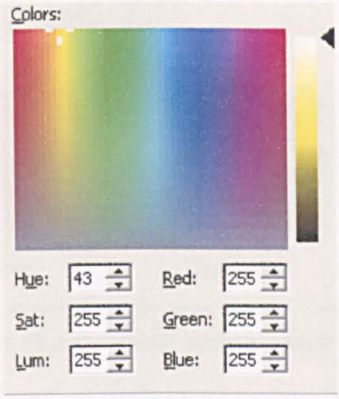

Fig. 4. Colour spectrum and properties as displayed by the software package Microsoft Paint 1998

All of the values of the properties (Hue, Saturation and Luminance) shown in fig. 4 range from 0 to 255 as the properties are measured using the binary system recognised by computer memory.

Hue relates to the colour itself, that is, in everyday language hue refers to whether a colour is red, pink or blue etc. Its values increase from the left hand side of the colour spectrum shown in fig. 4 to the right hand side. Saturation is the intensity of the colour and as its value decreases, the colour appears to be more 'washed out'. Saturation decreases in value as you move down vertically on the colour spectrum shown in fig. 4. Luminance or brightness of the colour is demonstrated in the separate vertical bar on the right hand side of the main colour spectrum in fig. 4. The minimum value of 0 represents black, and the maximum value of 255 represents white.

Colour stimuli

To allow for the effect of colour preference to be tested independently of toy preference or shape preference, four stimuli, which consisted of a square coloured in one of the four colours were paired against each other. Fig. 5 shows the four stimuli used in the colour stimuli presentation. The combinations of pairings for the colour stimuli were as follows: red/blue; pink/pale blue; blue/pink; red/pale blue.

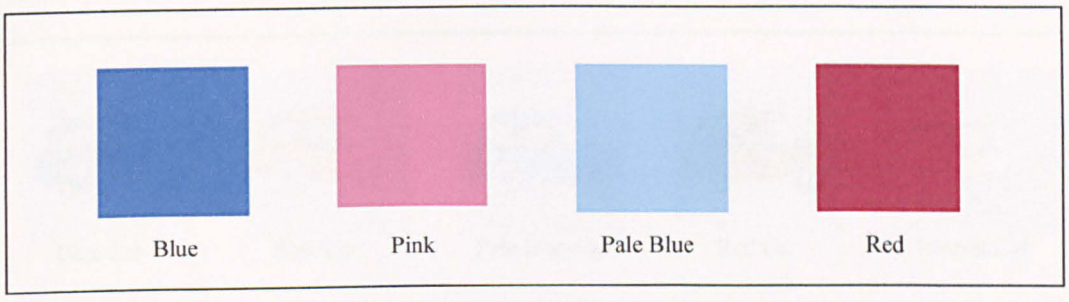

Fig. 5. Stimuli used for 'Colour stimuli'

Toy stimuli

Two sex-stereotypical toys were chosen based on previous research (O'Brien et al., 1985; Moller and Serbin, 1996; Campbell et al., 2000). The female stereotypical stimulus was a doll, and the male stereotypical stimulus was a car. Two simple line drawings of a doll and a car were drawn onto paper and then scanned into the computer. The images were mounted inside a square. Originally the squares were shaded white. However, pilot studies showed that this created too much glare causing the infant to squint. A soft shade of grey was therefore chosen (Hue = 160, Saturation = 0, Luminance = 202). Stimuli were limited to only one picture of a car and one of a doll, which were to be coloured in the 4 different colours (pink, blue red and pale blue). This was to ensure that any change in looking time was due to the colour combinations and the type of toy, as opposed to any novelty factor related to looking at a new set of toys.

The pictures of the toys were matched for size by ensuring that the car and doll covered the same area within the square that it occupied. The square itself measured 45x45 cm when projected. The final set of stimuli for the toy colour section were, Blue car, Blue doll, Pink car, Pink doll, Pale blue car, Pale blue doll, Red car and Red doll. In addition, two further stimuli were included, a doll and a car coloured in white in order to test for toy preference irrespective of colour. The stimuli can be seen in fig. 6.

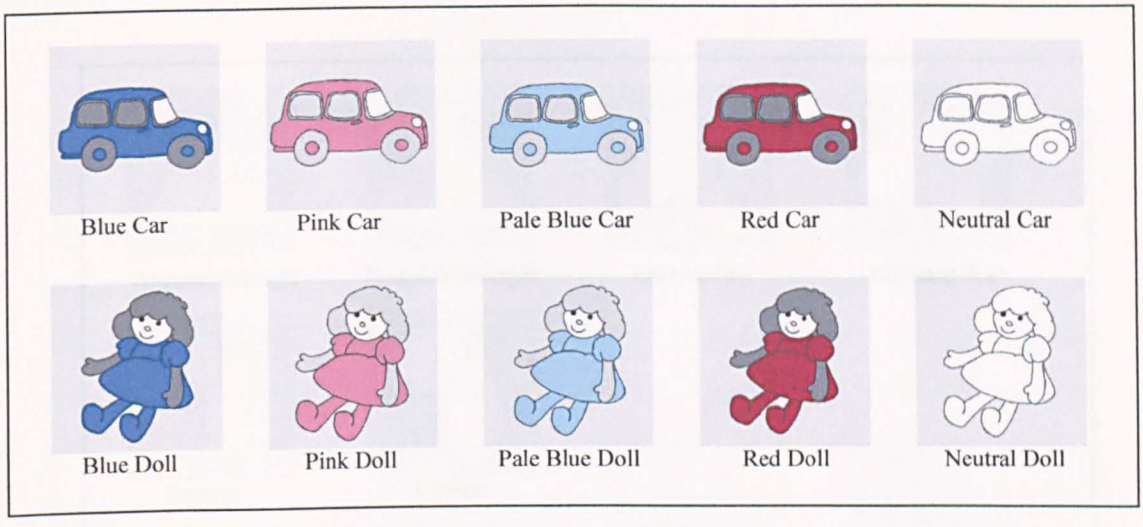

Fig. 6. Stimuli used for 'Toy Stimuli'

The combinations for the toy stimuli were as follows: pink doll v blue car; pink car v blue doll; red car v blue doll; red doll v blue car; pink doll v pale blue car; pink car v pale blue doll; pink car v pink doll; blue car v blue doll; neutral car v neutral doll; pink doll v blue doll and pink car v blue car.

Shape stimuli

In order to test preferences for angular shapes over rounded shapes, three sets of stimuli were created. These included an angular triangle paired with a triangle with rounded edges (rounded triangle), an angular star paired with a star with rounded edges (rounded star), and two overlapping squares (squares) paired with two overlapping circles (circles). The stimuli were mounted on a grey background identical in size and colour to those used for the toy stimuli. The shapes themselves were coloured in white.

To determine if any preference for either an angular shape or a rounded shape would still be found if the stimuli were coloured in sex-typed colours (pink or blue), 8 further stimuli were added. These were of the squares and circles coloured in each of the four colours used with the toy stimuli. The squares and circles were used as these

images matched each other in terms of quality and novelty of picture. The stimuli are shown in fig. 7.

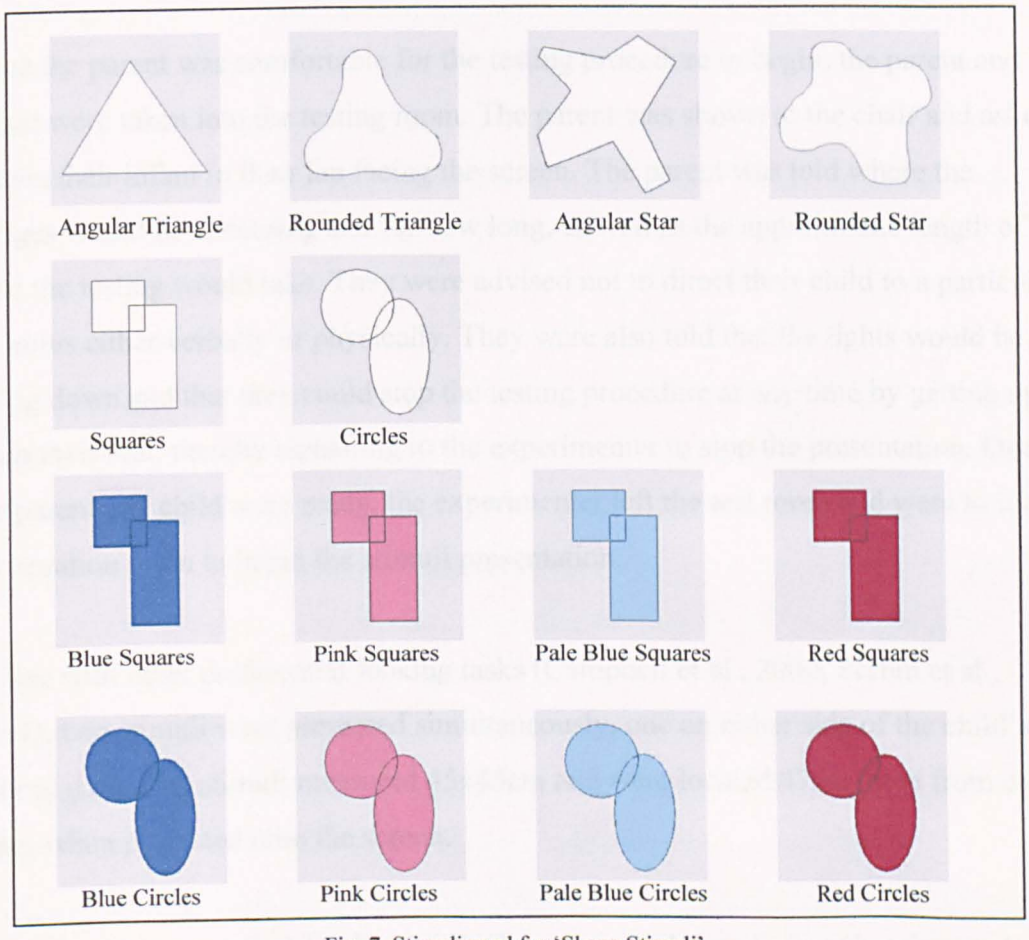

Fig. 7. Stimuli used for 'Shape Stimuli'

The combinations of pairs for the shape stimuli were as follows: angular triangle/ rounded triangle; angular star/rounded star; squares/circles; blue squares/pink circles; pink squares/blue circles; pale blue squares/pink circles; pink squares/pale blue circles; blue squares/red circles and red squares/blue circles.

Procedure

On arrival, parents and infants were taken into the reception room where the parent was informed about the study, and parental consent was obtained (See Appendix C for statement of confidentiality and Appendix D for consent form). The parent was told that one sequence of pairings would be shown (colour stimuli and toy stimuli), and the child would then be given a break in which the tester would interview the

parent to gain demographic information as well as information on the child's toy and colour preferences. The second sequence of pictures (shape stimuli) were shown after the break.

Once the parent was comfortable for the testing procedure to begin, the parent and infant were taken into the testing room. The parent was shown to the chair and asked to seat their infant in their lap facing the screen. The parent was told where the images would be appearing and for how long, as well as the approximate length of time the testing would take. They were advised not to direct their child to a particular stimulus either verbally or physically. They were also told that the lights would be going down and that they could stop the testing procedure at any time by getting up from their seat, thereby signalling to the experimenter to stop the presentation. Once the parent and child were ready, the experimenter left the test room and went to the observation room to begin the stimuli presentation.

In line with other preferential looking tasks (Campbell et al., 2000; Serbin et al., 2001), two stimuli were presented simultaneously, one on either side of the child's central gaze. The stimuli measured 45x45cm and were located 47cm apart from each other when projected onto the screen.

The experimenter waited for the child to have a central gaze before showing each pair of stimuli. However, the infant could also be encouraged to look centrally at the screen in one of two ways. Firstly, a red spot could be projected onto the central point of the screen by the experimenter, or a sound (chimes) could be played to direct the child to look towards the screen. The red spot was used when the infant was looking in the direction of the screen, but their gaze was not central. By projecting the red spot, the child's attention could be diverted to the central point of the screen. The chimes were used when an infant was looking away from the screen area or was being especially fidgety. The chimes would direct the child's attention towards the screen, and the red spot could then be projected if the child failed to look centrally.

The first set of stimuli consisted of the colour stimuli and the toy stimuli. There were a total of 15 pairings. To ensure counterbalancing, these pairings were shown twice, with each stimulus within a pair appearing on both the left and the right hand side of

the child's gaze. Thus, 30 pairs of stimuli were shown for 5 seconds each. These consisted of 4 pairs of colour stimuli, and 11 pairs of toy stimuli. Pilot studies were conducted using a total of 19 pairs of stimuli (38 once counterbalanced). However, the number of presentations proved too long as infants would not sit for the required length of time. Originally the length of time each pair was to be shown was 10 seconds, but again, infants in the pilot study were not prepared to sit attentively for that length of time, and the time was reduced to 5 seconds. The software randomised the order in which the pairings were shown to the infants, thereby counterbalancing the order of presentation.

Once all the pairings were shown the parent and infant were taken to the reception room. Here, demographic information was obtained from the parent by asking them questions and the experimenter filled in their details onto a form (see Appendix E for demographic data sheet). Parents were also asked a series of questions to determine the colours their child was exposed to at home (see Appendix F for colour data sheet). They were asked to name the colour of their child's bedroom walls, bedcovers, bedroom curtains as well as the colour of the room in which their child spent most of their time when at home. Parents were also asked to list the colours they dressed their child in at home and the experimenter also noted the colours the child was dressed in on the day of their visit. Next, parents were asked two questions to determine if their infant had any opposite sex-typed toys at home and if so, whether their child played with them or not. These questions were phrased 'Does (child) have toys at home that may be stereotypically considered to be boys/girls toys?' and (if yes) 'Does s/he play with them?' Finally, parents were asked to state three toys that their child played with the most. The colour of these toys was also noted.

The parent and infant were then led back to the testing room, where they were shown the second set of pictures (shape stimuli). The procedure was the same as that conducted with the colour and toy stimuli. A total of 9 pairs of shape stimuli were shown, counterbalanced to equal a total of 18 pairs shown for 5 seconds each. Once this was completed the parent was thanked for their help with the study and paid ten pounds for their participation.

Coding

Coding of the videotapes was carried out by playing the tape on a VHS video-recorder and freezing the initial image. The frame advance function was then used to move the picture frame by frame. Data were coded directly onto a spreadsheet where it was noted if the infant looked left or right during each frame. If the child was looking at neither image then the cell corresponding to that frame was left blank. There were a total of 25 frames per second. Total looking times in frames for the left hand and right hand image could then be calculated. As the images were counterbalanced by showing each stimulus per pair on each side of the child's central gaze, the total looking time for both images of a pair were added together. This meant that the final score obtained was from 0 to10 seconds (or 0 to 250 frames).

RESULTS: PREFERENTIAL LOOKING TASK

This chapter presents the results for the preferential looking task. There are three sections: colour stimuli, toy stimuli and shape stimuli.

Data Preparation

Data were lost for some subjects during the preferential looking task due to infant fussiness. As counterbalancing was achieved by showing the same pairings twice, (with each stimuli being shown on the right hand side as well as the left hand side of the child's view), some 'fussy' infants had only seen one of the two pairings. When this happened, the data for that subject for that particular pairing were deleted. Each pairing therefore had a different sample size. The minimum and maximum sample size for each separate section was as follows (the possible maximum sample size for each section was 120). Colour stimuli; minimum = 115, maximum = 117. Toy stimuli; minimum = 115, maximum = 117. Shape stimuli; minimum = 88, maximum = 93. The shape stimuli were shown last to the infants and, therefore, had fewer participants, as infants who were particularly fussy refused to take part in the second section of the stimuli presentation. Furthermore, there was a larger difference between the minimum sample size and maximum sample size for the shape stimuli in comparison to the other two sections, as infants were less likely to sit for the entire duration of the presentation.

Some infants spent longer looking at either of the two stimuli within a pair than others. In particular, older children tended to spend more time looking at the stimuli than younger infants. In order to account for the differing lengths of time an infant spent looking at either stimulus within a pair, the scores were converted into the proportion of time spent looking at any one stimulus over the total looking time for both stimuli. Proportions were transformed into percentage values. All subsequent analyses for the preferential looking tasks were conducted using these percentage values.

Presentation of results and Statistical Analyses

Results are presented in sections corresponding to the different research questions set out at the beginning of the study. For each section, the graphs displaying the mean percentage of time spent looking at one stimulus within each pair for males and females at 12, 18 and 24 months are shown first. Data were analysed in two ways. Firstly, group differences were examined by comparing the looking times of males to females, and of the different age groups. This was done using MANOVA/ANOVA. Secondly, each group was looked at separately to assess if infants within each sex looked at one stimulus more than the other stimulus during each stimuli presentation. This was done using one-sample *t*-tests. Thus, the graphs are followed by the results of the MANOVA/ANOVA and finally the one-sample *t*-tests.

Graphs displaying Means for males and females at 12, 18 and 24 months

For each separate analysis, graphs for each of the stimuli pairings displaying the means for males and females at each of the age groups are presented. This is to enable the results for sex and age to be observed, as well as to see any possible interactions. As the scores were converted into proportion scores, the looking time for the second stimulus within each pair was the inverse of the looking time for the first stimulus; therefore, only one graph per stimuli pairing is shown.

MANOVA / ANOVA

A series of multivariate analyses of variance (MANOVAs) were carried out. The MANOVA was selected because it allowed more than two dependent variables (mean % of time spent looking at each stimulus) to be entered into one analysis. The dependent variables (mean % of time spent looking at each stimulus) are referred to as within subject factors, and the independent variables (sex and age) are referred to as between subject factors. The MANOVA allowed any overall main effects for the two between subject factors (sex and age) to be determined, as well as any interactions to be observed between these two factors. Pillai's Trace statistics have been reported unless otherwise indicated, as Pillai's Trace has been found to be more robust in comparison to the other statistics (Tabachnick and Fidell, 1996).

The MANOVA results were followed up by univariate tests providing *F* values and significance values for each separate stimuli pairing. Thus, after the results of the MANOVA, two tables have been presented. The first table displays the sample size, mean, SD, *F* value (univariate) and significance value for males and females for each of the stimuli pairings entered into the MANOVA and the second table displays the sample size, mean, SD, *F* value (univariate) and significance value for the three age groups (12, 18 and 24 months) for each of the stimuli pairings. For illustrative purposes, these tables display the univariate *F* values irrespective of whether or not the overall main effects of sex and age were significant. Only significant findings are discussed.

Where only two dependent variables were looked at, analyses of variance (ANOVAs) were used instead of MANOVAs to analyse the findings. Data for the ANOVA results have been presented in tables using the same format as those used to present the results of the MANOVAs (see above).

One-sample t-tests

Because MANOVA and ANOVA show whether or not there are any significant differences in the looking times between groups (i.e. sex and age), one-sample t-tests were also conducted on the data to determine if there was a preference for one stimulus over the other stimulus (e.g. if infants looked more at the car than the doll) within each group. One-sample *t*-tests were carried out to assess if the means of the dependent variable (looking time at one stimulus within a pair) differed significantly from 50. The value of 50 was selected because the looking times were transformed into percentages, and 50% would indicate no preference for one stimulus over the other stimulus. For example, to assess if infants looked at the car more than the doll, a one-sample *t*-test was conducted to assess if the mean looking time at the car differed significantly from 50. The doll was therefore not entered into the analysis. This was because the scores were converted into the proportion of time spent looking at one stimulus over the other stimulus and therefore the mean for the time spent looking at the doll was the inverse of the amount of time spent looking at the car. Therefore within each pair, a significant difference between one stimulus and 50 would also indicate a significant difference between the second stimulus and 50.

The one-sample *t*-tests are divided into three sections, as they were conducted to determine firstly, if there was a preference for one stimulus over another stimulus (e.g. a preference for the car over the doll) within a pair irrespective of the infants' sex or age, secondly, to determine if there was a preference for one stimulus over the other stimulus within each sex, and thirdly to determine if there was a preference for one stimulus over the other stimulus within each sex at each of the age groups.

Results

Colour stimuli

1. Do boys and girls aged 12, 18 and 24 months show a preference for pink or blue?

Colour stimuli were presented to the infants to determine if there was a preference for a particular colour irrespective of any associated toy or shape. The stimuli consisted of a square coloured in either blue, pink, pale blue or red.

The mean proportion of time spent looking at each stimuli pairing for boys and girls at each age group is shown in the graphs in fig 8.

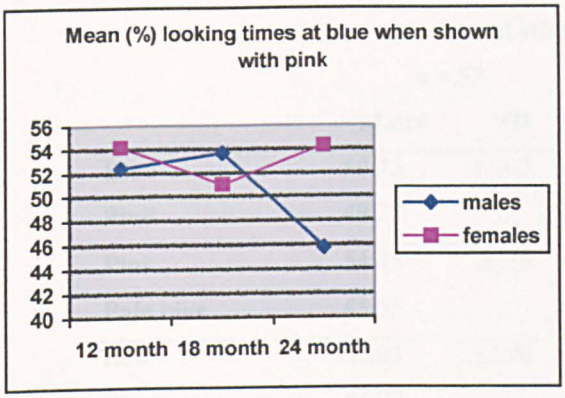

Fig.8.1

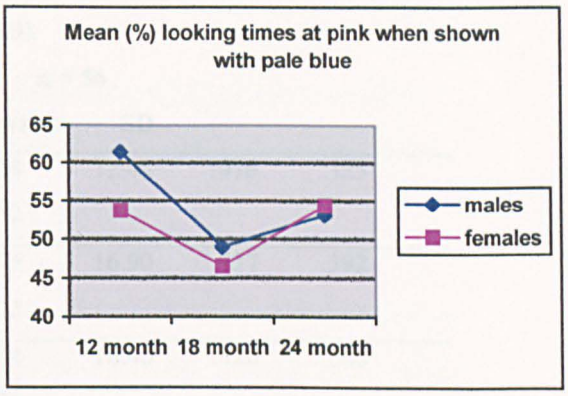

Fig.8.2

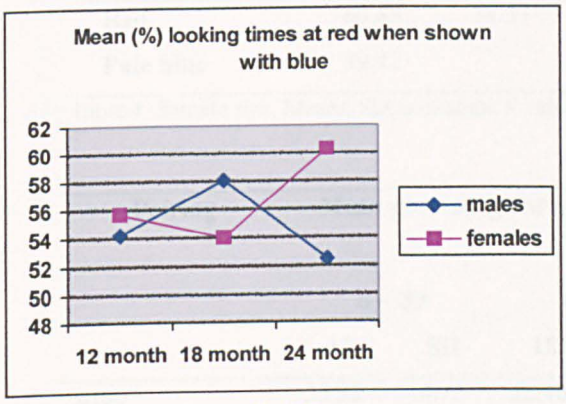

Fig.8.3

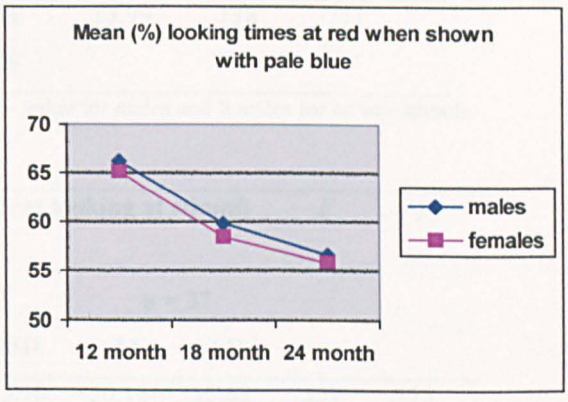

Fig.8.4

Fig. 8. Graphs to show the mean (%) looking times for males and females at 12, 18 and 24 months for the colour stimuli pairings

MANOVA

A 4x2x3 MANOVA was conducted with the four colour combinations (blue/pink; pink/pale blue; red/blue; red/pale blue) entered as within subjects factors and sex and age entered as between subject factors. There was no main effect of sex (F (4,104) = .749, p = .561). The main effect of age approached significance (F (8,210) = 1.93, p = .056) and there was no interaction between sex and age (F (8,210) = .873, p = .540). Table 4 shows the mean percentage looking times as well as the univariate F value and significance value for each of the stimulus pairings entered into the MANOVA for males and females. Table 5 shows the mean percentage looking times as well as the univariate F value and significance value for each of the pairings for each age group.

Pairing	Mean percentage of time spent looking at stimuli (SD)				*F*	*p*
	n = 57		n = 56			
	Males	SD	Females	SD		
Blue	50.75	15.02	53.28	12.45	.976	.325
Pink	49.25		46.72			
Pink	54.45	20.28	51.75	16.90	.737	.392
Pale blue	45.55		48.25			
Red	55.03	12.90	56.74	18.46	.328	.568
Blue	44.97		43.26			
Red	60.88	14.57	59.91	15.99	.138	.711
Pale blue	39.12		40.09			

Table 4. Sample size, Means, SD, univariate *F* value and *p* value for males and females for colour stimuli

Pairing	Mean percentage of time spent looking at stimuli (SD)						*F*	*p*
	n = 39		n = 37		n = 37			
	12	SD	18	SD	24	SD		
Blue	53.32	14.75	52.46	13.10	50.15	13.63	.557	.575
Pink	46.68		47.54		49.84			
Pink	57.45	19.86	47.92	20.68	53.72	13.76	2.646	.076
Pale blue	42.55		52.08		46.27			
Red	54.98	19.65	56.22	12.16	56.47	14.99	.082	.921
Blue	45.02		43.78		43.52			
Red	65.61	14.70	59.14	15.61	56.17	14.15	3.955	.022
Pale blue	34.39		40.86		43.83			

Table 5. Sample size, Means, SD, univariate *F* value and *p* value for 12, 18 and 24 month olds for colour stimuli

The MANOVA, thus, failed to find any differences in the preference for different colours (pink, blue, red and pale blue) between males and females. The main effect of age approached significance, and may be explained by the univariate tests (table 5), which show a significant difference ($p = .022$) between the age groups during the red/pale blue pairing. However, as the main effect did not reach statistical significance this finding was not examined further.

One-sample t-tests

The data were reanalysed using one-sample *t*-tests to examine whether infants favoured looking at one colour more than the other colour within each stimuli pairing.

Firstly, one-sample *t*-tests assessed whether there was a preference for one colour within a pair, for infants collapsed across sex and age. Infants looked significantly longer at red than blue ($t = 3.94$, df = 112, $p <. 001$) or pale blue ($t = 7.258$, df = 112, $p <.001$). Infants showed no preference when shown pink versus blue, or pink versus pale blue.

Secondly, one-sample *t*-tests were repeated for males and females separately. The same findings emerged. That is, boys looked significantly longer at red when shown with blue ($t = 2.943$, df = 56, $p = .005$ or pale blue ($t = 5.637$, df = 56, $p <.001$) and girls looked significantly longer at red when shown with blue ($t = 2.731$, df = 55, $p = .008$) or pale blue ($t = 4.637$, df = 55, $p <.001$). Boys and girls showed no preference during the pink/blue pairing or the pink/pale blue pairing.

Lastly, one-sample *t*-tests were conducted for males and females separately at each of the age groups. It was found that 12-month-old boys looked significantly longer at pink than pale blue ($t = 2.459$, df = 18, $p = .024$), and significantly longer at red than pale blue ($t = 4.513$, df = 18, $p<.001$). Twelve-month old boys showed no preference when looking at the red/blue and pink/blue pairing. Eighteen-month old boys looked significantly longer at red than blue ($t = 2.948$, df = 19, $p = .008$) and significantly longer at red than pale blue ($t = 2.822$, df = 19, $p = .011$). They showed no preference when looking at the pink/pale blue and pink/blue pairing. Twenty-four-month old boys looked significantly more at red than pale blue ($t = 2.517$, df = 17, $p = .022$). They showed no preference when looking at the red/blue, pink/pale blue and pink/blue pairing.

For girls, twelve-month-olds looked significantly longer at red compared to pale blue ($t = 4.761$, df = 19, $p<.001$). Twelve-month old girls showed no preference when looking at the red/blue, pink/pale blue and pink/blue pairing. Eighteen-month old

girls also looked significantly longer at the red than the pale blue ($t = 2.136$, df = 16, p=.048). They too showed no preference when looking at the red/blue, pink/pale blue and pink/blue pairings. Twenty-four month old girls looked significantly longer at red compared to blue ($t = 2.553$,df = 18, $p = .02$). They showed no preference when looking at the red/pale blue, pink/pale blue, and pink/blue pairing.

Summary of results for colour stimuli

- The MANOVA found no overall differences in the preference for the four different colours (pink, blue, red and pale blue) between males and females, or between 12, 18 and 24 month olds. No interaction between sex and age was found for the colour stimuli pairings.

- The one-sample *t*-tests revealed that:
    - Infants irrespective of their sex or age showed a preference for red when shown with blue and pale blue.
    - When boys and girls were analysed separately, boys aged 12-24 months showed a preference for red when shown with blue and pale blue, and girls aged 12- 24 months showed a preference for red when shown with blue and pale blue.
    - One-sample *t*-tests for boys conducted for each different age group showed that 12-month-old boys looked significantly longer at pink than pale blue, and significantly longer at red than pale blue, 18-month-old boys looked significantly longer at red than blue and pale blue, and 24-month-old boys looked significantly longer at red than pale blue.
    - One-sample *t*-tests for girls conducted for each different age group revealed that 12-month-old and 18-month-old girls looked significantly longer at red than pale blue and 24-month-old girls looked significantly longer at red than blue.

Toy stimuli

The toy stimuli data were analysed in sections by grouping the pairings that addressed the different research questions set out at the beginning of the study. Findings are reported in the order of these research questions.

2.a. Do boys and girls differ in their looking times for the pink doll versus the blue car and does this change with age?

The mean proportion of time spent looking at the pink doll when shown with the blue car for boys and girls at each age group is shown in fig 9.

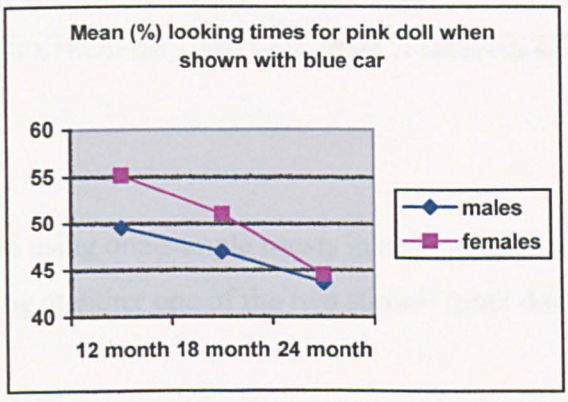

Fig. 9. Graph to show the mean percentage looking time for males and females at each age group for the pink doll when shown with the blue car.

ANOVA

A 2x3 ANOVA was conducted to examine infants' preference during the pink doll/blue car pairing. Sex (male and female) and age (12, 18 and 24 months) were entered as between-subject factors. There was no main effect of sex (F (1,109) = 1.053, p = .307), no main effect of age (F (2,109) = 1.945, p = .148) and no interaction between sex and age (F (2, 109) = .167, p = .846 (see table 3).

Table 6 shows the mean percentage looking times for the pink doll/blue car pairing for males and females, and Table 7 shows the mean percentage looking times for the pink doll/blue car pairing for the three age groups.

Pairing	Mean percentage of time spent looking at stimuli (SD)				*F*	*p*
	n=57		n=58			
	Males	SD	Females	SD		
Pink doll	46.67	17.24	50.32	19.50	1.053	.307
Blue car	53.34		49.68			

Table 6. Sample size, Means, SD, *F* value and p value for males and females for pink doll/blue car pairing

Pairing	Mean percentage of time spent looking at stimuli (SD)						*F*	*p*
	n=38		n=39		n=38			
	12	SD	18	SD	24	SD		
Pink doll	52.50	17.24	48.94	18.96	44.08	18.51	1.945	.148
Blue car	47.50		51.06		55.92			

Table 7. Sample size, Means, SD, *F* value and *p* value for 12, 18 and 24 month olds for pink doll/blue car pairing

One-sample t-tests

The data were analysed using one-sample *t*-tests in order to determine whether infants favoured looking at either one of the two stimuli (pink doll or blue car).

Firstly, one-sample *t*-tests were conducted to examine if infants, irrespective of sex and age, showed a preference for either the pink doll or the blue car. Infants showed no preference between the pink doll and blue car.

Secondly, one-sample *t*-tests were conducted for males and females separately. Again, boys and girls showed no preference for either stimulus during the pink doll/blue car pairing.

Thirdly, one-sample *t*-tests were conducted for males and females separately at each of the different age groups. The same findings emerged, that is, no preference was shown for either the pink doll or blue car for boys and girls aged 12, 18 and 24 months.

Summary of results for pink doll v blue car pairing

- The ANOVA found no difference in the looking times for the pink doll/blue car pairing between boys and girls, and between 12, 18 and 24 months olds. No interaction between sex and age was found for the pink doll/blue car pairing.

- One-sample *t*-tests found no difference in the amount of time spent looking at the pink doll compared to the amount of time spent looking at the blue car for all infants irrespective of sex or age. Nor were any preferences for either stimulus found for males and females separately or for males and females separately at each of the three age groups.

2.b. Do infants show sex-typed toy preferences if the toys are coloured in 'opposite sex-typed colours' (i.e. pink car and blue doll)?

The mean proportion of time spent looking at the pink car when shown with the blue doll for boys and girls at each age group is shown in fig 10.

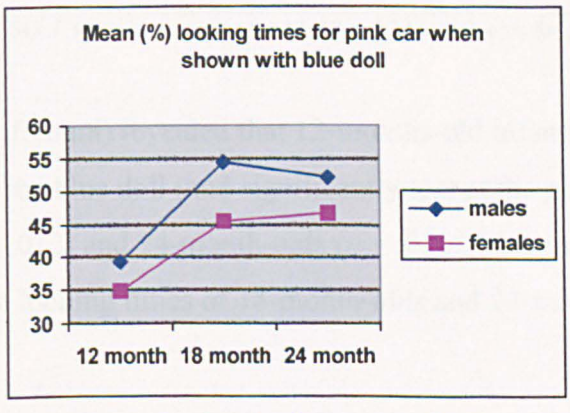

Fig. 10. Graph to show the mean percentage looking time for males and females at each age group for the pink car when shown with the blue doll.

ANOVA

A 2x3 ANOVA was conducted to examine infants' preference during the pink car/blue doll pairing with sex (male and female) and age (12, 18 and 24 months)

entered as between-subject factors. There was no main effect of sex (F (1,109) = 3.152, p = .079). A significant main effect of age was found (F (2, 109) = 5.523, p = .005). No interaction between sex and age was found (F (2,109) = .140, p = .870).

Table 8 shows the mean percentage looking times for the pink car/blue doll pairing for males and females and Table 9 shows the mean percentage looking times at the pink car/blue doll pairing for the three age groups.

Pairing	Mean percentage of time spent looking at stimuli (SD)				F	p
	n=58		n=57			
	Males	SD	Females	SD		
Pink car	48.78	20.62	42.11	19.19	3.152	.079
Blue doll	51.22		57.89			

Table 8. Sample size, Means, SD, F value and p value for males and females for pink car/blue doll pairing

Pairing	Mean percentage of time spent looking at stimuli (SD)						F	p
	n=39		n=38		n=38			
	12	SD	18	SD	24	SD		
Pink car	37.03	19.35	50.02	21.49	49.60	16.93	5.523	.005
Blue doll	62.97		49.98		50.41			

Table 9. Sample size, Means, SD, F value and p value for 12, 18 and 24 month olds for pink car/blue doll pairing

Post hoc analysis (Bonferonni) revealed that 12-months-old infants looked significantly longer at the blue doll (and significantly less at the pink car), compared to 18-month-olds (p = .012) and 24-month-olds (p = .016). There was no significant difference between the looking times of 18-month-olds and 24-month-olds.

One-sample t-tests

The data were analysed using one-sample t-tests to examine whether infants showed a preference for any one stimulus during the pink car/blue doll pairing.

Firstly, one-sample t-tests were conducted to see if infants collapsed across sex and age showed a preference for either the pink car or the blue doll. It was found that

infants looked longer at the blue doll compared to the pink car (t = -2.413, df = 114, p = .017).

Secondly, the one-sample t-tests were repeated for males and females separately. Only the difference between the two stimuli for the females reached statistical significance (t = -3.104, df = 56, p = .003). Thus, females looked significantly longer at the blue doll than the pink car.

Thirdly, one-sample t-tests conducted for each sex at each age group revealed that boys and girls at 12 months of age looked significantly longer at the blue doll compared to the pink car (males: t = -2.187, df =18, p = .042; females: t =-3.837, df = 19, p = .001). Boys and girls were not found to show a preference for either the blue doll or pink car at 18 and 24 months.

Summary of results for pink car v blue doll pairing

- The ANOVA found a main effect of age and post hoc tests revealed that 12 month olds looked longer at the blue doll compared to 18 month olds and 24 month olds. No main effect of sex was found and no interaction was found between sex and age.

- One-sample t-tests revealed that
    - Infants irrespective of sex and age showed a preference for the blue doll compared to the pink car.
    - When boys and girls were looked at separately boys aged 12-24 months showed no preference for either stimulus, but girls aged 12-24 months showed a preference for the blue doll.
    - Boys aged 12 months and girls aged 12 months looked significantly longer at the blue doll compared to the pink car.

2.c. If pink and blue are controlled for their differing brightness levels do the same patterns of sex-typed toy preferences emerge?

The four pairs of stimuli controlling for the different brightness levels of pink and blue were red car/blue doll, blue car/red doll, pale blue car/pink doll and pink car/pale blue doll. The mean proportion of time spent looking at the four stimuli pairings controlling for the different brightness levels of pink and blue for males and females at each of the age groups are shown in Fig.11.

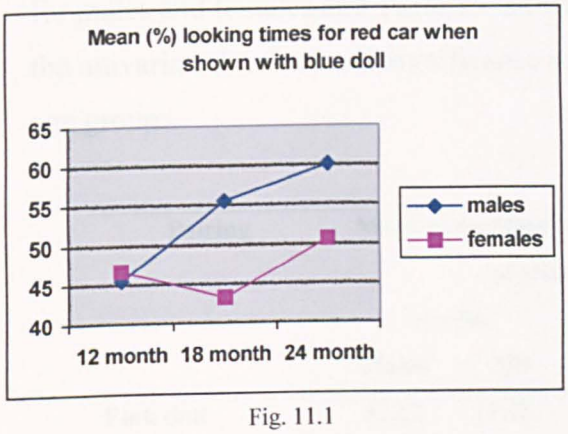

Fig. 11.1

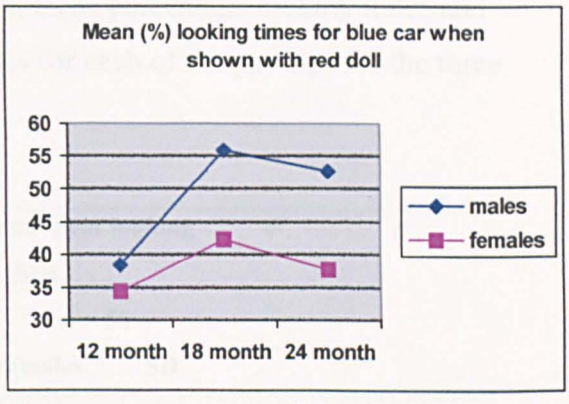

Fig. 11.2

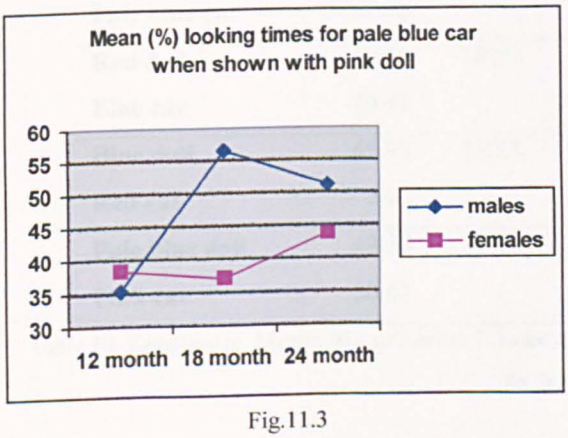

Fig.11.3

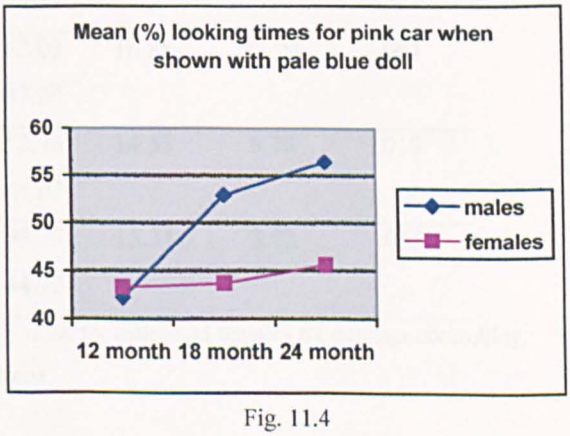

Fig. 11.4

Fig. 11. Graph to show the mean percentage looking time for males and females at each age group for toy stimuli pairings controlling for brightness.

MANOVA

A 4x2x3 MANOVA was conducted with the four pairs of stimuli which controlled for the different brightness levels of pink and blue (pink doll/pale blue car, red doll/blue car, blue doll/red car and pale blue doll/pink car), entered as within subject

factors and sex (male and female) and age (12, 18 and 24 months) entered as between-subject factors.

A significant main effect of child sex was found (F (4,102) = 4.065, p = .004) as well as a main effect of age (F (8,206) = 2.612, p = .01). There was no interaction between sex and age (F (8,206) = 1.522, p = .151).

Table 10 shows the mean percentage looking times and the univariate F values and significance values for each of the stimulus pairings controlling for brightness levels for males and females and Table 11 shows the mean percentage looking times and the univariate F values and significance values for each of the pairings for the three age groups.

Pairing	Mean percentage of time spent looking at stimuli (SD)				F	p
	n = 56		n = 55			
	Males	SD	Females	SD		
Pink doll	52.02	17.15	60.12	16.64	6.92	.010
Pale blue car	47.98		39.87			
Red doll	50.58	18.94	62.03	16.88	11.24	.001
Blue car	49.41		37.96			
Blue doll	45.99	17.22	52.93	14.53	5.70	.019
Red car	54		47.07			
Pale blue doll	49.38	19.25	55.77	15.31	3.75	.055
Pink car	50.61		44.22			

Table 10. Sample size, Means, SD, univariate F value and p value for males and females for pairings controlling for brightness

The univariate tests (using a Bonferroni adjusted alpha level of .0125) revealed that males and females differed in their looking times for the pink doll/pale blue car pairing and the red doll/blue car pairing. As table 10 shows females looked significantly longer at the pink doll when shown with the pale blue car compared to males (F(1,105) = 6.92, p = .010) and females looked significantly longer at the red doll when shown with the blue car compared to males (F (1,105) = 11.24, p = .001).

It is important to note that if the alpha level was not adjusted to the stringent level of .0125, and the conventional *p*-value of .05 was used to interpret the univariate tests shown in table 10, then the blue doll/red car pairing would reveal girls to look longer at the doll compared to boys. The pale blue doll/pink car pairing would approach significance and also suggest that girls looked longer at the doll than boys.

Pairing	Mean percentage of time spent looking at stimuli (SD)						*F*	*p*
	n = 37		n = 37		n = 37			
	12	SD	18	SD	24	SD		
Pink doll	63.11	17.64	52.45	18.42	52.54	13.68	5.282	.007
Pale blue car	36.89		47.55		47.46			
Red doll	63.33	14.83	50.38	18.97	55.06	20.21	4.867	.010
Blue car	36.67		49.62		44.94			
Blue doll	53.84	14.99	50.08	17.85	44.38	14.71	3.702	.028
Red car	46.16		49.92		55.62			
Pale blue doll	57.22	18.04	51.30	17.94	49.13	16.30	2.215	.114
Pink car	42.78		48.70		50.87			

Table 11. Sample size, Means, SD, univariate *F* value and *p* value for 12, 18 and 24 month olds for pairings controlling for brightness.

Univariate tests (using a Bonferroni adjusted alpha level of .0125) revealed age differences for the pink doll/pale blue car pairing ($F(2,105) = 5.282$, $p = .007$) and the red doll/blue car pairing ($F(2,105) = 4.867$, $p = .010$). Post hoc analysis (bonferonni) found that for the pink doll/pale blue car pairing, 12-month-olds looked longer at the pink doll compared to 18-month-olds ($p = .013$) and 24-month-olds ($p = .014$). For the red doll/blue car pairing, 12-month-olds looked significantly longer at the red doll compared to 18-month-olds ($p = .005$).

It is again important to note that if the alpha level was not adjusted to the stringent level of .0125, and the conventional p-value of .05 was used to interpret the univariate tests shown in table 11, then the blue doll/red car pairing would also reveal a difference between the three age groups.

One-sample t-tests

One-sample *t*- tests were conducted on the data to see if infants looked more at one stimulus than the other stimulus within each of the pairings controlling for brightness levels.

Firstly, one-sample *t*-tests were conducted to see if infants collapsed across sex or age looked at one stimulus more than the other stimulus within each pair. It was found that infants irrespective of sex and age looked significantly longer at the red doll than the blue car ($t = 3.512$, df = 110, $p = .001$), and significantly longer at the pink doll than the pale blue car ($t = 3.674$, df = 110, $p < .001$).

Secondly, the one-sample *t*-tests were conducted for each sex separately. Boys did not show any preference for any one stimulus within a pair. Girls, however, were found to look significantly more at the red doll than the blue car ($t = 5.286$, df = 54, $p < .001$), significantly more at the pink doll than the pale blue car ($t = 4.512$, df = 54, $p < .001$), and significantly more at the pale blue doll than the pink car ($t = -2.798$, df = 54, $p = .007$). There was no difference between girls' looking times at the red car and blue doll.

Thirdly, one-sample *t*- tests conducted for each sex at each of the age groups revealed that 12 month old boys looked significantly longer at the red doll than the blue car ($t = 3.012$, df = 17, $p = .008$) and significantly longer at the pink doll than the pale blue car ($t = 3.677$, df = 17, $p = .002$). At 18 months, boys showed no difference in the looking times of one stimulus over the other. At 24 months, boys looked significantly longer at the red car than at the blue doll ($t = 3.506$, df = 17, $p = .003$).

For girls, 12-month-olds looked significantly longer at the red doll than the blue car ($t = 4.764$, df = 18, $p < .001$), and significantly longer at the pink doll than the pale blue car ($t = 2.722$, df = 18, $p = .014$). Girls at 18 months looked significantly longer at the blue doll than the red car ($t = -2.291$, df = 16, $p = .036$) and significantly longer at the pink doll than the pale blue car ($t = 3.208$, df = 16, $p = .005$). For girls aged 24 months, only one of the pairings reached statistical significance, that of the red

doll/blue car pairing where girls looked significantly longer at the red doll than at the blue car ($t = 2.493$, df = 19, $p = .022$).

Summary of results for pairings controlling for the different brightness levels of pink and blue

- The MANOVA showed that taking all the pairings together and controlling for the different brightness levels, there was a main effect of sex and a main effect of age. No interactions were found between sex and age.
    - Univariate analyses showed that girls looked longer at the pink doll (when shown with the pale blue car) compared to boys, and longer at the red doll (when shown with the blue car) compared to boys.
    - Univariate analyses followed up by post hoc tests revealed that 12-month-olds looked longer at the pink doll when shown with the pale blue car compared to 18-month-olds and 24-month-olds and that 12-month-olds looked significantly longer at the red doll than at the blue car compared to 18-month-olds.

- One sample *t*-tests showed that:
    - Infants irrespective of sex and age looked significantly longer at the red doll than the blue car and significantly longer at the pink doll than the pale blue car.
    - Boys aged 12-24 months showed no preference for a particular stimulus during any of the pairings controlling for brightness levels. Girls aged 12-24 months looked significantly longer at the red doll than the blue car, significantly longer at the pink doll than the pale blue car, and significantly longer at the pale blue doll than the pink car.
    - When data for boys were analysed separately at each of the age groups, 12-month-old boys looked longer at the red doll than at the blue car and longer at the pink doll than at the pale blue car. At 18 months, boys showed no difference in the looking times for one

stimulus over the other for any of the four pairings. At 24 months boys looked longer at the red car than at the blue doll.

- For girls analysed separately at each of the age groups, 12-month-olds looked longer at the red doll than at the blue car and longer at the pink doll than at the pale blue car. Girls at 18 months looked longer at the blue doll than at the red car and longer at the pink doll than at the pale blue car. Twenty-four-month old girls were found to look longer at the red doll than at the blue car.

2.d. Do sex differences in toy preference exist when colour is kept constant? If so, at what age do they emerge?

There were three pairs of stimuli consisting of a car paired with a doll of the same colour (pink car/pink doll, blue car/blue doll and neutral car/neutral doll). The mean proportion of time spent looking at these three stimuli is shown in Fig 12.

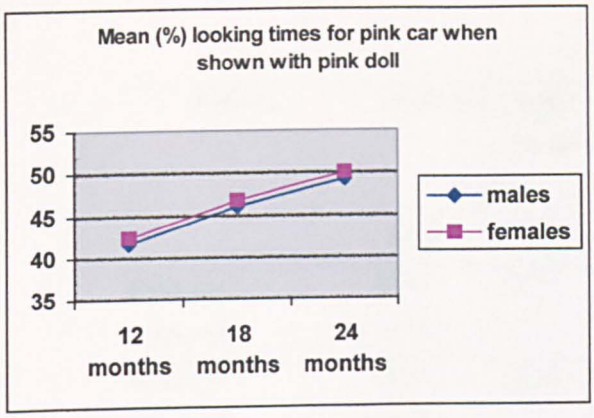

Fig. 12.1

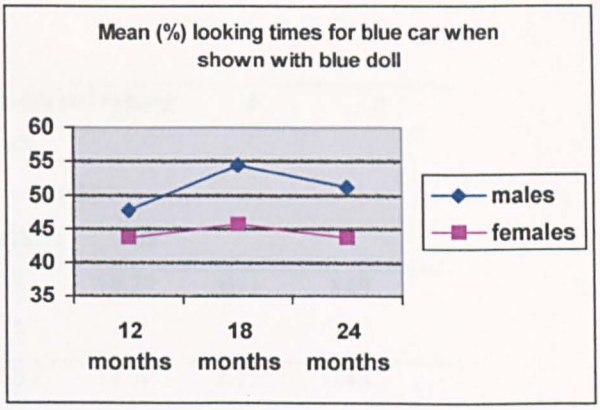

Fig. 12.2

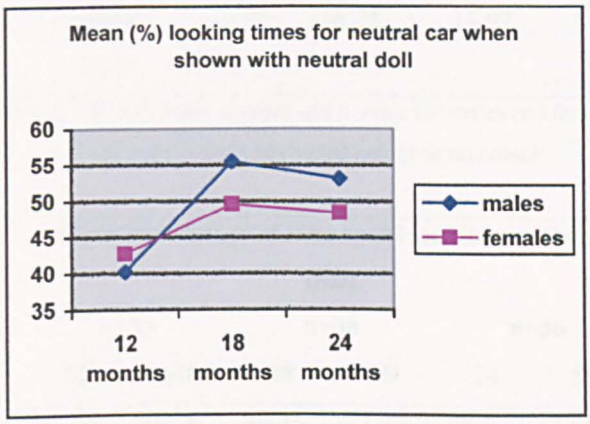

Fig. 12.3

Fig. 12. Graph to show the mean percentage looking time for males and females at each age group for pairings of different toys when colour is kept constant

MANOVA

A 3x2x3 MANOVA was conducted with the pink car/pink doll, blue car/blue doll and neutral car/neutral doll entered as within subject factors, and sex (male and female) and age (12, 18 and 24 months) entered as between subject factors. There was no main effect of sex (F (3,105) = .951, p = .419). However, a significant main effect of age was found (F (6, 212) = 2.405), p = .029). There was no interaction between sex and age (F (6,212) = .551, p = .769).

Table 12 shows the mean percentage looking times and the univariate F value and significance value for males and females for the pink car/pink doll, blue car/blue doll and neutral car/neutral doll pairings. Table 13 shows the mean percentage looking times and the univariate F value and significance value for the three age groups 12, 18 or 24 months for these three stimuli pairings.

Pairing	Mean percentage of time spent looking at stimuli (SD)				*F*	*p*
	n=57		n=56			
	Males	SD	Females	SD		
Pink car	45.61	19.07	46.24	18.29	.041	.840
Pink doll	54.39		53.76			
Blue car	49.25	18.17	44.36	17.10	2.122	.148
Blue doll	50.75		55.64			
Neutral car	49.66	15.72	46.75	13.97	1.038	.310
Neutral doll	50.34		53.25			

Table 12. Sample size, Means, SD, univariate *F* value and *p* value for males and females for pairings of different toys of the same sex-typed colour or no colour

Pairing	Mean percentage of time spent looking at stimuli (SD)						*F*	*p*
	n=39		n=38		n=36			
	12	SD	18	SD	24	SD		
Pink car	42.00	16.36	46.43	21.49	49.63	17.24	1.571	.213
Pink doll	57.10		53.57		50.37			
Blue car	42.75	18.57	50.31	18.02	47.56	16.02	1.751	.178
Blue doll	57.25		49.69		52.44			
Neutral car	58.52	15.56	47.29	13.44	49.24	13.27	6.804	.002
Neutral doll	41.48		52.71		50.76			

Table 13. Sample size, Means, SD, univariate *F* value and *p* for 12, 18 and 24 month olds for pairings of different toys of the same sex-typed colour or no colour

The Univariate tests revealed that only one of the three pairings showed a significant age difference (using a Bonferroni adjusted alpha level of .017). This was for the neutral car/neutral doll pairing ($F(2,107) = 6.804$, $p = .002$). Post hoc tests (Bonferonni) revealed that 12-month-olds looked longer at the neutral doll (and less at the neutral car) compared to 18-month-olds ($p = .002$), and 24-month-olds ($p = .016$). There was no significant difference between the looking times of 18 and 24 months olds for the neutral car/neutral doll pairing.

One-sample t-tests

A series of one-sample *t*-tests were carried out to determine whether or not infants looked at one stimulus more than the other within each of the pairings that showed a car versus a doll of the same colour (pink or blue) or no colour.

Firstly, one-sample *t*-tests were carried out to examine if infants, irrespective of sex and age, showed a preference for one stimulus within each pair. Infants looked significantly longer at the pink doll than the pink car (t = -2.329, df = 112, p = .022). They showed no preference during the blue car/ blue doll pairing or the neutral car/neutral doll pairing.

Secondly, one-sample *t*-tests were conducted for males and females separately. This revealed that boys aged 12-24 months showed no preferences for either of the three stimulus pairings. Girls, however, were found to look longer at the blue doll compared to the blue car (t = -2.469, df = 55, p = .017). Girls were not found to show a preference during the pink car/pink doll pairing and the neutral car/neutral doll pairing.

Thirdly, one-sample *t*– tests were conducted for each sex at each age group. For boys, it was found that 12-month-old boys looked significantly longer at the pink doll than the pink car (t =-2.171, df = 18, p = .044), significantly longer at the blue doll than the blue car (t = -2.899, df = 18, p = .010) and significantly longer at the neutral doll than the neutral car (t = 2.454, df = 18, p =.025). None of the pairings reached statistical significance for boys at 18 months and at 24 months. For girls, 12-month-olds looked significantly longer at the pink doll than the pink car (t = -2.088, df = 19, p = .050) and significantly longer at the neutral doll than the neutral car (t = 2.340, df = 19, p = .030). There was no difference in looking times at the blue car and blue doll. None of the pairings for girls at 18 months and 24 months reached statistical significance.

Summary of results for pairings assessing toy preference when colour is kept constant

- The MANOVA found an overall main effect of age. Univariate analyses revealed this to be significant for the neutral car/neutral doll pairing, whereby 12-month-olds looked significantly longer at the colourless doll compared to 18 and 24-month-olds.

- One sample *t*–tests revealed that:
    - Infants irrespective of sex and age looked at the pink doll more than the pink car.
    - Boys aged 12-24-months-old showed no preferences for any of the three stimuli pairings.
    - Girls aged 12-24-months-old showed a preference for the doll during the blue car/blue doll pairing.
    - When boys were looked at separately at each of the age groups significant preferences were found only for the 12-month-olds. Boys aged 12-months showed a preference for the doll during all three pairings (pink car/pink doll, blue car/ blue doll, neutral car/neutral doll).
    - When girls were looked at separately at each of the age groups, significant differences were once again only found for 12-month-olds. Girls aged 12 months looked significantly longer at the doll during the pink car/pink doll pairing and the neutral car/neutral doll pairing. They showed no preference during the blue car/blue doll pairing.

2.e. Do sex differences in colour preference exist when the toy is kept constant? If so, at what age do they emerge?

To examine preferences for colours, irrespective of the type of toy, two pairings of the same stimuli coloured in a different sex-typed colour were paired. The pairings were pink car/blue car, and pink doll/blue doll. The mean proportion of time spent looking at each stimulus within each pair is shown in Fig. 13.

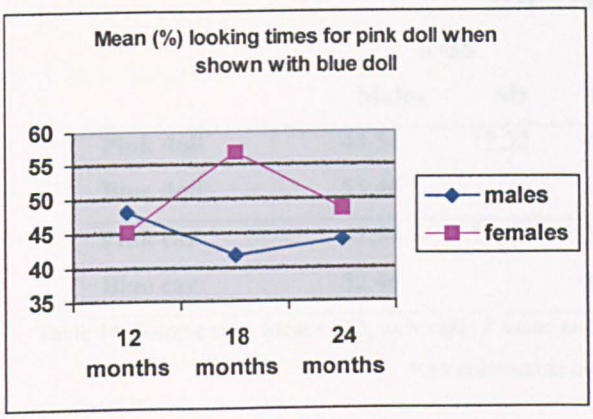

Fig. 13.1

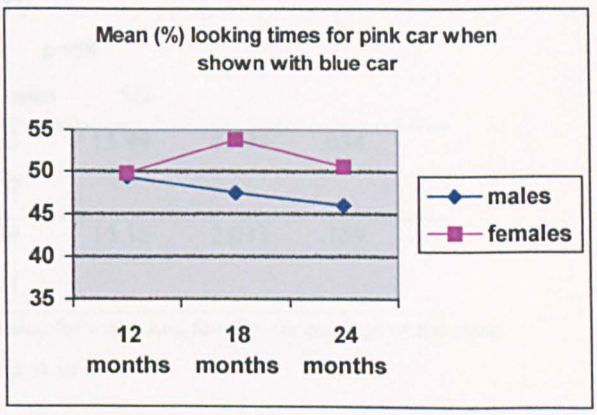

Fig. 13.2

Fig. 13. Graph to show the mean percentage looking time for males and females at each age group for pairings of the same toys coloured in either pink or blue

MANOVA

A 2x2x3 MANOVA was conducted with the two pairings (pink doll/blue doll and pink car/blue car) entered as within subject factors, and sex (male and female) and age (12, 18 and 24 months) entered as between subject factors. There was no main effect of age (F (4,220) = .374, p = .827). The main effect of sex (F (2, 109) = 3.044, p = .052) and the interaction between sex and age (F (4,220) = 2.059, p = .087) approached significance. Although the main effect of sex did not reach statistical significance, it did show a trend towards a difference between boys and girls. This trend could be explained by the univariate tests shown in table 14, suggesting that girls looked longer at the pink doll compared to boys, and boys looked longer at the blue doll compared to girls.

Table 14 shows the mean percentage looking times for males and females for the two pairings and Table 15 shows the mean percentage looking times for these pairings for the three age groups.

Pairing	Mean percentage of time spent looking at stimuli (SD)				*F*	*p*
	n=58		n=58			
	Males	SD	Females	SD		
Pink doll	44.54	12.32	49.10	15.99	4.594	.034
Blue doll	55.46		50.00			
Pink car	47.54	13.89	51.39	15.15	2.013	.159
Blue car	52.46		48.61			

Table 14. Sample size, Means, SD, univariate *F* value and *p* value for males and females for pairings of the same toys coloured in either pink or blue

Pairing	Mean percentage of time spent looking at stimuli (SD)						*F*	*p*
	n=38		n=38		n=40			
	12	SD	18	SD	24	SD		
Pink doll	46.59	16.62	48.96	16.51	46.32	9.62	.546	.581
Blue doll	53.41		51.04		53.68			
Pink car	49.62	17.44	50.52	15.18	48.31	10.91	.257	.774
Blue car	50.38		49.48		51.69			

Table 15. Sample size, Means, SD, univariate *F* value and *p* value for 12, 18 and 24 month olds for pairings of the same toys coloured in either pink or blue

One-sample t-tests

One-sample *t*-tests were conducted to determine whether infants looked at one stimulus more than the other stimulus within each pairing showing the same toy coloured in a different sex-typed colour.

Firstly, one-sample *t*-tests were carried out for infants collapsed across sex and age. It was found that infants looked significantly longer at the blue doll than the pink doll ($t = -2.062$, df = 117, $p = .041$). No difference was found between the looking times for the pink car/blue car pairing.

Secondly, the one-sample *t*-tests for the two pairings were repeated for males and females separately. Boys aged 12-24 months looked longer at the blue doll than the pink doll ($t = -3.373$, df = 57, $p = .001$). Girls did not show any preference for either of the two stimuli.

Thirdly, one-sample *t*-tests were carried out for males and females separately at each of the age groups. It was found that 18-month-old and 24-month-old boys looked significantly longer at the blue doll than the pink doll (18 months: $t = -2.842$, df = 19, $p = .010$; 24 months: $t = -2.866$, df = 19 $p = .010$). Neither of the pairings for girls at the separate age groups reached significance.

Summary of results for pairings assessing colour preference when the toy is kept constant

- The MANOVA showed no significant main effect of age and no significant interaction between sex and age. The main effect of sex approached significance, and may be explained by girls looking longer at the pink doll compared to boys, and boys looking longer at the blue doll compared to girls.

- The one-sample *t*-tests showed that:
    - Infants, irrespective of sex and age, looked longer at the blue doll compared to the pink doll.
    - Boys aged 12-24 months looked longer at the blue doll compared to the pink doll, but showed no preference between the pink car and blue car. Girls aged 12-24 months showed no preferences for either of the two stimulus pairings.
    - When boys were looked at separately at each of the age groups, 18-month-olds and 24-month-olds looked significantly longer at the blue doll compared to the pink doll.
    - When girls were analysed separately at each of the age groups, they showed no preference for either stimulus during the pink car/blue car pairing and the pink doll/blue doll pairing.

Shape stimuli

The shape stimuli data were separated into two sections. The first section consisted of colourless angular shapes (triangle, abstract shape, squares) paired against the

same shape with rounded edges (rounded triangle, rounded abstract shape, circles). This was done to determine whether infants showed any preference for either rounded or angular shapes. The second section consisted of coloured squares (blue squares, pink squares, pale blue squares and red squares) paired against coloured circles (blue circles, pink circles, pale blue circles, and red circles). This was done to determine whether any preference for either an angular shape or a rounded shape would be found if the stimuli were coloured in sex-typed colours (pink, blue, red or pale blue). The analyses comparing the pink and blue squares and circles were conducted first, and this was followed by separate analyses of the pairings controlling brightness.

3.a. Do boys and girls differ in their preference for angular or rounded shapes and does this change with age?

The mean proportion of time spent looking at the three pairs of stimuli which compared angular shapes to rounded shapes (angular triangle/rounded triangle, angular abstract shape/ rounded abstract shape, squares/circles), for males and females at each age group can be seen in Fig 14.

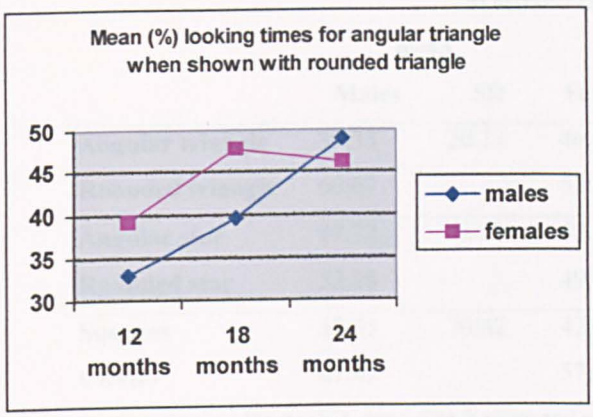

Fig. 14.1

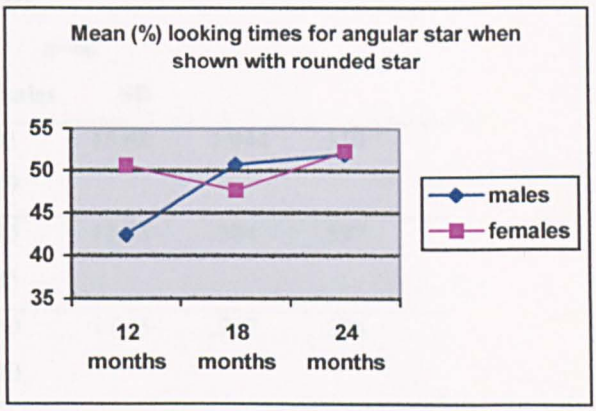

Fig. 14.2

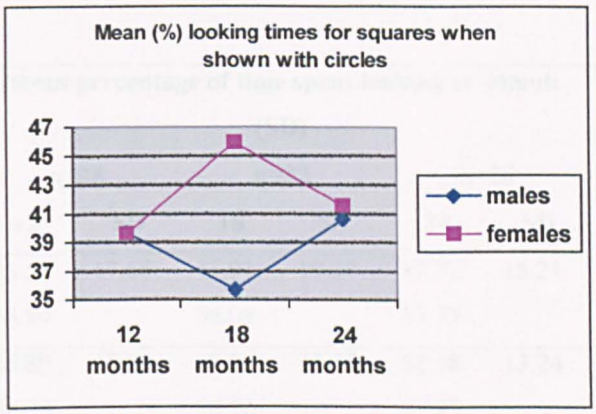

Fig. 14.3

Fig. 14. Graph to show the mean percentage looking time for males and females at each age group for shape stimuli pairings comparing angular to rounded shapes

MANOVA

A 3x2x3 MANOVA was conducted with angular triangle/rounded triangle, angular star/rounded star and squares/circles entered as within subject factors, and sex (males and females) and age (12, 18 and 24 months) entered as between subject factors. There was no main effect of sex (F (3,81) = .655, p = .582) and no main effect of age (F (6, 164) = 1.280, p = .269). There was no sex by age interaction (F (6,164) = .856, p = .529).

Table 16 shows the mean percentage looking times for males and females for the dependent variables and Table 17 shows the mean percentage looking times for the three age groups.

Pairing	Mean percentage of time spent looking at stimuli (SD)				*F*	*p*
	n=43		n=46			
	Males	SD	Females	SD		
Angular triangle	39.33	20.15	44.91	15.62	1.044	.310
Rounded triangle	60.67		55.89			
Angular star	47.72	16.12	50.15	12.03	.384	.537
Rounded star	52.28		49.85			
Squares	38.55	20.42	42.60	17.45	.767	.384
Circles	61.45		57.40			

Table 16. Sample size, Means, SD, univariate *F* value and *p* value for males and females for pairings comparing angular shapes with rounded shapes

Pairing	Mean percentage of time spent looking at stimuli (SD)						*F*	*p*
	n=28		n=32		n=28			
	12	SD	18	SD	24	SD		
Angular triangle	35.50	17.68	43.91	19.37	47.23	15.21	3.044	.053
Rounded triangle	64.50		56.09		52.77			
Angular star	45.80	15.29	49.04	13.55	52.18	13.24	1.094	.340
Rounded star	54.20		50.96		47.82			
Squares	39.65	25.59	41.11	16.08	41.13	13.84	.042	.959
Circles	60.35		58.89		58.87			

Table 17. Sample size, Means, SD, univariate *F* value and *p* value for 12, 18 and 24 month olds for pairings comparing angular shapes with rounded shapes

One-sample t-tests

One-sample *t*-tests were conducted to examine whether infants showed a preference for one stimulus over the other during the three pairings comparing angular shapes to rounded shapes.

Firstly, infants examined together collapsed across sex and age. It was found that infants looked significantly longer at the rounded triangle than the angular triangle (t = -4.064, df = 88, p <.001), and they looked significantly longer at the circles than the squares (t = -4.661, df = 88, p <.001). There was no difference between looking times at the angular abstract shape and the rounded abstract shape.

Secondly, the one-sample *t*-tests were carried out for males and females separately. Boys aged 12-24 months looked significantly longer at the rounded triangle than the angular triangle (t = -3.470, df = 42, p = .001), and significantly longer at the circles that the squares (t = -3.679, df = 42, p = .001). Girls aged 12-24 months also showed the same pattern, that is they looked longer at the rounded triangle compared to the triangle (t = -2.210, df = 45, p = .032), and they looked longer at the circles compared to the squares (t = -2.876, df = 42, p = .006). No preference was found for boys or for girls during the angular abstract shape/rounded abstract shape pairing.

Thirdly, one-sample t-tests were conducted for boys and girls separately, at each of the age groups. It was found that 12-month-old boys looked significantly longer at the rounded triangle compared to the triangle (t = -3.802, df = 16, p = .02). Eighteen-month-old boys looked significantly longer at the circles compared to the squares (t = -3.802, df = 14, p = <.001). None of the other pairings showed any significant preference for one stimulus over the other, for boys. For girls, 12-month-olds looked longer at the rounded triangle compared to the triangle (t = 2.279, df = 11, p = .044) Twenty-four-month-old girls looked significantly longer at the circles than the squares (t = -2.666, df = 16, p = .017). Girls did not differ in their looking times for the other pairings when examined at each of the ages.

Summary of results for pairings comparing angular shapes to rounded shapes

- The MANOVA found no main effect of sex and no main effect of age for the three stimuli pairings that compared angular shapes to rounded shapes. No significant interaction between sex and age was observed.

- The one-sample *t*-tests revealed that:
  - Infants irrespective of sex and age looked significantly longer at the rounded triangle than at the triangle, and significantly longer at the circles than the squares.
  - Boys aged 12-24 months also showed the same pattern, that is they looked longer at the rounded triangle (when shown with a triangle), and longer at the circles (when shown with the squares).

- Girls aged 12-24 months also looked significantly longer at the rounded triangle (when shown with a triangle), and longer at the circles (when shown with the squares).
- When boys were looked at separately at each of the age groups, only two significant preferences emerged. Twelve-month-old boys looked significantly longer at the rounded triangle than the triangle, and 18-month-old boys looked significantly longer at the circles than the squares.
- When girls were tested separately for each of the age groups, 12-month-olds girls looked significantly longer at the rounded triangle than the triangle. Girls looked significantly longer at the circles than the squares.

3.b.a. Do boys and girls differ in their preference for an angular shape or a rounded shape, if the shapes are coloured in sex-typed colours (pink or blue)?

Two stimuli pairings consisting of blue squares versus pink circles, and pink squares versus blue circles were shown to infants in order to determine whether their preference for angular or rounded shapes would differ if the shapes were coloured in sex-typed colours. The mean percentage looking times for the blue squares/pink circles pairing and the pink squares/blue circles pairing can be seen in Fig. 15.

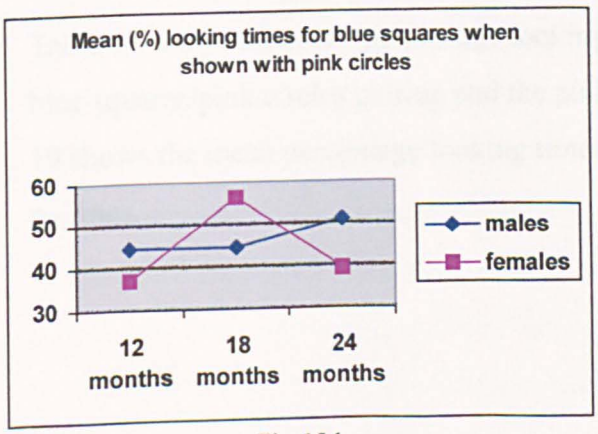

Fig. 15.1

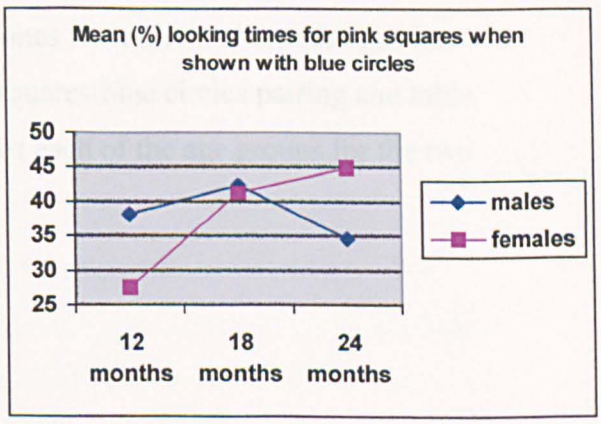

Fig. 15.2

Fig. 15. Graphs to show the mean percentage looking time for males and females at each age group for the blue squares/pink circles pairing and the pink squares/blue circles pairing.

MANOVA

A 2x2x3 MANOVA was conducted with the blue squares/pink circles pairing and the pink squares/blue circles pairing entered as within subject factors, and sex (males and females) and age (12, 18 and 24 months) entered as between subject factors. No main effect of sex was found (F (2,81) = .201, p = .819). However, there was a significant main effect of age (F (4,164, = 2.427, p = .05), and a significant interaction between child sex and age (F (4,164) = 3.169, p = .015).

Univariate tests (using a Bonferroni adjusted alpha level of .025) were used to follow up the significant main effect of age. Neither of the two stimuli pairings reached statistical significance. Univariate tests also failed to find a significant sex by age interaction for either of the two stimuli pairings (pink square/blue circle: F(2,82) = 2.769, p = .069, blue square/pink circle: F(2,82) = 3.623, p = .031).

However, it is important to note that if the alpha level had not been set to the more stringent value of .025, and the conventional value of .5 was used, then the univariate tests would show a significant interaction between sex and age for the blue squares/pink circles pairing and the pink squares/blue circles pairing would approach significance.

Table 18 shows the mean percentage looking times for males and females for the blue squares/pink circles pairing and the pink squares/blue circles pairing and table 19 shows the mean percentage looking times for each of the age groups for the two pairings.

Pairing	Mean percentage of time spent looking at stimuli (SD)				*F*	*p*
	n=43		n=45			
	Males	SD	Females	SD		
Blue squares	46.05	20.05	45.04	17.04	.393	.533
Pink circles	53.95		54.96			
Pink squares	38.69	17.92	39.11	15.88	.006	.940
Blue circles	61.31		60.89			

Table 18. Sample size, Means, SD, univariate *F* value and *p* value for males and females for the blue squares/pink circles pairing and pink squares/blue circles pairing.

Pairing	Mean percentage of time spent looking at stimuli (SD)						*F*	*p*
	n=29		n=32		n=27			
	12	SD	18	SD	24	SD		
Blue squares	41.30	22.36	50.70	14.66	43.96	17.08	2.223	.115
Pink circles	58.70		49.30		56.04			
Pink squares	33.69	19.24	42.11	15.31	40.71	14.87	2.586	.081
Blue circles	66.31		57.89		59.29			

Table 19. Sample size, Means, SD, univariate *F* value and *p* value for 12, 18 and 24 month olds for the blue squares/pink circles pairing and pink squares/blue circles pairing.

One-sample t-tests

One-sample *t*-tests were conducted to determine whether infants looked at one stimulus longer than the other stimulus during the blue square/pink circles pairing, and the pink square/blue circles pairing.

Firstly, one-sample *t*-tests were carried out to see if infants collapsed across sex and age showed a preference for one stimulus over the other during the two pairings. Infants showed a preference for the pink circles when shown with the blue squares ($t = -2.268$, df = 87, $p = .026$), and for the blue circles when shown with the pink squares ($t = -6.190$, df = 87, $p<.001$).

Secondly, one-sample t-tests were conducted separately for males and females. Boys aged 12-24 months were found to look longer at the blue circles compared to the pink squares ($t = -4.138$, df = 42, $p = <.001$) but showed no preference during the

blue squares/pink circles pairing. Girls aged 12-24 months showed the same pattern, that is, they looked longer at the blue circles compared to the pink squares (t = -4.599 df = 44, p = <.001) but showed no preference during the blue squares/pink circles pairing.

Thirdly, one-sample t-tests were carried out separately for males and females at each of the age groups. Boys looked significantly longer at the blue circles when shown with the pink squares at 12 months (t = -2.373, df = 17, p = .03) and 24 months (t = -4.16, df = 12, p = .001). No other significant differences were found for boys when looked at separately at each of the age groups.

For girls, it was found that 12 month olds looked significantly longer at the blue circles when shown with the pink squares (t = -6.925, df = 11, p <.001). Eighteen-month-old and 24-month-old girls did not show a preference for either of these two stimuli. For the blue square/pink circle pairing it was found that 12 and 18 month olds looked significantly longer at the pink circles than the blue squares (12 months: t = -2.559, df = 11, p = .027; 18 months: t = -3.042, df = 15, p = .008).

Summary of results for pairings comparing angular shape (squares) to rounded shapes (circles) coloured in sex-typed colours

- The MANOVA found a significant main effect of age and a significant interaction of sex and age. Univariate tests however failed to find any significant differences between the different age groups for the stimuli pairings when analysed separately. Furthermore, univariate tests also failed to find a significant interaction between sex and age for the stimuli pairings when analysed separately.

- The one-sample t-tests found that:
    - Infants irrespective of sex and age looked at the circles longer than the squares during the pink squares/blue circles pairing and the blue squares/pink circles pairing.

- Boys aged 12-24 months and girls aged 12-24 months looked longer at the blue circles compared to the pink squares, but showed no preference during the blue squares/pink circles pairing.
- When boys were analysed separately at each of the age groups, boys aged 12 months and 24 months looked significantly longer at the blue circles compared to the pink squares. No other preferences were found for boys when analysed separately at each of the age groups.
- When girls were analysed separately at each of the age groups, 12-month-olds looked significantly longer at the blue circles compared to the pink squares, and significantly longer at the pink circles compared to the blue squares. Twenty-four month old girls looked significantly longer at the pink circles than the blue squares. There were no other significant preferences for girls when they were analysed separately at each of the age groups.

3.b.b. Do the same patterns emerge if pink and blue are controlled for their differing brightness levels?

As pink and blue are made up of different brightness levels, four further pairs were examined during the shape stimuli preferential looking task. These stimuli consisted of the circles paired against the squares, but the sex-typed colours used were paired against the other sex-typed colour of the same brightness. Thus, pink was paired with pale blue, and blue was paired with red. This gave rise to the following four pairings: pale blue squares/pink circles, pink squares/pale blue circles, blue squares/red circles and red squares/blue circles.

The mean proportion of time spent looking at each of the four pairings for males and females at each of the age groups can be seen in Fig. 16.

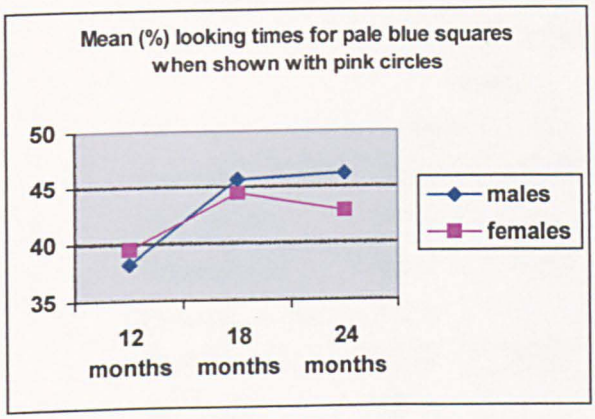

Fig. 16.1

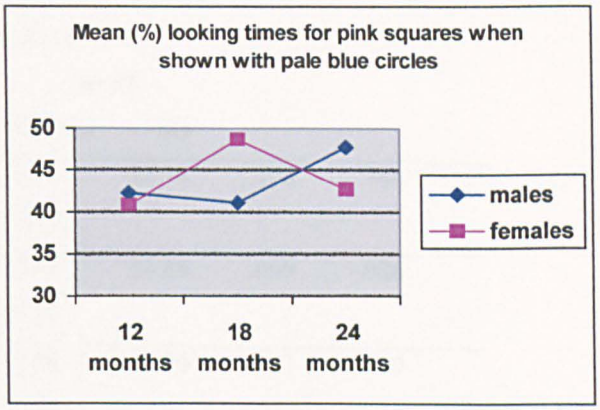

Fig. 16.2

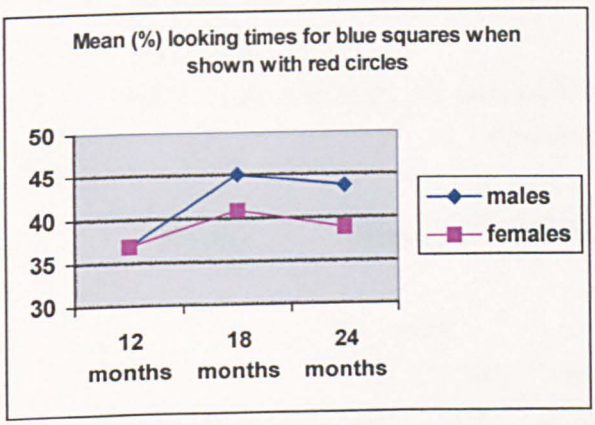

Fig. 16.3

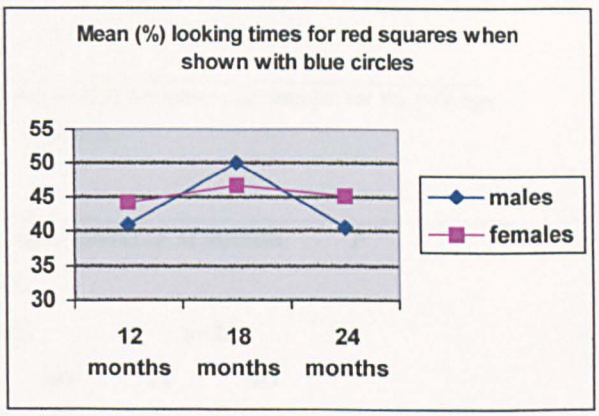

Fig. 16.4

Fig. 16. Graphs to show the mean percentage looking time for males and females at each age group for the pairings controlling for brightness

MANOVA

A 4x2x3 MANOVA was conducted with each of the pairings entered as within subject factors, and sex (male and female) and age (12, 18 and 24 months) entered as between subject factors. There was no main effect of sex ($F(4,78) = .292$, $p = .882$), no main effect of age ($F(8,158) = .981$, $p = .453$), and no interaction between sex and age ($F(8,158) = .584$, $p = .790$).

Table 20 shows the mean percentage looking times for males and females for the pairings controlling for brightness, and table 21 shows the mean percentage looking times for each of the age groups for these pairings.

Pairing	Mean percentage of time spent looking at stimuli (SD)				*F*	*p*
	n=42		n=45			
	Males	SD	Females	SD		
Pale blue squares	42.80	16.45	42.51	16.14	.106	.746
Pink circles	57.20		57.49			
Pink squares	43.14	16.52	44.41	13.89	.009	.926
Pale blue circles	56.86		55.59			
Blue squares	41.46	15.51	39.08	13.26	.927	.339
Red circles	58.54		60.91			
Red squares	44.07	21.41	45.39	14.11	.132	.717
Blue circles						

Table 20. Sample size, Means, SD, univariate *F* value and *p* value for males and females for the pairings controlling for brightness

Pairing	Mean percentage of time spent looking at stimuli (SD)						*F*	*p*
	n=29		n=32		n=26			
	12	Sd	18	SD	24	SD		
Pale blue squares	38.72	16.71	45.02	15.99	44.11	15.65	1.262	.289
Pink circles	61.28		54.98		55.89			
Pink squares	41.57	16.07	45.15	13.28	44.62	16.49	.526	.593
Pale blue circles	58.43		54.85		55.38			
Blue squares	36.96	13.87	42.81	15.30	40.71	13.50	1.339	.268
Red circles	63.04		57.19		59.29			
Red squares	42.23	20.17	48.20	19.09	43.33	13.11	.966	.385
Blue circles	57.77		51.80		56.67			

Table 21. Sample size, Means, SD, univariate *F* value and *p* value for 12, 18 and 24 month olds for the pairings controlling for brightness

One-sample t-tests

One-sample *t*-tests were conducted to determine whether infants looked longer at one stimulus compared to the other stimulus during the pairings that controlled for the different brightness levels of pink and blue.

Firstly, one-sample *t*-tests were carried out on infants collapsed across sex and age. Infants looked significantly longer at the circles compared to the squares irrespective of their colour (pale blue squares/pink circles: $t = -4.234$, df = 86, $p < .001$; pink

squares/pale blue circles: $t = 3.821$, df = 86, $p < .001$; blue squares/red circles: $t = 6.345$, df = 86, $p = < .001$; red squares/blue circles: $t = 2.731$, df = 86, $p < .008$).

Secondly, males and females were looked at separately. Boys aged 12-24 months looked significantly longer at the circles compared to the squares for three of the pairings (pale blue square/pink circle: $t = -2.838$, df = 41, $p = .007$; pink squares/pale blue circles: $t = 2.690$, df = 41, $p = .010$; blue square/red circle: $t = 3.567$, df = 41, $p < .001$. There was no difference for boys in their looking times at the red square and blue circle. For girls aged 12-24 months all four pairings were significant, showing that girls looked significantly longer at the circles than the squares irrespective of colour (pale blue squares/pink circles: $t = -3.113$, df = 44, $p = .003$; pink squares/pale blue circles: $t = 2.701$, df = 44, $p = .01$; blue squares/red circles: $t = 5.520$, df = 44, $p < .001$); red squares/blue circles: $t = 2.189$, df = 44, $p = .034$).

Thirdly, one-sample *t*-tests examined whether boys and girls looked significantly longer at one stimulus than another stimulus within a pair, at each of the age groups. For boys it was found that 12-month-olds looked significantly longer at the red circles than the blue squares ($t = 3.260$, df = 16, $p = .005$) and significantly longer at the pink circles than the pale blue squares ($t = -2.674$, df = 16, $p = .017$). At 18 months boys looked significantly longer at the pale blue circles than the pink squares ($t = 2.438$, df = 14, $p = .029$). Twenty-four-month-old boys looked longer at the blue circles than the red squares ($t = 3.334$, df = 9, $p = .009$).

Girls aged 12 months looked significantly more at the pink circles then the pale blue squares ($t = -2.422$, df = 11, $p = .034$), significantly more at the pale blue circles then the pink squares ($t = 3.755$, df = 11, $p = .003$), and significantly more at the red circles than the blue squares ($t = 4.633$, df = 11, $p = .001$). Eighteen-month-old girls looked significantly more at the red circles than the blue squares ($t = 2.664$, df = 16, $p = .017$), and 24 month old girls looked significantly more at the red circles than the blue squares ($t = 2.980$, df = 15, $p = .009$).

Summary of results for shape stimuli pairings controlling for brightness levels

- The MANOVA did not find a main effect of sex or of age. There was no interaction between sex and age.

- The one-sample *t*-tests found that:
    - Infants irrespective of sex and age looked significantly longer at the circles during all four of the stimuli pairings.
    - Boys aged 12-24 months looked significantly longer at the circles during the pale blue square/pink circle, pink squares/pale blue circles and the blue square/red circle. They showed no preference between the red squares and blue circles.
    - Girls aged 12-24 months looked longer at the circles compared to the squares during all four stimuli pairings.
    - When boys were looked at separately at each of the age groups 12-month-old boys looked significantly longer at the pink circles and red circles compared to the blue squares of equal brightness. Eighteen-month-old boys looked significantly longer at the pale blue circles compared to the pink squares, and 24-month-old boys looked significantly longer at the blue circles compared to the red squares.
    - When girls were looked at separately at each of the age groups, 12 – month-olds looked at the circles more than the squares for three of the pairings (pink circles/pale blue squares, pale blue circles/ pink squares and red circles/blue squares. Girls at 18 months and 24 months looked significantly longer at the red circles compared to the blue squares.

RESULTS: PARENTAL INTERVIEW

This chapter looks at the results of the data collected using interviews from the parent. Data were collected in three areas. The first section called 'environmental colour inventory', includes data obtained from parents about the colour of their infant's bedroom, bedroom curtains, bedcovers, and the colour of the room their infant played in the most. They were also asked to list the colour of the clothes they dressed their child in and the colour of their infant's clothes on the day of their visit to the laboratory was also noted. The second section called 'toy inventory', includes data obtained from parents about the type and colour of the three toys their infant played with the most. The third section called 'opposite sex-typed toys', includes data obtained from parents about the play and availability of opposite sex-typed toys.

Data preparation for environmental colour inventory

Parents had been asked to list the colour of their child's bedroom, bedroom curtains, bedcovers, and the colour of the room their child spent most of their time in. The predominant colour was the one that was recorded. These colours were categorised into the following categories: pink; blue; pale colours; bold colours and neutral colours. The Pale colour category consisted of the following colours: Pale Blue, Yellow, Lilac, Peach and Pale Green. The Bold colour category consisted of Red, Green, Purple, and Orange. Neutral colour category consisted of White, Black, Brown (including Beige), Grey and Cream.

Parents were also asked to list the colour of the clothes they dress their child in, and the experimenter noted the colour of the infant's clothes on the day of their visit to the laboratory. These data were also categorised into the 5 colour categories. However, because infants were often dressed in more than one colour, and all the colours were noted, infants could be placed in more than one colour category.

Data Preparation for toy inventory

Parents had been asked to list the three toys their child played with most. At the time of data collection, the type of toy and description were noted. These were later classified into the categories used by Pomerleau et al. (1990). In Pomerleau et al.'s (1990) study, toys were recorded and grouped into 19 categories. In the present study, the same categories were used but three were removed as no toys mentioned by parents fit into these categories. The categories removed were 'gardening and beach toys', 'rattles' and 'tools'. The following categories were used in this study: 'Activity Centres', 'Animals', 'Balls and Balloons', 'Books', 'Construction Toys', 'Dolls', 'Educational/art Toys', 'Fictional Characters', 'Childs' Furniture', 'Kitchen Appliances and Utensils', 'Miniature Figures and Puppets', 'Musical and Talking Toys', 'Other Toys for Manipulation', 'Sports Equipment', 'Large Vehicles' and 'Small Vehicles'.

As in Pomerleau et al.'s (1990) study, the category of 'other toys for manipulation' was split into two further categories: 'Symbolic toys' and 'Other toys'. 'Symbolic toys' included toys that "allowed children to imitate adults' activities" (Pomerleau et al., 1990, p 364). Examples of these from the current study included pushchairs, telephones and dollhouses. 'Other toys' included objects such as beads and puzzles. These two categories will be referred to as 'Manipulation-Symbolic toys', and 'Manipulation- Other toys'. The final list of toys therefore consisted of 17 categories. Examples of toys in each category are displayed in the table below.

Toy Category	Toys mentioned by parents
Activity Centres	Activity Centres, Musical Activity Centres
Animals	Stuffed animals, Animal figurines
Balls and Balloons	Balls
Books	Books
Construction Toys	Stacking cups/rings, Building Blocks /Bricks
Dolls	Dolls
Educational/Art Toys	Colour pencils, Etch-a-sketch
Fictional Characters	Teletubby characters, Fimbles characters
Childs Furniture	Chair
Kitchen Appliances and Utensils	Tea-sets, Toy kitchens
Miniature figures and Puppets	Finger puppets
Musical and talking toys	Radio, Xylophone, Piano
Manipulation-Symbolic Toys	Farmyard, Doll House, Pram, Telephone
Manipulation-Other toys	Beads, Shape Sorter, Puzzles
Sports equipment	Snorkel
Large vehicles	Tricycle, Bicycle
Small vehicles	Car, Truck, Motorbike

Table 22. Toy categories used for toy inventory

In addition to the type of toy that infants played with, parents were also asked to name the colour of the toy. Only the predominant colour of the toy was noted. The colours were categorised into the following categories: Pink; Blue; Pale Colours; Bold Colours and Neutral Colours.

Results

Environmental Colour Inventory

The colour of infants' surroundings that included the child's bedroom, bedroom curtains, bedcovers, and playroom (the colour of the room the child spent most of their time in) were classified into 5 separate colour categories (pink; blue; pale colours; bold colours and other colours). For example, if a parent said their child had blue bed covers then a 1 was given to that child in the blue category. Results are presented for each of the separate infants surroundings. Tables have been provided to show the number of infants who had each of the five colours in their surroundings. As the number of infants who had surroundings in some of the colour categories was

small, it was not possible to run chi-square analyses on the data. This was because in order for the assumptions of chi-square to be met, expected cell counts had to be greater than 5. For this reason, the colour categories were collapsed to produce three colour categories of pale colours, bold colours and neutral colours, and chi-square analyses have been conducted on these new colour categories where appropriate. For interest, the tables displaying the frequency of subjects with environments in each of these new colour categories also show the number of subjects with pink and blue.

Child's bedroom

Table 23 shows the number of males and females reported to have pale coloured, bold coloured and neutral bedrooms.

Colour of bedroom		**Males**		**Females**		χ^2	*p*
		n	**%**	**n**	**%**		
Pale Colours	YES	19	15.8	23	19.2	.586	.444
(of which pink)		(0)	(0)	(4)	(3.3)		
	NO	41	34.2	37	30.8		
Bold Colours	YES	21	17.5	12	10	3.386	.066
(of which blue)		(9)	(7.5)	(3)	(2.5)		
	NO	39	32.5	48	40		
Neutral colours	YES	19	15.8	25	20.8	1.292	.256
	NO	41	34.2	35	29.2		

Table 23. Number and % of males and females reported to have pale coloured, bold coloured and neutral coloured bedrooms and chi-square and *p* values.

Chi-square analyses were conducted to see if there was a difference between males and females for any of the three colour categories. No significant associations were found between infants sex and bedroom colour for pale colours (χ^2 (df = 1, N = 120) = .586, p =.444) and neutral colours (χ^2 (df = 1, N = 120) = 1.292, p =.256). The relationship between sex and bold colours approached significance (χ^2 (df = 1, N = 120) = 3.386, p =.066).

Bedroom curtains

Table 24 shows the number of males and females reported to have pale coloured, bold coloured and neutral bedroom curtains.

Colour of curtains		Males		Females		χ^2	*p*
		n	%	n	%		
Pale Colours	YES	25	20.8	32	26.7	1.637	.201
(of which pink)		(1)	(.83)	(6)	(5)		
	NO	35	29.2	28	23.3		
Bold Colours	YES	37	30.8	33	27.5	.589	.459
(of which blue)		(17)	(14.2)	(17)	(14.2)		
	NO	23	19.2	27	22.5		
Neutral colours	YES	30	25	30	25	.000	1.0
	NO	30	25	30	25		

Table 24. Number and % of males and females reported to have pale coloured, bold coloured and neutral coloured bedroom curtains and chi-square and *p* values.

Chi-square analyses were conducted to assess if males and females differed in the colour of their bedroom curtains. No significant associations were found between infant sex and colour of infants bedroom curtains for Pale Colours (χ^2 (df = 1, N = 120) = 1.637, p =.201), Bold Colours (χ^2 (df = 1, N = 120) = .589, p =.459) and Neutral Colours (χ^2 (df = 1, N = 120) = .000, p =1.0).

Bedcovers

Table 25 shows the number of males and females reported to have pale coloured, bold coloured and neutral bedcovers.

Colour of bedcovers		Males		Females		χ^2	*p*
		n	%	n	%		
Pale Colours	YES	17	14.2	22	18.3	.950	.330
(of which pink)		(0)	(0)	(8)	(6.7)		
	NO	43	35.8	38	31.7		
Bold Colours	YES	14	11.6	20	16.7	1.477	.224
(of which blue)		(9)	(7.5)	(10)	(8.3)		
	NO	46	38.3	40	33.3		
Neutral colours	YES	27	22.5	18	15	2.880	.09
	NO	38	31.7	35	29.2		

Table 25. Number and % of males and females reported to have pale coloured, bold coloured and neutral coloured bedcovers and chi-square and *p* values.

Chi-square analyses were conducted to assess if males and females differed in the colour of their bedcovers. No significant associations were found between infant sex and colour of infants bedcovers for Pale Colours (χ^2 (df = 1, N = 120) = .950, *p* =.330) and Bold Colours (χ^2 (df = 1, N = 120) = 1.477, *p* =.224). The relationship between sex and Neutral Colours approached significance (χ^2 (df = 1, N = 120) = 2.880, *p* =.09).

Play room

Table 26 shows the number of males and females reported to have pale coloured, bold coloured and neutral coloured playrooms.

Colour of playroom		Males		Females		χ^2	*p*
		n	%	n	%		
Pale Colours	YES	8	6.7	22	18.3	8.711	.003
(of which pink)		(2)	(1.7)	(6)	(5)		
	NO	52	43.3	38	31.7		
Bold Colours	YES	13	25.8	6	5	3.064	.080
(of which blue)		(2)	(1.6)	(3)	(2.5)		
	NO	47	39.2	54	45		
Neutral colours	YES	34	28.3	32	26.7	.135	.714
	NO	26	21.7	28	23.3		

Table 26. Number and % of males and females reported to have pale coloured, bold coloured and neutral coloured playroom and chi-square and *p* values.

Chi-square analyses were conducted to assess if males and females differed in the colour of their playroom. There was a significant association between sex and colour of playroom for pale colours (χ^2 (df = 1, N = 120) = 8.711, p =.003) with more females than males being reported to have pale coloured rooms that they spent most of their time playing in. The association between sex and Bold Coloured playroom approached significance (χ^2 (df = 1, N = 120) = 3.064, p =.08). No association was found between sex and Neutral Coloured playroom (χ^2 (df = 1, N = 120) = .135, p =.714).

Clothes inventory

Data relating to the infants' clothing colour were obtained in two ways. Firstly, parents were asked to name the colours they dressed their child in. Parents mentioned up to 4 colours and these colours were later categorised into the 5 colour categories of pink, blue, pale colours, bold colours and neutral colours. Chi-square analyses were conducted to examine differences between the number of boys and girls that were dressed in clothes of each of the colour categories. Secondly, the experimenter noted the colour of the clothes the infants wore on the day of their visit to the laboratory. These colours were later classified into the five colour categories. Chi-square analyses were conducted to examine any differences between boys and girls.

Colour of clothes reported by parents

Table 27 shows the number of males and females who were reported to be dressed in each of the five colour categories.

		Males		Females		χ^2	*p*	*d*
		n	%	n	%			
Pink	Yes	1	.83	44	36.7	65.742	<.001	.759
	No	59	49.2	16	13.3			
Blue	Yes	56	46.7	31	25.8	26.123	<.001	.614
	No	4	3.3	29	24.2			
Pale colours	Yes	9	7.5	12	10	.519	.471	.652
	No	51	42.5	48	40			
Bold	Yes	45	37.5	34	28.3	4.483	.034	.366
Colours	No	15	12.5	26	21.7			
Neutral	Yes	21	17.5	15	12.5	1.429	.232	.412
Colours	No	39	32.5	45	37.5			

Table 27. Number and % of males and females reported to be dressed in pink, blue, pale, bold and neutral colours and chi-square and *p* values.

As Table 27 shows, a significant difference was found between the number of boys and girls that were reported to be dressed in pink. Girls were significantly more likely to be reported to be dressed in pink compared to boys (χ^2 (df = 1, N = 120) = 65.742, p >.001). Boys were more likely to be reported to be dressed in blue (χ^2 (df = 1, N = 120) = 26.123, p >.001) and bold colours (χ^2 (df = 1, N = 120) = 4.483, p =.034) compared to girls. There was no significant difference between the number of boys and girls reported to be dressed in pale colours and neutral colours.

Colour of clothes worn to the laboratory

Table 28 shows the number of males and females who wore clothes belonging to each of the five colour categories on their visit to the laboratory.

		Males		Females		χ^2	p	d
		n	%	n	%			
Pink	Yes	0	0	37	30.8	53.494	<.001	.726
	No	60	50	23	19.2			
Blue	Yes	42	35	24	20	10.909	.001	.316
	No	18	15	36	30			
Pale colours	Yes	4	3.3	13	10.8	5.551	.018	.733
	No	56	46.7	47	39.2			
Bold	Yes	30	25	19	15.8	4.174	.041	.260
Colours	No	30	25	41	34.2			
Neutral	Yes	22	18.3	17	14.2	.950	.330	.129
Colours	No	38	31.7	43	35.8			

Table 28. Number and % of males and females dressed in pink, blue, pale, bold colours and neutral colours on visit to laboratory and chi-square and p values.

As Table 28 shows, more girls wore pink (χ^2 (df = 1, N = 120) = 53.494, p <.001) and pale colours (χ^2 (df = 1, N = 120) = 5.551, p =.018) to the laboratory compared to boys, and more boys wore blue (χ^2 (df = 1, N = 120) = 10.909, p =.001) and bold colours (χ^2 (df = 1, N = 120) = 4.4174, p =.041) to the laboratory compared to girls. There were no differences found between the number of boys and girls who wore neutral colours to the laboratory.

Toy Inventory

The number of toys a parent mentioned within each category was recorded. Thus, if a child was reported to play with a digger, a truck and a ball, then a score of 2 was given to that child in the 'small vehicles' category, and a 1 was placed in the 'balls and balloons' category. The maximum number that could be placed in each category was therefore three (as each parent was asked to name three toys their child played with the most). As parents were not asked to mentioned toys in any particular order, each toy was treated equally, i.e. not in any order of importance. Some parents, however, failed to mention three toys, and in order to take account of the different number of toys mentioned, the scores for the number of toys in each category were converted into proportion scores measured in percentages. This eliminated any problems resulting from some parents mentioning fewer toys than others.

In order to assess any difference between males and females and between each age group, as well as any relationship between sex and age group, a MANOVA was conducted with all of the toy categories entered as within subject factors, and sex (males and females) and age (12, 18, 24 months), entered as between subject factors.

A significant main effect of sex (Pillai's trace: $F(16,96) = 6.137, p < .001$) was found as well as a significant main effect of age group (Pillai's trace: $F(32,194) = 2.161, p = .001$). A significant interaction between sex and age group was also found (Pillai's trace: $F(32,194) = 1.583, p = .032$).

The main effect found for sex was followed up with univariate tests. The Univariate tests (using a Bonferroni adjusted alpha level of .002) revealed males and females differed significantly in their play with dolls ($F(1,111) = 34.890, p < .001$) and small vehicles ($F(1,111) = 37.321, p < .001$). The means for males and females for doll and small vehicles can be seen in Table 29.

Toy category	Mean proportion of toys (%) infants reported to play with (SD)				*F*	*p*	*d*
	n = 58		n = 59				
	Males	SD	Females	SD			
Dolls	1.15	6.14	15.8	19.9	34.89	.000	.99
Small Vehicles	34.12	28.17	9.6	15.23	37.32	.000	1.08

Table 29. Mean, SD, univariate *F* value and *p* value for dolls and small vehicles.

Table 29 shows that girls were reported to play significantly more with dolls compared to boys. Boys were reported to play significantly more with small vehicles compared to girls. It is important to note that had the *p* value not been set to the stringent level of .002 and the conventional *p* value of .05 was used then the MANOVA would also have found girls to play with more fictional characters ($F(1,111) = 5.876, p = .017$) and manipulation-symbolic toys ($F(1,111) = 6.701, p = .011$) compared to boys.

The significant main effect found for age was followed up with univariate tests. Using a bonferroni adjusted alpha level of .002, only one of the toy categories, that of dolls, showed a statistically significant difference between age groups ($F(1,111) =$

9.794, p<.001). It is important to note that had the conventional p value of .05 been used then the age difference for vehicles would also have reached statistical significance ($F(2,111) = 3.088, p = .05$). For illustrative proposes, the means for vehicles are shown in table 30 along with the means for dolls, but the results for vehicles have not been discussed further.

Toy Category	Mean proportion of toys (%) infants reported to play with (SD)						*F*	*p*
	n = 39		n = 39		n = 39			
	12	SD	18	SD	24	SD		
Dolls	.85	5.34	11.11	15.92	13.67	21.24	9.794	.000
Vehicles	15.38	22.42	23.08	27.74	26.92	25.82	3.088	.050

Table 30. Mean SD, univariate *F* value and *p* value for age group differences found for dolls.

Post hoc analysis (Bonferroni) showed that 12-month-olds were reported to play with dolls significantly less than 18-month-olds ($p = .003$) and significantly less than 24 month olds ($p < .001$).

The significant interaction observed by the MANOVA was followed up using univariate tests. It was found that using a Bonferroni adjusted alpha level of .002, only the toy category of doll showed a significant interaction between sex and age ($F(2,111) = 7.078, p = .001$). The sex by age interaction for vehicles failed to reach statistical significance ($F(2,111) = 2.160, p = .120$). Fig. 17 shows the means for each sex at each age group for dolls.

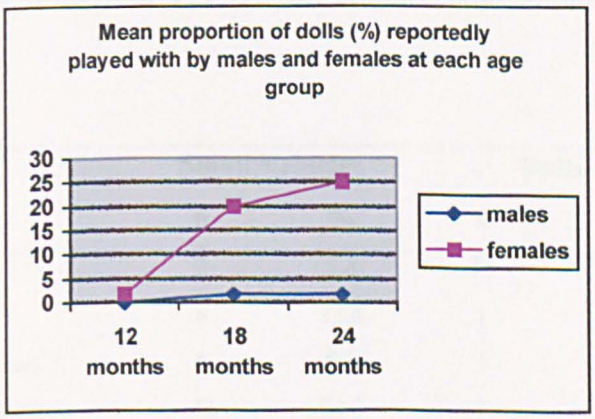

Fig. 17 Graph to show Mean proportion of dolls reportedly played with by males and females at each age group

A series of independent *t*-tests were conducted to analyse the interaction effect that was observed for the proportion of dolls infants were reported to play with. Firstly, a series of t-tests were conducted to assess whether males and females differed significantly in their reported play with dolls at each of the age groups. There was no difference in the number of dolls males and females reportedly played with at 12 month of age (t = -1.00, df = 18, p = .330). However, significant differences were found between males and females at 18 months and 24 months, with more girls reportedly playing with dolls compared to boys at each of these ages (12 months: t = -4.411, df = 26.8, p <.001; 18 months: t = -4.136, df = 23, p <.001).

T-tests also revealed that males did not differ in their play with dolls at each of the age groups. Females, however, reportedly played with significantly more dolls at 18 months (t = -4.411, df = 26.8, p <.001) and 24 months (t = -4.136, df = 23, p <.001) compared to 12 months of age. Females were not found to differ significantly in their play with dolls between 18 months and 24 months of age (t = -.767, df = 34, p = .449).

Toy Colour

As significant sex differences were found for the doll and small vehicles categories, and because these two categories had the largest sample sizes, only the toy colour of these two toys was looked at. Table 31 shows the colours of the dolls and small vehicles with which infants were reported to play with. The colours were categorised into the 5 colour categories of pink, blue, pale colours, bold colours and neutral colours.

Colour	Small Vehicles		Dolls	
	n	%	n	%
Pink	2	3.4	15	57.7
Blue	8	13.8	1	3.8
Pale Colours	5	8.6	1	3.8
Bold Colours	43	74.1	1	3.8
Neutral Colours	0	0	8	30.8

Table 31. Colour of vehicles and dolls infants reported to play with

Chi-square analyses could not be conducted on the data because of small cell counts. Expected cell counts need to be greater than 5 for the assumption of chi-square to be met (Field, 2000). As the data for the colours of toys had smaller expected cell counts, chi-square could not be performed. However, as the table shows, the majority (74.1%) of the vehicles that infants were reported to play with were bold colours in comparison to the majority (57.7%) of the dolls that infants were reported to play with, which were pink.

Opposite sex-typed toys

Parents were asked whether their child had access to opposite sex-typed toys at home and if so whether or not their child played with them. Chi-square analyses were conducted to analyse these data. A significant association was found between sex and availability of opposite sex-typed toys ($\chi^2 = 14.070, p < .001$). Fifty-eight girls (97%) from a total of 60 were reported to have opposite sex-typed toys available to them compared to 43 (72%) boys. With regards to play with opposite sex-typed toys, it was found that 34 (79%) boys and 52 (90%) girls played with opposite sex-typed toys if they had them available to them. A Chi-square analysis was not found to be significant ($\chi^2 = 2.188, p = .116$).

RESULTS: RELATIONSHIP BETWEEN PREFERENTIAL LOOKING TASK AND PARENTAL INTERVIEW

Two main research questions were addressed. Firstly, does exposure to certain colours in a child's environment relate to preferences for certain colours on the preferential looking task? And secondly, is reported play with vehicles and dolls related to looking times at the car and doll on the preferential looking task?

4.a. Does exposure to pink and blue in a child's environment relate to preferences for pink and blue on the preferential looking task?

Infants were categorised into two groups for each colour of pink and blue. For example, for pink bedcovers, infants were categorised into those that did have pink bedcovers and those that did not, for blue bedcovers infants were categorised into those that did have blue bedcovers and those that did not. Due to the small sample sizes of infants who had the colours pink and blue in their environment, statistical tests could not be carried out to explore differences. However, the data are reported in cases and means. The average looking time at pink and at blue were calculated by adding together the looking times at pink during the colour stimuli looking task, and dividing this by the number of times pink was shown. Thus, the average looking time for pink was calculated using the mean of the pink/blue and pink/pale blue pairing, and the average looking time for blue was calculated using the mean of the pink/blue blue/red pairings.

Table 32 shows the mean (%) looking time at pink and blue for male and female infants who had a pink environment (bedroom, bedroom curtains, bedcovers, playroom), who did not have a pink environment, who had a blue environment and who did not have a blue environment.

	Mean percentage of time spent looking at Pink											
	Males						Females					
	Pink Environment			No Pink Environment			Pink Environment			No Pink Environment		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Bedroom	-	-	0	51.85	12.78	57	47.05	4.52	3	49.48	9.84	54
Curtains	54.49	-	1	51.80	12.89	56	45.86	8.95	5	49.69	9.70	52
Bedcovers	-	-	0	51.85	12.78	57	50.51	11.64	7	49.19	9.44	50
Playroom	51.01	9.24	2	51.88	12.96	55	47.96	8.69	6	49.52	9.79	51

	Mean percentage of time spent looking at Blue											
	Males						Females					
	Blue Environment			No Blue Environment			Blue Environment			No Blue Environment		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Bedroom	52.74	6.67	9	46.94	10.38	48	47.36	5.73	3	48.11	11.82	54
Curtains	50.51	9.47	17	46.74	10.21	40	45.12	11.59	17	49.33	11.46	40
Bedcovers	47.71	9.37	8	47.88	10.26	49	48.15	8.87	9	48.06	12.11	48
Playroom	45.70	8.67	2	47.94	10.17	55	50.62	31.19	2	47.98	10.97	55

Table 32. Mean, SD and sample size for average looking time at pink and blue for infants who had a pink and blue environment.

As Table 32 shows, the number of infants who had a pink and blue environment was very small and therefore statistical analysis could not be conducted on the data. To overcome this the data were recoded.

Bold colours versus pale colours

The data were recoded to run a statistical analysis to examine the differences between infants who were surrounded with bold colours in their environment to infants who were surrounded with pale colours in their environment.

A series of separate MANOVA's were conducted with the average looking time at pink and the average looking time at blue entered as within subject factors, and the bold and pale colour categories for each aspect of the child's environment entered as between subject factors. None of these MANOVA's was found to be significant. When the MANOVA's were repeated for males and females separately no significant differences emerged.

Summary of results for relationship between pink and blue in child's environment and preference for pink and blue on the preferential looking task

- The colour of a child's environment was not found to relate to the preference for pink and blue on the preferential looking task.
- Sample sizes for infants who had pink and blue environments were very small, and therefore did not allow for statistical tests to be conducted.
- Data were re-categorised into bold and pale coloured environments in order for statistical tests to be conducted. The MANOVA's revealed no difference in the looking times at pink and blue between infants who had bold coloured environments and those who did not, and between those infants who had pale coloured environments and those who did not.

Does the clothes a child is dressed in relate to preferences for certain colours on the preferential looking task?

A series of analyses were conducted in order to determine the differences between infants who were dressed in pink and blue and infants who were not dressed in pink and blue, and their preference for these colours on the preferential looking task. Because data were obtained on both what the parents reported to dress their child in, and the colours their child was dressed in on the day of their visit to the laboratory, two analyses were conducted; one for the colours of clothes reported by parents, and one for the colours the child was dressed in to the laboratory.

Colour of clothes reported by parents

Two separate analyses were conducted, one for males and one for females. For females, a MANOVA was carried out with the average looking time at pink and blue entered as within subject factors, and infants who were 'reported to wear pink clothes', and infants who were 'reported to wear blue clothes' entered as between subject factors.

For females, no main effect of pink clothes (Pillai's trace: F (2,52) = .906, p =.410) or blue clothes (Pillai's trace: F(2,52) = .930 p = .401) was found. There was no significant interaction between the two within subject factors (Pillai's trace: F(2,52) = .765, p = .470). The means, SD and sample size for females are displayed in table 33.

	Mean percentage of time spent looking at pink and blue (SD)					
	Reported to wear pink					
Colour looked at	Yes			No		
	Mean	SD	n	Mean	SD	n
Pink	50.42	9.07	42	46.37	10.80	15
Blue	47.35	12.09	42	50.08	10.04	15
	Reported to wear blue					
	Yes			No		
	Mean	SD	n	Mean	SD	n
Pink	47.83	6.97	30	51.05	11.82	27
Blue	49.80	10.78	30	46.15	12.29	27

Table 33. Mean, SD and sample size for infants looking at pink and blue for females reported to wear pink and blue.

For males, only one male was reported to wear pink clothes by his parent. Thus wearing pink clothes was not entered into the analyses. Thus there was only one between subject factor (infants reported to wear blue clothes). Thus, for boys a MANOVA was conducted with the average looking times at pink and blue entered as within subject factors, and infants who were reported to wear blue clothes entered as a between subject factor.

For males, no main effect of blue clothes was found (Pillai's trace: F (2,52) = 1.050, p = .357), suggesting that there was no difference between boys who were reported to wear blue, and boys who were not reported to wear blue, in their looking times at blue and pink during the preferential looking task. The means, sd and sample size for males are displayed in table 34.

	Mean percentage of time spent looking					
	Reported to wear blue					
	Yes			No		
Colour looked at	Mean	SD	n	Mean	SD	n
Pink	51.35	12.26	54	60.85	21.61	3
Blue	47.88	10.00	54	47.54	13.62	3

Table 34. Mean, SD and sample size for infants looking at pink and blue for males reported to wear blue.

Colour of clothes worn to the laboratory

The analyses for clothes reported by parents were repeated for clothes worn to the laboratory. Thus, for females, a MANOVA was conducted with the average looking times at pink and blue entered as within subject factors and infants who wore pink clothes, and infants who wore blue clothes entered as between subject factors.

No main effect of pink clothes (Pillai's trace: $F(2,52) = .223$, $p = .801$) or blue clothes (Pillai's trace: $F(2,52) = 1.402$ $p = .225$) was found. There was no significant interaction between the two factors (Pillai's trace: $F(2,52) = 1.402$, $p = .255$). The means, SD and sample size for females are displayed in table 35.

	Mean percentage of time spent looking at pink and blue (SD)					
	Wore pink to laboratory					
	Yes			No		
Colour looked at	Mean	SD	n	Mean	SD	n
Pink	49.96	9.41	35	48.40	10.10	22
Blue	48.44	13.47	35	47.48	7.88	22
	Wore blue to laboratory					
	Yes			No		
	Mean	SD	n	Mean	SD	n
Pink	50.33	10.20	23	48.70	9.31	34
Blue	49.62	15.40	23	47.02	8.11	34

Table 35. Mean, SD and sample size for infants looking at pink and blue for females who wore pink and blue.

For males, none of the boys wore pink to the laboratory and therefore wearing pink clothes was not entered into the analyses. Thus, there was only one between subject

factor (infants who wore blue clothes). For boys, a MANOVA was conducted with the average looking times at pink and blue entered as within subject factors, and infants who wore blue clothes entered as a between subject factor.

For males, no main effect of blue clothes was found (Pillai's trace: $F(2,52) = 1.402$, $p = .225$), suggesting that there was no difference in looking times at blue and pink between boys who wore blue, and boys who did not wear blue to the laboratory. The means, sd and sample size for males are displayed in table 36.

	Mean percentage of time spent looking at pink and blue (SD)					
	Wore blue to laboratory					
Colour looked at	Yes			No		
	Mean	SD	n	Mean	SD	n
Pink	51.35	13.27	41	53.12	11.76	16
Blue	48.90	9.05	41	45.18	12.21	16

Table 36. Mean, SD and sample size for infants looking at pink and blue for males who wore blue.

Summary of results for relationship between clothing colour and preference for pink and blue on the preferential looking task

- The MANOVA conducted for females showed no difference in the looking times at pink or blue between girls who were reported to wear pink, and girls who were not reported to wear pink and girls who were reported to wear blue and girls who were not reported to wear blue.
- The MANOVA conducted for males showed no difference in the looking times at pink or blue between boys who were reported to wear blue and boys who were not reported to wear blue
- The MANOVA conducted for females showed no difference in the looking times at pink or blue between girls who wore pink to the laboratory, and girls who did not and girls who wore blue to the laboratory and girls who did not.
- The MANOVA conducted for males showed no difference in the looking times at pink or blue between boys who wore blue to the laboratory, and boys who did not.

Relationship between infants being dressed in pink and blue and their preference for pink and blue toys on the preferential looking task

Because the sample sizes for infants who wore pink and blue were larger than the sample sizes for infants who had a pink and blue environment, additional analyses could be conducted to examine the relationship between infants who were dressed in pink and blue and their preference on the preferential looking task when the stimuli were of a toy (car or doll) coloured in either pink or blue. Average scores were computed by adding together all the looking times at the pink toy stimuli and dividing this by the number of stimuli shown, and the same was done for the blue toy stimuli. Males and females were looked at separately. The first two MANOVA's looked at the colour of clothes reported by parents, and the second two MANOVA's looked at the colour of clothes infants wore on the visit to the laboratory.

Colour of clothes reported by parents

A MANOVA was conducted for females, with the two newly computed average looking times at a pink toy and blue toy entered as within subject factors and girls who were reported to wear pink clothes, and girls who were reported to wear blue clothes entered as between subject factors. There was no main effect of pink clothes ($F(2,49) = .157, p = .855$). A non-significant trend towards a main effect of blue clothes was found ($F(2,49) = 3.091, p = .054$). No interaction was found ($F(2,49) = 2.126, p = .130$). The means, SD and sample size can be seen in Table 37.

	Mean percentage of time spent looking at pink and blue (SD)					
	Reported to wear pink					
	Yes			No		
Looked at	Mean	SD	n	Mean	SD	n
Pink Toy	49.94	3.83	39	50.06	4.42	15
Blue Toy	49.66	4.05	39	49.40	3.97	15
	Reported to wear blue					
	Yes			No		
	Mean	SD	n	Mean	SD	n
Pink Toy	49.63	4.54	29	50.37	3.19	25
Blue Toy	50.63	4.38	29	48.37	3.17	25

Table 37. Mean, SD and sample size for females who were reported to wear pink and blue for average looking time at pink toy and blue toy

For Males, a MANOVA was conducted with pink toy and blue toy entered as within subject factors and boys who were reported to wear blue clothes entered as a between subject factor. There was no main effect of blue clothes found ($F(2,50) = 1.393$, $p = .258$). The means, SD and sample size can be seen in Table 38.

	Mean percentage of time spent looking at pink and blue (SD)					
	Reported to wear blue					
Looked at	Yes			No		
	Mean	SD	n	Mean	SD	n
Pink Toy	48.58	4.78	51	47.24	3.59	2
Blue Toy	51.03	4.51	51	48.42	2.47	2

Table 38. Mean, SD and sample size for males who were reported to wear blue for average looking time at pink toy and blue toy

Colour of clothes worn to the laboratory

A MANOVA was conducted for females, with the looking times at a pink toy and blue toy entered as within subject factors and girls who wore pink clothes to the laboratory, and girls who wore blue clothes entered as between subject factors. There was no main effect of pink clothes ($F(2,49) = .006$, $p = .944$) and no main effect of blue clothes ($F(2,49) = .289$, $p = .750$). No interaction was found ($F(2,49) = 1.215$, $p = .306$). The means, SD and sample size can be seen in Table 39.

	Mean percentage of time spent looking at pink and blue (SD)					
	Wore pink to laboratory					
Looked at	Yes			No		
	Mean	SD	n	Mean	SD	n
Pink Toy	50.11	3.93	33	49.75	4.10	21
Blue Toy	49.58	3.87	33	49.60	4.28	21
	Wore blue to laboratory					
	Yes			No		
	Mean	SD	n	Mean	SD	n
Pink Toy	50.10	3.79	21	49.89	4.12	33
Blue Toy	49.73	4.30	21	49.49	3.85	33

Table 39. Mean SD and sample size for infants who wore pink and blue for average looking time at pink toy and blue toy

For Males, a MANOVA was conducted with pink toy and blue toy entered as within subject factors and boys who were reported to wear blue clothes entered as a between subject factor. There was no main effect of blue clothes found ($F(2,50) = 1.724$, $p = .189$). The means, SD and sample size can be seen in Table 40.

	Mean percentage of time spent looking at pink and blue (sd)					
	Wore blue to laboratory					
Looked at	Yes			No		
	Mean	sd	n	Mean	sd	n
Pink Toy	48.21	5.07	38	49.35	3.75	15
Blue Toy	51.59	4.71	38	49.26	3.37	15

Table 40. Mean SD and sample size for males who wore blue for average looking time at pink toy and blue toy

Summary of relationship between clothing colour and toy colour on the preferential looking task

- The MANOVA conducted for females showed no difference in the looking times at the pink toy or blue toy between girls who were reported to wear pink, and girls who were not reported to wear pink and girls who were reported to wear blue and girls who were not reported to wear blue.

- The MANOVA conducted for males showed no difference in the looking times at the pink toy or blue toy between boys who were reported to wear blue and boys who were not reported to wear blue
- The MANOVA conducted for females showed no difference in the looking times at the pink toy or blue toy between girls who wore pink to the laboratory, and girls who did not, and girls who wore blue to the laboratory and girls who did not.
- The MANOVA conducted for males showed no difference in the looking times at the pink toy or blue toy between boys who wore blue to the laboratory, and boys who did not.

4.b. Is reported play with vehicles and dolls related to looking times at the car and doll on the preferential looking task?

The relationship between playing with dolls and vehicles and looking times at dolls and vehicles on the preferential looking task were assessed in two ways. Firstly, correlations between the play and looking times were conducted, and secondly, an ANOVA was conducted to assess any differences in the looking times at the car and doll between those infants who played with cars and dolls, and those infants who did not.

Correlations

Pearson correlations were conducted to assess any relationship between looking times at the doll or car and the number of vehicles and dolls a child was reported to play with. In order to do this, an average score for the proportion of time spent looking at the car and at the doll was computed. This was done by adding together the looking times for the car and the looking times for the doll and dividing this by the number of stimuli pairs. Only the pairings showing a car versus a doll were used in the computation. Thus the average looking time for the car and the average looking time for the doll was computed by totalling 9 of the stimuli looking times together and dividing this by 9. The 9 stimuli pairs used to compute the average looking times for car and doll were pink doll v blue car; pink car v blue doll; red car

v blue doll; red doll v blue car; pink doll v pale blue car; pink car v pale blue doll; pink car v pink doll; blue car v blue doll; neutral car v neutral doll.

A significant positive relationship was found between reported play with vehicles and average looking time at the car on the preferential looking task, with a Pearsons correlation coefficient of $r = .268$, $p = .006$. When these correlations were repeated for males and females separately, the correlation for males approached significance ($r = .240$, $p = .086$), whereas for females no significant correlation was found ($r = -.049$, $p = .725$).

No relationship was observed between reported play with dolls and average looking time at the doll on the preferential looking task ($r = .038$, $p = .704$). When males and females were looked at separately, no relationship between these two variables was found for males ($r = .046$, $p = .747$) or females ($r = .170$, $p = .224$).

ANOVA

In order for the ANOVA to be conducted, the data were recoded to categorical data. Infants were categorised depending on whether or not they played with vehicles (category called 'play with vehicles') and whether or not they played with dolls (category called 'play with dolls').

An ANOVA was conducted with the average looking time at the car entered as a within subject factor, and 'play with vehicles' and 'play with dolls' entered as between subject factors (Because the looking times had been converted into proportion scores the average looking time at the doll was the inverse of the average looking time at the car as explained in chapter 3, therefore only the average looking time at the car was entered into the ANOVA).

The means for the average looking times at the car for infants who played with vehicles, and infants who played with dolls can be seen in table 41.

	Mean percentage of time spent looking at car (SD)						*F*	*p*
	Yes			No				
	Mean	SD	n	Mean	SD	n		
Play with Doll	46.06	9.94	23	47.08	11.53	82	.039	.844
Play with Vehicles	49.73	11.45	52	44.05	10.21	53	1.959	.165

Table 41. Means, SD, Sample size, univariate *F* value and *p* value for infants who played with dolls and infants who did not play with dolls for time spent looking at toy stimuli.

The ANOVA did not find a significant difference in looking times at the car and doll between infants who played with dolls and infants who did not play with dolls ($F(1,101) = .039, p = .844$) or between infants who played with vehicles and infants who did not play with vehicles ($F(1,101) = 1.276, p = .261$). No interaction was found between play with dolls and play with vehicles ($F(1,101) = 1.276, p = .261$).

ANOVAs were conducted again for males and females separately. The means for the average looking times at the car for males and females who played with vehicles and males and females who played with dolls can be seen in table 42.

	Mean percentage of time spent looking at car for males (SD)						*F*	*p*
	Yes			No				
	Mean	SD	n	Mean	SD	n		
Play with Doll	47.05	2.27	2	49.96	12.6	14	.382	.539
Play with Vehicles	52.14	11.47	38	43.64	12.99	14	5.439	.024
	Mean percentage of time spent looking at car for females (SD)						*F*	*p*
	Yes			No				
	Mean	SD	n	Mean	SD	n		
Play with Doll	45.97	10.41	21	42.59	7.89	32	1.732	.194
Play with Vehicles	43.19	8.81	14	44.2	9.21	39	.034	.855

Table 42. Means, SD, Sample size, *F* value and *p* value for male and female infants who played with dolls and male and female infants who played with vehicles.

The ANOVA for males revealed that male infants who played with vehicles looked significantly longer at the car compared to infants who did not play with vehicles ($F(1,49) = 5.439, p = .024$). There was no difference in the looking times at the car

and doll for boys who played with a doll and boys who did not ($F(1,49) = .382$, $p = .539$). The ANOVA for females did not find any significant differences.

Summary of results for relationship between play with vehicles and dolls, and looking times at doll and car on the preferential looking task

- The Pearson correlations found a positive correlation between reported play with cars and average looking time at the car on the preferential looking task for males and females when analysed together.

- The ANOVA for all infants found no difference in the amount of time spent looking at the car and doll between infants who played with vehicles and infants who did not, and between infants who played with dolls and infants who did not. However, when the ANOVA was done for males and females separately, it was found that boys who played with vehicles looked significantly longer at the car compared to boys who did not play with vehicles.

DISCUSSION

The findings from the present study are discussed under headings corresponding to those used in the results section. Thus, the findings from the preferential looking task are discussed first in order of the separate subsections (colour stimuli, toy stimuli and shape stimuli). Next, the findings from the parental interview are discussed (environmental colour inventory and toy inventory) followed by the relationship between the findings from the preferential looking task and the parental interview. Finally, the limitations of the study are discussed and ending with general conclusions.

Preferential looking task

Colour stimuli

Do boys and girls aged 12, 18 and 24 months show preferences for pink or blue?

The present study failed to find support for the hypothesis that there would be a sex difference in infants' visual preference for pink and blue. That is, girls were not found to show a preference for pink, and boys were not found to show a preference for blue at any of the ages studied. These findings are, therefore, not consistent with research conducted into the colour preferences of older children, which have found sex-typed colour preferences in children from the age of 3 (Chiu et al., 2004; Picariello et al., 1990). Significant sex differences may not have been found because of the age of the children studied. It may be possible that sex-typed preferences for colours do not appear until later in life, and for this reason, infants aged 12-24 months tested in the present study, failed to show such preferences. This is the first study to look at infants' sex-typed colour preferences, and more research would be needed to clarify exactly at what age children begin to display these preferences.

Do boys and girls aged 12, 18 and 24 months show preferences for pink or blue when brightness is controlled?

As pink and blue are made up of different brightness levels with pink being brighter than blue, two additional colours were introduced to control for this (red and pale

blue). Red matched the pink in hue and the blue in brightness, and pale blue matched the blue in hue and the pink in brightness. It was hypothesised that a sex difference would be found in infants' preference for pink and blue when brightness was controlled. However, the findings did not support this hypothesis. The present study did, however, find that infants showed a preference for red, irrespective of their sex. This finding is consistent with other studies of infants' colour preferences, where it has been found that infants from as young as 2 months look longer at red (Adams, 1987; Bornstein, 1975; Staples, 1932). Being able to replicate findings from previous studies supports the choice of methodology employed in the present study, as it suggests that the lack of sex differences found by the present study was not a result of methodological flaws.

Summary and theoretical implications for colour stimuli

The fact that colour preferences were not found in the present study may have important theoretical implications. The absence of sex differences in infants' colour preferences may be interpreted as evidence for a social basis of colour preference, whereby boys and girls learn through the process of imitation and reinforcement which colours are appropriate for each sex. As the present findings did not find sex-typed colour preferences, it is plausible that this process does not occur until after the age of 2.

The biological theory posits that biochemical or genetic differences between males and females gives rise to behavioural differences. This would have been supported if infants were found to show visual preference for different colours. Although sex-typed colour preferences were not detected in 12-24 month old infants, biological influences cannot be ruled out altogether. It could be possible that any biological factor related to sex-typed colour preference may not come into effect until later on in life.

The lack of sex differences found in infants' colour preference is in line with the cognitive developmental theory of gender development, which suggests that sex differences in children's behaviour can only be displayed once a child is aware of their own gender. Thus, from the cognitive developmental perspective, children

should not be able to display sex differences in their behaviour until after the age of 3. Other studies have found children from the age of 3 to show sex-typed colour preferences (Chiu et al., 2004; Picariello et al., 1990), a finding that is consistent with the cognitive model. Sex differences in colour preferences may therefore only appear once a child has reached the stage of gender stability.

In summary, male and female infants did not differ in their preference for sex-typed colours, that is, boys did not prefer blue and girls did not prefer pink. Thus, sex differences in colour preference are not present in 12-24 month-old infants, and may not emerge until later on in life. The later onset of sex-typed colour preferences may be a result of socialisation, or of children becoming more aware of their own gender, and of what behaviours and preferences are most acceptable for their own sex. Nevertheless, it could also be possible that biological factors do not come into play until later on in life and thus the lack of sex differences in colour preferences in infants cannot completely rule out a biological basis for sex-typed colour preferences. The present study found that both boys and girls preferred red, a preference found during all three age groups tested. Therefore, male and female infants' colour preferences may be similar rather than different.

Toy stimuli

Do boys and girls differ in their looking times at the pink doll versus the blue car and does this change with age?

It was hypothesised that a sex and age difference would be found for infants' preference for the pink doll and blue car. The study failed to support this hypothesis. That is, no sex and age differences were found between infants' preferences for the blue car and pink doll. Furthermore, within each sex, infants showed no preference for one stimulus over the other. This finding is inconsistent with previous findings, where boys have been found to look longer at cars and girls have been found to look longer at dolls. In the study by Campbell et al. (2000), in which infants aged 3, 9 and 18 months were shown pictures of sex-typed toys, it was found that boys showed sex-typed toy preferences from 9 months of age. One possible explanation as to why the present study did not find boys to prefer the car is that the images used in the

current study were different to those used by Campbell et al. (2000). The current study used only one image of a car, whereas the study by Campbell et al. (2000) used 5 types of masculine toys (ball, steering wheel, train, cars and blocks). It is conceivable that toys other than a car are required to detect sex-typed preferences. This, however, is unlikely, as later stimuli pairings used in the current study, particularly those controlling for brightness levels, did find sex differences. It is more likely that the difference in the brightness levels of the pink doll and the blue car confounded the results.

Do infants show sex-typed toy preferences if the toys are coloured in 'opposite sex-typed colours'? i.e. pink car versus blue doll?

The hypothesis that infants would show sex and age differences when shown sex-typed toys coloured in opposite sex-typed colours, that is, a pink car versus a blue doll, was not supported. However, an examination of infants' preferences for one stimulus over the other within each sex found that girls aged 12-24 months looked longer at the blue doll compared to the pink car, whereas boys aged 12-24 months showed no preference. Thus, for girls, their preference for the doll was displayed when it was coloured in an opposite sex-typed colour. However, the analysis by age showed that both boys and girls aged 12 months looked longer at the blue doll than the pink car. When the infants were shown a pink doll with a blue car this preference for the doll was not shown; thus, the colour blue combined with the doll was responsible for 12-month-olds preference for the doll. As mentioned previously, pink and blue differ in their brightness. It seems plausible that the preference for the blue doll over the pink car at 12 months of age was a result of the colour and toy combination. Again, this finding illustrates the importance of controlling for the difference in brightness levels of pink and blue.

If pink and blue are controlled for their differing brightness levels do the same patterns of sex-typed toy preferences emerge?

A novel aspect of the current study was that it controlled for the brightness of pink and blue, and it was when brightness was controlled, that significant sex differences were observed. Compared to boys, girls looked longer at the pink doll and red doll

when shown with a blue car of equal brightness. Because the looking times were converted into the proportion of time spent looking at each stimulus over the total length of time spent looking at both stimuli, this finding also meant that compared to girls, boys looked longer at the pale blue car and the blue car when shown with a pink doll of equal brightness. In contrast, there were no differences between the preferences of boys and girls for the pairings of sex-typed toys coloured in opposite sex typed colour (blue doll/red car or pale blue doll/pink car).

To reiterate, the present study supported the hypothesis that when the confounding factor of brightness was removed, boys and girls showed sex differences in their preferences for sex-typed toys coloured in sex-typed colours. Sex differences were observed when the images were of a same sex-typed toy coloured in a same sex-typed colour, and sex differences were not observed when the images were of a same sex-typed toy coloured in an opposite sex-typed colour.

Controlling for brightness was particularly important in the present study, as the images were presented in a darkened room, and the initial attraction to an image may be influenced by the brightness of the colour rather than the hue of the colour. This possibility is supported by previous research that has found the brightness of colours to influence children's preferences for sex-typed colours (Boyatzis and Varghese, 1994; Chiu et al., 2004). Chiu et al. (2004) initially found that 3-12-year-old boys and girls did not differ in their preference for blue, but closer analyses of the findings revealed that girls' preferred paler shades of blue compared to boys. Boyatzis and Varghese (1994) asked 4-7-year old children to describe how they feel when they see different colours. They found that girls were more likely to associate positive emotions with brighter colours compared to boys. Boys were more likely to associate positive emotions with darker colours compared to girls.

The present study was not designed to assess directly whether boys and girls differ in preferences for the same colours of varying brightness, for example, pink versus red and pale blue versus blue. However, this is an important research issue that is intertwined with the study of colour preference, as stereotypically masculine colours (such as blue) differ from stereotypically feminine colours (such as pink) not only in the colour itself, but also in the level of brightness. Further studies are required to

assess sex differences in infants' and children's preferences for the same colours varying in brightness.

Significant age differences were also observed for the stimuli pairings controlling for differing brightness levels. Twelve-month-olds, irrespective of sex, looked longer at the pink doll and at the red doll, when shown with a blue car of equal brightness, compared to older infants. This preference for the doll at 12-months was not predicted but was also revealed by the t-tests, which looked at the preference for one stimulus over the other within each sex and age group. A possible explanation for 12-month-old boys' and girls' preference for the doll over the car could be due to the presence of facial features in the doll. There is evidence that young infants can recognise faces from an early age. Newborns show a preference for faces compared to non-face images (Johnson and Morton, 1991; Macchi, Cassia, Turati and Simon, 2004) and 3-month-olds look longer at a face compared to an upside down image of the same face (Turati, Valenza, Leo and Simion, 2005). The preference for faces from an early age may be due to the importance of face recognition for human survival, as it enables individuals to distinguish among the people around them (Gauthier and Curby, 2005).

Serbin et al. (2001) also found that 12-month-old boys and girls showed a preference for dolls over cars. They showed images of 6 types of vehicles paired with 6 types of dolls in a preferential looking task similar to that used in the present study. This again suggests that the type of masculine and feminine toys used in the study may influence young infants preferences. As mentioned earlier, Campbell et al. (2001) used a variety of different toys and found sex-typed toy preferences for boys at 9 months of age. The present study, and that of Serbin et al. (2001) used vehicles paired with dolls, and both studies found the 12-month-old infants preferred the doll. Thus, it could be possible that the doll, and more specifically the face of the doll, was influencing infants' preferences. This could be overcome by using feminine-typed toys that did not have a face, such as those used by Campbell et al. (2001), or, by pairing the doll with a masculine-typed toy that also has a face.

Within group comparisons (t-tests) also revealed that girls looked longer at the doll than at the car at each of the age groups when brightness was controlled. For boys,

however, a different pattern emerged. Twelve-month-old boys looked longer at the red doll and pink doll compared to the blue car of equal brightness, 18-month-old boys failed to show a preference and 24-month-old boys looked longer at the red car compared to the blue doll. This pattern suggests preferences in boys may shift from the doll to the car between the ages of 12-24 months. It is important to note, however, that the change from the preference for a doll to the car for boys was influenced by the colour of the toys. Boys' preference for the car at 24 months was only found when the car was coloured in red. Similarly, girls' preference for the doll at 24 months was only found when the doll was coloured in red. As mentioned earlier, red has been found to be a favourite colour for boys and girls in infancy, a finding replicated by the present study. This preference for red may override infants' preferences for their own sex-typed colour and may explain why at age 24 months, boys looked longer at the red car compared to the blue doll, and girls looked longer at the red doll compared to the blue car.

Do sex differences in toy preference exist when colour is kept constant? If so, at what age do they emerge?

Infants were shown a car with a doll when both toys were coloured in pink, blue or neutral. This procedure tested whether infants would differ in their preference for the car and doll when the toys were coloured in the same colour or no colour. No sex or age differences were observed. This lends further support for the idea that the combination of the colour and the toy is of importance in the detection of sex differences. That is, when the toy and doll were coloured in the same colour, infants failed to show a preference. Examination of the preference for one stimulus over the other stimulus within each sex, revealed that 12-month-old boys and girls looked longer at the doll than the car. In contrast, 18-month-old and 24-month-old boys and girls showed no preference. Again, this finding shows that 12-month-old infants, irrespective of their sex, prefer the doll to the car.

Do sex differences in colour preferences exist when the toy is kept constant? If so, at what age do they emerge?

Boys and girls did not differ in their looking times at the pink car paired with the blue car and at the pink doll paired with the blue doll. Thus, when the toy was held constant and the colour was manipulated, boys and girls showed no sex-typed preference. Thus, the hypothesis that boys and girls would look longer at the toy of the same-sex-typed colour, compared to the same toy of the opposite sex-typed colour, was not supported. However, analyses within each group showed that 18 month and 24 month-old boys looked longer at the blue doll compared to the pink doll. Girls were not found to show any preferences. This suggests that colour preferences may influence older boys preferences for feminine typed toys.

Summary and theoretical implications for toy stimuli

The toy stimuli data show that when the differing brightness levels of pink and blue are controlled for, boys and girls show differences in their preference for the car and doll, with both sexes preferring the same-sex-typed toy coloured in the same-sex typed colour. Other similar studies have also found sex-typed toy preferences in a young sample. Campbell et al. (2000) found boys to prefer male-typical toys from as young as 9 months of age. Serbin et al. (2001) found sex-typed toy preferences in infants aged 18 and 24 months of age. This early presence of toy preferences suggests either that socialisation of boys and girls occurs at a very young age, or that some biological component must be influencing toy preference. The present study adds to the growing number of studies that are finding infants below the age of 3 to display sex-typed toy preferences.

The present study and the study by Serbin et al. (2001) failed to find sex-typed toy preferences in 12-month-old infants. At 12 months, boys and girls both showed a strong preference for the doll. This early preference for the doll is in line with the evolutionary importance of face recognition for human survival. In the present study girls' preference for the doll continued through to 24 months. For boys, however, the preference for the doll changed to a preference for the car between the ages of 12-24 months. It could be possible that it is between these ages that socialisation processes

come into effect for boys. This theory is supported by previous empirical research, which has looked at parent-child play with sex-typed toys. Fagot (1974) found that parents of 18-24-month-old infants encouraged their daughters to play with dolls and their sons to play with blocks. Snow et al. (1983) in their observation of father-child play, found that fathers withheld dolls from their 12-month-old sons, but played with dolls with their daughters. These studies therefore demonstrate that young infants are socialised to play with different toys and this differential socialisation may explain boys' gradual preference for the car between the ages of 12 and 24 months.

Finding sex-typed toy preferences during infancy is most problematic for the cognitive approach. The infants in the current study would not have reached even the first stage of gender acquisition (gender labelling), and thus should not, according to the cognitive theory, display sex-typed toy preference.

There is evidence that young infants may display some understanding of gender even before they reach the stage of gender labelling. Serbin et al. (2001) demonstrated that girls aged 18 months show awareness of gender associations. They assessed this using the preferential looking task. Infants were first shown an image of either a masculine toy or a feminine toy. This was followed by two images shown simultaneously of a male and a female face. It was found that 18 and 24-month-old girls (but not boys) looked longer at the face of the child who was the same gender as the toy that had been displayed prior to it. Thus, they were able to match male and female faces to the sex-typed toys. Serbin et al. (2001) conclude that the role of gender identity in the acquisition of gender role learning needs to be re-evaluated, because toy preferences are found in male infants, even though they are not yet aware of gender identity.

The finding that toy preference may be influenced by the colour of the toy could be important for cognitive theorists, as it sheds some light onto some of the innate properties of toys that children may find attractive. For example, same sex-typed toy preferences were only found when the toys were coloured in same sex-typed colours. Thus, it could be possible, that something more complex than a simple attraction to a doll or a car is at work. This would need further investigation.

To summarise, findings from the toy stimuli presentations add to the growing number of studies that are finding sex-typed toy preferences during infancy. However, the findings suggest that this preference is influenced by the colour of the toy. Sex-typed toy preferences are found when the toys are coloured in sex-typed colours, and sex-typed toy preferences are not found when the toys are coloured in opposite sex-typed colours. Twelve-month-old infants, both male and female, were found to look longer at the doll, and this may be a result of an inborn attraction to faces. Future studies could attempt to show images of a doll paired with an image of a vehicle that also has a face, such as 'Thomas the tank engine', or 'broom' (a cartoon character of a car with a face). This would enable a better comparison of the two toys to be made. However, the comparison of dolls to cars is problematic as they can differ from each other in numerous ways (features, texture, type of play the toy elicits) and thus confounding factors may not always be able to be controlled.

Shape stimuli

Do boys and girls differ in their preference for angular or rounded shapes and does this change with age?

The present study did not find support for the hypothesis that boys and girls would differ in their preference for angular or rounded shapes. To my knowledge, this was the first study to assess sex differences in infants' preference for rounded versus angular images. Previous research looking at children's preference and production of shapes has found inconsistent findings, with some studies showing that boys prefer angular shapes and girls prefer rounded shapes (Iijima et al., 2004; Munroe et al., 1976), and other studies showing the opposite pattern (McElroy, 1954). The present study found that infants irrespective of sex and age looked longer at the rounded shapes in comparison to the angular shapes, when the images were of the triangle/rounded triangle or squares/circles. No differences were found between the angular star versus the rounded star.

A possible explanation of why a preference for the rounded image was not observed during the angular star/rounded star pairing is that unlike the other shapes (triangle, squares and circles) the star used in the current study was not geometrical. Both

images may have been equally attractive as they were both novel objects and thus no preferences were observed. The geometric shapes used in the other pairings, may already be familiar to infants and thus, they may have been responding to the differences between the two images (i.e. the degree of angularity), and not to the novelty of each stimulus. This hypothesis would need further investigation.

Do boys and girls differ in their preference for an angular shape or a rounded shape, if the shapes are coloured in sex-typed colours?

When the shapes were coloured in sex-typed colours, the same pattern emerged. That is, no sex or age differences were found in infants' preference for angular or rounded shapes. Infants irrespective of sex and age looked at the circles longer than the squares and this was more pronounced when the image was of a blue circle paired with a pink square. Interestingly, 12 and 24-month-old boys looked longer at the blue circle compared to the pink square but did not show a preference during the pink circle/blue square pairing. Similarly, 12-month-old girls looked longer at the blue circle compared to the pink square but unlike the boys, they also looked longer at the pink circle than the blue square as did the 24-month-old girls. This suggests that colour may influence infant preferences for rounded or angular shapes. Thus, for 12 and 24-month-old boys and 24-month-old girls, the preference for an image with rounded edges was only present if the image was coloured in the same-sex typed colour. Again, these findings suggest that colour is influential in infant preferences, but they work in combination with either the toy (as discussed above) or the shape of the image. One explanation for this could be that colour preferences may be influenced by socialisation.

Are sex differences in shape preference found if pink and blue are controlled for their differing brightness levels?

The coloured shapes controlling for different brightness levels of pink and blue also showed the same pattern, that is, no sex differences or age differences were observed in infants preferences for angular versus rounded shapes. Boys and girls looked longer at the circles than the squares and this was more so at 12 months of age. At the age of 24 months, boys only looked at the circle more than the square when it

was blue, and girls looked at the circle more than the square when it was red. Again, the differences between boys and girls suggest that their preference for rounded images over angular images may be influenced by the colour of the image. The importance of colour in influencing shape preferences needs further investigation.

Summary and theoretical implications for shape stimuli

In summary, the shape stimuli data showed that infants, irrespective of sex or age, looked longer at the rounded shapes than the angular shapes when the images consisted of geometric shapes. Twelve and 24-month-old boys and 24-month-old girls looked longer at the rounded image if it was coloured in the same-sex typed colour and paired with an angular image of an opposite sex-typed colour, suggesting that shape preferences may be influenced by the colour of the image. The lack of sex differences in shape preferences can be interpreted in a number of ways. It could be possible that the small sample size, relative to that of the toy stimuli and colour stimuli data, meant that significant sex differences could not be detected. The shape stimuli data were presented last to the infants, and some infants refused to take part. Also, infants that did take part in viewing the shape stimuli were less likely to sit for the entire duration of the presentation, thereby leading to a smaller sample size. However, the within group comparisons were able to detect significant findings, showing that male and female infants both looked at rounded images more than angular images. Thus, the findings are more likely to be an accurate interpretation of infant preferences. Previous researchers have found inconsistent findings when assessing sex differences in children's preferences for angular versus rounded shapes. An alternative explanation could be that children's preferences for shapes are in fact similar for both sexes and thus studies have not been able to detect consistent findings. Hyde (2005) put forward the gender similarities hypothesis in which she argued that males and females are in fact similar on most psychological variables. It seems that in the case of shape preference, boys and girls are similar in that they both show a preference for rounded images.

Older children's sex-typed shape preferences may also be explained by socialisation influences. Pennell (1994) examined over 1000 toys to assess how children are taught an ideology of gender through toy advertising. She found that miniature

bicycles, designed for 2-5 year olds, were decorated differently for boys and girls. The girl's bike had a 'ribbon like' motif, whereas the boy's bike had a 'lightning bolt' motif. It is suggested that curved lines symbolize passivity, softness and femininity and straight lines symbolize boldness, hardness and masculinity (Pennell, 1994). Such findings suggest that older children's shape preferences may be a result of being taught these preferences through the toys and objects they play with. However, the lack of consistent findings from studies of older children raises questions about the size or reliability of this sex difference. Furthermore, the lack of research conducted into shape preference makes it difficult to form any firm conclusions. However, the findings from the present study suggest that during the early years of a child's life, sex differences in shape preferences do not exist.

Parental Interview

Environmental colour inventory

It was hypothesised that sex differences would be found in infants' bedrooms, bedcovers, bedroom curtains, playroom and clothing. Previous research has found significant differences between males and females with respect to the colour of children's rooms. Rheingold and Cook (1975) catalogued 1-6 year olds bedrooms and found that girls' rooms had more floral furnishings and more items bearing ruffles, fringe or lace. In a later study by Pomerleau et al. (1990) comparing the home environments of infants aged 5, 13 and 25 months, it was found that girls had more yellow bedding compared to boys and boys had more blue bedding compared to girls. Furthermore, boys were reported to wear more blue, red and white compared to girls, and girls wore more pink and multicoloured clothing compared to boys.

The present study failed to find differences in the colours of children's environment except for their playroom and clothing colour. There are a number of reasons why the present study failed to replicate the findings of Rheingold and Cook's (1975) and Pomerleau et al.'s (1990) study. Firstly, the present study relied on parental report to assess children's environmental colour, whereas in Rheingold and Cook's (1975) and Pomerleau et al.'s (1990) study, an experimenter visited children's home to directly catalogue the child's environment. Because parental report is not as reliable as direct

observation, this could have resulted in the current study finding fewer sex differences. Secondly, parents' attitudes to colour coding infants environments based on their sex may have changed. Today's parents may be more egalitarian in their beliefs about gender stereotypes, and therefore may not define their children's environment as strongly on their child's gender. This latter theory is also supported by the number of parents from the present study who had decorated their child's bedroom (n=44), bedroom curtains (n = 60), bedcovers (n=45) and playroom (n=66) in 'neutral colours' (e.g. cream and white).

There was a sex difference in the frequency of infants who had pale coloured playrooms with more girls having pale coloured playrooms compared to boys. Because the room the child spent most of their time in was not always decorated for the purposes of being the infant's primary room (often the rooms the child played in the most included the kitchen or living room), it is unlikely that parents had consciously chosen to decorate these rooms with their infant's sex in mind. This result therefore has to be interpreted with caution.

The present study did, however, find differences between males and females in the colour of the clothes in which infants were dressed. Parents of boys reported that they dressed their infants in blue and bold colours significantly more than parents of girls. Girls were reportedly dressed in more pink than boys. The colour of infants' clothes on their visit to the laboratory also showed significant sex differences, with girls wearing more pink and pale coloured clothes, and boys wearing more blue and bold coloured clothes. This pattern was similar to that found in previous studies, which have also found that girls were dressed in pink and boys were dressed in blue (Pomerleau et al., 1990). It is also in line with young children's stereotypes of colour where 3-7 year old children labelled bold coloured toy pigs as male and pale coloured toy pigs as female (Picariello et al., 1990). The present study looked at young infants whose clothing colour would largely be chosen by parents and other adults around them. It therefore can be assumed that the colours of infants' clothes were a reflection of adults' colour stereotypes.

Summary and theoretical implications for environmental colour inventory

The limited research available on sex-typed colour preferences of young children has found that boys and girls do differ in their preferences for pink and blue. The study by Chiu et al. (2004) demonstrated that boys aged between 3 to 12 years preferred blue and girls preferred pink. Furthermore, it was found that boys preferred the darker shades of blue and girls preferred the paler shades of blue. Boys' preference for bolder colours, and girls' preference for paler colours, was also reported by Boyatzis and Varghese (1994). In line with the social learning theory, it is possible that the colours that infants are exposed to in their environment by parents and other adults may influence children's preferences for sex-typed colours. The present study shows that infants are exposed to these sex-typed colours through their clothing, from at least 12 months of age, and this exposure may influence their preferences for these colours in later life.

However, exposure to sex-typed colours is limited to clothing colour only, as the study failed to find any differences in the colours of other aspects of the child's environment. Nevertheless, children's exposure to sex-typed colours through their clothing may be an important influence on their later gender stereotypes. Picariello et al. (1990) found that clothing colour influenced 4-8 year old children's perceptions and impressions of others. Individuals, regardless of their sex, who were dressed in feminine-typed colours such as pink, were also expected to display feminine-typed behavioural preferences, and individuals dressed in masculine typed colours such as blue, were expected to display masculine-typed behavioural preferences. The exact relationship between infants own sex-typed clothing colour, and their perceptions of other individuals dressed in sex-typed colours has yet to be studied. It would be interesting to determine if infants who were dressed in extremely sex-typed colours would form stronger stereotyped perceptions compared to infants who were not dressed in sex-typed colours.

Toy inventory

The present study tested the hypothesis that boys and girls would be reported to play with different toys. It was found that, in response to an open ended question of what

three toys infants played with most, boys were reported to play with more vehicles than girls, and girls were reported to play with more dolls than boys. Female play with dolls was found to change with age with more girls being reported to play with dolls at 18 months and 24 months compared to 12 months. No age differences were observed for boys' reported play with vehicles. This finding may be explained in a number of ways. Firstly, boys have been found to show a preference for vehicles from as early as 1 year of age (Snow et al., 1983). Girls have been found to display preferences for sex-typed toys later than boys. Studies have found sex-typed toy play in girls from 20 months (O'Brien and Huston, 1985), 4 years (Blakemore et al., 1979) and 5 years of age (Robinson and Morris, 1986). The finding from the current study, that girls are reported to play less with dolls at 12 compared to 18 and 24 months, supports the idea that girls' interest in doll play may be acquired more gradually. Secondly, reported play with vehicles and dolls may relate to the availability of such toys. Twelve-month-old girls may not have been reported to play with dolls because they did not have access to dolls. In the present study, parents were not asked whether their daughters had dolls at home. A future study could ask this question to examine whether the lack of reported play with dolls for 12-month-old girls, is a result of not having dolls to play with.

Relying on parental report can be problematic as parents may be biased in their responses. However, the fact that sex-typed preferences were observed suggests that parents were being honest in their responses, as parents when referring to the play of their own children, may be more likely to show egalitarian beliefs rather than sex-typed beliefs, as they may feel egalitarian beliefs are socially more acceptable (Idle et al., 1993). Furthermore, Campenni (1999) found that parents were more likely to view sex-typed toys as gender neutral when compared to non-parents suggesting that when parents reported the toys their child played with the most, they may not have viewed the toys as particularly sex-typed. The reliance on parental reports could have been overcome by conducting home visits and observing the infants playing with their own toys in their natural environment. However, this method would have been exceptionally time consuming. In addition, conducting home observations has its own flaws, in that the presence of the researcher may influence children's behaviour and toy choice.

The toy inventory data also tested the hypothesis that girls' toys would be coloured in pale colours and boys toys would be coloured in bold colours. Although statistical analyses could not be conducted on the data, descriptive results suggested that the majority of vehicles that infants were reported to play with were coloured in bold colours (74.1%) and the majority of dolls were coloured in pink (57.7%). This provides some support for the hypothesis that sex-typed toys are colour coded depending on the sex appropriateness of the toy.

Summary and theoretical implications for toy inventory

Play with dolls was found in girls from 18 months, whereas boys were reported to play with vehicles from 12 months of age. This supports previous studies that have found that boys and girls show sex-typed toy preferences from an early age. Secondly, it supports the theory that boys may be displaying sex-typed toy preferences earlier than girls, although it may be possible that 12-month-old girls did not play with dolls because they were not available.

The children in the current study were young and therefore may not have been able to request toys themselves. This suggests that parents or other adults may be responsible for providing sex-typed toys to young infants. Thus, socialisation of infants sex-typed toy play could be happening from a very young age. It could, however, be equally possible that parents are providing children with a number of different toys, and boys and girls are choosing to play with toys that are most sex-typed, suggesting that young infants may be responding to an innate attraction to these toys.

For the cognitive approach, the fact that boys and girls are reported to play with sex-typed toys from 12 months (for boys) and 18 months (for girls) creates further doubt on the importance of cognitive awareness of ones own sex. The present research adds to the growing number of studies that are finding infants to show sex-typed toy play before they display gender stability.

Opposite sex-typed play

Parents were asked if their infants had opposite sex-typed toys available to them and, if so, whether or not they played with them. It was found that more girls than boys had opposite sex-typed toys available to them, but boys and girls were not found to differ in their play with opposite sex-typed toys if available. Previous research conducted on parental toy play with young children has shown that parents are more sex-typed in their play with boys than with girls (Snow et al., 1983). The present study supports this finding, as it shows that girls were more likely than boys to have opposite sex-typed toys available to them. Despite the sex difference found in reported availability of opposite sex-typed toys, no significant differences were found in reported play with sex typed toys although the means suggested that girls might be more likely than boys to play with them (90% of girls compared to 79% of boys).

Relationship between toy and environmental colour inventory and preferential looking task

No relationships were observed between exposure to pink and blue in a child's environment and looking times at pink and blue on the preferential looking task. The number of infants who had pink and blue in their environments was very small, which did not allow statistical tests to be carried out. However, even when the environmental colours were collapsed into two categories of bold colours and pale colours, no relationships were observed. Thus, the present study did not find any relationship between infants environmental colour and their visual preferences for pink and blue.

A positive relationship was found between reported play with vehicles and looking times at the car when males and females were examined together. Differences were found between males who played with vehicles and males who did not play with vehicles, with males who played with vehicles looking longer at the car on the preferential looking task. These findings suggest that visual preferences for toys may be related to actual play with the toys. It is possible that infants' visual preference for

toys may indicate an actual preference for these toys, as boys who were reported to favour playing with vehicles also looked longer at the car.

Theoretical implications for relationship between preferential looking task and toy inventory

This is the first study designed to address the relationship between infant's visual preference for sex-typed toys and their actual play with sex-typed toys. A study by Vance and MaCall (1934) looked at this relationship in older children by examining 32 3-6 year old children's visual preference for toys and their actual play with these toys. This study was, however, dated and the sample size was small. In addition, it was studying older children and not infants. Because of the increasing number of studies finding sex-typed toy play in infancy, and because of the increasing number of studies using the preferential looking task to assess pre-verbal infants toy preferences, it is important to be able to validate the methodology. The current study shows that young infants actual play with vehicles is positively related to their visual preference for vehicles. This is particularly true for boys. No relationship was observed between actual play with dolls and visual preference for dolls. The current study may not have detected a relationship for dolls, as not as many infants played with dolls (23 infants from a total of 120) compared to vehicles (52 infants from a total of 120).

Limitations of the study

The study of infants is particularly problematic as data can be lost due to infant fussiness. In the present study, some data for the shape stimuli task were lost for this reason. Breaks were given to the child whenever the parent requested, and sometimes when the researcher felt a break was required, and the majority of infants did sit for the entire duration of the presentations. The attention seeking devices of the chimes and red spot on the screen were particularly important to direct the child's gaze to a central location. Because the traditional method of preferential looking relies on two stimuli being presented to the infants at any one time, a large number of trials are required. It is important that when conducting studies with infants that the correct

balance is reached between the length of study and the average length of time that infants would be happy to sit still.

A number of separate analyses were conducted on the data, as data were analysed in order of the research questions set out at the beginning of the study. Conducting a number of analyses on the same data can increase the likelihood of a Type 1 error, whereby a significant difference is observed when none exists. However, this can be overcome by adjusting the p value to be more stringent. For each analysis conducted, p values were set to be more stringent using Bonferonni adjustments, which took account of the number of dependent variables entered into each analysis. However, even if all the toy stimuli data were to be analysed using a single MANOVA, then the pairings controlling for the differing brightness levels during the toy stimuli presentations, would still show a significant sex difference, as the p values in some cases were less than .001.

Overall Conclusions

The present study fills a gap in the available literature on sex-typed toy preference. To date, no studies have directly addressed the relationship between colour and sex-typed toy preference. No study has been designed to directly assess sex differences in colour preference and shape preference during infancy. The current study found that infants displayed toy preferences that were influenced by the colour of the toys. Infants looked longer at a same-sex typed toy of a same-sex typed colour compared to an opposite sex-typed toy of an opposite sex-typed colour, when the colours were matched for brightness. Sex differences were not found for infants' preferences for sex-typed colours alone or for angular versus rounded shapes. Parents were found to dress their infants in different colours, boys wore more blue and bold colours compared to girls, and girls wore more pink and pale colours compared to boys. Furthermore, parents reported that boys played with more vehicles compared to girls and girls played with more dolls compared to boys.

The finding that infant preferences for sex-typed toys may be influenced by the colour of the toys is particularly interesting, as it suggests that by manipulating toy colour, infants may be encouraged to show an interest in opposite sex-typed toys.

When boys were forced to choose between a blue doll and a pink doll, they showed a visual preference for the blue doll. Therefore, for boys, their preference for feminine-typed toys may have been influenced by toy colour. Toy manufacturers may be able to encourage opposite sex-typed play by producing more dolls in bold colours, such as blue, and more cars in pale shades, such as pink. Furthermore, if differences between the cognitive abilities of boys and girls result from the differences in the type of toys that boys and girls play with (as suggested by Block, 1983; Caldera et al., 1989), then by encouraging opposite sex-typed toy play, the gap between boys' and girls' cognitive abilities may also be lessened.

Colour appears to be sex-typed through infant clothing colour from as young as 12 months, and parents and other adults could be reinforcing colour stereotypes. Although infants themselves are not displaying visual preferences for sex-typed colours, this early exposure to sex-typed colours through their clothing and toys may contribute to older children's sex-typed colour preferences. It could, therefore, be suggested that boys and girls are born with similar colour preferences, that is, both sexes prefer the colour red. However, societal stereotypes of colours, imposed on infants through their environment, may contribute to older boys and girls displaying different preferences for colours.

A strength of the current study was its large sample size. A total of 120 infants took part in the study. Few studies looking at infants have large sample sizes. The current study employed a methodology that has not been widely used to study toy preference. Findings from the present study, coupled with previous studies (Campbell et al., 2000; Serbin et al., 2001), suggest that the preferential looking task is a useful tool for examining young pre-verbal infants' toy preferences. In addition, the present study found that infants' reported play with vehicles was positively correlated with their visual preference for vehicles, providing some support for the validity of the preferential looking task as a measure of toy preferences.

The current study failed to find sex differences in infants' shape preferences. Infants were found to be similar with regards to their preference for rounded shapes over angular shapes. Hyde (2005) claims that men and women are in fact similar on most psychological variables. Furthermore, she argues that the emphasis on sex

differences can lead to harm, causing society to treat males and females differently, even though these differences do not really exist. The present study found that male and female infants were similar in their preference for red, and in their preference for rounded shapes. Yet, sex differences in colour preferences and to a lesser extent, in shape preferences have been detected in older children. The size of these sex differences is unknown, as few studies have explored sex differences in children's colour and shape preference. It seems plausible to conclude from the findings of the present study, that with regards to colour and shape, male and female infants during their second year of life show similar preferences to one another.

The finding that infants' visual preference for sex-typed toys was influenced by the colour of the toys, demonstrates the importance of looking at the low level properties of toys that boys and girls find attractive. More studies are required to address what other properties of toys (e.g. motion, texture, facial features) influence children's attraction to sex-typed toys (Alexander and Hines, 2002; Campbell et al., 2000). This would enable researchers to gain a clearer understanding of the underlying mechanisms for children's sex-typed toy preferences.

APPENDIX A : Letter for parents

<DATE>

Dear Parent,

Researchers at City University are conducting a study looking at how infants see colour.

We are looking for parents of 10-24-month-old infants who will be willing to bring their child to the University to take part in a study lasting approximately 1 hour. Your infant would be seated on your lap and shown some pictures of toys during which their eye movements would be recorded using a video recorder. You would be paid ten pounds to cover expenses.

If you would like to take part in the research or would like some more information please call me on 020 7040 8387. If I am unable to take your call then please leave a message for me with your name and contact details and I will get back to you. Alternatively you can fill in the attached slip and send it to me at the above address.

If you know of anyone else who has a child aged between 10 to 24 months then I would be grateful if you could inform him or her about the study.

Your help would be greatly appreciated.

Yours sincerely,

Vasanti Jadva
Research Psychologist

APPENDIX B : Leaflet for parents

DO YOU HAVE A 10 to 25-MONTH-OLD INFANT?

Researchers at **City University** are conducting a study looking at why boys and girls like different toys and colours.

We are looking for parents of 10-25-month-old infants who would be willing to bring their child to the University to take part in a study. The visit will last approximately 45 minutes.

You would be paid £10 to cover expenses.

If you would like to take part in the research or would like some more information, please leave your contact number with Vasanti on
020 7040 8387 or 07970 212396

Vasanti Jadva
Family and Child Psychology Research Centre
City University
Northampton Square
EC1V 0HB
e-mail v.kerai@city.ac.uk

APPENDIX C : Information sheet

Infant colour preferences at 1-year of age

As part of this study you will be asked some questions about the toys and belongings of your child after which your infant will be shown some pictures of toys.

If you agree for your child to take part in this study s/he will be seated on your lap opposite a screen. Pictures of toys will be projected onto the screen from behind you. Your child's eye movements will be recorded using a video recorder placed behind the screen. The researcher will then study and code the videos at a later date.

Testing can last up to one hour. During the test your child will be given breaks at routine times. If you wish for further breaks to be given let the researcher know during the procedure. If you wish to withdraw your child from the study at any stage, or you do not wish to answer some questions, just let the researcher know.

Your child's test results will be confidential. This means that:

- Any data entered onto the computer for analysis will not include names, addresses or any other identifying information.

- When the results of the project are published your child will not be identified as having taken part in the research; neither will information which might make your child identifiable be published.

You will be paid ten pounds for taking part in this study regardless of whether or not your child completes the task.

If you have any further questions about the research please ask your researcher.

You can complain about the study if you don't like something about it. To complain about the study, you need to phone 020 7040 8010. You can then ask to speak to the Secretary of the Ethics Committee and tell them that the name of the project is **Infant colour preferences.**

You could also write to the Secretary. That person's address is

Saran Simpson
Secretary to Senate Ethical Committee
Academic Registry
City University
Northampton Square
London
EC1V 0HB
Email: s.e.simpson@city.ac.uk

APPENDIX D : Consent form

CONFIDENTIAL

Parent/Guardian Consent Form

Infant colour preferences at 1-year of age

I agree for my child to take part in the above City University research project. I have had the project explained to me, and I have read the Explanatory Statement, which I may keep for my records. I understand that agreeing to take part means that I am willing to:

- be interviewed by the researcher about my child
- allow the procedure to be videotaped
- allow my child to participate in the research

I understand that any information I provide is confidential, and that no information that could lead to the identification of any individual will be disclosed in any reports on the project, or to any other party.

I understand that my child's participation is voluntary, that I can choose not to allow my child to participate in part or all of the project, and that I can withdraw my child at any stage of the project without being penalised or disadvantaged in any way.

Name of parent/guardian: ..... (please print)

Signature: .....Date: .....

APPENDIX E : Demographic details

ID no.

Contact Address

Date of testing

Time of Testing

Name of mother

Contact tel no.

Name of child

Child sex	M.....1 F..... 2
Childs date of birth	DOB.....
Childs race/ethnicity	*CRE classification* White.....1 Black-Caribbean.....2 Black-African.....3 Black-Other.....4 Chinese.....5 Indian.....6 Pakistani.....7 Bangladeshi.....8 Other (please specify)_____....9
Was child premature?	Yes.....1 No..... 2 Days_____
Does (child) have a twin? If so which twin is s/he? I.e. 1st 2nd 3rd	Yes.....1 No.....2
Were there any problems with the pregnancy and birth?	No problems.....1 Minor complications.....2 Moderate complications.....3 Major complications.....4
What was his/her birthweight	_____kg

Any medical problems in the past or currently?	Note any problems
Is (child) left or right handed?	Left.....1 Right.....2
Does (child) have any brothers or sisters in the household?	Yes.....1 No.....2
If so how many?	.....
Whats (childs) birthorder? (include siblings outside of house)	
Does (child) have any brothers or sisters in that don't live with you?	Yes.....1 No.....2
If so how many?	.....
Sibling 1	M.....1 F.....2 Age..... DOB.....
Sibling 2	M.....1 F.....2 Age..... DOB.....
Sibling 3	M.....1 F.....2 Age..... DOB.....
Sibling 4	M.....1 F.....2 Age..... DOB.....
Mothers age	Age..... DOB.....

Mother working	No.....1 Full Time.....2 Part Time.....3
Mothers occupation	Professional.....1 Managerial/Technical.....2 Skilled non-manual.....3 Skilled manual.....4 Partly Skilled.....5 Unskilled.....6 Not applicable.....888
Have you had any further training after o-levels?	None.....1 Apprenticeship.....2 Non-professional training.....3 Professional non-graduate.....4 Graduate.....5
Mothers ethnic identity	*CRE classification* White.....1 Black-Caribbean.....2 Black-African.....3 Black-Other.....4 Chinese.....5 Indian.....6 Pakistani.....7 Bangladeshi.....8 Other (please specify)_____....9
Does you have a partner that lives with you? If no ask details of previous partner	Yes.....1 No.....2
Is he (childs) father?	Yes.....1 No.....2
Partners age	Age..... DOB.....
Partners occupation	Professional.....1 Managerial/Technical.....2 Skilled non-manual.....3 Skilled manual.....4 Partly Skilled.....5 Unskilled.....6 Not applicable.....888

Has (partner) had any further training after o-levels?	None.....1 Apprenticeship.....2 Non-professional training.....3 Professional non-graduate.....4 Graduate.....5
Partners ethnic identity	*CRE classification* White.....1 Black-Caribbean.....2 Black-African.....3 Black-Other.....4 Chinese.....5 Indian.....6 Pakistani.....7 Bangladeshi.....8 Other (please specify)_____....9
Is child regularly looked after by somebody else? How many hours a week is s/he with them?	Yes.....1 No.....2 If yes No. of hours per week_____
Where?	In own home relatives.....1 In own home, others.....2 Outside home, relatives.....3 Outside home, others.....4 Day nursery/creche.....5 Not applicable.....888
Developmental milestones When did s/he start ...	Babbling/talking_____ Crawling_____ Walking_____
History of colour blindness	Yes.....1 No.....2

Would you be happy to be contacted again for any further studies being done? In particular at age 3 to do a colour blindness test? Yes/no

Would you like a brief summary of the results? Yes/no

APPENDIX F : Colour details sheet

ID_____

Colour details data sheet

Name_____

Childs home colour inventory

Object	Colour
Bed covers	
Bedroom	
Curtains	
Playroom(Room played in the most)	
Own Clothes (what colour does s/he tend to wear at home)	
Clothes dressed in	

Does (child) have toys at home that may be stereotypically considered to be boys/girls toys?

And does s/he play with them?

Top three toys [What toys does (child) play with most when at home)

Name of toy	Description	Colour (if more then one list in order of most dominant)

REFERENCES

Adams, R. J. (1987). An evaluation of color preference in early infancy. *Infant Behavior and Development, 10*, 143-150.

Alexander, G. M. (2003). An evolutionary perspective of sex-typed toy preferences: pink, blue and the brain. *Archives of Sexual Behaviour, 32*, 7-14.

Alexander, G. M., & Hines, M. (1994). Gender labels and play styles: Their relative contribution to children's selection of playmates. *Child Development, 65*, 869-879.

Alexander, G. M., & Hines, M. (2002). Sex differences in response to children's toys in nonhuman primates (Cercopithecus aethiops sabaeus). *Evolution and Human Behaviour, 23*, 467-479.

Baennenger, M., & Newcombe, N. (1989). The role of experience in spatial test performance: A meta-analysis. *Sex Roles, 20*, 327-343.

Bem, S. L. (1981). Gender-schema theory: A cognitive account of sex-typing. *Psychological Review, 88*, 354-364.

Berenbaum, S. A., & Hines, M. (1992). Early androgens are related to childhood sex-typed toy preferences. *Psychological Science, 3*, 203-206.

Blakemore, J. E. O., LaRue, A. A., & Olejnik, A. B. (1979). Sex-appropriate toy preference and the ability to conceptualize toys as sex-role related. *Developmental Psychology, 15*, 339-340.

Block, J. H. (1978). Another look at sex differentiation in the socialisation behaviors of mothers and fathers. In J. A. Sherman & F. L. Denmark (Eds.), *The psychology of women: Future directions in research.* New York: Psychological Dimensions.

Block, J. H. (1983). Differential premises arising from differential socialization of the sexes. *Child Development, 54*, 1335-1354.

Bornstein, M. H. (1975). Qualities of color vision in infancy. *Journal of Experimental Child Psychology, 19*, 401-419.

Bornstein, M. H. (1985) Human infant color-vision and color perception. *Infant Behavior and Development, 8*, 109-113.

Boyatzis, C. J., & Varghese, R. (1994). Children's emotional associations with colors. *Journal of Genetic Psychology, 155*, 77-85.

Bradley, B. S., & Gobbart, S. K. (1989). Determinants of gender-typed play in toddlers. *Journal of Genetic Psychology, 15*, 453-455.

Budd, B. E., Clance, P. R., & Simerly, D. E. (1985). Spatial configurations: Erikson reexamined. *Sex Roles, 12*, 571-577.

Burkitt, J.S., Barrett, M., & Davis, A. (2003). Children's colour choices for completing drawings of affectively characterised topics. *Journal of Psychology and Psychiatry, 44*, 445-455.

Bussey, K., & Bandura, A. (1999). Social cognitive theory of gender development. *Psychological Review, 106*, 676-713.

Caldera, Y. M., Huston, A. C., & O'Brien, M. (1989). Social interactions and play patterns of parents and toddlers with feminine, masculine and neutral toys. *Child Development, 60*, 70-76.

Caldera, Y. M., & Sciaraffa, M. A. (1998). Parent-toddler play with feminine toys: Are all dolls the same? *Sex Roles, 3*, 657-668.

Campbell, A., Shirley, L., Heywood, C., & Crook, C. (2000). Infants' visual preference for sex-congruent babies, children, toys and activities: A longitudinal study. *British Journal of Developmental Psychology, 18*, 479-498.

Campenni, C. E. (1999). Gender stereotyping of children's toys: A comparison of parents and nonparents. *Sex Roles, 40*, 121-138.

Caplan, P. (1979). Erikson's concept in inner space: A data-based re-evaluation. *American Journal of Orthopsychiatry, 49*, 100-108.

Carter, C. B., & Levy, G. D. (1988). Cognitive aspects of early sex-role development: The influence of gender schemas on preschoolers' memories and preferences for sex-typed toy activities. *Child Development, 59*, 782-792.

Chiu, S. W., Johnson, L. L., Owen-Anderson, A. F. H., Bradley, S. J., Gervan, S., Fairbrother, C., & Zucker, K. J. (2005). Sex-dimorphic color preference in children with gender identity disorder: A comparison to clinical and community controls. *Sex Roles, In Press.*

Cohen, L. B., DeLoache, J. S., & Strauss, M. S. (1979). Infant visual perception. In J. D. Osofsky (Ed.), *Handbook of infant development* (pp. 393-438). New York: John Wiley and Sons.

Cole, H.J., Zucker, K.J., & Bradley, S.J. (1982). Patterns of gender-role behaviour in children attending traditional and non-traditional day-care centres. *Canadian Journal of Psychiatry, 27*, 410-414

DiPietro, J. A. (1981). Rough and tumble play: A function of gender. *Developmental Psychology, 17*, 50-58.

Doering, R. W., Zucker, K. J., Bradley, S. J., & Macintyre, R. B. (1989). Effects of neutral toys on sex-typed play in children with gender identity disorder. *Journal of Abnormal Child Psychology, 17*, 563-574.

Eaton, W. O., Von Bergen, D., & Keats, J. G. (1981). Gender understanding and dimensions of preschooler toy choice: Sex stereotype versus activity level. *Canadian Journal of Behavioral Science, 13*, 203-209.

Ehrhardt, A. A. (1987). A transactional perspective on the development of sex differences. In J. M. Reinisch, L. A. Rosenblum, & S. A. Sanders (Eds.), *Masculinity/femininity: Basic perspectives*. New York: Oxford University Press.

Ehrhardt, A. A., & Baker, S. W. (1974). Fetal androgens, human central nervous system differentiation and behavior sex differences. In R. C. Freeman, R. M. Richart, & R. L. Vande Wiele (Eds.), *Sex Differences in Behavior*. New York: Wiley.

Ehrhardt, A. A., Meyer-Bahlburg, H. F. L., Feldman, J. F., & Ince, S. E. (1984). Sex-dimorphic behavior in childhood subsequent to prenatal exposure to exogenous progestogens and estrogens. *Archives of Sexual Behavior, 13*, 457-477.

Eisenberg, N., Tryon, K., & Cameron, E. (1984). The relation of preschoolers' peer interaction to their sex-typed toy choices. *Child Development, 55*, 1044-1050.

Eisenberg, N., Wolchik, S. A., Hernandez, R., & Pasternack, J. F. (1985). Parental socialization of young children's play: A short-term longitudinal study. *Child Development, 56*, 1506-1513.

Erikson, E. H. (1951). Sex differences in the play configurations of preadolescents. *American Journal of Orthopsychiatry, 21*, 667-692.

Etaugh, C., & Liss, M. B. (1992). Home, school, and playroom -Training grounds for adult gender-roles. *Sex Roles, 26*, 129-147.

Fagot, B.I. (1974). Sex differences in toddlers' behavior and parental reaction. *Developmental Psychology, 10*, 554-558.

Fagot, B.I. (1977). Consequences of moderate cross-gender behavior in preschool children. *Child Development, 48*, 902-907

Fagot, B. I., & Hagan, R. (1991). Observations of parent reactions to sex-stereotyped behaviors. *Child Development, 62*, 617-628.

Field, A. (2003). *Discovering Statistics using SPSS for windows*. London: SAGE Publications.

Fisher-Thompson, D. (1990). Adult sex typing of children's toys. *Sex Roles, 23*, 291-303.

Franck, K., & Rosen, E. (1949). A projective test of masculinity-femininity. *Journal of Consulting Psychology, 13*, 247-256.

Fridell, S.R. (2001). *Sex-typed play behavior and peer relationships in boys with gender identity disorder.* Doctoral dissertation, Ontario Institute for Studies in Education of the University of Toronto.

Furby, L., & Wilke, M. (1982). Some characteristics of infants preferred toys. *Journal of Genetic Psychology, 140*, 207-210.

Gauthier, I., & Curby, K. M. (2005). A perceptual traffic jam on highway N170. Interference between face and car expertise. *Current Directions in Psychological Science, 14*, 30-33.

Golombok, S., & Fivush, R. (1994). Gender Development. Cambridge: Cambridge University Press.

Golombok, S., & Hines, M. (2002). Sex differences in social behavior. In P. K. Smith & C. H. Hart (Eds.), *Blackwell handbook of childhood social development.* (pp. 117-136). Malden, MA: Blackwell Publishing.

Guinn, M. F. (1985). Gender type toy preference of native American, non-native American preschool children in day care, non-day care settings. *Dissertation Abstracts International, 45*, 3541.

Henderson, B. A., & Berenbaum, S. A. (1997). Sex-typed play in opposite-sex twins. *Developmental Psychobiology, 31*, 115-123.

Hines, M. (2004). *Brain gender*. New York: Oxford University Press.

Hines, M., Fane, B. A., Pasterski, V. L., Mathews, G. A., Conway, G. S., & Brook, C. (2003). Spatial abilities following prenatal androgen abnormality: Targeting and mental rotations performance in individuals with congenital adrenal hyperplasia. *Psychoneuroendocrinology, 28*, 1010-1026.

Hines, M., Golombok, S., Rust, J., Johnston, K.J., Golding, J., & the ALSPAC Study Team. (2002). Testosterone during pregnancy and gender role behaviour of

preschool children: A longitudinal, population study. *Child Development*, 73, 1678-1687.

Hines, M., & Kaufman, F. R. (1994). Androgen and the development of human sex-typical behavior: Rough-and-tumble play and sex of preferred playmates in children with congenital adrenal hyperplasia (CAH). *Child Development, 65*, 1042-1053.

Hurlbert, A. C., Ling, Y., & Sweeting, L. (2003, September). "Real men don't like pink": Sex differences in colour preference. Poster session presented at the 26th European conference on visual perception, Paris, France.

Huston, A. C. (1983). Sex-typing. In M. Hetherington (Ed.), *Socialization, Personality, and Social Development* (Vol. 4, pp. 397-467). New York: Wiley.

Idle, T., Wood, E., & Desmarais, S. (1993). Gender role socialization in toy play situations: Mothers and fathers with their sons and daughters. *Sex Roles, 28*, 679-691.

Iervolino, A.C., Hines, M., Golombok, S., Rust, J., & Plomin, R. (2005). Genetic and environmental influences on sex-typed behavior during the preschool years. *Child Development, 76,* 826-840.

Iijima, M., Arisaka, O., Minamoto, F., & Arai, Y. (2001). Sex differences in children's free drawings: A study of girls with congenital adrenal hyperplasia. *Hormones and Behaviour, 40*, 99-104.

Jacklin, C. N., DiPietro, J. A., & Maccoby, E. E. (1984). Sex-typing behavior and sex-typing pressure in child/parent interaction. *Archives of Sexual Behavior, 13*, 413-425.

Jahoda, G. (1956). Sex differences in preferences for shapes: A cross-cultural replication. *British Journal of Psychology, 47*, 126-132.

Johnson, M. H., & Morton, J. (1991). *Biology and cognitive development: The case for face recognition*. Oxford, UK: Blackwell.

Karp, E. M., & Karp, H. B. (1988). Color associations of male and female fourth-grade school children. *The Journal of Psychology, 122*, 383-388.

Katz, S. E., & Breed, F. S. (1922). The color preferences of children. *Journal of Applied Psychology, 6*, 255-266.

Knickmeyer, R. C., Wheelwright, S., Taylor, K., Raggatt, P., Hackett, G., & Baron-Cohen, S. (2005). Gender-typed play and amniotic testosterone. *Developmental Psychology, 41*, 517-528.

Kohlberg, L. (1966). A cognitive-developmental analysis of children's sex-role concepts and attitudes. In E. E. Maccoby (Ed.), *The development of sex differences* (pp. 82-173). Stanford, CA: Stanford University Press.

Kohlberg, L. (1969). The cognitive developmental approach. In D. A. Goslin (Ed.), *Handbook of socialization theory and research.* Chicago: Rand McNally.

Lamb, M. E. (Ed.). (1997). *The role of the father in child development (3rd edition).* New York: Wiley.

Langlois, J. H., & Downs, A. C. (1980). Mothers, fathers, and peers as socialization agents of sex-typed play behaviours in young children. *Child Development, 51*, 1217-1247.

Leaper, C. (2000). Gender, affiliation, assertion, and the interactive context of parent-child play. *Developmental psychology, 36*, 381-393.

Lewis, C., Scully, D., & Condor, S. (1992). Sex stereotyping of infants: A re-examination. *Journal of Reproductive and Infant Psychology, 10*, 53-63.

Lloyd, B., Duveen, G., & Smith, C. (1988). Social representations of gender and young children's play: A replication. *British Journal of Developmental Psychology, 6*, 83-88.

Lytton, H., & Romney, D. M. (1991). Parents' differential socialization of boys and girls: A meta-analysis. *Psychological Bulletin, 109*,267-296.

Macchi Cassia, V., Turati, C., & Simion, F. (2004). Can a nonspecific bias toward top-heavy patterns explain newborns' face preference? *Psychological Science, 15*, 379-383.

Maccoby, E. E., & Jacklin, C. N. (1974). *The psychology of sex differences*. Stanford, CA: Stanford University Press.

Martin, C. L., & Halverson, C. (1981). A schematic processing model of sex typing and stereotyping in children. *Child Development, 52*, 1119-1134.

Martin, C.L., Ruble, D.N., & Szkrybalo, J. (2002). Cognitive theories of early gender development. *Psychological Bulletin, 128*, 903-933.

Masters, J. C., & Wilkinson, A. (1976). Consensual and discriminative stereotypy of sex-type judgments by parents and children. *Child Development, 47*, 208-217.

McElroy, W. A. (1954). A sex difference in preferences for shapes. *British Journal of Psychology, 45*, 209-216.

Moller, L. C., & Serbin, L. A. (1996). Antecedents of toddler gender segregation: Cognitive consonance, gender-typed toy preferences and behavioral compatibility. *Sex Roles, 35*, 445-460.

Money, J., & Ehrhardt, A. A. (1972). *Man and woman, Boy and Girl: The differentiation and dimorphism of gender identity from conception to maturity.* Baltimore: John Hopkins University Press.

Munroe, R. H., Munroe, R. L., & Lansky, L. M. (1976). A sex difference in shape preference. *The Journal of Social Psychology, 98*, 139-140.

Nordenstrom, A., Servin, A., Bohlin, G., Larsson, A., & Wedell, A. (2005). Sex-typed toy play behaviour correlates with the degree of prenatal androgen exposure assessed by CYP21 genotype in girls with Congenital Adrenal Hyperplasia. *The Journal of Endocrinology and Metabolism, 87*, 5119-5124.

O'Brien, M., & Huston, A. C. (1985) Activity level and sex-stereotyped toy choice in toddler boys and girls. *The Journal of Genetic Psychology, 146*, 527-533.

Pasterski, V. L., Geffner, M. E., Brain, C., Hindmarsh, P., Brook, C., & Hines, M. (2005). Prenatal hormones and postnatal socialization by parents as determinants of male-typical toy play in girls with congenital adrenal hyperplasia. *Child Development, 76*, 264-278.

Pennell, G. E. (1994). Babes in toyland: learning an ideology of gender. *Advances in Consumer Research, 21*, 359-364.

Picariello, M. L., Greenberg, D. N., & Pillemer, D. (1990). Children's sex related stereotyping of colors. *Child Development, 61*, 1453-1460.

Pomerleau, A., Bolduc, D., Malcuit, G., & Cossette, L. (1990). Pink or blue-environmental gender stereotypes in the 1st 2 years of life. *Sex Roles, 22*, 359-367.

Powlishta, K. K., Serbin, L. A., & Moller, L. C. (1993). The stability of individual-differences in gender typing- Implications for understanding gender segregation. *Sex Roles, 29*, 723-737.

Quadagno, D. M., Briscoe, R., & Quadagno, J. S. (1977). Effects of perinatal gonadal hormones on selected nonsexual behavior patterns: A critical assessment of the nonhuman and human literature. *Psychological Bulletin, 84*, 62-80.

Rekers, G.A., & Yates, C.E. (1976). Sex-typed play in feminoid boys vs. normal boys and girls. *Journal of Abnormal Child Psychology, 4*, 1-8.

Rheingold, H. L., & Cook, K. V. (1975). The contents of boys' and girls' rooms as an index of parents' behavior. *Child Development, 46*, 459-463.

Robinson, C. C., & Morris, J. T. (1986). The gender-stereotyped nature of Christmas toys received by 36-, 48-, and 60-month old children: A comparison between requested and nonrequested toys. *Sex Roles, 15*, 21-32.

Rodgers, C. S., Fagot, B. I., & Winebarger, A. (1998). Gender-typed toy play in dizygotic twin pairs: A test of hormone transfer theory. *Sex Roles, 39*, 173-184.

Roopnarine, J. L. (1985). Mothers and fathers behaviours toward the toy play of their infant sons and daughters. *Sex Roles, 14*, 59-68.

Ruble, D. N., Balaban, T., & Cooper, J. (1981). Gender constancy and the effects of sex-typed televised toy commercials. *Child Development, 52*, 667-673.

Schau, C. G., Kahn, L., Diepold, J. H., & Cherry, F. (1980). The relationships of parental expectations and preschool children's verbal sex typing to their sex-typed toy play behaviour. *Child Development, 51*, 266-270.

Seavey, A. A., Katz, P. A., & Zalk, S. R. (1975). Baby X: The effect of gender labels on adult responses to infants. *Sex Roles, 1*, 103-109.

Serbin, L.A., Connor, J.M., Burchardt, C.J. & Citron, C.C. (1979). Effects of peer presence on sex-typing of children's play behavior. *Journal of Experimental Child Psychology*. 27, 303-309.

Serbin, L.A., Poulin-Dubois, D., Colburne, K.A., Sen, M.G. & Eichstedt, J.A. (2001). Gender stereotyping in infancy: Visual preferences for and knowledge of gender-stereotyped toys in the second year. *International Journal of Behavioral Development, 25,* 7-15.

Servin, A., Bohlin, G., & Berlin, L. (1999). Sex differences in 1-3-, and 5-year-olds' toy-choice in a structured play-session. *Scandinavian Journal of Psychology, 40*, 43-48.

Sidorowicz, L. A., & Lunney, G. S. (1980). Baby X revisited. *Sex Roles, 6*, 67-73.

Snow, M. E., Jacklin, C. N., & Maccoby, E. E. (1983). Sex-of-child differences in father-child interaction at one year of age. *Child Development, 49*, 227-232.

Staples, R. (1932). The responses of infants to color. *Journal of Experimental Psychology, 15*, 119-141.

Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics* (3rd ed.). New York: Harper and Row.

Turati, C., Valenza, E., Leo, I., & Simion, F. (2005). Three-month-olds' visual preference for faces and its underlying visual processing mechanisms. *Journal of Experimental Child Psychology, 90*, 255-273.

Vance, T. F., & McCall, L. T. (1934). Children's preferences among play materials as determined by the method of paired comparisons of pictures. *Child Development, 5*, 267-277.

Zentner, M.R. (2001). Preferences for colours and colour-emotion combinations in early childhood. *Developmental Science, 4*, 389-398.

Zucker, K.J., Doering, R.W., Bradley, S.J., & Finegan, J.K. (1982). Sex-typed play in gender-disturbed children: A comparison to sibling and psychiatric controls. *Archives of Sexual Behavior, 11*, 309-321.