The development of sex-congruent preference in infancy - a longitudinal study

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Declaration

The research contained in this thesis was carried out by the author between 1996 and 1999 while a postgraduate student in the Department of Psychology at the University of Durham. None of the work contained in this thesis has been submitted in candidature for any other degree.

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Abstract

Gender schematic processing theory suggests that children will use gender knowledge about themselves and others to make 'like me' judgements about others. They will use the behaviour of 'like me' others to create appropriate 'own-sex' schemas which will guide their behaviour. The research presented here examines this main premise of gender schematic processing theory. Because gender schematic processing posits a unitary source for the development of sex-typed behaviour i.e. the development of gender cognitions, the trajectory of development is presumed to be the same for boys and girls. This assumption is also examined in this thesis.

The sex-typed preference of sixty infants at 3, 9, and 18 months was studied using measures of duration of attention to simultaneously-presented male/female pictures of peers, toys, and play activities. Self-recognition (thought to be an early manifestation of self-concept) was measured by observing mirror behaviour (rouge test) and through monitoring the infants' preferential looking to their own image paired with that of a same-age, same-sex peer. The infants' gender labelling ability was assessed at eighteen months, and demographic information was collected at each session.

The infants showed self-recognition on both measures at eighteen months, but their poor performance at the gender labelling task suggested that their formal understanding of gender identity had not yet developed. The infants as a group did not show sex-typed preferences for attending to peers, or play activities, although same-sex preference was found for male infants in both areas. Despite an apparent lack of gender-related cohnitions, there was a significant sex-congruent preference for toys when the group of infants was tested at eighteen months. The trajectory of development of this sex-typed behaviour was different for male and female infants suggesting that the gender schematic processing model is not adequate in its present form to predict the ontogeny of sex-typed behaviour.

Dedication

To Agatha and Madeleine who kept me going, and to Kevin and my parents for giving me the opportunity to stop.

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On a personal note, I owe the biggest debt of gratitude to Anne Campbell, not just for supervising this project, but also for unerring personal support over the past few years.

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Chapter One

'Boys will be boys'

There are some behaviours whose frequency or form are seen to vary in adult males and females that can be seen emerging in childhood. These include tendencies toward nurturance or aggression, styles of individual and group interaction, and preference for same-sex friends and sex appropriate conduct (Eagly, 1987; Ruble and Martin, 1997; Maccoby, 1998; Mealey, 1999; Whiting and Edwards, 1981). Although an intuitive answer to the genesis of sex differences[1] might be that a child's biological sex will direct his or her behaviour, this is not the emphasis found in current psychological literature, perhaps due to a fear that in 'demonstrating' a biological basis for sex differences, science will be seen to condone the inequalities this sometimes produces. Instead, the most popular approach to date is one which relies on the child interpreting their environment and choosing to act in a similar way to others whom they perceive to be like themselves. The purpose of the study described in this thesis is to investigate this proposed environmental answer to the question of where sex differences originate. In the introductory chapter, some recent theories of the development of sex-typed behaviour in childhood will be discussed. The most popular theory to date is that of gender schematic processing (Martin and Halverson, 1981). This theory will be discussed in depth and its premises investigated using current evidence in three areas where children's behaviour has been shown to be strongly sex-differentiated -

[1]A note on terminology
There is a preference by some researchers and editors to use the term 'sex' when referring to a biological characteristic and 'gender' when the characteristic is deemed to be socially determined. However, as the introductory chapter will illustrate, there is no absolute consensus concerning the origins of differences between males and females, and therefore, throughout the text of this thesis, sex and gender will be used interchangeably. When evidence is introduced from research by other authors, the terminology used in their articles/books will be reproduced in the text here.

preference for same-sex peer, toy choice, and choice of play activity. As there are still some questions left unanswered by gender schematic processing theories, the final section will introduce some evidence for the notion that there are some differences between the sexes that may be present at birth.

1.1 Social learning theory

Until fairly recently, the most commonly held view of the development of sex-typed behaviour in childhood came from social learning theory (Bandura, 1963; Mischel, 1966). Social learning theorists argue that children are differentially reinforced for the enactment of 'appropriate' sex-typed behaviours and empirical work has provided evidence for this assertion (Fagot, 1984; Fagot, Hagan, Leinbach and Kronsberg, 1985). Although stemming from behaviourist traditions, social learning theory differed in the introduction of the concept of observational learning. Although experiential learning was important, it was noted that one could learn a behaviour simply by watching others perform the behaviour and observing the reinforcement they gained from that behaviour.

Criticisms were levelled at the emphasis of this theory on the part played by imitation. Maccoby and Jacklin (1974) conclude, after reviewing over twenty studies involving subject and model of the same and different sex, that same-sex imitation cannot explain sex-typing. Other reviews including a greater number of studies reached similar conclusions (Barkley, Ullman, Otto, and Brecht, 1977). However, as Perry and Bussey (1979) note, most of the studies relied on a situation in which the child was presented with a single same-sex and single opposite-sex model who were strangers to them. They argue that this did not allow the child to designate the models' actions as sex-typical. When they created a situation, intended to alleviate this difficulty, where a

group of same-sex and opposite-sex models were available to the children, they found significant preferences for imitating sex-typical same-sex models. It is therefore important for the child to believe that the model's behaviour is *appropriate* or inappropriate to their sex before adopting them as a model. Bandura's original suggestion was that the child's choice of model depended on factors including the perceived consequences of the model's actions, the salience of the behaviour, and whether one is able to conceive of oneself achieving the same ends by imitating the behaviour. In Perry and Bussey's study, a greater role is attributed to the importance of the model representing typical masculine or feminine behaviour. The likelihood of the child imitating a model depends then on their understanding of what is stereotypically masculine or feminine, judged by watching similar behaviour in several models. This emphasis brings social learning theory much closer to gender schema theory.

Social learning theorists continue to adopt a more cognitive orientation to their theorising. Recently, Bussey and Bandura (1992) suggested that there are two processes guiding sex-typed behaviour which are active at different points in the child's development. The first mechanism for the regulation of behaviour is the application of 'external sanctions and direction' i.e. social influence. 'Initially, behaviour is regulated on the basis of anticipatory outcomes mediated by the social environment' (Bussey and Bandura, 1992, p.1238). Increasing cognitive maturity leads to the child constructing their own personal standards (according to their knowledge of sex-congruent behaviour) and their behaviour becomes regulated by self-censure. Bussey and Bandura showed in their study the tendency of children to censure others on the gender appropriateness or inappropriateness of their behaviour prior to displaying self-censure.

The acknowledgement by social learning theorists of the importance of establishing prototypical models brings them conceptually much closer to cognitive

theorists, but they still require that the infant arrive in the world as a 'blank slate' on which 'culture' acts (Tooby and Cosmides, 1992). Cognitive theories of the development of sex-typed behaviour maintain that there is a part played by imitation and external influence, but hold that the child's knowledge of their own sex develops in the same way as all other knowledge, through their own active construction of the world. The child is driven to explore their environment - "conceptual awareness is regarded as the cause rather than the outcome of processing the environment for sex-role information" (Durkin, 1995).

The foundations of cognitive theory can be found in the model proposed by Kohlberg (1966). Although Kohlberg's work has since been superseded by the gender schematic processing model (Martin and Halverson 1981; Bem, 1981) it will be described here, as its major premise -- that the child's development of sex-typed behaviour occurs in a stage-like process -- still holds in current cognitive theorising.

1.2. Kohlberg and cognitive developmental theory

Kohlberg (1966) believed that sex typing could be likened to Piagetian stages of cognitive development. The three stages proposed by Kohlberg were: (1). Gender labelling. This occurs between 2.5 and 3 years. The child comes to recognise categories such as 'man' and 'woman.' (2). The next stage, gender stability, is said to occur between the ages of 3.5 and 4.5, when gender comes to be seen as a durable characteristic. (3). Gender consistency, supposed to appear at around the same time as other conservation abilities (4.5 to 7 years), finds the child aware that gender is conserved and thus consistent across situations and context. In tasks measuring gender consistency, children are asked whether they (or another person) would change sex if they wore sex-incongruent clothing, play with sex-incongruent toys or played sex-

incongruent games (Slaby and Frey, 1975). Kohlberg's theory suggests that gender constancy (all three stages reached)must be achieved before the child manifests sex-typed preferences.

There have been some efforts made to assess Kohlberg's proposals. Carter and Levy (1988) researched the possible relationship between sex-stereotyped knowledge, stereotype flexibility, gender constancy, sex-typed toy preferences, gender schematisation, and recognition memory for gender-relevant illustrations in children of 33-68 months. Although they found that gender identity (measured by the ability to label accurately on the basis of sex) was important to other sex-typing phenomenon, evidence supporting the emphasis placed by Kohlberg on the full achievement of gender constancy was not apparent. A study by Slaby and Frey (1975) investigated the relationship between gender constancy and sex-typed behaviour (preference for watching male/female models on a split-screen presentation of silent, moving pictures). They hypothesized that if children begin to watch same-sex models following the acquisition of gender constancy, same-sex-looking bias should be most marked in children with high marks on a gender constancy task. They found this for boys, but although a similar trend emerged in girls, it did not reach levels of significance. They suggest that children come to understand gender constancy gradually through stages and this progressive understanding may increasingly affect their gender role development by bringing new and added meaning to the behaviours they observe in male and female models. Slaby and Frey speculate that perceived similarity to the model may be only one of the variables which influence selective attention to male or female models; desired characteristics such as perceived power may be another. It may be that for girls there are conflicting tendencies to attend to similar (female) and powerful (male) models. Fagot (1985) presented two studies that confirmed Kohlberg's suggested

trajectory of children's understanding of gender, but did not find this progression to be related to sex-typed behaviour. Fagot speculated that cognitive testing is generally carried out too late and that by the age of three, sex-typed behaviour does not involve any "rational thought processes," but has become an over-learned and automatic response.Although it is unclear what role Fagot assigns cognition once the child reaches three, Fagot suggests that between 12 and 36 months the relationship between cognition and behaviour would be stronger than is evident after this time because the child tries actively to match its own behaviours to the correct gender category. Ruble and Martin (1997) in their overview of sex typing research, note that the methodology of choice in measures of gender constancy may give misleading results. For example, it has been found that children show higher levels of constancy using theoretical transformations than when shown actual transformations. Also, requirements for determining whether the child has achieved constancy vary, with some arguing that their responses to questions are not enough, but that justifications for those responses also need to be examined.

Kohlberg's theory requires that the child achieve gender constancy before they begin to act in a sex-typed way. More current theories, however, require a less sophisticated knowledge of gender. The most popular theory of the development of sex-typed behaviour at present is gender schematic processing theory (GSP) proposed by Martin and Halverson (1981), among others. In the following section this theory will be described and evidence of its premises critically discussed. The model has been extended since its original conception, and recent work will also be introduced.

1.3. Gender schematic processing theory

Martin and Halverson (1981) discuss the development of sex-typed behaviour in terms of information processing. According to this theory, the stereotypes which we hold as adults of typical males and females are formed during childhood, and serve to guide the development of our own behaviour. Stereotypes function as schemas that organise and structure information. The model is presented in diagrammatic form in Figure 1.

When faced with an object or person, the child makes a number of decisions about the relevance of the object to him/herself. The first decision regards whether the object is 'self-relevant.' Following the decision that the object is self-relevant, the child must then decide that the object is 'for girls/boys'. Their subsequent interest in that object is dependent on the congruency of the object with their own sex. In the example given above, the child (a girl) finds that the doll is relevant to her and consequently approaches the object, storing information about the object efficiently, and making retrieval of the information easier in future encounters.

The development of the sex-typed child is thought to depend on two sex-related schemas. First, there is an overall 'in-group-out-group' schema. This schema consists of general information about what is appropriate for males and for females. These general male/female associations serve to provide information, not only about things relevant to the child, and so what to approach, but also to inform the child about what to avoid. A second schema is learned which consists of 'own-sex' information. This is more detailed information about how to do 'girl-type' or 'boy-type' things.

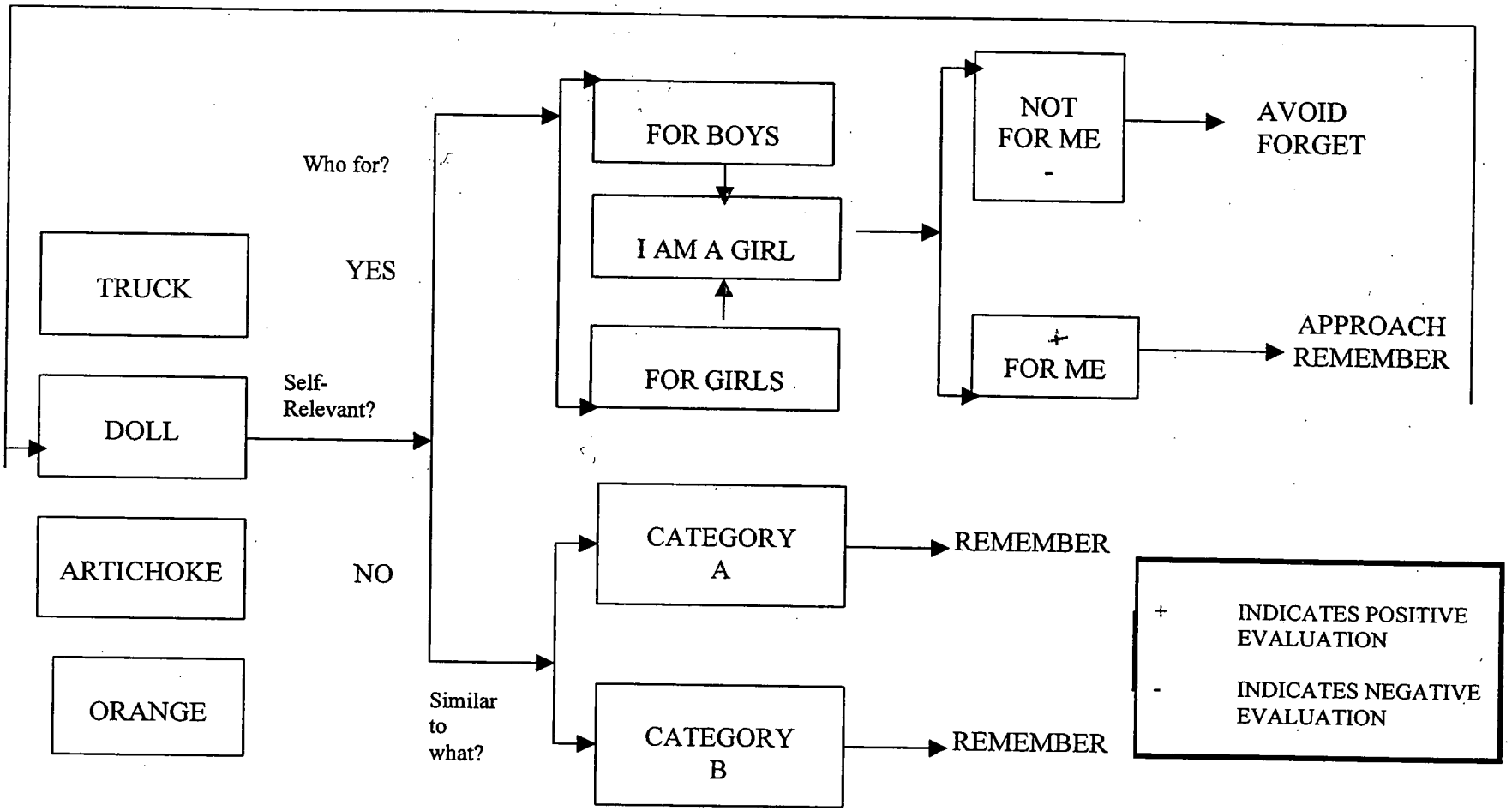


Figure. 1 1 The schematic-processing model of sex role stereotyping

As an example, Martin and Halverson suggest that a girl may know that 'boys fix cars' because it is part of their in-group-out-group schema, but she will not be motivated to include this skill in her 'own sex' schema, having already established that it is 'for boys'. However, a girl would be motivated to learn to sew.

Some of this model's premises are evident from the diagram. (1) The decision 'that dolls are for me' is dependent on the child's understanding of their own sex and the sex of others (gender identity), and (2) the labelling of an object will be sufficient motivation for the child to attend preferentially to that object. The model also contains implicit premises (3) that sex schema will precede sex-typed behaviour and, lacking any statement to the contrary, (4) that sex schemas develop in the same way for boys and for girls. A discussion of these premises will be presented in the following section.

1.3.1. Understanding sex of self and sex of others

If the predicted trajectory of GSP theory is correct, children should be able to identify their own sex and that of others prior to showing a behavioural preference. Evidence relevant to this prediction comes from studies of the emergence of self-awareness in infancy and research mapping the trajectory of same-sex preference and sex-typed behaviour.

Lewis (1981) suggests that infants attain gender knowledge of self and others at the same time, but not until around 8-12 months. Up to 3 months the infant 'acts as a consequence of biological determinism' (Lewis, 1981, p. 403). Self-other differentiation has begun but only to the extent that the infant is beginning to act on objects. Between 3 and 8 months the infant takes part in social and reciprocal activity. Around 8-12 months, concepts of self-permanence and the self-other distinction are manifest in recognition of self in reflected surfaces and other contingency conditions. According to Lewis, gender

knowledge of self and others is acquired at this point through the interaction of infants with the social world.

One of the most frequently used tests of self-recognition, thought by Lewis to signify the achievement of the concept of self is the rouge test, developed simultaneously in 1968, by Amsterdam (with infants) and Gallup (with chimps). In this paradigm, the infants view themselves in a mirror – first without any make-up, then with a dot of rouge surreptitiously painted onto their nose. Noticing the make-up on the reflected image and attempting to remove it from their actual face is thought to constitute self-recognition. Lewis and Brooks (1975) have used this paradigm in a variety of studies and found that nose-directed behaviour of infants of around 18 months was present in between 25% and 40% of the participants. Because the rouge test requires a degree of co-ordination that may not be available to young infants, Lewis and Brooks also looked at body-directed behaviour in a mirror. The infant was allowed to explore their image in both the no-make-up and make-up condition. A difference score, obtained by subtracting body touching before application from body touching after application, indicated that self-recognition was apparent even at nine months. They conclude that the difference observed with age might reflect increased ability to point to a particular part (such as the nose) as a function of muscular development and motor co-ordination.

A more recent study of self-recognition in preverbal infants comes from Bahrick, Moss and Fadil (1996). They used a visual preference paradigm and presented infants of two, three, five, and eight months with static and moving pictures of their own faces side by side with that of an age-matched peer. Bahrick et al hypothesised that if infants recognised their own face as familiar, they would selectively look at the novel, peer's face. Infants as young as three months were reported to have demonstrated this

preference for the peer. However, in this study, the sex of the subject is not reported and the sex of the peer has not been reported to be varied. It is difficult, therefore, to reach firm conclusions about the beginnings of self-recognition as the results may have been confounded by a same-/opposite-sex bias.

While self-recognition must be a precursor to self-gender identity, it is not sufficient to explain sex-typed behaviour. According to GSP theory, prior to the child exhibiting same-sex peer preferences, they would need to be able to identify the sex of themselves and the sex of others. Leinbach and Fagot (1993) used the habituation technique to demonstrate categorical knowledge of gender in nine and twelve-month-old babies, although the effect was not significant in five and seven-month-old babies. In habituation paradigms, the infant is shown one stimulus picture (or a series of pictures from the same category of objects) until their attention significantly decreases on each subsequent presentation of the stimulus. That is, they have habituated to it. A new stimulus (a picture from an alternative categorical set) is presented. Dishabituation is said to have occurred if the infant shows significantly more interest in the new picture (i.e. looks longer). Leinbach and Fagot showed a series of slides of 'attractive adult men' or 'highly stereotypical women' to infants of five, seven, nine and twelve months until the infant became habituated to that category. A renewal of interest to the screen when an exemplar of the alternative category appeared was taken as evidence of categorical recognition. In a second experiment, some of the sample was shown male and female faces with the hair and clothing cues removed. Infants in this condition did not show a renewal of interest suggesting that infants under a year rely on information about sex-typical hair length or clothing styles for differentiating between men and women. However, other studies have shown that infants readily learn to habituate to categorical members of non-human stimuli in the experimental situation (Younger and

Cohen, 1983), and it may be that Leinbach and Fagot's findings do not illustrate anything more than an ability to categorise without prior knowledge of sex as a distinct binary category.

GSP theory requires that knowledge of gender of *self and other* is present before behavioural preferences are manifest. Lewis believes that self-knowledge and gender knowledge mature in tandem. Lewis and Brooks-Gunn conducted a study where infants of 10 and 14 months were shown a series of photographs of faces including one of themselves, a same-sex peer and a peer of the opposite sex (Lewis and Brooks-Gunn, 1979). Measures of preference were taken by comparing looking times to each picture. They found that infants differentiated between the self and infants of the opposite sex, but not between self and same-sex infants in the length of time they looked to each stimulus. Lewis and Brooks-Gunn take this to demonstrate that babies understand their own shared gender-category membership. It is possible, though, that this finding could also be interpreted to mean that the infant did not recognise themselves, but paid similar attention to another exemplar of a member of the preferred (same) sex.

Studies, which rely on verbal mediation, do not demonstrate such an advanced understanding of own sex or gender-category membership of others. Martin and Little (1990) asked children to point to pictures of boys/girls. This ability was not present in children under 35 months. Weinraub, Clements, Sockloff, Etheridge, Gracely and Myers (1984) found that children at 26 months could provide a verbal label for a boy/girl picture (verbal labelling), but were not able to recognise themselves in a group of three pictures (verbal identity) until 31 months. The finding by Lewis that 10 and 14 month-old infants showed both self-recognition and understanding of categorical membership was not repeated in the Martin and Little (1990) paradigm. Here, group-membership and self-recognition were tested by providing the child with a target picture

of either a boy or girl and another pair of pictures (boy and girl). The child was asked to point to the picture most like the target. The sets used also included a picture of the participant. It was not until 35 months that children reliably completed the entire task. From this evidence, it would seem either that the traditional methods of establishing knowledge of one's own gender are extremely insensitive, or the 10 and 14 month-old infants in the Lewis and Brooks study were demonstrating some behaviour other than gender knowledge – possibly a preference for same-sex peer.

The evidence discussed above indicates that infants are able to recognise themselves possibly at three months (pictorial representation), but certainly by eighteen months (in reflected image). Their understanding of the sex of themselves and others is not in place until late in the second year according to tests relying on verbally elicited information. The achievement of the ability to label sex of self and others should signal the start of the development of sex schemas which would build up as the child incorporated more information about people and objects from their environment. The manifestation of sex-typed behaviour, then, should occur sometime after gender identity has been achieved.

A number of studies have investigated the onset of sex-typed behaviour and have found that the appearance of typically male or female behaviour comes prior to the ability to differentiate by sex (at least, as evidenced by the studies above). For example, sex differences in gender-congruent toy choice have been found at 14 to 18 months of age (Caldera, Huston and O'Brien, 1989; O'Brien and Huston, 1985). Boys and girls exhibit different styles of play activities by 13 months of age (Goldberg and Lewis, 1969) and by toddler hood boys are more dominating, active and competitive than are girls (Maccoby, 1990a; Pellegrini, 1989). A pervasive aspect of children's development is preference for same-sex peers (Maccoby and Jacklin, 1987). This preference becomes

evident behaviourally by the age of 27 months of age even before children can accurately label the sex of the child with whom they are playing (Hoyenga and Hoyenga, 1993) and well before they begin to converge into same-sex play groups (Yee and Brown, 1994). The trajectory of development of sex-congruent behaviour will be discussed later in this chapter.

1.3.2. Gender labelling

The ability to label the sexes correctly (i.e. recognition of gender categories) is thought by Fagot (1985) to be sufficient for children to begin to form rules concerning gender. The increasing ability to label things 'correctly' as sex-appropriate or inappropriate is an indication of developing gender schematisation, and cognitive associations are said to be easier for young children to make when sex congruent labels are used. For example, Martin, Eisenbud and Rose (1995) found that when pre-schoolers were asked about their preferences for a group of unfamiliar toys, they used the gender-based labels provided by the experimenter to guide their judgement. Applying labels can enhance children's memories for sex-congruent stimuli. Cann and Newbern (1984) studied children's performance on a picture recognition task in which the two pictures presented varied the sex of the person performing an everyday activity. Verbal labels were provided with the pictures, some of which were stereotype-consistent and others that were stereotype-inconsistent. Recognition was inhibited for stereotype-inconsistent-labelled pictures compared to stereotype-consistent-labelled pictures.

There does seem to be evidence that the use of gender labels affects children's behaviour, causing them to attend to sex-congruent and avoid sex-incongruent stimuli as predicted by the GSP model. However, there is less evidence that the acquisition of

labels is necessary or sufficient to provide motivation for the child to act in a sex-typed way. Evidence is needed indicating that children use sex-typed labels before they show sex-typed behaviour, yet the available literature shows that some sex-typed behaviour is manifest prior to the achievement of gender labelling The following section will discuss the relationship of schema to sex-congruent behaviour using evidence specific to the development of preferences for same-sex playmates, sex-congruent play activities, and sex-typed toys. These three areas or *domains* of behaviour are commonly found to be sex-typed and the manifestation of sex-typed behaviour in these domains is well documented. Each subsection will describe the nature and extent of sex-typed behaviour in these domains, discuss current theorising, and comment on subsequent implications for the model of GSP. The final section on the original GSP model will discuss the assumption made by GSP theory that, as sex-typed behaviour is thought to come from a unitary source (recognition of self and others as male/female), male and female children will develop sex-typed behaviour in a similar way.

1.3.3. The relationship of schema and behaviour

Peer Preference

One of the most pervasive and universal aspects of sex differences is the tendency for males and females to communicate and socialise in exclusive same-sex groups. Girls begin to segregate into same-sex groupings around 27 months with boys closely following at 36 months (La Freniere, Strayer and Gauthier, 1984) and in-group/out-group biases appear about age 5, continuing into middle childhood (Yee and Brown, 1994; Maccoby, 1998). Segregation often occurs in an environment where everyday tasks are allocated according to sex, but the trend for segregation in play

appears before the age at which children would normally be divided for education or employment purposes and is universal (Whiting and Edwards, 1981).

Studies addressing the timing of the onset of same-sex preference will be discussed in this section and an alternative explanation for children's convergence into same-sex groups will be discussed - that of behavioural compatibility.

(1) Same-sex preference in infancy

Studies of same-sex preference in infancy have largely relied on visual preference techniques. Looking behaviour is considered especially useful in infant studies as it emerges early relative to other behaviours. The two techniques most commonly used in studying looking behaviour are habituation and simultaneous-presentation visual preference tasks. Habituation tasks allow the researcher to make inferences about the infant's implicit knowledge about the existence of category, but does not allow them to make predictions about preference for the stimuli. Leinbach and Fagot (1993) used this technique to show categorical gender recognition in infants (see section1.3.1 for full description and discussion of this study).

Other visual paradigms requiring infants to make gender related *choices*, however, suggest that same-sex preferences are in place before, or at least are developing in tandem with, knowledge about gender categories. Another technique that relies on infants' looking behaviour is the visual preference paradigm. In studies using this technique, infants are presented with a pair or series of stimuli and their relative attention to each of the stimuli is measured. Fagan (1972) delineated 'visual preference' as when one of a pair of targets receives significantly more than 50 % of an infant's fixation.

Bower (1989) reported that infants under one-year showed a preference for looking at faces of other children of the same sex as themselves when presented with a

choice between two simultaneously presented photographs of children's faces. Bower and his colleagues were also interested in the possible cueing effects of hair and clothing. They presented 10 and 14-month-old infants with moving stimuli in the form of point-light displays. Despite the lack of facial or cultural cues, the infants' preferential looking was in the direction of the same-sex model. As noted earlier, when Lewis and Brooks-Gunn (1979) presented a series of photographs to infants (the photographs were the infant's mother, infant subject, female and male babies of same age, female and male 5-year-olds, female and male 10-year-olds, and female and male adult), they found infants of 16-18 months looked longer at the same-sex peer photograph. Although this finding is interpreted as evidence for a same-sex preference, the results from infants in younger and older age groups taking part in the same study did not reveal a significant preference in attention.

(2) 'In-group' preference

GSP theory predicts that same-sex-groups form on the basis of 'like-me' attraction. The child learns about its own sex and the sex of others, and uses same-sex groupings as a means of learning and practicing sex-appropriate social and cognitive skills. There is, however, debate on the causative factors behind same-sex groupings. Another theory, that does not depend on 'like me' recognition, is that groups form on the basis of behavioural compatibility (Goodenough, 1964; Serbin, Moller, Gulko, Powlishta and Colburne, 1994). This theory suggests that children are drawn to one another on the basis of a shared interest in the activity being performed.

Studies have shown that boys prefer outdoor, rough and tumble games whereas girls seem to prefer more sedate activities which tend to take place indoors (Fagot, 1976; Halverson, 1973). Even when children's activity *level* has not been differentiated by virtue of sex, the *type* of activity/game performed by each sex is often different

(DiPietro, 1981; Pellegrini and Smith, 1998). Boys' active games are often competitive in nature (e.g. football) where girls' are co-operative (e.g. skipping) (see Leaper, 1994; Maccoby, 1988, 1990a, for reviews). Evidence that behavioural compatibility forms the basis for sex segregation is mixed, and it has been noted that the direction of causality between play style and preferred play mate is unclear (Maccoby, 1998).

Compatible groupings need not form solely on the basis of the activity being performed. The child's reward for same-sex relationships may derive from a different source – for example, increased levels of interaction. Serbin, Moller, Gulko, Powlishta, and Colburne (1994) monitored the frequency of social interaction between mixed and same-sex dyads at play and found the highest degree of social interaction between same-sex partners. They hypothesised that it is not the activity *per se* that is rewarding to the child, but that interactive play is more enjoyable than solitary play and children seek out same-sex groups 'as this is the context in which that interaction most often takes place.' Segregation may more strongly depend on avoidance than preference and occur from an attempt by both sexes to avoid one another's conflicting interaction styles (Fabes, 1984). Halverson (1973) suggests that children are more active when in the company of their own sex. Particularly, the greater level of activity in boys may reflect excitability produced by peer interaction and so is dependent on the setting. Boys might be more aroused than girls by peer interactions. A physiological basis for sex segregation is suggested by Fabes (1994) who cites evidence that male and female children have different levels and thresholds of arousability and subsequent ability to restore themselves to a state of equilibrium. Moss (1974) showed that female infants restore themselves to state of equilibrium without maternal intervention more often than males. Hawiland and Malatesta (1981) found that females were capable of tolerating

more emotional arousal and for longer than males, before becoming deregulated and distressed.

Labelling tasks described in section 1.3.1 show that children may be able to differentiate between males and females at the beginning of their second year, and many children can already identify themselves in mirror recognition tasks, but it is some time later that they are able to recognise themselves as members of one of these categories in sorting tasks. (Martin and Little, 1990; Weinraub, Clements, Sockloff, Etheridge, Gracely and Myers, 1984). So, the evidence presented here has demonstrated some problems in GSP theory. Firstly, an awareness of self does not necessarily confer the ability to make 'like-me' judgements but same-sex preference has been found at one year. Secondly, segregation in play need not rely on identifying oneself as male or female, leading to an attraction to and imitation of 'like-me' others. It is probable that there is some relationship between preference for playing with same-sex others and children's preferred play style, but the evidence noted here shows that the direction of causality is not clear.

Activity preference

When discussing differences in activity preferences and play styles of boys and girls, the evidence for behavioural compatibility documented above needs to be taken into consideration. If we accept that girls and boys prefer to play with same-sex others because it is intrinsically rewarding, we need to accept that there are fundamental differences between boys and girls that are unexplained by social learning or gender schema theories. A number of differences in the preferred activities of boys and girls have been noted and require explanation from the GSP model. Particularly salient are

(1) the tendency for boys to indulge in rough and tumble play and (2) the context within which play takes place (group composition and setting).

(1) Rough and Tumble play

Rough and tumble has been defined by DiPietro (1981, p. 50) as "the set of play behaviours that are displayed during exuberant arousal and that mimic more intentionally aggressive actions.... Motor patterns such as pushing, pulling, hitting, chasing, and wrestling displayed without hurting one another.'

Research in a variety of human cultures has shown that boys' greater tendency to rough and tumble play is a cross-cultural phenomenon (Whiting and Edwards, 1981), although the degree of differentiation between the sexes may depend on cultural factors. Blurton-Jones and Konner (1973), for example, found that for !Kung boys and girls the difference in rough and tumble play did not reach significance. Fagot, Hagan, Leinbach and Kronsberg (1985) note that rough and tumble play is not rewarded by adults, and rough and tumble play which leads to more aggressive action is censured by a child's peers (Pellegrini, 1994). The fact that rough and tumble is a cross-cultural and cross-species phenomenon (Sackett, 1970; Hansen, 1966) suggests that there may be some evolutionary function for it and that this could provide an explanation for sex-differentiation. Some suggestions have been that it provides direct training in aggressive skills and mechanisms for coping with the affective and physical outcomes that accompany an aggressive encounter (Hartup, 1983). Boulton (1996) notes that rough and tumble play may provide practice for the development of real fighting skills, or serve as a safe way to establish or display social dominance. Rough and tumble play may provide young males with social skills over and above those provided by other forms of social interaction (Humphreys and Smith, 1987). Although other types of social interaction, such as 'co-operative social games, comfort contact and conversation'

share features with rough and tumble play (reciprocal role-taking, social problem-solving, and symmetrical peer groupings), rough and tumble differs in that it is more flexible (in generating 'novel behavioural patterns') and vigorous (Maccoby, 1986). However, Pellegrini (1993) was unable to pinpoint a relationship between the aspects of play distinctive to rough and tumble and popularity within a group of schoolboys, so its role to developing social skills remains unclear. Rough and tumble play does not seem to be a simple manifestation of exuberant behaviour which might lead to an increased level of activity as activity level *per se* has been shown to be similar across the sexes (Di Pietro, 1981).

In a study by DiPietro (1981), a 'playroom on wheels' was designed into which same-sex triads were invited. The study was intended to assess the components of rough and tumble play and provided a setting designed to maximise the amount of rough and tumble play displayed. DiPietro found that there was little overall difference between the male and female triads in activity *level*, but that differences could be seen in terms of the degree of male and female rough and tumble play. A robust sex difference was observed in the amount and intensity of rough and tumble play for both targets and partners. Pellegrini and Smith (1998) differentiate between rough and tumble play and other forms of vigorous play activity in that rough and tumble is characterised by a particular type of social interaction. They describe another form of vigorous play which is prevalent earlier in childhood. 'Exercise play' is defined as 'gross locomotor movements in the context of play' such as running, jumping, and climbing where 'rough and tumble' play involves the participation of two or more willing partners and might include 'wrestling, grappling, kicking and tumbling' (Pellegrini and Smith, 1998, p.578-579). Pellegrini and Smith suggest that there is a lesser degree of sex differentiation in the extent of exercise play. Boulton (1996) found that boys show greater levels of rough

and tumble play than girls. Boys engaged in more chase initiation activities, more bouts of brief rough and tumble play, more bouts of restraining, and more bouts of boxing and hitting than girls.

If rough and tumble serves a specific function or, as suggested by Fabes (see the previous section on in-group preference) is the result of increased levels of arousability in boys, it may not require any further explanation in terms of cognition.

(2) The context of play

One of the most frequently noted sex differences in children's play is that boys spend more time interacting in groups whereas girls interact in dyadic relationships (Benenson, 1990; Ladd, 1983). It is thought that this play style is a precursor to later adult social preferences and may be related to sex differences in play style and attention span (Rutter and Rutter, 1993). Benenson, Apostoleris, and Parnass (1997) note some methodological problems with the studies which reach conclusions of sex-differentiation. The studies tend to use different measures of group interaction making comparisons across ages difficult; dyadic and group interaction are usually coded as mutually exclusive groups; and results are confounded with sex differences in toy and activity preference. In their study involving two groups of children (4 and 6 years), they found that boys and girls engaged in similar frequencies of dyadic interaction when this did not preclude simultaneous group interaction. Also, after 5 years of age, boys engaged in more group interaction than they had done previously. It has been suggested that there is some period of cognitive transition around this time marked by the child being able to view their peer group as a whole with the achievement of concrete operations (Parker and Omark, 1980).

Another difference between the play patterns of boys and girls that has received attention is the extent to which boys and girls prefer to play indoors or outdoors. Sex

differences in preference for indoor or outdoor play often occur as a function of the type of activity in which the child is participating and the toys being utilised in the play. Fagot and Littman (1976) found that pre-school boys prefer *active outdoor* play significantly more than girls, and girls preferred *indoor play with toys* more than boys. Halverson and Waldrop (1973) also found boys to be more active outdoors than girls and more consistent in their style of play across indoor and outdoor situations. Girls' play style is not generalised across play settings and their outdoor activity preferences seem relatively independent of play indoors indicating, according to Halverson and Waldrop, greater responsivity to situational factors. Stoneman, Brody, and MacKinnon (1984), looking at 22 school-aged children and their siblings playing at home, found that the selection of play activities varied with the gender and composition of the group. Once more, girls played indoors more than boys, engaged in doll play more frequently than boys, and boys engaged in competitive physical activity more. Tendency toward indoor or outdoor play may also be associated with the proximity of the child to adults. Boys' play tends to occur in more public places with less surveillance than is given to girls (Newson and Newson, 1986; Whiting and Edwards, 1988).

Gender schematic processing theory would predict that sex-typed activities and play would appear in response to the realisation of the existence of the 'in-group/out-group' dichotomy and would follow the manifestation of a same-sex preference. Alexander and Hines (1994) investigated the relative contribution of sex of potential playmate and play styles to playmate selection in 60 children, 4-8 years when understanding of gender category should be firmly in place. They found that within each sex, the children's preferences for play styles and gender of the target child were unrelated. When targets' play styles and targets' gender labels were presented as competing dimensions, boys of all ages chose female targets with masculine play styles

over male targets with feminine play styles showing that play style was more important to them than sex of play mate. Younger girls (4-5- years) chose female targets with masculine play styles whereas older girls (6-8 years) chose male targets with feminine play styles. Alexander and Hines believe this evidence suggests possible sex differences in the contribution of gender labels and of play styles in the development of children's preferences. It appears from this evidence that the play *styles* of playmates may be more critical than the sex of playmates for boys, a finding in line with theories of behavioural compatibility. The predicted preference for in-group members is not apparent.

Once the child has constructed a gender schema, s/he should show schematised behaviour. GSP would predict a conceptual relationship between sex-congruent activities and the context typically associated with boys/girls (indoor/outdoor play). According to GSP theory, children should attend differentially on the basis of sex-congruence of the person/object/activity. It would follow that boys' attention would be directed toward outdoor activities, and girls' towards indoor activities. Levy (1994) studied forty-one children between 44 and 81 months of age, measuring their classification and clustering in recall of gender-typed indoor and outdoor toys. He found that their recall was gender differentiated and context dependent. In line with GSP theory, boys were more accurate at remembering outdoor toys traditionally associated with boys and girls were more accurate at remembering indoor toys traditionally associated with girls.

If there is a single underlying cause to all sex-typed behaviour, as predicted by GSP (i.e. the classification of people and things according to gender), we should see some relationship between children's preference for same-sex activity and other sex-typed behaviour. Turner, Gervai and Hinde (1993) accumulated evidence from 4 year-olds in Cambridge and Budapest and looked at the inter-correlation among a number of

sex-typing measures. They found that preferences were more sex-typed for males than for females, and that children showed more sex-typing in their play activities and toys than in their social interactions. However, the relationships between any of the measures were 'at most moderate' (Turner, Gervai and Hinde, 1993, p. 340) The prediction that preference for same-sex playmate would be associated with preference for sex-congruent activity was not in evidence.

Preference for sex congruent activities does not seem to follow the expected systematic developmental pathway as predicted by GSP theorists. Maccoby and Jacklin (1979) noted that the degree to which children were gender stereotyped in their activities at 45 months was unrelated to whether they showed preference for same-sex play or playmates a year later. Further, the preference for children to participate in the same activities as others of their own sex may be explained directly in terms of preferred activity, without reference to gender recognition. The evidence for the effects of gender schematic processing on activity preference appears mixed and inconclusive. There is no obvious shared developmental trajectory following the attainment of gender identity or in/out-group comprehension and there has been evidence of sex differences in activity appearing before the age at which children have developed an understanding of their own and others' gender (Goldberg and Lewis, 1969; Maccoby, 1990b; Pellegrini, 1989).

Toy Preference

Sex differences in toy choice have been noted from as young as eighteen months (Caldera, Huston, and O'Brien, 1989; O'Brien and Huston, 1985). Toys typically associated with girls tend to be related to domesticity and nurturance, while boys' toys traditionally include transportation vehicles and construction kits (Rheingold and Cook,

1975; Miller, 1986; Robinson, 1986). Children's toy preferences have proved of considerable interest to psychologists as they are thought to relate to the development of children's visual-spatial abilities (Liss, 1981, 1983). Investigation into the ontogeny of toy preference relative to the development of gender cognition has provided inconclusive evidence regarding the centrality of gender knowledge to toy choice. Research to date has investigated the strength of gender schema, the centrality of the role played by labelling and identification, and the relationship of schema to behaviour.

(1) The strength of gender schema

Ruble, Balaban, and Cooper (1981) investigated the relationship between some measures of gender cognition and the extent to which children were influenced by TV commercials in their toy choice. They found that gender schematisation (measured by monitoring reaction times of children pointing to their favourite toy from a male-female pair was positively correlated with children's same-sex toy preferences and negatively associated with both recognition memory for stereotype-inconsistent behaviours and preferences for opposite sex toys. They interpreted their findings as showing that gender schematisation is the most important predictive variable in sex typed behaviour. This study would have been more persuasive, however, if the measure of schematisation had used some group of objects or activities other than toys. Using toys to assess schematisation, sex-typed behavioural preferences and memory for sex-typed stimuli may have tapped into some set of cognitions peculiar to this set of objects.

(2) Gender labelling and identification

Martin, Eisenbud and Rose (1995) performed three studies in which they investigated the effect of sex-typed labels on the attractiveness of toys for boys and girls. They found that when the toys were presented to the children with gender labels,

the children consistently showed a sex congruent preference even when the toys designated as sex-inappropriate were very attractive.

Blakemore, LaRue and Olejnik (1979), found that for two, four and six-year old girls, both sex-appropriate toy preference and ability to label on the basis of gender increased with age. Boys' gender identification also increased with age but their preferences were consistently strong at all ages. As toy preference seemed to appear in girls at age 4, but was not apparent at 2 years, Blakemore et al carried out a further study with a group of 3-year-old girls in an attempt examine the process by which toy preference develops. These girls showed knowledge of the appropriateness of the toys for each sex, but only showed sex-congruent preferences themselves when gender category labels were made salient by first being asked to identify the toys as boys' or girls'.

It seemed that even though girls possessed gender knowledge, it was not used spontaneously when making personal choices. In contrast, boys at 2 years were already showing strong behavioural preferences for same-sex toys even though they were not able to identify toys as belonging to boys or girls. This study suggests only a tenuous relationship between cognition and toy choice.

(3) Toy preference correlated with other sex-typed behaviour

Other studies have investigated the correlation between preference for toys and other sex-typed behaviour. A study by Brush and Goldberg (1978) found some association between pre-schoolers' preference for same-sex playmates at home (according to maternal report) and preference for sex-appropriate toys. However, correlations were relatively low and inconsistent, and the children's own reports of peer preference were unrelated to toy preference. Connor and Serbin (1977) noted that pre-schoolers who expressed same-sex peer preferences were more likely to also show sex-

typed toy play preference, and those having more opposite-sex peer interactions were more likely to demonstrate 'sex inappropriate' toy play behaviours. However, this latter finding was restricted to the boys in the sample.

Some literature has demonstrated that preference for same-sex playmates is stronger than the tendency toward sex-congruent toy choice. Berndt and Heller (1986) found strong same-sex peer preference even for unknown children with untraditional interests, especially by younger children (e.g. a boy described as liking to play with girls and kitchen sets was liked as much by boys as one who played with boys and liked football). However, research which does not present toy preference and preference for same-sex peer in competition finds the reverse. Turner, Gervai and Hinde (1993), in their cross-cultural study of children's play, peer and toy preferences, found that play and toy-preference were more clearly sex-typed than social interactions.

GSP theorising suggests that once gender schema is in place and the self has been assimilated into it, sex typing should be visible in a number of domains including toy preference. However, children demonstrate behavioural preference for sex-congruent toys and learn the sex-appropriateness of toys prior to reliably labelling on the basis of sex or naming children of their own sex as preferred play partners. So, explanations for the development of toy preference need to be found elsewhere. The evidence for two possible alternative explanations will be discussed here -- toy preference resulting from social influence, and toys holding differential ecological appeal.

The role of learned preferences

An alternative explanation for the robustness of sex typed toy preference might be that children are taught from a very early age about the 'appropriate' toys for their sex. Several studies have investigated the impact of parental choice on children's

preference for same-sex toys. Rheingold and Cook (1975), for example, took a note of the sex-typed toys present in the rooms of 96 children under 6-years-old. They found that boys were provided with more vehicles, educational art materials, sports equipment, toy animals, depots, machines, fauna and military toys where girls had more dolls, doll houses and domestic toys. The authors suggested that the findings were indicative of parental ideas about the appropriateness of toys for their children. Fagot (1978) found that parents positively reinforce play with sex-traditional toys and give negative feedback for cross-sex play behaviours. The same pattern has also been found in schools (Fagot, 1984). However, when Robinson and Morris (1986) obtained lists of toys bought as Christmas presents for 36, 48 and 60-month-old children, they found that toys *requested* by the children were more likely to be stereotyped than unsolicited gifts. This would seem to indicate that children's preferences actively guide parental choice of toy and that children's preferences are stereotypical from a young age. Although these studies suggest that children might lead sex-typed toy choice, parents are not the only, or necessarily the strongest form of social influence and external factors may still play a significant role in guiding sex-typed choice (Harris, 1995). Cole, Zucker and Bradley (1982) studied sex-typed toy preferences in two day-care centres. One of the nurseries adhered to a 'non-sexist' child-rearing policy; the other did not explicitly practise such a philosophy. They found that children in a 'non-sexist' nursery showed sex-stereotyped behaviour to the same-degree as those in traditional day care. Surprisingly, the toys provided by the parents were also sex-stereotypical. One explanation suggested by Cole et al is that parents may 'reluctantly give in' to requests for stereotypical toys from their children.

Influence may be horizontal as well as vertical. Children seem to monitor the behaviour of their peers in their choice of play behaviour. Shell and Eisenberg (1990)

watched groups of children approaching and playing with gender-neutral toys. They found that children's engagement in toy play was influenced by the amount of same-sex peer's participation relative to amount of opposite sex peer's participation. Shell and Eisenberg suggest that children's toy-related behaviour is probably a function of multiple factors including reinforcement contingencies, the desire to conform to gender-related norms, and opportunities to interact with/avoid interaction with same/opposite sex peers.

The evidence accrued for the role of gender schematic processing in the child's development of sex-typed toy preferences shows that the child's toy choice may depend on the perceived appropriateness of a toy to their sex, ascertained from adult or peer models. However, this process is well explained by the revised social learning theory (Perry and Bussey, 1979; Bandura, 1986), and the importance of systemmatic gender-related thinking has not been proven.

Ecological appeal

Toys have been designated as sex stereotypical on the basis both of observing children at play (Fagot, 1974; Fagot and Patterson, 1969; Block, 1982) and by canvassing adult opinion (Miller, 1987; Schwartz and Markham, 1985). These studies have shown that 'girls'' toys generally provide opportunities to practice domestic skills or nurturance (dolls, cuddly animals, miniature kitchen sets, prams etc.) whereas boys are given toys encouraging exploration, manipulation, invention and construction (blocks, toy cars, guns and swords). The suggestion in the previous section that parents may be reacting to their children's requests in the provision of sex-typed toys indicates the possibility that there is something about the toys which the sexes find differentially appealing.

Campbell (1998) suggests that early sex-typed preference for toys may be explicable by differential attunement to toys as a function of gender. 'Attunement' is a term from ecological psychology and describes the process by which an individual takes notice of certain objects above others as a result as the *affordance* of that object. Affordances have been described as 'the possibilities for action and learning offered by features in the environment' (McArthur and Baron, 1983). For example, girls would be attuned to dolls because they afford the opportunity for nurturance; boys would be attuned to weapons, which afford the possibility of competition and aggression (Campbell, 1998, p. 340).

In order to further investigate the possibility that children are responding to some attribute of the toy in their preference, it would be necessary to establish what attributes differentially appeal to male and female children. Miller (1987) recognised the need to identify the properties of those toys traditionally associated with one sex or the other. She attempted to develop a system of toy classification which would permit systematic exploration of the suggestion that early play experiences of boys and girls may contribute to gender differences in cognitive and social development. Ratings for 50 stereotypical masculine and feminine toys were given on the basis of manipulability, creativity, nurturance, attractiveness, symbolic play, competition, constructiveness, handling, aggressiveness and sex appropriateness by 100 undergraduate students. She found that many toys which might not conceptually be associated with one another (e.g. guns and balls) were contained in the same cluster and described in very similar ways (high in competition, aggressiveness and handling, male, low in constructiveness). These findings would suggest that there may be aspects of certain toys which hold appeal for boys and girls by virtue of their affordances (Gibson, 1969), not simply their label.

However, when children are not given a choice of toy, there is some suggestion that their behaviour is guided by their own play history rather than the affordance of the toy they are presented with. Liss (1981) analysed sex differences in patterns of boys' and girls' play with identical toys (2 stimulus toys taken from dolls, trucks and musical instruments). She found that the children played differentially with the toys as a function of sex (of child). This finding would support the notion that the child brings a sex-typed play-style to the toy that constructs the possibilities for play that it affords. Liss suggests the possibility that play style may be a central force in both peer group preference *and* toy choice. Karpoe and Olney (1983), however, found that sex-typed toys produced male/female type play styles. They found that only girls showed significant sex-typed toy preferences when allowed to choose between a variety of sex-typed and neutral toys, but for both sexes, feminine play constructions and descriptive stories occurred with girls' toys, and masculine ones with boys' toys. In a second study, when boys and girls were limited to boys' toys (vehicles) or girls' toys (dolls and dolls' furniture) and blocks (thought to be gender-neutral), play constructions and stories once again reflected the gender association of the toys provided, rather than the child's sex.

1.3.4. Sex differences in the development of sex-typed behaviour

GSP theory does not differentiate in its predictions about the development of sex-typed behaviour in boys and girls as it is assumed that all sex-typed behaviour emanates from a unitary source - the understanding of one's own sex and the sex of others. However, several bodies of research have noted that there are differences in the timing of appearance and the strength of sex-typed preferences and behaviour between boys and girls. This section will illustrate points in the proposed cognitive process (see diagram on page 8) at which male and female children differ and will suggest areas

where the model described by Martin and Halverson (1981) might benefit from incorporating other theoretical stances.

1. Points at which male and female children differ

The first manifestation of sex-typed behaviour is presumed to be a preference for same-sex others, as they form the 'in-group' which guides the child's development in other areas (through recognition of 'for me'/'not for me'). From previous research it seems clear that preference for same-sex others is not equally strong in boys and girls. LaFreniere, Strayer and Gauthier (1984) observed the interactions of 15 peer groups over a three year period. The ages of the children involved ranged between 1 and 6 years. They found that same-sex preference increased in a linear fashion with age but that girls showed a significantly greater preference for same-sex peers than boys at 27 months, and boys showed significantly greater same-sex preference than girls at 36 months. LaFreniere et al suggest that the steady increase in boys' preference and the levelling off of the girls' preference is a function of the differences in rates of maturation in boys and girls. The systematic increase in degree of same-sex preference found in male children is also noted by Serbin and Sprafkin (1986). They used two measures of children's use of gender as a schematic dimension. The first measure was intended to assess the degree to which they categorised on the basis of gender and the second reflected the degree to which the children used the gender dimension to make personal affiliation choices when other schematic dimensions were available. No sex differences were found in gender-based classification. However, boys increased their gender-based affiliation choices in a linear fashion from 31% preferring same-sex adult at age 3 to 74% at age 7. Girls responded fairly consistently in the different age groups (between 40 and 46% gender-based affiliation choices). Maccoby (1998) notes that boys' groups tend to be more cohesive and exclusionary than girls' groups and suggests

that conditions making gender identity salient may be different on an individual and on a group basis. From studies with verbal infants and children, then, same-sex preference is stronger for boys, and there seems to be a different trajectory of development between the sexes.

It is unclear when this difference in the strength of same-sex preference starts. Lewis and Brooks-Gunn (1979) report a same-sex preference in 16-18-month-old infants when they are presented with a series of photographs (see section 1.3.3), but this only reached significance in female infants. In a second study, however, neither sex showed preferential same-sex looking. Other studies into early infant preferences for same-sex others do not report any sex differences (Bower, 1989). Unfortunately, research studies using the preferential looking of infants tend to ignore the effects of sex of participant, assuming, instead, that early infant behaviour is undifferentiated by sex (Bahrik, Moss and Fadil, 1996; Poulin-Dubois, 1994; Legerstee, Anderson, and Schaffer, 1998; Maurer and Barrera, 1981), although some studies using this paradigm have reported no significant differences as a function of infants' sex (Langlois, Roggman, Ritter, Rieser-Danner, and Jenkins, 1987; Samuels and Ewy, 1985). It is possible that important information on sex differences in the developmental trajectory for person perception has been lost as a consequence of inconsistent investigation.

Another part of the cognitive process clearly differentiated by sex is the impact of the decision 'for me' or 'not for me.' Labelling is thought to indicate the ability of a child to categorise by sex and make behavioural choices on the basis of that categorisation (Fagot, 1986). Although there have been no sex differences reported in the development of children's ability to label on the basis of gender (Fagot, 1986), boys appear to be more emphatically sex-typed in their preference for 'for me'. One area in which this is particularly obvious is toy choice. There have been differences noted

between boys and girls both in the expressed preference for sex-typed toys, and in the relationship of gender labelling of toys and toy preference. Robinson and Morris (1986) compiled list of Christmas toys received and requested by children 31 to 65 months. Boys' requests show that they develop sex-typed interest in toys earlier than girls. They requested 72%, 76%, and 75% gender-stereotyped toys in the corresponding age groups of 36-, 48-, and 60- months. The girls' requests were less frequently sex-typed - 29%, 51%, and 73% in the corresponding age groups. Blakemore, LaRue and Olejnik (1979) found that sex-appropriate toy preference and the ability to label on the basis of gender increased with age for the girls, but that boys' preferences were strong even before being able to label. These studies and others (e.g. Turner, Gervai, and Hinde, 1993) find a stronger sex-typed toy preference in boys. Given this and the differing impact of gender-labelling in boys and girls, it seems that the two sexes either use toy labels differently or that the motivation behind their choice of toys is different.

When a child has categorised something as 'for me,' according to the schematic processing model, the outcome is that they will approach and preferentially remember that thing. Conversely, when the decision is made that the thing is 'not for me,' the child is predicted to avoid and forget it. Not only have boys been shown to make sex-typed toy choices more strongly than girls, there is also evidence that their avoidance of things categorised as 'not for me' is greater than girls. Hartup, Moore and Sager (1963) studied avoidance by presenting toy attractiveness and gender appropriateness as competing dimensions to children aged between 3 and 8 years. They found that for both sexes, but *more uniformly in boys*, avoidance of cross-sexed toys increased with age. Boys are also more likely to avoid opposite-sex others in play situations. This was demonstrated by Shell and Eisenberg's (1990) study into the effect of peer presence on preference for playing with non-sex-typed toys. They found that the boys in their study (but not the

girls) ceased attending to toys they had previously been playing with when there were more opposite-sex peers present than when they arrived.

2. Other explanations

The dependence on sex-related cognition for sex-typed preferences and behaviour creates problems for GSP theory given the evidence of differential development of boys and girls, particularly because the cognitions on which the theory relies (gender identity and the ability to label on the basis of gender) have not been reported to vary as a function of sex (Trautner, 1992; Fagot, 1986). Although there is almost certainly some element of cognitive processing involved in the development of sex-typed behaviour, especially in later childhood, there is insufficient evidence that gender understanding provides the underlying motivation for all sex-typed preferences and behaviour.

Two alternatives to explain apparently differential motivation both to attend to sex-typical stimuli and to make sex-typical choices will be discussed here. Research on infant predisposition and innate abilities suggest the existence of sex-related differences, and may be useful in discussing the early manifestation of sex-typing. Studies on socialisation influences and social-role expectations have shown continuous differential treatment of children as a function of their sex (and some sex of child/ sex of adult interactions). These studies suggest that the relative strength of male and female preferences and behaviour are a function of reinforcement and expectation.

Infant predisposition

Tooby and Cosmides note the tendency of the 'standard social science model' to treat the child as if it is a blank slate on which 'culture' acts. They also suggest that social scientists who have subsequently acknowledged a place for cognitive psychology have exchanged the blank slate with 'blank cognitive procedures' (Tooby and

Cosmides, 1992, p.29). The GSP model fits this description when it describes a process whereby all children are predicted to follow a particular cognitive pathway. It possible, however, that children begin this process with fundamental differences which mean they experience inputs and influences differently. The possibility of sex differences in arousal has already been noted in children (see Section 1.3.3 on in-group preference) but physiological differences may affect the child's consequent cognitions from birth. It is possible that in the search for an encompassing description of the development of sex typing, some abilities of the child will remain unexplained in terms of cognition, and must, instead be considered as originating at, or even before, the birth of the infant.

The conclusions reached by Fagot and Leinbach (1993) in their habituation task-- that infants are able to categorise on the basis of gender from around 9 months-- led them to speculate on the existence of some type of 'tacit knowledge' guiding infants' abilities to categorise social stimuli. Some other cognitive abilities have been identified in very young infants and are thought to be innate. Geary (1996) proposes the existence of 'primary (mathematical) abilities' which form 'part of a species-typical biologically primary cognitive domain' (Geary, 1996, p.220). Numerosity is said to be evident in human infants in the first few weeks of life while ordinality (counting and one-to-one correspondence) is evident in 18 month-old infants (Cooper, 1984). Some infants as young as 18 months are able to use some form of 'tag' to determine the numerosity of sets of up to three items (Starkey, 1992). Simple arithmetic has also been shown to emerge early; five-month-olds are aware of the effects that the addition and subtraction of one item has on a small set of items (Wynn, 1992). The evidence for early manifestation of many behaviours and capacities previously understood as part of the infant's cognitive and social development suggests that we may be overestimating the amount of acquired 'knowledge' required by the infant to perform some behaviours.

The early existence of some capabilities might also go some way to explaining sex differences in the development and degree of sex typing. McGuinness and Pribram (1979) propose that differences in the cognitive and social behaviour of children and adults are the result of sex-differentiated attentional systems. The attentional systems they identify are reflex attention (arousal), vigilant readiness, and effort (in which the input is coded to produce a change in a neuronal model). If some types of stimulus information are more salient to one sex than the other, this would have implications for the efficiency with which this information is used. The developing child may differ according to sex in the way they control and interpret their environment. For example, from childhood on, females are more sensitive to higher sound frequencies (Corso, 1959), and intolerant of loud levels of sound (McGuinness, 1972). Males and females have different physiological responses when showing interest - heart deceleration and vocalisation were correlated in males, while heart deceleration and motor arrest were found in females (McCall and Kagan, 1967). McGuinness and Pribram suggest that the male is biased to express himself through action and the female through communication.

It is possible then, that the infant does arrive with some pre-wiring, differentiated both as a function of its species (for example, babies show an early preference for human over non-human faces) and as a function of its sex. Marler (1991) suggests the possibility of a species-specific 'instinct to learn.' He uses the concepts of Lorenz and Tinbergen -- 'sensitive periods', 'releasers,' and 'innate release mechanisms' -- to present possible scenarios for the way in which these instincts might act. Marler gives the example of species of birds that have distinctive physiological mechanisms for 'constraining or facilitating improvisation, guiding learning preferences, directing motor development and establishing the timing of sensitive

periods.' What physiological form this instinct, 'constraint' (Lumsden and Wilson, 1981) or 'privileged relationship' (Gallistel, Brown, Carey, Gelman, and Keil, 1991) might take in humans' social behaviour remains to be seen, but there seems to be evidence indicating sex linkage or sex limitation in some domains.

In a recent finding, Skuse, James, Bishop, Coppins, Dalton, Aamodt-Leeper, Bacarese-Hamilton, Creswell, McGurk, and Jacobs (1997) have identified a sex-linked chromosome which they believe affects human sociability. This team looked at measures of social cognition, social dysfunction, and academic ability in a group of females suffering from Turner's syndrome, a disorder of human females in which all or part of one X chromosome is deleted. Intelligence is usually normal in these women but social adjustment problems are common. The investigators divided the group into females who had inherited their single X chromosome from their father, and those who inherited it from their mother. Those women and girls who inherited this chromosome from their mother were found to experience more academic problems, were more likely to experience 'clinically significant' social difficulties, and were more likely to score highly on the social dysfunction scale than those whose X chromosome was paternally derived. The researchers also found, by performing the same tests on a group of 'normal' males and females in the same age groups that normal males were more likely than normal females to score highly on the social dysfunction scale. They suggest that it is the paternal chromosome which mediates social interaction in Turner's patients and in the normal population, and, therefore, that a genetic basis exists for social cognition.

Biological sex-differentiation can also take the form of sex-limitation (hormonal influence). The gonads and adrenal glands secrete sex-hormones during the perinatal period, circulating in the blood stream to reach all the growing child's organs. Their effects on these organs depend on reversibility of effect, the specific period that the

effects are felt (critical/sensitive periods), and whether their effects are structural or functional i.e. affect neural interconnections or cell biochemistry (Hoyenga and Hoyenga, 1993). Hoyenga and Hoyenga note that the differential exposure of an organism to sex hormones affects the levels of brain proteins and rates of brain synthesis, so the effects of hormones on anatomy and behaviour will depend on the organism's genes even within a species. Differential sexual development depends on the presence of androgens that are causal in the development of the reproductive organs, and also in brain organisation (Hoyenga and Hoyenga, 1993). McGuinness and Pribram (1979) theorise that the infants' differential attention to stimuli will produce differing signal amplitudes to the brain resulting in an early modality bias. This effect could be felt even prior to the birth of the child.

Social role expectations

Archer (1984) notes that theories to date, specifically social learning and cognitive developmental theories, tend to acknowledge differences in the ultimate content of children's gender roles without examining the possibility of differential processes producing that content. Archer suggests four dimensions along which children are differentiated in their development which could provide a structure for future research. The first of these – the rigidity/flexibility of the child's gender role -- has direct relevance to part of the process suggested in the GSP model.

Once the child has labelled an object they are expected to make the decision to approach it if it has been recognised as 'for me' and to avoid it if it has been labelled 'not for me.' It was previously noted that boys show more avoidance behaviour of toys than girls, and Archer cites studies which show avoidance of other (e.g. Gold and Berger, 1978). Further to this, he notes that adults are more proscriptive in their encouragement of gender-typed behaviour in boys than in girls, and that this is more

evident in fathers than in mothers (Goodenough, 1957). The evidence presented by Archer suggests that boys receive early and strict differential socialisation and that the nature and extent of this socialisation leads to avoidance of cross-gender behaviour which would be 'long-lasting, deep-rooted and have a strong affective component' (Archer, 1984, p.248). Studies have shown that the ability to label is insufficient to predict differential sex-typed behaviour (e.g. Blakemore et al, 1976). Early socialisation of male role rigidity seems a probable partner in influencing behaviour.

The prediction of the GSP model, that the child will know more about the in-group than the out-group and their in-group knowledge will enable them to form an own sex schema, must also be questioned given suggestions by Archer that extent of the child's knowledge of own-sex social role expectations may differ between the sexes. The second of the dimensions suggested is the complexity or simplicity of children's understanding about gender roles. It is possible that the extent of the child's knowledge of male/female social roles may depend on the availability of models and boys' own sex information may remain incomplete for some time. For example, boys' male models may tend to be peers or adolescents leading to a simplified and incomplete picture of the male role, one which is heavily weighted in the direction of physical strength and toughness. Being generally in the company of their mother and other females, it may be expected that boys would know as much, if not more about the social role of the opposite-sex than they would of their own. It is difficult to understand how boys come to exhibit more robust sex-typed behaviour when the tool they are expected to use (extensive own sex schema gleaned from information about in-group members) is probably incomplete in early childhood.

With regards to a third dimension (consistency/inconsistency), boys may be receiving more inconsistent messages about their role than girls. For example, they are

expected to exhibit rough behaviour, but this is simultaneously disapproved of. This phenomenon has been noted by, for example, Knox and Kupferer (1971) and Tieger (1980) [cited in Archer, 1984]. It is possible that the conflicting demands made by adults on male children may be the reason that boys are more likely than girls to respond to peer than adult approval/disapproval (Fagot, 1985). If girls and boys differentially respond to input from different sources, this could be an underlying factor in the differences in the rate at which they adopt sex-typed behaviour. This seems especially likely given that children show stronger disapproval responses to cross-gender behaviour than adults (Ruble and Martin, 1997), and it is the peer group who seems to provide the stronger reference point for boys (Fagot, 1985).

The final dimension suggested by Archer is the difference in continuity and discontinuity of role across the developmental span for boys and girls. The male role is thought to be characterised by discontinuity, especially as adult males become parents themselves. Even in childhood, distinct phases in male development have been noted which can be differentiated from development in girls. David and Brannon (1976) suggest that boys learn a set of negative rules or avoidance behaviours first and then are given positive information about what is expected of them. Although girls experience discontinuity in expectations later during adolescence, their childhood is characterised by greater role flexibility. The impact of social role expectations on the child's reaction to labelling 'for me' and 'not for me' is unacknowledged by the schematic processing model.

In summary, boys and girls differ in the strength and timing of the appearance of sex-typed behaviour. If learning about gender produces behaviour, girls and boys not only differ in what they learn, but also in how they learn. Two possible explanations for this discrepancy have been introduced. Firstly, girls and boys may differ fundamentally

in the way they process information, possibly by virtue of predispositional factors (e.g. attunement to the environment), or that the information they receive and the importance placed on that information differs as a function of the child's sex. The GSP model may require the addition of biological proclivity, social influence, or both.

1.3.5. More recent GSP theorising

In a more recent paper, Martin (1989) notes that there are discrepancies between the timing of gender-related thinking and sex-typed behaviour. However, she believes that the apparent discord between GSP theory and data could be the result of the fact that most studies seem to assess children's knowledge regarding a particular content area, and then assess children's behaviour and thinking concerning that content. Assessments of children's gender-related knowledge require that the child possess a well-formed schema of gender knowledge in that domain. It is possible, argues Martin, that the boy may know one part of a stereotype (e.g. that boys play with trucks), and consequently be more interested in trucks, even though his overall level of stereotype knowledge is low. In this paper, Martin proposes an extension of the schematic processing model which is aimed at increasing the predictive utility of gender knowledge. In the Dynamic Schematic Processing model, Martin (1989) considers factors such as, accessibility or salience to the child of gender stereotype knowledge and gender-related values, and how situational contexts influence whether stereotype knowledge is used. In this revision of the theory, Martin uses categories established by Deaux and Lewis (1984) in their research on adult gender stereotyping, and divides the child's gender knowledge into components (role behaviour, occupation, traits and physical features) about which associations are formed. The strength of these associations depends on the child's own experience; an incomplete associative network

would be the result of a lack of experience in an area. Recent work has indicated that children learn vertical associations between sex-typed attributes prior to learning horizontal associations (Martin, 1993). For example, a child may associate a car with 'maleness' and football with 'maleness' but it might be some time later that 'car' and 'football' become associated with one another The premises from the original GSP model, though, that children will possess the ability to differentiate between the sexes prior to behaving in a sex-typed way, remain.

1.3.6. Summary of GSP discussion

Gender schematic processing theories propose that sex stereotypes become important to children after they have formed an understanding of their own sex, and the sex of others. The cognitive biases attributed to the in-group-out-group dichotomy cause the child to preferentially attend to and process information on same-sex others and things. Stereotypes about in-group and out-group members form the basis of the child's own-sex schema. Each child's development will depend on the experience they have had in a particular domain, and the child is predicted to develop associations between objects and a particular sex (e.g. trucks are for men, or dolls are for girls) before they associate objects/activities with one another (e.g. people who drive trucks are likely to enjoy football, children who like dolls will also like to cook).

GSP theory assumes that children will know that they are either male or female and be able to identify others in the same way before they act in a sex-typed manner. It also predicts that the sex-typed child uses labels about the sex of a person or the sex-typing of an object in order to guide their behaviour. Few sex differences have been found in the development of sex-typed cognitions (Hort, Leinbach and Fagot, 1991; Trautner, 1992), and consequently, no predictions are made in the model of differential

development of behaviour according to the child's sex. Evidence has been introduced which brings some of the GSP model's assumptions and predictions into question. Most importantly, knowledge of the sex of self and others does not seem to predate sex-typed behaviour, the child may prefer some things without having labels available to them, and the development of sex-typed behaviour is sometimes seen to differ between the sexes.

Martin and Halverson (1981) propose that children must be able to identify the sex of others before acting according to schemas but acknowledge that it is 'conceivable that young children could show sex-typed behaviour prior to their formation.' They suggest that 'such possibilities would need to be explained by resorting to explanations involving biological proclivities and/or our inability to assess information-processing strategies in very young children' (Martin and Halverson, 1981, p. 112). They do not make clear, however, what the potential role might be for biological proclivities in the acquisition of sex-related schemas, or why if biological proclivities do have a hand in the manifestation of such behaviour these tendencies no longer influence the child once a sex schema has formed.

1.4. Alternatives to GSP

Babies are born with different genetic make-up and brain organisation as a function of their sex (Hoyenga and Hoyenga, 1993). As the child matures, sex-differentiated hormones cause increasing differences in male and female physiology. Working in tandem is the maturation of a neural network in which neural connections become stronger as a result of environmental influence, the effects of practise and reinforcement, and, possibly, innate attentional bias. This would suggest the possibility that some of the preferences thought to be cognitive or social in origin might have a

biological basis, and would provide an alternative platform for beginning to discuss the difference in development between boys and girls. The extent to which the process of sex typing relies on 'tacit knowledge' rather than learning and cognition is left unexamined by gender schematic theorising and the majority of research involves young children rather than infants. Fagot (1985) notes that much of the research assessing the relationship between gender cognitions and actual behaviour has involved children over 36 months, by which time sex-typed behaviour has become an automatic response and there is insufficient variance to examine correlations between cognitions and behaviour. Studies of early infancy have not so far provided conclusive evidence for any of the theories of sex typing mentioned. Establishing an early base-line measurement of sex differences and sex-typed behaviour would enable future research to evaluate differing theories.

1.5. Chapter summary

It seems that some sex differences manifest in adulthood correspond to those found among children. In addressing the development of these differences, social learning theorists emphasise the social influences which affect the child both through direct experience, and by their observation of others. More recent theories such as gender schematic processing, propose that, once the child has identified their own gender group membership, and is able to recognise other members of their gender group, the child builds up a schematic picture of 'appropriate' behaviour. The child will preferentially attend to their own sex, and gradually assimilate sex-congruent behaviour. Two particular problems with this theory remain unaddressed. GSP requires that the child know its own sex and that of others prior to adopting sex-typed behaviours. Studies of infant self-awareness indicate that children under 15 months are generally

unable to recognise themselves, and it is not until the second to third year that children can reliably label themselves or others on the basis of gender. Second, while studies into the development of gender schema have not shown significant sex differences, investigations which map behaviour to cognition have shown that boys tend to adopt sex-typed behaviour more quickly and robustly than do girls. This would suggest that other influences might be at work.

Fagot identified the possibility of a 'tacit knowledge' of gender that would enable an infant to categorise social stimuli. Other researchers have proposed that a number of capacities and preferences in the infant are innate and may have a biological basis. On the basis of these suggestions, it is not possible to unreservedly accept the GSP approach to the development of sex-typed behaviour. More work is warranted which documents the development of sex typing from infancy to childhood, comparing behavioural measures to the proposed trajectory of gender schema theory.

1.6. Conclusion and rationale for the present study

Much of the research supporting the theory of gender schematic processing has come from studies with adults (e.g. Bem, 1981) and a body of robust evidence has been built up showing that having a strong gender schema causes people to: (1) pay preferential attention to same-sex stimuli, (2) use their gender schema to 'fill in the gaps' in situations where information about others is lacking, and (3) employ gender schema to guide their behaviour. The point at which an individual's schema matures sufficiently to have this organisational power remains unclear, though Fagot suggests that by the age of 36 months, infants have developed an automated response pattern as a function of gender schema. However, an inconclusive pattern of results has emerged from the available evidence correlating measures of sex-typed behaviour with the

child's attainment of gender schema (Blakemore, LaRue and Olejnik, 1979; Fagot, Leinbach and Hagan, 1986; Turner, Gervai, and Hinde, 1993). Infant behavioural preferences in a number of areas that have been found to be sex-typed from early childhood - for peers, activities, and toys - do not follow the trajectory predicted by GSP theory. The development of these preferences differs between male and female children, and they often appear before the child can demonstrate knowledge of their own sex and the sex of others.

The present study is intended to investigate the utility of the gender schematic processing models of the development of sex-typed behaviour. Early sex-congruent preferences will be identified by following a cohort of infants over time and monitoring their preferential looking to simultaneously presented sex-congruent and sex-incongruent stimuli. In the next section, current research pertinent to the design of the study being undertaken will be reviewed and assessed.

1.7.1. Factors in exploring the emergence of sex-typed behaviour

(1) Age at testing

Fagot (1985) believes that sex-typed behaviour in young children is an example of 'automatic behaviour' or 'non-thinking behaviour' (Langer, 1978). Once sex-typed behaviour has become so over-learned as to be automatic, relationships between cognitive variables and behaviour may be poor as the behaviour is 'enacted without engaging rational thought processes' (Fagot, 1985). Fagot suggests that between 12 and 36 months children are engaged in 'actively trying out behaviours to match their developing gender categories' and would, therefore, be more likely to show behaviour corresponding to their gender schema. Fagot tested this hypothesis in a study using simplified gender knowledge questions. In children between 20 and 30 months, she

found a correlation between the percentage of time children spent playing with same-sex peers and their ability to identify pictures on the basis of gender. She suggests this indicates that an understanding of gender labels guides playmate choice.

However, in reaching this conclusion, she makes two assumptions. First, Fagot suggests that playing with a member of the same sex can be construed as 'an attempt to match your behaviour to someone you perceive as like you'. It seems equally possible that children are beginning to categorise those children in terms of shared enjoyment of games or activity style. The second assumption, reflected in the restriction of this study to infants 20 to 30 months, is that infants' behavioural preferences do not emerge prior to measurable cognitive processes. In order to investigate the predictions of gender schematic processing theory thoroughly and allow consideration of other possible developmental mechanisms such as 'attentional bias' (McGuinness and Pribram, 1979), it is necessary to rule out the possibility that sex-typed preferences occur earlier than the development of gender cognitions. This can be achieved by taking measures of behavioural preference from the preverbal infant. Infants as young as three months have been shown to demonstrate preference to some stimuli by showing preferential attention (Barrera and Maurer, 1981), though even basic gender categorisation has not been found prior to 9 months (Leinbach and Fagot, 1993). A complete discussion of GSP requires an investigation of the development of behavioural preference prior to the manifestation of gender-related cognition.

(2) Measurement issues

Sensitivity of measurement

A number of researchers have suggested the possibility that the child expresses preferences from a very early age. McGuinness and Pribram (1979) believe that male and female responses to sensory stimuli are different from birth, and manifest

themselves in various ways – girls vocalise more than boys to social stimuli for example. When investigating preferences in preverbal infants, it is necessary to employ a paradigm sensitive enough to pick out these first manifestations. Lumsden (1988) writes that human development can be regarded as a process of focusing from general to more specific classes of stimuli during periods that last from days to years. In his opinion, the first stage may be little more than an automatically greater attraction for one set of stimuli over others. He notes that visual paradigms such as those employed by Fantz (1961) have shown a focusing sequence, beginning with an automatic restriction to stimuli filtered by the sensory receptors and coding interneurons, and manifested in a preference for certain stimuli over others. This process finally ends with a preference for particular objects. Infant visual studies may be an appropriate way to measure the first manifestations of behavioural preference in the preverbal infant.

Visual preference paradigms have been shown to be sensitive to very early infant behaviour. Recognition of the mother's face over that of a stranger has been found as young as 5 weeks (Bushnell, Sai and Mullin, 1989). Barrera and Maurer (1981) used the habituation paradigm to investigate 3-month-olds' ability to discriminate and recognise faces of strangers using photographs judged to be similar or dissimilar. In both cases, infants discriminated following intensive exposure to one of the pictures. Infants seem to be especially good at attending to human faces; Kagan and Lewis (1965) found that fixation time to a male or female face was longer than fixation to a panda bear, checker board or bulls eye pattern. They also show a preference for faces commonly held as attractive. Langlois, Roggman, Ritter, Rieser-Danner, and Jenkins (1987) used the visual preference technique to measure infant preferences for attractive over unattractive faces and found that attractive faces elicited more looking from infants as young as 2/3 months. They suggest that because of the importance of the

information conveyed by faces for social interaction, infants may have a built in or an early developing preference for those aspects of visual stimuli that are most similar to features of attractive or prototypical faces. It seems that by 3 months, the infant is able to demonstrate a preference for and between face stimuli.

Time viewing target

Significant findings in studies of visual attention may depend on the length of time the infant views the stimuli and the measure of the gaze taken to indicate attention. Fagan (1972) notes that the amount of time infants need to study stimuli before distinguishing among them differs as a function of the infant's age and variance between targets. At five months, 20 seconds of prior exposure is needed for an infant to distinguish among similar stimuli as opposed to only 4 seconds for widely varying targets. Langlois, Roggman, Casey, Ritter, Rieser-Danner, Loretta, Jenkins, and Vivian (1987) presented stimuli to infants in two age groups (2-3 months and 6-8 months) in blocks of two trials of 10 seconds each. In the discussion of their findings, they note that 'the failure of the younger infants to show preference in this condition is probably best explained by the developmental competence of the two age groups...' (Langlois et al, 1987, p.366). They speculate on the possibility that younger infants are unable to release their attention readily from visual stimuli, whilst older infants are 'more able or more willing to look away.' They suggest that increasing the length of stimulus presentation might overcome this problem for younger infants.

Measures of 'looking behaviour' - What is measured?

There is some question about what preferential looking tasks actually measure. The technique was first used in order to investigate visual processing in infancy. The assumption was that by directing significantly more looking to one of two simultaneously presented stimuli, the infant was demonstrating the ability to

discriminate between those targets. However, since Fantz (1961), researchers have taken advantage of this seemingly innate tendency to fixate, to discover what aspects of stimuli promote differential attention. Lewis, Kagan, and Kalafat (1966) suggest there may be two reasons for an infant to fixate on a stimulus for long periods – (1) a preference for looking at the stimulus in terms of pleasure or (2) desire to categorise stimulus or comprehend its meaning. The problem of discerning which processes are at work is common to all techniques relying on measures of preferential looking. Paired-presentation visual preference paradigms such as those presented by Langlois et al (1987) and Samuels and Ewy, (1985) would be most likely to measure infant preference between two categories of stimuli as they are presented as competing dimensions.

Studies of preferential-looking in infancy do not always rely on measures of fixation *duration* in order to show preference, and there has been some discussion as to the correct form of measurement to use. A study considering cardiac deceleration, visual fixation, and body movement as possible indicators of attention to stimuli concluded that the most reliable indicator was a combination of cardiac deceleration and length of total fixation (Lewis, Kagan and Kalafat, 1966). Kujawski and Bower (1993) examined duration of first look and total looking at same/opposite sex stimuli. As only the former provided significant results they conclude that duration of first look is the more reliable measure. However, it is probable that the various dependent measures actually tap into different aspects of the infants' behaviour.

In the Lewis (1975) study, preferential looking was gauged by presenting a series of single stimuli and evaluating the looking to each stimulus. The measures used were total fixation time, longest fixation time, first fixation duration and the number of fixations. They found that all the measures of fixation were positively correlated, but that longest and first look duration were the best indicators of preference; once an infant

fixated on a highly interesting pattern, it tended to remain fixated. There was a correspondingly low correlation between total fixation and number of fixations. Another study intending to define measures of looking behaviour was one by Cohen (1969). Cohen measured the latency of the first fixation and duration of total fixation. He concluded that the attributes of a stimulus that cause an infant to attend in the first place may be different from those determining the length of fixation. Cohen showed how an infant can learn, after repeated trials, to orient in a certain direction, and suggests this demonstrates that attention-getting involves more than an automatic orienting reflex, but is, in fact, under the control of the infant.

A study by Campbell, Shirley, Heywood, and Crook (1997) of preferential looking to pairs of simultaneously presented stimuli (depicting same-sex and opposite-sex same-age infants) utilised five measures of visual preference. These were: total duration of looking, first look duration, longest look, number of looks and direction of first look. Although there was substantial inter-trial variability in the stability of each of the measures, the inter-correlations between measures were positive, largely significant, and stable over trials. This study also notes some dissociation between measures thought to indicate attention-holding (duration, first look duration and direction of longest look) and measures of attention getting (number of looks and first look) and concludes that duration of looking is the best index of attention.

(3) Individual differences in sex-typing

Attainment of sex-typed behaviour

Martin (1989) suggests that most studies do not consider the range of factors that may increase our ability to predict gender knowledge. She proposes an extension of gender schematic processing - Dynamic Schematic Processing. This theory is more able to explain the existence of individual differences. The model states that the formation of

simple associations between model and stereotypic attributions (e.g. a man will like football) does not necessarily guarantee the formation of logical links between other items which one might associate with that sex (e.g. someone who likes football will most probably wear trousers). If each child's schema develops at a different rate according to experience, as this model would predict, we would expect to see some continuity over time on an individual basis. Unfortunately, research into the development of sex typing has tended to take cross-sectional 'snapshots' of cognitions and behaviours. A study using longitudinal measurement would allow us to gather evidence on individual patterns of development of sex-typed behaviour.

External influence on sex-typed behaviour

Several studies have discussed the possibility of a link between parental attitudes and the child's sex-typed behaviour resulting in individual differences (e.g. Fagot and Leinbach, 1989). There is evidence that children of working mothers hold less sex-stereotypical attitudes than children whose mother's have taken on a more stereotypical sex-role in the home from age three through to adolescence, and maternal employment is associated with less gender-typed preferences and behaviours in girls, though not in boys (Huston and Alvarez, 1990; Lerner, 1994). The strength of social influence may be further investigated by looking at the relationship between the child's development of sex-typed preferences and his/her family background.

(4) Sex differences in sex-congruent behaviour

Gender schematic processing theory assumes that all sex-typed behaviour develops from gender cognition. However, little mention is made of differences existing in cognitions between the sexes in studies investigating gender-related concepts, though there is ample evidence of sex differences in the onset and strength of sex-typed behaviour (Blakemore and La Rue, 1979; Caldera, Huston and O'Brien, 1989; O'Brien

and Huston, 1985). This would suggest that either sex differences in gender-related concepts have not been reported, or that they do not exist. Trautner (1992) investigated a number of measures of gender-related concepts and behaviour in a longitudinal study and found that while behavioural measures of choice of playmate and same-sex toy figures showed differences between the male and female participants, this was not the case for the cognitive measures used. If there are not significant sex differences in cognitions, there must be some other, possibly supplementary, reason for the appearance of robust sex differences in the trajectory of children's behaviour.

(5) Behavioural domains discussed in isolation

GSP theory suggests that sex typed behaviour develops from a unitary source – the attainment of a gender schema. However, following evidence of a lack of correspondence between cognitive measures of sex-typing, and children's actual behaviour and preferences, there have been calls for a 'mulitdimensional' approach (Trautner, 1992; Hort, Leinbach, and Fagot, 1991; Downs and Langlois, 1988). Unfortunately, even this revision fails to describe the available data. While conclusions of multidimensionality correctly emphasise the lack of correspondence between cognitive measures of sex-typing, they largely neglect to mention the different developmental trajectories in preference and behaviour *as a function of domain* (Downs and Langlois, 1988). For example, Trautner (1992) exposes poor correlations between cognitive measures but systematic investigation of differences between behavioural domains is lacking. Studies which do illustrate differences between domains of behaviour and preference generally use varying measures for each domain (e.g. Turner, Gervai and Hinde, 1993) and research shows that the extent of sex typing across behavioural domains is not necessarily related (e.g. Maccoby, 1966). Moreover, there is disagreement as to the relative strength of behavioural preferences in various domains

(Berndt and Heller, 1986; Turner, Gervai, and Hinde, 1993). GSP theory would predict that peer preference would emerge first, leading to a preference for same-sex activities. However, Alexander and Hines (1994) found that play-style was a more important dimension than sex of play partner to boys and older girls. Turner, Gervai and Hinde (1993) found the prediction that preference for same-sex playmate would lead to preference for sex-congruent activity was not evident in their cross-cultural sample of male and female children. Employing different measures may confuse measurement of preference across domains. It would, therefore, be of some interest to measure preference across a number of domains using the same paradigm, allowing the trajectory of each to be established.

(6) Self-awareness as a necessary cognitive precursor to knowledge of one's own sex

Much of the research relating to gender schema theory assumes the presence of a concept of self without directly measuring it in the experimental sample. This is an oversight considering the continued debate about what constitutes self-recognition. The most common measure of self-recognition is the rouge test in which the child is considered to show self-recognition if they attempt to rub off rouge placed surreptitiously on their nose which they see in a mirror image. Other studies have attempted to demonstrate self-recognition through photographic representation. Recent work has suggested that infants as young as three months can recognise themselves from photographs (Bahrick, Moss and Fadil, 1996). However, research to date has not presented evidence of self-awareness in children who show sex-typed behaviour, assuming, instead, that it is already present. The GSP theory remains fallible as long as this assumption remains untested.

In view of the above findings, the following study has seven main purposes.

(1) To date the appearance of sex-typed preference in pre-verbal infants using a sufficiently sensitive measure to tap the preferences of very young infants. A simultaneous-presentation visual preference technique will be used to maximise the probability that the infant is attending to stimuli on the basis of preference. The infant will be given sufficient time to fixate on both stimuli.

(2) The criterion by which visual attention is judged will be duration of looking to target stimuli as this has been shown to demonstrate attention-holding.

(3) GSP theory will be tested using a longitudinal study in order to provide analysis of preference for a group and for individual children over time.

(4) In order to further assess the relationship of social and cognitive factors to sex-typed behaviour, the infants' parents will be asked for information concerning their employment, day-care of the child, the number and sex of other children and information on the toys their children most recently received. At eighteen months, the infant will complete a gender-labelling task, designed to elicit information about their ability to identify others on the basis of sex.

(5) When measures of a variety of behavioural preferences have been obtained, there has been little correlation between the degrees of sex typing shown. Studies measuring more than one behavioural domain do not generally rely on a single measurement tool; this makes it more difficult to make cross-domain comparisons. This study will provide a comparison of group differences across the behavioural domains described – peers, activities and toys – using the same method of measurement for each. This will allow us to comment on whether sex-typed behaviour emerges from a unitary source.

(6) Research into sex typing has frequently shown different strengths of behavioural preference between boys and girls. In order to investigate this further, the data will be analysed for the group as a whole, and as a function of sex in order to track a possibly differing developmental trajectory.

(7) GSP theory assumes that behavioural preferences will not be shown until the infant has a degree of self-awareness, but this assumption is not generally tested on the experimental sample. It is intended in this study to test for self-recognition in the participants using both the rouge test and photographic representation of the infant.

Chapter Two

This study aims to investigate some of the assumptions implicit in gender schematic processing theories. In particular, using a longitudinal design, this study will map the developmental trajectory of infants' sex congruent behavioural preferences in three domains of interest from preverbal infancy to the age of eighteen months.

Cross-sectional and Longitudinal Analysis

Cross-sectional studies are designed to draw conclusions about the behaviour of children of a certain age on the basis of a representative sample of infants. There are certain advantages to cross-sectional design of experiments in developmental psychology. Participants are only required to participate for one testing session. The same number of participants can be recruited to take part in various aspects of the test without relying on maintained interest. Participants do not become attuned to the intentions of the experimenter through practise of the task or test. However, because the primary aim of this study is to monitor the development of sex-typed behaviour, the data will also be considered longitudinally. This study is presented in a way which intends to take advantage of cross-sectional analysis (specifically maintaining subject numbers) but, by bringing the results together in the final analysis, it is able to track the development of one cohort over time.

The results from this study will be presented in two ways. Firstly, the analysis will be performed cross-sectionally. This will involve a presentation of the results from the first, second and third testing sessions. The fourth results chapter (Chapter Six) will describe the analysis of the three sets of data taken together. To be included in this analysis, the infants needed to have completed all three sessions and met the criteria for

inclusion in each domain (see later explanations for inclusion criteria). One of the drawbacks in longitudinal research is the subject loss either from subjects withdrawing from the study, or not consistently completing the task across the testing periods. However, longitudinal studies allow us to track the developmental trajectory of individual children by correlating measures of their performance in each area across time, and ensure that the personal circumstances of the cohort remain relatively consistent between testing sessions.

Each cross-sectional analysis will be presented and discussed briefly in terms of the immediate findings of that session (see chapters 3,4 and 5). The longitudinal analysis will describe the results across time and will discuss the possible implications of subject loss between sessions. In the present chapter, I will outline the method for the three testing sessions.

2:1. Participants

Sixty infants (36 male, 24 female) were recruited through local health visitors and media advertising. The infants were tested at approximately three months (Mean=13.97 weeks, Standard deviation = 1.51), nine months (mean = 38.32 weeks, standard deviation = 3.07), and eighteen months (mean = 86.47 weeks, standard deviation = 5.35). All the infants were full-term and healthy at time of study. All but one infant was White, with the remaining infant of mixed (Japanese-Caucasian) parentage. The data from one infant (male) were discarded for each of the three sessions due to fussiness on each occasion.

Changes in participants. Two babies from the first testing period were unable to attend the remaining sessions, and were replaced by infants of the same sex. Three children (including the child from mixed parentage) who had participated in the first two trials

were unable to attend the final session; they were not replaced in the third wave of data collection.

Each subject was given an identification number both to maintain confidentiality, and to reduce the number of clues to the babies' sex for the markers of the videotapes.

2:2. Measures and Materials

Infants were tested at each stage for their preference between pairs of male and female stimuli. In addition to this, information was taken from the parents regarding employment, child-care arrangements, and siblings. As the infant developed, each child carried out the rouge test, and finally, a gender-labelling task. A brief summary of the measures taken at particular stages in the testing can be seen in Table 2.1.

Table 2.1. Summary of measures and timing of data collection points

Age of Child	Measures and Procedures
0-3 months	Recruited via HV's, media and word-of-mouth
3 months (approx.)	First testing session:
	Visual preference
	Demographic information
9 months (approx.)	Second testing session
	Visual preference
	Any changes in demographic information
	Rouge test
18 months (approx.)	Third and Final testing session
	Visual preference
	Any changes to demographic information
	Rouge test
	Gender labelling task

2.2.1. Visual preference task

Self-recognition

On each of the three testing sessions, a photograph of the infant was presented alongside another infant of the same sex interspersed with the paired pictures of the infants' peers. The face size, background and body orientation was kept constant between the 'self' and 'other' photograph, and the photographs of the other infant pairs. A different pair of male-female photographs was used to represent each age group. All male participants saw the same (male) 'other' picture and all female participants saw the same (female) 'other' picture at each session.

Peer preference

Each infant viewed five male-female pairs of photographs of babies of their own age (either three-, nine-, or eighteen-months according to the testing session). The pictures were obtained from a professional photographer working in a studio. The face size (subtending ~ 16o x 130 of visual angle), body orientation and background were held constant within pairs. The infants also viewed five sets of photographs of the faces of 4-year-old boy-girl pairs. The photographs of the older children were included to gauge whether the infants showed preference when given more obvious gender clues. Previous work has shown that children are able to discriminate gender from cultural cues such as hair length and clothing (Fagot and Leinbach; 1993, Bower, 1989). These photographs were obtained from a school photographer, and the background, face size and body orientation was again held constant. The children were dressed normally in variations of a standardised school uniform, and no attempt was made to disguise the sex of the child.

Toy preference

The infants also saw five pairs of toy photographs. Five male-female pairs of toys were taken from pictures in a toy catalogue. These pictures can be found in Appendix One. The stimuli originated from the same source and the images were transferred onto the computer using identical method, equipment, and on the same day. It was thought that brightness would, therefore, be stable across all the pictures. The pairings were ball-doll, toaster-steering wheel, cooker-train, cars-dustpan and brush, pram-blocks. The toys were paired on the basis of similarity in colouring, size in the catalogue picture, and the background colour. An attempt was also made to control for complexity of stimuli in matching pictures in terms of number of parts and general 'busyness' of photograph.

Activity preference

The children watched two videos presented simultaneously of children (7-8 years) of the same sex as themselves participating in either male or female-type play activities (chasing - drawing, wrestling - pat-a-cake, whispering - climbing, doll-play – cowboys, jumping – phoning).

Choice of stimuli for toy and activity preference conditions

The choice of toys to represent stereotypically masculine and stereotypically feminine toy choice was guided by research noting that girls tend to play with/ be given domestic toys or toys encouraging nurturance and boys receive/ are given vehicles, construction toys, and sports items (Fagot and Littman, 1976; Robinson and Morris, 1986; Miller, 1987; Tracey, 1987; Rheingold and Cook, 1975; Perry, Perry, and White, 1984; Connor and Serbin, 1977).

The major sex difference noted in play activities is the propensity for boys to engage in more rough play and more gross motor activity (Charlesworth and Dzur,

1987; Pitcher and Schultz, 1983; Maccoby and Jacklin, 1974; Pellegrini, 1992). Boys are also thought to be more competitive while girls' play is characterised by turn-taking and co-operation (Crombie and Desjardins, 1993; Maccoby, 1998). In games of make-believe, boys replicate fighting and heroics, while girls and more likely to imitate domestic scenes (Flannery and Watson, 1993; McLoyd, 1983). The activities chosen as stimuli in the play activities condition aimed to reproduce these general tendencies.

2.2.2. Rouge Test

The developmental laboratory was divided into three areas: the booth containing the screens for presentation of the visual preference paradigm; an area where the parent could sit comfortably whilst nursing their child, filling out paperwork, or waiting between sessions; and a square area of carpet (see diagram and measurements in Appendix One) in the corner of the room. This area was blocked off on three sides by two walls and a set of filing cabinets. One of the walls had been fitted with a wide full-length mirror (120 cm x 135 cm) in which the child could see its entire body. This was the area in which the rouge test took place. A portable camcorder was set up unobtrusively to record the infant's behaviour during the rouge test.

2.2.3. Gender Labelling Task

The design of this test is taken from the gender labelling task created and utilised by Fagot, Leinbach and Hagan (1986) (see Section 2.3.3). Five pairs of photographs of boys and girls were presented on opposite pages in the front of a loose-leaf photograph album. The photographs used were those of the older children already seen in the still visual preference presentation. The pictures were presented in the same pairings as before and one order of pairings was shown to all of the children. Five pairs of

photographs of adult males and females were presented in the back of the album. Half of the participating parents were asked to begin at the back of the album, and half at the front. This meant that an equal number labelled the adults first and labelled the children first. The first and the last page of the album contained printed instructions to the parent as follows:

Each time you turn the page, you will see two photographs - one boy and one girl.

Without pointing to either picture, attract your child's attention to the book and say *"Which is the boy?" or "Which is the girl?"*

When your child points to the picture or makes verbal choice, please repeat their choice so it is clear when the video is played back.

Please alternate asking for the girl and asking for the boy.

Don't try to help your child make a choice. If they are unwilling or unable to make a choice, turn the page to the next pair.

After the set of children's photographs, the instructions read:

The next set of photographs are of adults

This time, please ask your child

"Which is the man?" or "Which is the woman/lady?"

Please remember to alternate which you ask for first.

2.2.4. Parental Information

The parents were asked to complete a questionnaire each time their infant attended for testing (see Appendix One). The same information was elicited on each occasion: number and sex of siblings in the household, occupation of parents and daytime childcare arrangements. Between the ages of three and eighteen months, a

child's social world is generally fairly limited, and it was thought that these areas would give some measure of the social influences available to each participant. In addition to this information, the parents were asked to give information about the last three toys their child had received. This was intended to cover both gifts from friends and relatives, and hand-me-downs from siblings. It is possible that the gift of a toy could be a reflection of the child's expressed preference (perhaps indicated by their behaviour on coming across a similar toy). However, as infants of this age do not generally make 'requests' as such, it was thought that this measure would go some way to indicating the sex-typing influences regarding toy choice around the child.

2.3. Procedure and data coding

The testing session took place in a carpeted, well-lit room, and took approximately one hour to complete. At the beginning of the session, the infant's photograph was taken by digital camera and the image was copied to the computer running the presentation of the still stimuli. The parent later received a copy of the photograph incorporated into a certificate of participation. The child was given some time to adjust to the unusual surroundings before the session started. Mothers were told that they should speak to their child if they wished, but were requested not to physically or verbally guide their child in any way towards one or other picture.

2.3.1. Visual Preference Task

A. Procedure

Testing took place in the developmental laboratory in a booth (123 x 170 cm) created with plain hessian screens which contained a pair of computer screens on one wall, and a pair of TV screens on the opposite wall. See the diagram in Appendix One.

Presentation time

In the first and second testing session, the still picture-pairs were presented for a fixed period of 30 seconds each. The video - pair sequences also lasted 30 seconds each. A small pilot study run prior to the beginning of the third period of data collection showed that 30 seconds was too long for the still-pair presentation, as the children quickly lost interest and became fussy. Subsequently, the period of presentation was cut to 15 seconds for the still pictures. The same effect was not found for the video stimuli, presumably reflecting the infants' greater interest in movement, and the infants saw the moving stimulus-pairs in 30 second presentations as previously.

Order of presentation

Stills: Eight computer programmes (four containing pictures of a male 'other', and four containing pictures of a female 'other') had been created in which the paired photographs were randomised both on the basis of order in which they appeared, and the side on which each stimulus was presented. Male and female participants were randomly assigned to one of the eight orders of stimulus according to the sex of participant. The pairing of the stimuli did not alter between participants. In addition, there were three orders of presentation of the domains so that any systematic effect could be evaluated. Group one viewed the static stimuli in the order ; toys, children, peers; Group two viewed the static stimuli in the order; children, peers, toys. Group three viewed the stimuli in the order; peers, toys, children. Half of the infants saw their own face on the left and half on the right. Approximately half of the sample watched the moving stimuli first, and half began the session with the stills' presentation.

Moving stimuli: Four video sequences were created for male infants and four for female infants. The videos showed children of the same sex as the participants playing boy-/girl-type games. These activities were randomised both on the basis of the order in

which they appeared and the side on which each activity was presented.

Peer, photographic self-recognition, and toy preference

The participants were seated on their parent's knee at a distance of 60 cm from the midpoint of two computer screens (38cm screens) which were 20 cm apart. A video camera recorded the baby's eye movements through a hole in the hardboard screen at a central point between the computer screens, and a raised camera behind the mother and child recorded the images that the baby was seeing on the screens. The two images were combined through a video-mixing desk and presented on a TV screen visible only to the experimenter. This allowed the experimenter to judge when the infant's gaze was central to the two screens, and to see when the stimuli on the screens had switched off. As each set of stimuli disappeared from the screen, the infant's attention was attracted to a central point between the computer screens by the experimenter squeaking a toy through a hole in the hardboard screen just above the camera. When the baby's attention was central, the experimenter would bring the next set of stimuli up onto the screen.

When the infant had viewed all 16 pairs of photographs, they were given a short break outside the booth. Sessions were interrupted according to the needs of the child (regarding sleep, feeding and changing), and the trial would restart with the next picture in the sequence.

Activity preference

The physical positioning of the mother and infant in regard to the screens, and the positioning of the recording equipment was as above, facing in the opposite direction. The experimenter waited for the baby to look centrally before beginning the trial, but as the video sequences ran consecutively, there was no attempt to centralise attention

between each pair of activities shown. This part of the session lasted approximately two and a half minutes, and was aborted if the infant showed excessive fussiness.

B. Coding

To establish the inter-judge reliability, two scorers coded the videotapes of six infants' performance on all of the trials. Intraclass correlations between the two scorers were .98 for on-target looking at either stimuli, .95 for left look duration, and .94 for right look duration. The remainder of the tapes was coded individually. Coding of each pair began with the first frame in which the stimuli appeared and ceased when the stimuli disappeared from the screen. Directional durations of looking times were originally calculated in frames ($1/40^{th}$ of a second) then converted to milliseconds for subsequent analysis.

In the domains described above, the stimuli shown to the infants were stereotypically masculine or feminine (play and toys) or were pictures of males and females. In the analysis of the data, the stimuli will be referred to as sex-congruent or sex-incongruent or same-sex and opposite-sex depending on the sex of the participant. This is intended to reflect the emphasis of the thesis on measuring the 'appropriateness' of the stimuli for the child's sex. That means, for example, that preference for stereotypically masculine toys would be scored as sex-congruent preference for males but sex-incongruent for females.

2.3.2. Rouge test

A. Procedure

This test for self-recognition requires the child to face the mirror in three states. First, the child and mother sit or stand together in front of the mirror and the child is

given the opportunity to explore the mirror. Second, the parent or experimenter places a small dot of rouge on the infant's nose without them noticing. The infant is then once again given the opportunity to explore their own image. Finally the infant's parent places a dot of rouge on their own nose in view of the infant. Both parent and child then turn to face the mirror. The rouge test was not performed for all participants during the first session, as attempts early in the testing period indicated a lack of any sort of response from the three-month-old infants. Parents in the second session were given on-going verbal instructions for carrying out the task. However, to avoid any experimenter intrusion in the third session, when infants were more aware of being observed, written instructions were provided for the parents at time three. These were based on Amsterdam's original series of experiments in which the infant was asked 'See?' and 'Who's that?' (Amsterdam, 1972). The following instructions were in view of the parent during this procedure in session three:

PLEASE FOLLOW THESE INSTRUCTIONS VERY CAREFULLY

1. Take your child's hand and walk towards the mirror. Say "Look in the mirror, what can you see?"
2. Do not say anything else. Allow your child to explore the mirror.
3. After a minute or so, walk your child away from the mirror. Wipe your child's nose with the red makeup.
4. Take your child's hand and walk towards the mirror. Say "Look in the mirror, what can you see?"
5. Do not say anything else. Allow your child to explore the mirror.
6. Stay in front of the mirror, put some make-up on your own nose so your child can see.

Point to your reflection, say *"Who is this in the mirror?"*

Point to your child's reflection and say, *"Who is this in the mirror?"*

B. Coding

Amsterdam (1972) recorded the responses in 88 infants from three to twenty-four months to their own mirror image. On the basis of her observations, she defined full self-recognition as self-directed behaviour to their mirror image indicating the infant's awareness of a red spot on their nose i.e. touching their nose. This type of full recognition was not thought by Amsterdam to have occurred before 20-24 months. Also at this age, infants began to show other conscious signs of self-recognition such as 'preening' and 'strutting' and embarrassed behaviour. Amsterdam found two other distinct phases (also described earlier by Dixon, 1957). The 'playmate' phase describes the period where the child treats the image as an interacting peer and the 'withdrawal' phase in which the child expresses wariness at their mirror image. However, she suggests that these phases are examples of the infant reacting to a peer and should not be taken to be self-recognition.

Using this technique, Lewis and Brooks-Gunn (1979) found that infants as young as fifteen months responded to their reddened noses in a way that was indicative of self-recognition (19% of the 15-month-olds tested touched their noses after an application of rouge). Lewis and Brooks-Gunn took a number of measures of the behaviour of their participants both before, and following, the application of rouge. These measures included facial expression, vocalisation, mirror directed behaviour, imitation, self-directed behaviour, and number of looks at image. They report that general body-directed behaviour increased substantially after the application of rouge across the age ranges tested (9-24 months). Taken with other data that they gathered on the infants' ability to recognise themselves in contingent and non-contingent TV representations between 9 and 12 months (Lewis and Brooks-Gunn, 1979a), these

researchers suggest that infants are showing signs of self-recognition by 9 months. In this study, full self-recognition will be judged according to Amsterdam's criteria. However, on the evidence to date, this behaviour seemed unlikely to be performed by infants in the first two sessions, and note was taken of any sign of the 'body-directed' behaviour described by Lewis and Brooks-Gunn.

The scoring criteria in the third session, when most of the infants were expected to show self-recognition, was as follows: The infant was scored as having achieved one of three levels

- No recognition – this score was allocated if the infant made no attempt to remove the make-up from their nose after having seen their reflection in the mirror
- Recognition with prompt – this score was allocated if the infant attempted to remove the make-up after their parent had cued them to its presence by applying some to themselves and asking 'Who is this in the mirror?'.
- Recognition – this score was awarded if the infant noticed the make-up on the mirror image and attempted to wipe it off their actual nose prior to their parent applying make-up onto themselves.

2.3.3. Gender Labelling task

A. Procedure

This task took place in the waiting area of the developmental laboratory. The parent carried out this task in order to maximise the chances of infant response. The parents were asked to read through the instructions printed in the book prior to beginning the test. A portable camcorder was trained on the seating area and the experimenter started to film when the parent indicated that they had understood the

instructions. Half of the participants were asked to begin the task at the front of the book, and half at the back.

B. Coding

In the Fagot and Leinbach (1986) gender labelling task, the participant was presented with 12 pairs of photographs of children and was asked to point to the boy or girl. The infant was considered to have successfully shown the ability to label on the basis of sex if they correctly discriminated on 10 or more of the 12 trials. In the test used here, 5 pairs of children's faces, and 5 pairs of adults' faces were presented. The child was considered to have shown the ability to correctly identify the pictures on the basis of sex if they succeeded in pointing correctly (according to the sex asked for by the parent) to four of the five adult pairs and four of the five child pairs. If the child was unable to identify 4/5 pictures in either of the groups they were marked as 'No labelling', if they correctly pointed to adults only, they were marked as 'Adults only'. If they correctly identified 4/5 pictures in both groups, they were marked as 'Labelling.' There was no category for achieving labelling of children but not adults as this did not occur.

2.3.4. Parental Information

Siblings

The number and sex of the infants' siblings was noted. The infant was coded as having no siblings, sibling/s of the same sex, sibling/s of the opposite sex, or siblings of both sex. At the third session, some parents reported the birth of a younger child in the family. However, it was hypothesised that the direction of influence would most likely be from the older sibling to the younger infant. Therefore, account of this information was not taken in the analysis at eighteen months.

Parents' occupation.

The occupation of the infants' parents was coded in the final analysis according to their work status. The parents could be coded either as both working full-time, one working full-time and one part-time, both working part-time, or both unemployed.

Daytime child-care.

The parents were asked the number of hours their child spent in childcare. Parents were also asked the sex of the main care-provider for their child. However, as the infants in this sample were exclusively cared for by women, this information was not included in any subsequent analyses.

Toys received

The parents were asked to provide a list of the last three toys or items their child had been given. A list of all of the answers given by the parents was compiled and given to 50 undergraduate students who were asked to indicate whether they would categorise each of the toys as traditionally male, female, or neutral. The criteria for categorisation was as follows: toys were categorised as 'male' if the majority of respondents (over sixty percent) categorised them in this way, or the responses were made up of a combination of 'male' and 'neutral' replies (and did not reach the criteria to be included in the 'neutral' category); 'female' toys were categorised in the same way; 'neutral' toys were those which received a majority of 'neutral' responses or the responses were made up of a combination of all three toy types and not reaching the criteria to be included in 'male' or 'female' toy category. Each of the infants then received a score according to the description of the last toys they had received. If two or three of the toys received were sex-congruent (for example, a combination of two male toys and one female or one 'neutral' toy), the child was scored as having received sex-typed toys. If only one of

the toys were sex-congruent and the other two were either sex-incongruent, or non-sex-typed (or all three were gender-neutral), the child was scored as having received non-sex-typed toys

Chapter Three

In order to investigate the emergence of sex-typed preferences in infants, it is desirable to begin collecting information as early as possible and to retest the same infants at regular intervals. The age of three months was chosen as an appropriate starting point for the present study because the infant of this age has generally reached maturity in the areas required for the visual preference task. By the age of two months, infants' colour vision appears close to that of adults (Bornstein, 1992). By two/ three months, infants stop fixating on the external contours of a stimulus and begin to notice and concentrate more on internal contours. The infant has matured in other important ways - the infant's posture will generally have developed sufficiently for them to hold their head erect and steady when held vertically. By 12 to 16 weeks, parents are also more able to predict what time of day their child is most alert as the pattern of sleeping at night and being awake during the day becomes established (Berg and Berg, 1987). The first wave of testing infants for a longitudinal study of the development of sex-congruent preferences is presented in this chapter.

This study tests the prediction that infants will begin to show sex-congruent preference in a number of areas following acquisition of self-recognition, by showing them a number of paired male-female stimuli and monitoring their looking toward each member of the pair. Self-recognition is measured by monitoring the infants' looking behaviour when a picture of themselves is presented alongside the photograph of a same-sex peer. The results presented here reflect recent thinking on the development of sex-typed behaviour. GSP theories suggest that the development of self-concept (here measured using tests of self-recognition) will encompass formation of understanding of

one's own sex. Once the child has this basic understanding (or simultaneous to developing this understanding) the child will show a preference for same-sex others. Once this preference has become established, the child will form preferences in other areas, such as toy and activity preference. The following results are presented in the order: self-recognition, peer preference, and preference for toys and activities to reflect this prediction.

Testing at three months

3.1. Participants

Sixty infants took part in the first wave of testing (36 males and 24 female) at approximately three months of age (Mean=13.97 weeks, Standard deviation = 1.51, Range = 10 – 18 weeks). Thirty-three percent of the sample had older siblings of the opposite sex and 26% had older same-sex siblings. At this stage, all of the infants were being cared for by their mothers on a full-time basis, although many of the mothers were about to return to work after maternity leave. All of the infants were living with both parents. Both parents were in full-time employment (not withstanding maternity leave) in 26% of the sample (N=16); one member of the household was in full-time employment in 25% of the families; both parents worked part-time in two families (3%) and both were unemployed in one family (1%). Most commonly, one member of the household held full-time paid employment and another worked part-time and looked after the infant for the remainder of the week (41%, N=25).

3.2. Method and procedure

The method, procedure, and scoring protocol for the first testing session are described in Chapter Two. At this stage the infant was required to undertake the visual

preference task, viewing both moving and still stimuli, and information was taken from the parents regarding employment, childcare, and the participant's siblings. Although it was originally intended that the participants should complete the rouge test at each stage of the study there was no observable response from the first twelve infants tested at this point and this stage was dropped from the procedure for the rest of the sample in this first session.

3.3. Results

Each pair of stimuli was presented for 30 seconds, so possible scores for duration of looks ranged from nought to thirty seconds for each member of the pair. However, scores of 0 and 30 seconds indicate that the infant fixated on only one of the stimuli, and in order to demonstrate a preference between two stimuli, the infant must have attended to both stimuli. Therefore, the infants' looking scores for each of the five trials in each domain were trimmed with any pairs of data having entries of nought or thirty seconds being removed.

The infant viewed five pairs of stimuli for each domain of sex-typing being studied. The pairings of the stimuli remained the same for each infant, but the pairs differed in the order in which they appeared, and the side on which the male/female target was presented (see 'Procedure and Coding' in Chapter Two). The infant's mean score on duration of looks was calculated across the five trials. If the infant did not complete all of the trials in any one domain, their mean was calculated from the trials they did complete (provided that they completed three trials or more). The mean score for each subject was calculated separately for each domain. A separate mixed model Anova was conducted for each of the domains (self-recognition, peers, older children, toys and activities). There was one between subjects factor (infant sex) and one within

subject factor (same-sex versus opposite-sex preference stimulus). Although these calculations were performed on data expressed as milliseconds, the tables which appear in this and following chapters show durations of looking rounded up to the nearest second for ease of reference. The main Anova summary tables for the results of this session and for subsequent sessions are given in Appendix Two.

3.3.1. Visual preference

Self-recognition

The infants' ability to recognise themselves was tested by showing them a photograph of themselves alongside the photograph of a same-sex peer. The means (and standard deviations) for looking times to self or other for male and female participants are given in Table 3.1.

Table 3.1. *Mean durations (and standard deviations) of looking to self or other for male and female participants*

	MALE		FEMALE	
	Self	Other	Self	Other
Duration of Looks (seconds)	11.24 (7.96)	8.86 (7.49)	8.75 (8.60)	12.64 (8.53)

There were no main effects of self-other stimulus ($F(1,49)= 0.14$, $p>.05$ n.s.) or subject sex ($F(1, 49)=0.31$, $p>.05$ n.s.), neither was there a significant infant sex by stimulus interaction ($F(1,49)= 2.50$, $p>.05$ n.s.). These results indicate that infants at three months do not show preference for pictures of themselves above another child or vice versa, suggesting lack of featural self-recognition at this age.

Peer preference

The infant viewed five pairs of photographs of male and female infant faces. Table 3.2 presents the means and standard deviations of the group's duration of looking to same/opposite-sex peers.

Table 3.2. *Mean durations (and standard deviations) of looking to same- or other-sex peers for male and female participants*

	MALE		FEMALE	
	Same-Sex Peer	Opposite-Sex Peer	Same-Sex Peer	Opposite-Sex Peer
Duration of Looks (seconds)	14.56 (4.75)	11.37 (4.40)	12.54 (5.69)	14.03 (6.01)

There was no significant difference in looking time towards same- or opposite-sex peers ($F(1,55)=1.43$, $p>.05$ n.s.) and there was no main effect of subject sex ($F(1,55)=0.07$, $p>.05$ n.s.). There was a significant sex by stimulus interaction ($F(1,55)=10.93$, $p<.002$). This is illustrated in Figure 3.1.

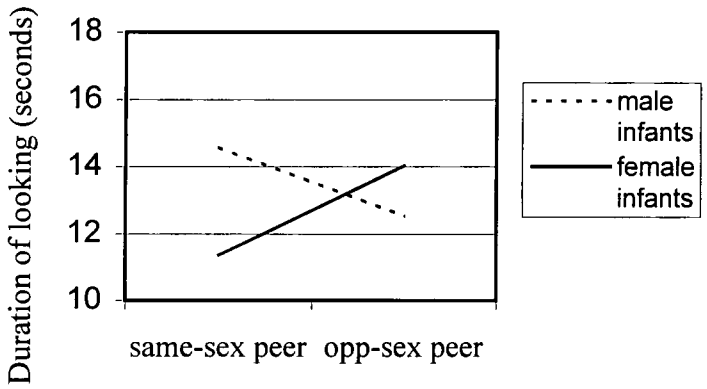


Figure 3.1. *Mean duration of looking to same-/opposite-sex peers for male and female infants*

Tests of simple effects for male and female participants separately show that males significantly preferred to look at other male infant faces (F (1,55)=12.14, p<.01) but females showed no significant preference for either stimulus (F= (1,55)=1.86, p>.05 n.s.). Given that the number of female infants included in this analysis (N=22) was smaller than the number of males (N=34), an estimate of effect size was calculated using the formula given in Howell (p.208, 1989)

$$d = \frac{y_1 - y_2}{s}$$

Where y_1 and $_2$.are the mean durations of looking to same-/ opposite-sex peers and s is the pooled standard deviation of these means.

In this case, the effect size found for girls was -.25, and for the boys, was .67. This corresponds roughly to Cohen's definition of a 'small' effect for girls and a 'medium' to 'large' effect for boys. In this case, it appears that the simple effects reflected an actual difference in the magnitude of effect and was not a function of sample size.

It was of interest to measure the relative contribution of the pairs to this finding. The analysis included male and female stimuli as the pairings remained constant within and between subjects and any preference shown for one stimulus was relative to the attractiveness to the infant of its pair. A 2 (sex of participant) x2 (sex of stimulus picture) x5 (stimulus pair) Anova was performed to test for the possibility that the preference was a function of the one particular stimulus pair. Table 3.3 presents the means and standard deviations of durations of looking for each of the pairings of peer stimuli.

There were no main effects of sex of infant (F(1,52)=0.007, p>.05 n.s.) or stimulus pair (F(4, 208)=0.03, p>.05 n.s.). There was a main effect of preference for peer (F(1, 52)=7.00, p<.01) with the photographs of the male peers receiving longer

durations of looking across the group than the photographs of female infants. Although the original two-way Anova showed no main effect of preference for peer and did show a sex of infant by sex of stimulus interaction, the calculations for the current analysis were not based on the *sex-congruence* of the stimuli (same-/opposite-sex) but the *sex* of the stimuli (male/female). The main effect of peer preference is a reflection of this. There were no other significant interactions. The results found in the two-way Anova are not affected by any particular stimulus pair.

Table 3.3. *Means and standard deviations for duration of looking of male and female infants to pairs of peer faces*

Pair	Stimulus Sex	Sex of Baby	Mean Duration (seconds)	Standard Deviation
One	Boy	Male	13.22	11.12
		Female	10.03	9.07
	Girl	Male	9.53	9.95
		Female	12.46	9.37
Two	Boy	Male	11.26	8.67
		Female	11.50	9.98
	Girl	Male	11.08	8.44
		Female	12.06	10.63
Three	Boy	Male	13.51	8.91
		Female	14.19	10.34
	Girl	Male	9.63	9.04
		Female	8.46	10.05
Four	Boy	Male	14.05	9.32
		Female	14.79	9.73
	Girl	Male	8.52	9.15
		Female	8.04	8.45
Five	Boy	Male	11.29	9.40
		Female	10.47	8.43
	Girl	Male	11.56	9.43
		Female	12.31	9.14

Peer preference - older child

The infant viewed five pairs of photographs of the faces of male and female children. Table 3.4 represents the mean durations of looking and standard deviations of male and female infants.

Table 3.4 *Mean durations (and standard deviations) of looking to same- or other-sex children for male and female participants*

	MALE		FEMALE	
	Same-Sex Child	Opposite-Sex Child	Same-Sex Child	Opposite-Sex Child
Duration of Looks (seconds)	12.26 (6.54)	12.87 (6.31)	12.63 (6.94)	10.66 (4.47)

There was no significant main effect for either target sex ($F(1,55)=0.96$, $p>.05$ n.s.) or subject sex ($F(1, 57)=0.509$, $p>.05$ n.s.) and there was no sex of infant by stimulus interaction ($F(1,55)=3.327$, $p>.05$ n.s.). These results suggest that infants of three months do not show a preference for attending to the pictures of older children on the basis of their own sex or the sex of the stimulus.

Activity preference

The infants viewed five pairs of videos depicting boy/girl-type play activities. The mean durations of looking (and standard deviations) are reported in Table 3.5.

Table 3.5 *Mean durations (and standard deviations) of looking to same- or other-sex play activities for male and female participants*

	MALE		FEMALE	
	Same-Sex Play	Opposite-Sex Play	Same-Sex Play	Opposite-Sex Play
Duration of Looks (seconds)	19.01 (5.03)	7.28 (5.21)	9.90 (6.16)	18.30 (5.19)

There were no main effects of sex-congruence of stimulus ($F(1,53)=1.80$, $p>.05$ n.s.) or participant sex ($F(1, 53)=0.60$, $p>.05$ n.s.). However, there is a highly significant sex by sex-congruence of stimulus interaction for duration of looking to play activities ($F(1,53)=62.87$, $p<.0001$). This is illustrated in Figure 3.2.

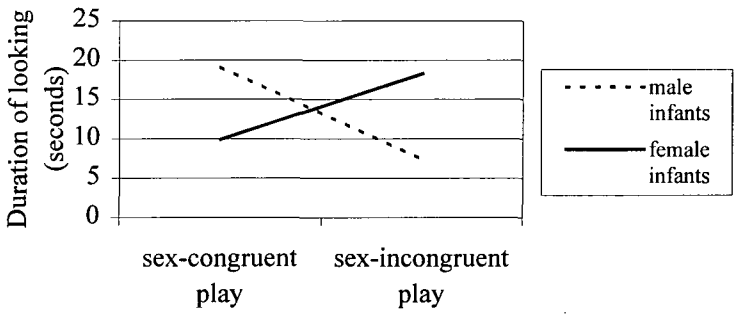


Figure 3.2. *Mean duration of looking to same-/opposite-sex play for male and female infants*

Tests of simple main effects for male and female infants show that both sexes show significant looking preferences. Male infants, however, are alone in preferring same-sex stimuli (male infants - $F(1,53)=49.33$, $p<.01$; female infants: $F(1,53)=19.25$, $p<.01$), as the mean looking times show that both sexes show strong preferential looking toward the boy-type activities. There was no significant difference between the male preference and the female preference for masculine activity ($F(1,53)=2.07$, $p>.05$ n.s.).

Toy preference

The infants viewed five pairs of male-female toy photographs. The mean durations of looking (and standard deviations) are presented in Table 3.6.

Table 3.6 *Mean durations (and standard deviations) for looking to same- or other-sex toys for male and female participants*

	MALE		FEMALE	
	Same-Sex Toy	Opposite-Sex Toy	Same-Sex Toy	Opposite-Sex Toy
Duration of Looks (seconds)	10.23 (3.54)	11.76 (3.68)	11.18 (3.59)	10.09 (3.41)

There is no significant main effect of sex-congruence of stimulus ($F(1,57)=0.02$, $p>.05$ n.s.) or sex of subject ($F(1,57)=0.48$, $p>.05$ n.s.), though there is a significant interaction between sex of subject and preference for sex-congruent toys ($F(1,57)=6.71$, $p<.05$). This is illustrated in Figure 3.3.

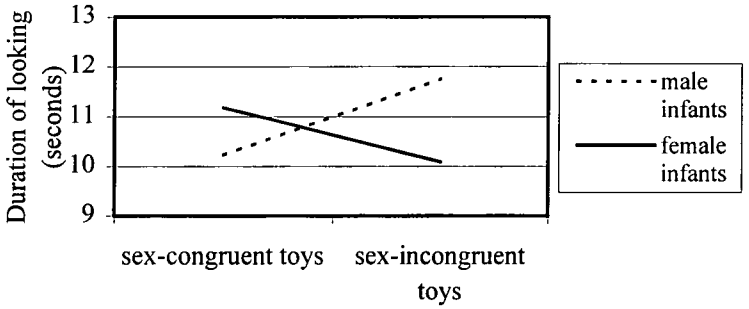


Figure 3.3. *Mean duration of looking to same-/opposite-sex toys for male and female infants*

Calculation of simple effects shows that neither sex, taken in isolation, show significant differences in looking duration to the sex-congruent or incongruent toy

stimuli (male infants, $F(1,57)=4.48$, $p>.05$ n.s.; female infants, $F(1,57)=1.64$, $p>.05$ n.s.). However, as the scores for the male infants were approaching significance (showing a preference for sex-incongruent toys, $p<.06$), and the initial analysis showed an interaction by sex, a 2 (sex of participant) x2 (sex-type of toy) x5 (stimulus pairing) Anova was performed to check for the possibility that the preference was a function of the stimulus pairs. As there was a significant preference shown by the male infants, it was of interest to measure the relative contribution of the pairs to this finding. The analysis included male and female stimuli as the toy pairings remained constant within and between subjects and any preference shown for one stimulus was relative to the attractiveness to the infant of its pair. Table 3.7 presents the mean looking durations and standard deviations for each of the pairings of toy stimuli.

There were no significant main effects of pairing of stimuli ($F(4,132)=0.37$, $p>.05$ n.s.) or sex of subject ($F(1,33)=0.03$, $p>.05$ n.s.). There was a significant main effect of sex-type of toy ($F(1, 33)=5.60$, $p<.05$) with both sexes preferring to attend to feminine toys, and no significant sex of infant by sex-type of toy interaction ($F(1,33)=3.93$, $p>.05$ n.s.). Because the calculations in this analysis are based on the sex-type of the stimulus (male/female) rather than the sex-congruence of the toy (same-/opposite-sex), these results reflect those found in the 2(sex of subject) x 2(sex-type of stimulus) Anova calculation where male infants were found to preferentially attend to opposite-sex toys, and female infants to same-sex toys. There was a highly significant interaction of toy pairs by sex-type of stimulus ($F(1,132)=3.18$, $p<.05$) indicating that looking duration is influenced by the sex-typing of the toys in their specific pairings, but no significant three way (pairing x sex of subject x sex-type of toy) interaction ($F(1, 132)=0.71$, $p>.05$ n.s.). A pair-by-pair analysis was performed on the whole data set to establish whether a particular pair could have been leading the preferential looking.

Table 3.8 shows the mean durations of looking toward each pair of toy pictures by the participants, and the results of t-tests carried out on those means.

Table 3.7. *Means and standard deviations for duration of looking of male and female infants to pairs of toys*

Pair	Stimulus Sex	Sex of Baby	Mean Duration (secs)	Standard Deviation
One	Ball	Male	13.04	7.62
		Female	11.33	6.34
	Doll	Male	8.10	4.34
		Female	13.50	6.48
Two	Wheel	Male	12.77	6.23
		Female	9.25	5.42
	Toaster	Male	10.57	6.48
		Female	11.24	6.29
Three	Train	Male	12.92	6.84
		Female	10.17	6.01
	Cooker	Male	10.90	7.03
		Female	11.37	6.95
Four	Cars	Male	9.16	5.54
		Female	9.38	5.96
	Duster	Male	12.84	6.16
		Female	12.97	6.82
Five	Blocks	Male	7.80	4.89
		Female	8.00	4.95
	Pram	Male	14.58	7.12
		Female	14.82	6.40

Table 3.8. *T-tests on mean durations of looking to toy pairs by all participants*

Stimulus	Mean duration (seconds)	t value	df	Level of Significance
Ball Doll	11.86 10.54	.71	45	.48
Wheel Toaster	11.44 10.06	-.89	53	.38
Train Cooker	10.74 11.41	.39	53	.70
Cars Duster	9.99 12.52	-1.56	45	.13
Blocks Pram	8.28 13.81	-3.27	45	.002

When the Bonferroni correction is applied to the resulting t values, only one of the pairs of toy stimuli produced preferential attention from this group of infants (crit t-value = 2.69, df = 45, $p<.05$). It seems the effects found in the two-way Anova were led by preference by the group for the pram over the blocks. The lack of an interaction by sex of participant in the 3-way Anova suggests that this toy is preferred on some basis other than sex-congruence.

3.3.2. Inter-domain comparisons

Self-recognition and sex-congruent preferences

In order to ascertain whether infants who showed self-recognition were more likely to show early sex-congruent behaviour, the infants were divided into those who looked longer at themselves and those who preferred to look at the 'other.' This was achieved by subtracting the duration of looking time to the 'other' from duration of looking to 'self' and re-coding the scores in binary form to construct two subject groups. A preference score was calculated for each of the other domains by subtracting duration of looking to opposite-sex stimuli from duration of looking to same-sex

stimuli. A one-way Anova was performed on the resulting scores. There was no significant relationship between preference for the photograph of self or other, and sex-congruent looking to play activities, peers or toys. However, there was a significant relationship between preference for self/other and preferential looking to the photographs of the older children ($F(1, 47)=4.64$, $p<.05$). Those who preferred to spend more time attending to the photograph of the 'other' showed a preference for same-sex children (mean preference score = 0.07), while those who attended more to self attended more to opposite-sex children (mean preference score = -0.05). This is a finding that directly contradicts the GSP

Cross domain comparisons

The infants' differential interest to each behavioural domain is illustrated in the bar chart in Figure 3.4. The data for duration of looking to play activity is not represented here because the video stimuli were shown consecutively. The decreased likelihood of the infant removing their attention from either of the screens is likely to have resulted in exaggerated mean looking duration for activity stimuli.

Figure 3.4 *Error bar to show mean total duration of looking to stimuli in each domain by all participants*

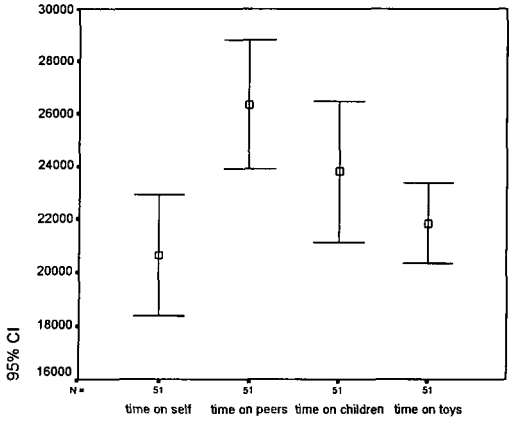


Figure 3.4. illustrates the preference by the group of infants to attend longer to the group of photographs of other same-age babies at this point in testing. The difference in preferential looking durations between the groups of stimuli is found to be significant when a one-way Anova is performed on the data ($F(3,150)=9.26$, $p<.001$). Bonferroni post hoc comparisons show that time spent attending to peers is significantly longer than to self/other ($t=5.00$, $df=50$, $p<.05$) and to toys ($t=-4.07$, $df=50$, $p<.05$). There is not a significant difference between duration of attention to peers and duration of attention to older children ($t=-2.05$, $df=50$, $p>.05$). There is no significant difference between attention to toy and self/other stimuli ($t=1.38$, $df=50$, $p>.05$), or toy and child stimuli ($t=-1.72$, $df=50$, $p>.05$).

Cross domain stability was calculated for the group of participants, and separately by sex. The preference score used to measure the degree of correlation between domains was calculated as total mean duration of looking to opposite-sex stimuli subtracted from total mean duration of looking to same-sex stimuli. Correlation matrices can be found in Appendix Two. There were no significant relationships found among the group data and only one significant relationship in the data taken by sex. For girls only, preference for same-sex peer photographs was positively related to self/other preference. This finding does not exceed the levels of chance given the number of possible correlations.

3.3.3. Parental Information

The parents were asked to provide a list of the last three toys or items their child had been given. A list of all of the answers given by the parents was compiled and given to 50 undergraduate students. The students were asked to indicate whether they would categorise each of the toys as traditionally male, female, or neutral. Each of the infants

then received a score according to the description of the last toys they had received. The criteria for categorisation can be found in Chapter Two. Table 3.9 lists the possible combinations of toys and the score each infant received.

Table 3.9. *Scores allocated to infants receiving various combinations of toys.*

Score allocated to child	combinations of toys received	No. of infants in category
masculine toys received	male, male, female	0
	male, male neutral	0
	male, male, male	1
feminine toys received	female, female, male	0
	female, female, neutral	0
	female, female, female	0
neutral toys received	neutral, neutral, male	3
	neutral, neutral, female	5
	neutral, neutral, neutral	52
	male, female, neutral	0

Only one child received a combination of toys that indicated sex-typed toy ownership and no further analysis of the data was undertaken.

3.3.4. Order of presentation and demographic details

Preference scores were obtained as described in Section 3.3.2. One-way Anovas were performed on each resulting score to test for any significant differences in looking behaviour according to (1) the order in which the domains were presented (static stimuli) (2) the order in which the stimuli were presented within domains (static stimuli and moving stimuli) (3) variations in parental employment of the participants (4) number and sex of siblings (see Chapter Two for a full description of the levels of each variable) The Anova tables can be found in Appendix Two.

There was no significant difference in the mean preference scores of males or females in any of the domains as a function of stimulus order or side on which the stimuli were presented. Neither was there a difference as a function of the order in which the domains appeared. There was no significant difference between groups of participants as a function of their parents' employment or number and sex of siblings.

3.4. Discussion

A clear pattern of sex-typed preferences did not emerge at this stage of the study. Previous studies which have looked at self-recognition in early infancy have reported positive and significant results (Lewis and Brooks-Gunn, 1979; Bahrik, Moss and Fadil, 1996 - see Chapter One for a critique of the theoretical assumptions made in these studies), although utilising different criteria. In the Lewis study, infants in three age groups (9-12 months, 15-18 months, and 21-24 months) were presumed to be showing self-recognition if they spent longer looking at their own face when it appeared in a sequence of photographs including photographs of same-age, same- and opposite-sex infants. Bahrick et al (1996) concluded that their sample of infants demonstrated featural self-recognition because they looked longer at the picture of the other child in a two-choice visual-preference paradigm. Five and eight month-old infants were shown both static and moving presentations of their own face paired with that of an age-matched peer. At eight months, the infants showed significant preference for the peer over self ($t(31)=2.50$, $p<.02$). In a previous study (Bahrick and Watson, 1985), infants at three months showed a strong bimodal response to the paired presentation of self and peer photograph. Bahrick and Watson hypothesised that 3 months marks the transition period from interest in self to interest in peer. In the current study, infants of approximately three months of either sex did not show any featural self-recognition

indicated either by showing preference for their own face over that of another child, or vice versa.

There was no evidence of preferential looking to same-sex peers for the group as a whole. However, there was a significant effect of sex of infant by sex of peer photograph. Further analysis showed that male infants showed a significant preference for male infants. Female infants also demonstrate a preference for the photographs of male infants, but this did not reach significance. Studies by Langlois, Roggman, Casey, Ritter, Rieser-Danner, Jenkins (1987) have suggested that infants will show a preference for attractive over unattractive faces, so the effect may be a function of differential stimulus attractiveness. A pair-by-pair analysis was performed on the peer data. There was no significant difference in the infants' response to the different pairs of stimuli. The possibility that the infants were guided in their attention by the increased attractiveness of particular stimuli would still not explain the sex difference found.

Previous work by Leinbach and Fagot (1993) and Bower (1979) has noted that even adults find the differentiation of infant sex difficult when social and cultural cues such as clothing and hair style are removed. Infants, too, begin to use these cues within their first year (Leinbach and Fagot, 1993). It is surprising, then, that the male participants showed a same-sex preference when these cues were removed, as in this study. Also interesting is the fact that, despite male infants' same-sex preference in the baby stimuli, the participants in this study showed no attentional preference toward same-sex older children. This is particularly surprising because there was no attempt to remove the cultural cues of clothing or hair length given in these photographs. When the relationship between infants' preference to looking at their own photograph and their sex-typed preferences for play, peers and older children was investigated using Anova, a difference was found between those infants who attended to their own photograph for

longer than that of the 'other' and preference for same-sex children ($F(1,47)=4.64$, $p<.05$). Current literature does not provide an obvious explanation for this finding, and it is possible that this result occurred by chance.

There was no evidence of a same-sex toy preference for the group as a whole, but there were differences in the male and female responses that resulted in a significant interaction between sex of subject and sex-type of stimulus. Means comparisons for males and females did not produce significant findings although the difference in the male scores approached significance. A three-way Anova resulted in a significant interaction between the stimulus pairing and the sex-type of the toy. A series of t-tests showed that one of the pairs produced significant results. The infants spent longer looking at the picture of the pram when it was paired with a photograph showing a group of blocks. Although the pictures were matched as far as possible for colour of background, brightness, and toy colour, it is possible that some configuration of these differences affected the infants' attention. There are a number of stimulus parameters not controlled for in the choice of toy stimuli, and some measure of, for example, the relative complexity of the stimuli would have been helpful in assessing the source of the infants' preference. The photograph of the pram could have more clearly portrayed its affordances for play. The picture of the blocks was a close-up shot and, therefore, may not have resembled a toy as closely as the pram. Another possibility is that infants recognise the pram as their chief method of mobility thus affording pleasure. It would be of interest to further investigate the reasons for this highly significant preference.

Although there was no same-sex preference for play activity, there was a highly significant sex of infant by stimulus interaction. Tests of simple effects showed that both sexes very strongly preferred watching the lively male-type activity than the sedate female activities. Infants have been shown to preferentially attend to moving rather than

static stimuli from birth (Slater, Morrison, Town and Rose, 1985) and it is likely the present result is a function of this phenomenon.

In summary, there is no clear pattern of sex-typed preference in early infancy from this data. However, there have been significant preferences shown toward certain stimuli differing as a function of sex that may be worth further investigation.

Chapter Four

The second testing session in this study was carried out when the original group of infants was approximately nine months of age. It is thought that by this age, infants will use gender over other cues to differentiate between faces. Fagan and Singer (1979) found that infants of five to six months are more likely to recognise that a face is familiar on the basis of gender than on the basis of facial structure. Also, at the age chosen for this testing period, infants are thought to possess the ability to form categories on the basis of sex (Leinbach and Fagot, 1993). Infants of 10 months can detect correlations among systematically varied attributes and, when shown male faces with systematically varying features, they have demonstrated the ability to abstract a prototypical representation of a male face (Younger and Cohen, 1983). Habituation and visual preference studies have shown that infants well under a year can discriminate individual male and female faces (Cornell, 1974; Fagan, 1976). We might expect, then, that infants at this stage of development would begin to show differential attention on the basis of sex.

Testing at nine months

4.1. Participants

60 infants participated in the second stage of the study. (mean age = 38.32 weeks, standard deviation = 3.07, range = 31 –48 weeks). Two of the babies (one male and one female) from the first session were unable or unwilling to attend further sessions, and were replaced for the remainder of the study with infants of the same sex who were born in the same month. Parental occupations of the original sample remained unchanged. The employment situation of the replacement participants' parents mirrored

that of those who had left the study. The majority of the mothers who had been on maternity-leave had now returned to work. Fifty percent of the infants received childcare outside the home. Of these 20% were taken care of by another female relative and 80% spent time with a childminder or attended a nursery school. The number of hours spent in childcare ranged from 7 to 40 hours per week.

4.2. Method and procedure

The method and procedure have been described in Chapter Two. The infants completed the visual preference task, viewing both the still and the moving stimuli. They also carried out the rouge test. Sessions usually lasted between 45 and 60 minutes.

4.3. Results

The results from this stage will be presented in the order in which we would expect them to occur according to gender schematic processing theory – recognition of self, preferential attention to same-sex peers and older children, and finally preference for sex-congruent play activity and toy stimuli. The main Anova tables for this testing session can be found in Appendix Three.

4.3.1. Visual preference

Self-recognition

Two measures of self-recognition were used at this stage – the visual preference paradigm (which relies on featural recognition) and the rouge test (which combines featural recognition with contingent movement). Results from the rouge test can be found in the next section.

The infants' ability to recognise themselves was tested by showing them a photograph of themselves alongside the photograph of a same-sex peer. The means (and standard deviations) for durations of looking to self and other are given in Table 4.1.

Table 4 1. *Mean durations (and standard deviations) of looking to self or other for male and female participants*

	MALE		FEMALE	
	Self	Other	Self	Other
Duration of Looks (seconds)	8.95 (5.22)	7.68 (3.22)	8.38 (4.10	7.48 (3.57)

There was no significant difference for looking to self or other ($F(1,54)=1.63$, $p>.05$ n.s) and there was no main effect of sex of infant ($F(1,54)=0.25$, $p>.05$ n.s.). Nor was there a significant sex of infant by stimulus interaction ($F(1,54)=0.05$, $p>.05$ n.s.). This would seem to indicate that the infant has still not achieved featural self-recognition by nine months.

Peer preference

The infant viewed five pairs of photographs of male and female infants' faces. As the photographs used were taken from a same-age cohort unknown to the infant, these were different stimuli to those used to represent the same-age infants in the first session. Table 4.2 represents the means (and standard deviations) of the durations of looking for the male and female participants.

Table 4.2. *Mean durations (and standard deviations) of looking to same- or other-sex peers for male and female participants*

	MALE		FEMALE	
	Same-Sex Peer	Opposite-Sex Peer	Same-Sex Peer	Opposite-Sex Peer
Duration of Looks (seconds)	8.44 (2.20)	7.82 (2.19)	7.71 (1.86)	1.78 (2.34)

There were no significant main effects of sex of peer ($F(1,56)=0.71$, $p>.05$ n.s.) or sex of subject ($F(1,56)=0.66$, $p>.05$ n.s.). Nor was the sex of infant by stimulus interaction significant ($F(1,56)=1.12$, $p>.05$ n.s.). From these results, it would appear that infants of nine months do not discriminate their peers on the basis of sex of peer or sex of self.

Preference for older child

The infant viewed five pairs of photographs of the faces of male and female children. Table 4.3 represents the means and standard deviations of the group's looking durations.

Table 4.3. *Mean durations (and standard deviations) of looking to same- or other-sex children for male and female participants*

	MALE		FEMALE	
	Same-Sex Child	Opposite-Sex Child	Same-Sex Child	Opposite-Sex Child
Duration of Looks (seconds)	8.22 (2.67)	8.84 (2.93)	8.84 (2.76)	8.18 (2.49)

The main effects of sex of stimulus ($F(1,58)=0.50$, $p>.05$ n.s.) and sex of infant ($F(1,58)=0.26$, $p>.05$ n.s.) were not significant. The sex of infant by stimulus interaction was also not significant ($F(1,58)=0.86$, $p>.05$ n.s.).

Activity preference

The infants viewed five short video sequences where children the same sex as them played boy-/girl-type games. Table 4.4 shows the means (and standard deviations) of the duration of looking for male and female participants.

Table 4.4. *Mean durations (and standard deviations) of looking to same- or other-sex play activities for male and female participants*

	MALE		FEMALE	
	Same-Sex Play	Opposite-Sex Play	Same-Sex Play	Opposite-Sex Play
Duration of Looks (seconds)	13.65 (4.62)	6.80 (2.95)	5.17 (1.70)	14.39 (2.85)

There were no significant main effects of sex-congruence of play ($F(1,56)=3.74$, $p>.05$ n.s.) or sex of participant ($F(1, 56)=0.40$, $p>.05$ n.s.). However, there was a highly significant sex of infant by stimulus sex-congruence interaction ($F(1,56)=166.880$, $p<.001$). This is illustrated in Figure 4.1. Tests of simple main effects on male and female scores show that although both boys and girls show highly significant looking preferences, boys attend preferentially to same-sex stimuli ($F(1,56)=79.57$, $p<.01$) whereas the female infants prefer opposite-sex stimuli ($F(1,56)=88.79$, $p<.01$). Once again, there was no significant difference between the male and female participants in their preference for masculine activity ($F(1,56)=3.74$, $p>.05$ n.s.).

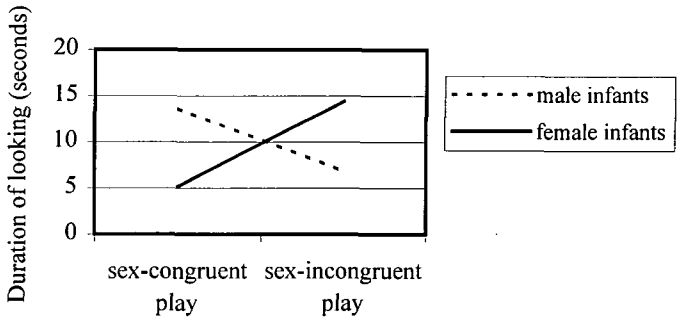


Figure 4.1. *Mean duration of looking to same-/opposite-sex play for male and female infants*

Toy preference

The infants viewed five pairs of photographs of male-/female-type toys. The means and standard deviations of the durations of looking time for male and female participants are represented in Table 4.5.

Table 4.5. *Mean durations (and standard deviations) of looking to same- or other-sex type toys for male and female participants*

	MALE		FEMALE	
	Same-Sex Toy	Opposite-Sex Toy	Same-Sex Toy	Opposite-Sex Toy
Duration of looks (seconds)	9.49 (2.97)	7.81 (2.08)	8.09 (2.56)	8.39 (2.84)

The main effects of sex-congruence of stimulus ($F(1,55)=2.44$, $p>.05$ n.s.) and sex of subject ($F(1, 55)=0.54$, $p>.05$ n.s.) were not significant but the sex of infant by stimulus-congruence interaction reached significance ($F(1,55)=5.07$, $p<.05$). This is illustrated in Figure 4.2.

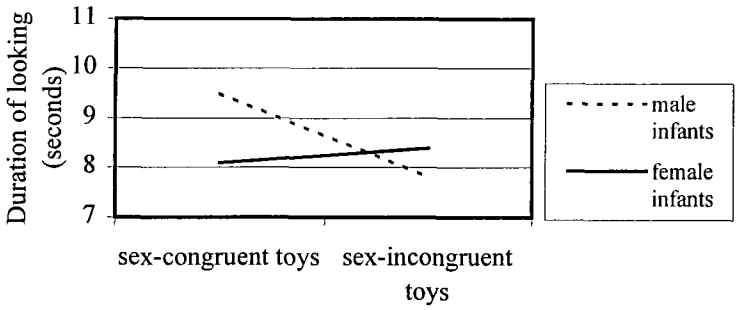


Figure 4.2. *Mean duration of looking to same-/opposite-sex toys for male and female infants*

Simple main effects calculated from male and female scores show that it is the male infants who lead this effect ($F(1, 55)=9.00$, $p<.01$) with their preference for same-sex stimuli. Females show no significant difference in their looking time to sex-congruent or sex-incongruent toys ($F(1,55)=0.20$, $p>.05$ n.s.). Estimations of effect size (calculated using the formula from page 81) indicate that there are differences between the male and female infants which are not a function of the size of the male/female sample. The effect size for male infants is .57 (a medium effect), and for female infants is -.12 (a small effect).

As there was a significant preference shown by the male infants to sex-congruent stimuli, it was of interest to measure the relative contribution of the pairs to this finding. The analysis included male and female stimuli as the toy pairings remained constant within and between subjects and any preference shown for one stimulus was relative to the attractiveness to the infant of its pair. A 2 (sex of infant) x 2 (sex-type of stimulus) x 5 (toy pairs) Anova was performed on the toy pairs to establish whether any of these particular pairs led the results that had been obtained. Table 4.6 shows the means and standard deviations for duration of looking to each stimulus.

Table 4.6. *Means and standard deviations for duration of looking of male and female infants to pairs of toy stimuli*

Pair	Stimulus	Sex of Baby	Mean Duration (seconds)	Standard Deviation
One	Ball	Male	7.74	3.56
		Female	7.42	3.92
	Doll	Male	9.86	4.83
		Female	10.49	6.35
Two	Steering Wheel	Male	11.57	5.76
		Female	10.55	5.22
	Toaster	Male	5.74	3.28
		Female	5.59	2.83
Three	Train	Male	10.14	6.16
		Female	9.71	6.27
	Cooker	Male	6.35	3.26
		Female	6.47	4.19
Four	Truck	Male	10.03	4.37
		Female	8.33	5.58
	Dustpan and Brush	Male	8.83	4.21
		Female	8.93	3.68
Five	Blocks	Male	8.55	5.54
		Female	7.82	4.78
	Pram	Male	8.65	4.37
		Female	9.85	4.80

There was no significant main effect of sex of subject ($F(1, 51)=0.20$, $p>.05$ n.s.). There was no significant main effect of stimuli pairing ($F(4,204)=1.25$, $p>.05$ n.s.) and no sex of infant by pair interaction ($F(1, 51)=0.49$, $p>.05$ n.s.). There was a main effect of preference for male/female toys ($F(1,51)=5.35$, $p<.05$). This result was expected because the data for this calculation have been entered on the basis of their sex-typing rather than their sex-congruence. There was no interaction by sex

($F(1,51)=1.62$, $p>.05$ n.s.). There was, however, a significant interaction between preference for male/female stimuli and the pair in which the toys were presented ($F(4,204)=9.43$, $p<.001$). There was no significant three-way interaction ($F(2,204)=0.08$, $p>.05$ n.s.).

As there was no interaction by sex of participant, a series of paired samples t-tests were performed on the entire data set. The mean duration of looking to each stimulus in the pair and the results of the t-test performed on this is presented in Table 4.7.

Table 4.7. *Paired samples t-tests on duration of looking to toy stimuli*

Toy	Mean Duration	t value	Degrees of Freedom	Level of Significance
Ball Doll	7.38 9.99	-2.51	55	.02
Steering Wheel Toaster	11.06 5.59	-5.68	53	.001
Train Cooker	9.98 6.20	-3.53	56	.001
Truck Dustpan and Brush	8.82 8.52	.40	57	.69
Blocks Pram	8.18 9.24	-.97	55	.34

When the Bonferroni correction is applied to the data, two of the stimulus pairs show significant differences in duration of attention between the pair of toys presented. The steering wheel-toaster (crit t-value = 2.67, $df=53$, $p<.05$) and the train-cooker (crit t-value = 2.68, $df=56$, $p<.05$) pairs show increased attention was paid to the masculine-type stimulus in each pairing.

4.3.2. Rouge test

The protocol for scoring the rouge test can be found in Chapter Two. None of the infants at this stage of testing reached the criteria set by Amsterdam for a demonstration of self-recognition i.e. mark or nose-directed behaviour to self. Many of the infants attempted to remove the make-up from the nose of the mirror image either with their hand or licking the image but no attempt was made to remove the make-up from their own nose. Self-recognition was not evident even according to the looser criteria of increased in body-directed behaviour after the application of rouge (Lewis and Brooks-Gunn, 1979a).

4.3.3. Inter-domain comparisons

Self-recognition and sex-congruent preference

The infants were divided into two groups on the basis of the criteria described in Chapter Three: those who looked longer at themselves and those who attended more to the 'other.' Four separate one-way Anovas were performed using this self-recognition score as the independent variable and where the dependent variables were duration of sex-congruent looking (duration to same-sex minus duration to opposite-sex) in the behavioural domains of play, peer, and toy preference. There was no significant relationship between preference for the photograph of self or other and sex-congruent behaviour in any of the domains.

Cross-domain comparisons

The infants' differential interest to each behavioural domain is illustrated in the bar chart in Figure 4.3. Once again, the data for duration of looking to play activity is not represented here because the video stimuli were shown consecutively. (See section 3.3.2).

Figure 4.3. *Error bar to show mean total duration of looking to stimuli in each domain by all participants*

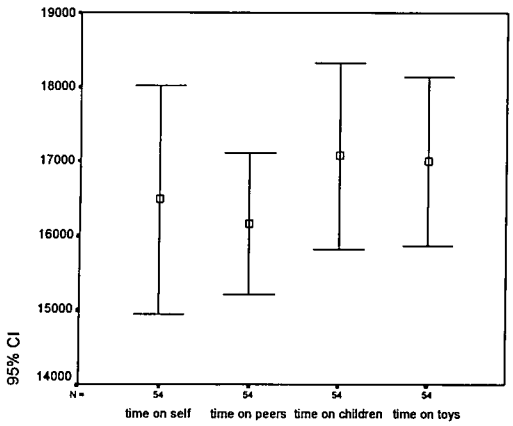


Figure 4.3 illustrates the preference by the group of infants to attend marginally longer to the group of photographs of children at this point in testing. However, this preference does not reach levels of significance when Anova calculations are performed on the data ($F(3,159)=0.72$, $p>.05$ n.s.).

The relationship of individual sex-congruent preferences between domains was calculated by correlating individual preference scores (described in Chapter Three) across each area of investigation (see Appendix Three for full results). The group data correlated in two areas. There was a weak negative correlation between same-sex preference for children's photographs and peer preference ($r=-.29$, $p<.05$) and a positive relationship between same-sex preference for the children stimuli and preferential looking toward self ($r=.37$, $p<.01$). When the group was divided by sex, these correlations were replicated in the case of the girls (preference for children and peers , $r=-.43$, $p<.05$; preference for children and self/other, $r=.48$, $p<.05$) and partially replicated by the male infants (preference for children and peers, $r=-.21$, n.s; preference for children and self/other, $r=.34$, $p<.05$). The significance of these relationships is unclear and once again, their number is not beyond the levels of chance.

4.3.4. Parental information

As in the first testing session, the parents were asked to provide a list of the last three toys or items their child had been given. A list of all of the answers given by the parents was compiled and given to 50 undergraduate students who were asked to indicate whether they would categorise each of the toys as traditionally male, female, or neutral. Each of the infants then received a score according to the description of the last toys they had received (see Chapter Two for criteria of categorisation). No information was received from the parents of 12 infants. Table 4.8 lists the possible combinations of toys and the score each child was given.

Table 4.8. *Scores allocated to infants receiving various combinations of toys.*

Score allocated to child	combinations of toys received	No. of infants in category
masculine toys received	male, male, female	0
	male, male neutral	2
	male, male, male	0
feminine toys received	female, female, male	0
	female, female, neutral	0
	female, female, female	0
neutral toys received e	neutral, neutral, male	7
	neutral, neutral, female	6
	neutral, neutral, neutral	30
	male, female, neutral	0

Anova calculations were performed on the data from the second session, omitting scores from the participants who received sex-typed toys or for whom no data were received, to take into account the possibility that sex-typed toy preference could be a function of toys the infant received. The outcome of the Anovas remained similar - there was no main effect of sex of stimulus for duration of looking ($F(1).99$, $p>.05$ n.s.) but there was a significant sex of infant by stimulus interaction ($F(1)=4.70$, $p<.04$).

Tests of simple main effects on the corrected data show that males are responsible for these results, showing a preference for sex-congruent toys ($F(1, 41)=6.39$, $p<.01$), where females show no significant preference ($F(1,41)=0.62$, $p>.05$ n.s.).

4.3.5. Order of presentation and demographic details

Preference scores were obtained as described in Chapter Three. One-way Anovas were performed on each resulting score to test for any significant differences in looking behaviour according to (1) the order in which the domains were presented (static stimuli) (2) the order in which the stimuli were presented within domains (separated by static/moving stimuli) (3) variations in parental employment of the participants (4) number and sex of siblings (see Chapter Two for a full description of the levels of each variable). The Anova tables can be found in Appendix Three.

There was no significant difference in preference scores between the groups varying in domain order, and there was no significant difference in the mean preference scores of males or females in any of the domains as a function of stimulus order or side on which the stimuli were presented. There was no significant difference between groups of participants as a function of their parents' employment, or sex and number of siblings.

4.4. Discussion

At approximately nine months of age, infants still do not show any clear pattern of sex-typed behaviour. Neither the visual preference task nor the rouge test was successful in eliciting signs of self-recognition in these infants. There was no apparent sex-congruent peer preference or preference for older children as a function of sex.

There was a significant difference between male and female participants in their attention toward the toy stimuli, with males showing a significant preference for sex-congruent toys. These infants showed a significant preference for traditionally masculine toys. A pair-by-pair analysis showed that three of the toy pairings in particular showed significant differences in looking duration, a preference expressed by the group as a whole. This might indicate that some aspect other than sex-typing of the toy is attractive to the infants. As the pairs leading the effect in the second session are different to the first session, it seems that the toys differ in their attractiveness as a function of the child's age. More research would be needed to establish the basis of attraction.

There were two stimulus pairings which did not produce the predicted direction of preferential looking in the male infants. The male-type stimuli in these pairings were a ball and a set of blocks. An earlier review of the literature on sex-typed toys had suggested that blocks and balls are typically 'masculine' toys (Caldera, Huston and O'Brien, 1989; Miller, 1987; Levy, 1994). However, the undergraduate responses that were used to gauge the degree to which the toys received by the infant are generally perceived as sex-typed, suggest that these items may have become less sex-typed since these studies. It is also important to note that the ball was paired with the picture of the doll. It is possible that the doll attracted greater looking from the infants as a function of its human baby-like appearance. As was noted in the introductory chapter, face-like stimuli have proven more attractive than non-social stimuli (Kagan and Lewis, 1965). The comparison of total on-target looking time across the domains does not show a preference for face stimuli over toy stimuli. This may have been because the two types if stimuli were not presented in competition. It is interesting that it is the male infants who first show some significant sex-typed preference for toys. This early sex difference

has been shown in other toy research. Blakemore, La Rue and Olejnik (1979) found that 2 year-old boys who were unable to label toys as sex-appropriate still strongly preferred 'boys toys,' while girls' sex appropriate preferences did not become apparent until around three years. Even then, they only appeared when the sex-role dimension was brought to the subjects' attention. This precocious sex-typed behaviour is reflected in later childhood when boys have been shown to adopt sex-typed behaviour in a number of areas earlier and with more vigour than girls (Blakemore et al, 1979; Cole, Zucker and Bradley, 1982; Turner, Gervai and Hinde, 1993).

Infants of this age continue to find male-type activities more interesting or captivating than female-type activities. Both boys and girls at this stage of development paid more attention to the male play sequences than the female sequences.

It was somewhat surprising to find so few significant preferences among this age group as previous infant studies have suggested that infants of around this age are able to categorise on the basis of sex (Leinbach and Fagot, 1993). However, it is possible that this is the responsibility of inappropriate lengths of presentation of stimuli. In the previous testing session, the infant saw each pair of stimuli for thirty seconds. This was felt appropriate given the suggestion of Langlois, Roggman, Casey, Ritter, Rieser-Danner, Loretta and Jenkins (1987) that infants in their visual preference study failed to show a preference because the stimuli were shown for a short length of time. Very young infants find it difficult to release their attention from visual stimuli. Older infants, however, are more able and willing to look away. A recent study by Bahrick, Moss and Fadil (1997) used exposure times of 30 seconds for moving stimuli and 15 seconds for static stimuli, having found that 5 and 8 month-old infants seemed restless when viewing the static stimuli for longer. It was certainly the case in this study that these infants, at nine months, show shorter mean durations of looking times to the visual

stimuli for the second session than for the first session. Following a small pilot study (see Chapter Five), it was decided that, when tested at eighteen months, the infants should view the stimuli for fifteen second presentations.

Chapter Five

Infants of eighteen months have developed in a number of cognitive and physical areas. Somewhere between fifteen and twenty-four months, infants come to recognise their own reflected image and will spontaneously remove a dot of rouge placed on their nose when they are exposed to that image (Amsterdam, 1972; Lewis and Brooks, 1975). They will have begun to vocalise, and some will be able to form simple sentences. They are more able to express their needs and wants and may be able to respond to simple questions about their preferences. By eighteen months, some sex-typed preferences have been shown to emerge. Infants may already be discerning over toy choice (Caldera, Huston, and O'Brien, 1989), and boys and girls may be showing different styles of play and interaction (Maccoby and Jacklin, 1987). Although infants do not reliably label on the basis of sex at eighteen months (Fagot and Leinbach, 1989), male/female categorisation is thought to have been in place for some time (Leinbach and Fagot, 1993). If sex-typed preference is linked to gender recognition, we would expect to see some indication of the emergence of these preferences in children at around eighteen months of age.

Testing at eighteen months

5.1. Participants

57 infants participated in the third stage of the study (mean age in weeks = 86.47, range = 75-97, standard deviation = 5.35). Three of the infants from the previous sessions (all male) were unable or unwilling to attend this session. Because of the longitudinal nature of the study, they were not replaced at this stage. Parental occupations were as previously stated. There were no reported changes in childcare.

5.2. Method and Procedure

The method and procedure have been described in Chapter Two. During this session, the infants carried out the visual preference task for both the static and moving stimuli and completed the rouge test. They were also given the gender labelling task (see Chapter Two) that the parents administered while being recorded unobtrusively by a camcorder. As well as answering questions on their own occupation, childcare arrangements, the child's mother also completed a list of the infants' most recent toy acquisitions.

Given the nine months between testing sessions, there was some question as to whether the procedure described would be suitable for this age group of children. A small pilot study (N=6) was conducted to assess the suitability of the procedure, where the pilot participants were simply required to view some stimuli (static Teletubby cartoons) for the approximate amount of time required to conduct the session as described. These infants showed themselves capable of this task provided the stimuli were shown for the shortened time of 15 seconds. Consequently, the decision was made to reduce the exposure time to each pair of static stimuli to fifteen seconds. The pilot group also viewed the moving stimuli. As they were able to maintain interest for the amount of time required to view all five pairs, the videos showing the play activities were not altered and the group of participants saw each pair of moving stimuli for thirty seconds.

5.3. Results

The results for this session will be presented in the order they have appeared in previous chapters; recognition of self, preferential attention to same-sex peers and older

children, and finally preference for sex-congruent play activity and toy stimuli. Mixed model Anovas were used to assess for main effects of sex of stimulus and for sex of infant by stimulus interaction. The Anova tables can be found in Appendix Four.

5.3.1. Visual preference

Self-recognition

This was assessed using two tasks – the visual preference paradigm (which relies on featural recognition) and the rouge test (which combines featural recognition with contingency movement). The results of the rouge test are presented in the next section.

The infants viewed photographs of themselves along with a photograph of a same-sex peer. This pair was interspersed with the other pairs of photographs of same-age children. Table 5.1 shows the means (and standard deviations) of the looking duration to each of the stimuli for male and female participants.

Table 5.1. *Mean durations (and standard deviations) for looking to self or other for male and female participants*

	MALE		FEMALE	
	Self	Other	Self	Other
Duration of Looks (seconds)	5.15 (2.36)	5.11 (2.27)	5.22 (2.74)	3.99 (1.97)

There was significantly more attention paid to the photograph of the 'self' ($F(1,54)=5.10$, $p<.05$), but there was no main effect of subject sex ($F1, 54)=0.01$, $p>.05$ n.s.). There was also a significant sex of infant by stimulus interaction ($F(1,54)=4.75$, $p<.05$). This interaction is illustrated in Figure 5.1.

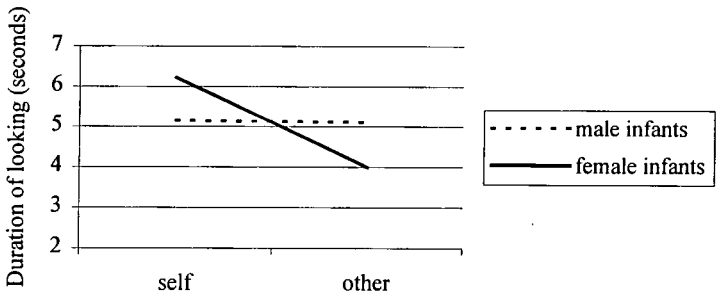


Figure 5.1. *Mean duration of looking to self/other for male and female infants*

A test of simple main effects shows that the difference in looking scores toward the self/other stimuli was led by the female participants ($F(1,54)=8.62$, $p<.01$) who showed a preference for looking toward photographs of the self, while male participants did not show a preference for either member of the pair ($F(1,54)=0.003$, $p>.05$ n.s.).

Peer preference

The infants were shown five pairs of photographs of male and females infants of approximately eighteen months. The means (and standard deviations) of their looking durations are presented in Table 5.2.

Table 5.2. *Mean durations (and standard deviations) for looking to same- or other-sex peers for male and female participants*

	MALE		FEMALE	
	Same-Sex Peer	Opposite-Sex Peer	Same-Sex Peer	Opposite-Sex Peer
Duration of Looks (seconds)	5.09 (1.59)	4.46 (1.78)	4.62 (1.12)	5.63 (1.37)

There were no main effects of sex of infant in the photographs ($F(1,54)=1.18$, $p>.05$ n.s.) or sex of infant ($F(1, 54)=1.23$, $p>.05$ n.s.), though there was a sex of infant

by stimulus interaction (F(1,54)=21.58, p<.001) This is illustrated in Figure 5.2.

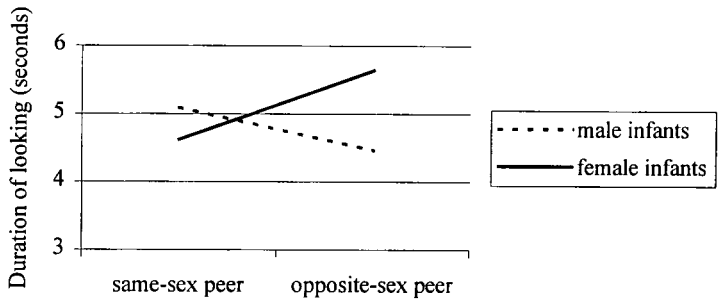


Figure 5.2. *Mean duration to same-/opposite-sex peer for male and female infants*

Tests of simple main effects show that both male and female infants show differences in looking behaviour (Male; F(1,54)=7.38, p<.01; female; F(1,54)=14.38, p<.01). However, when we look at the means, it is possible to see that the direction of preference is different as a function of sex, with male infants showing a preference for same-sex peers, and female infants showing a preference for opposite-sex peers.

As there was a significant preference shown by the male infants to sex-congruent stimuli, it was again of interest to measure the relative contribution of the pairs to this finding. A 2 (sex of infant) x2 (preference for male/female-peer) x5 (peer pairings) repeated measures Anova was performed to establish whether any of the particular pairings led the results that had been obtained. Table 5.3 presents the means and standard deviations for looking to each of the pairings of peer stimuli.

Table 5.3. *Means and standard deviations for duration of looking of male and female infants to pairs of peer faces*

Pair	Stimulus Sex	Sex of Baby	Mean Duration (seconds)	Standard Deviation
One	Boy	Male	5.06	2.62
		Female	5.31	2.22
	Girl	Male	4.37	2.63
		Female	4.04	1.85
Two	Boy	Male	5.64	2.58
		Female	5.21	2.49
	Girl	Male	4.67	2.20
		Female	5.24	2.38
Three	Boy	Male	4.01	2.13
		Female	5.44	1.33
	Girl	Male	5.08	2.32
		Female	5.28	2.35
Four	Boy	Male	4.99	2.86
		Female	5.84	2.88
	Girl	Male	4.55	2.70
		Female	4.43	2.15
Five	Boy	Male	5.51	2.44
		Female	7.04	2.82
	Girl	Male	4.15	1.94
		Female	4.52	2.65

There was no main effect of stimulus pairing ($F(4, 196)=1.58$, $p>.05$ n.s.). In the original two-way Anova, there was no main effect of looking toward sex-congruent/incongruent stimuli, but there was a significant interaction between sex of infant and attentional preference to male/female peers. In the current analysis, the pairings are being scrutinised on the basis of preference for infants to look towards either male or female pictures rather than sex congruent or incongruent stimuli. This change in emphasis has had the expected effect in the current analysis of producing a

significant main effect of preference ($F(1, 49)=18.74$, $p<.001$) but no significant preference by sex of participant interaction ($F(1, 49)=2.77$, $p>.05$ n.s.).

There was a significant pairing by preference interaction ($F(4, 196)=2.71$, $p<.05$) but there was no three-way interaction with the sex of the participant ($F(4,196)=0.76$, $p>.05$ n.s.). As there was no interaction by sex, a series of paired samples t-tests were performed on the entire data set. The mean duration times to each stimulus and results of the analysis are presented in Table 5.4.

Table 5.4. *Paired samples t-tests on duration of looking to peer stimuli*

Pair Number	Sex of Stimulus	Mean Duration (seconds)	t value	Degrees of Freedom	Level of Significance
One	Male Female	4.19 5.04	-1.88	54	.07
Two	Male Female	4.91 5.54	-1.37	54	.17
Three	Male Female	4.98 4.60	.95	54	.35
Four	Male Female	4.33 5.40	-1.87	55	.07
Five	Male Female	6.08 4.34	3.48	53	.001

When the Bonferroni correction is applied to the t-values, it is apparent that the preference for male peer faces is not generalised across the pairings. There is a significant preference for the male faces in one of the pairings – pair five (crit t-value = 2.67, df=53, $p<.05$).

Preference for older child

The infants viewed five pairs of photographs of male and female children of around four years of age. The mean durations of looking time to the stimuli (and standard deviations) appear in Table 5.5.

Table 5.5. *Mean durations (and standard deviations) of looking to same- or other-sex children for male and female participants*

	MALE		FEMALE	
	Same-Sex Child	Opposite-Sex Child	Same-Sex Child	Opposite-Sex Child
Duration of Looks (seconds)	4.72 (1.35)	4.70 (1.32)	5.27 (1.15)	5.22 (1.34)

The main effects of sex of child in picture ($F(1,53)=0.04$, $p>.05$ n.s.) and sex of participant ($F(1, 54)=3.61$, $p>.05$ n.s.) were not significant. The sex of infant by stimulus interaction was also not significant ($F(1,53)=0.01$, $p>.05$ n.s.).

Activity Preference

The participants viewed a video presentation in which five pairs of male- and female-type activities were performed by children of the same sex as the participant. The means (and standard deviations) of their looking durations are presented in Table 5.6.

Table 5.6. *Mean durations (and standard deviations) for looking to same- or other-sex play activities for male and female participants*

	MALE		FEMALE	
	Same-Sex Play	Opposite-Sex Play	Same-Sex Play	Opposite-Sex Play
Duration of Looks (seconds)	18.28 (4.50)	5.06 (1.96)	7.26 (5.18)	16.27 (4.74)

There were significant main effects of sex-congruence of stimulus activity ($F(1,47)=4.34$, $p<.05$), but not of sex of infant ($F(1, 47)=0.02$, $p>.05$ n.s.). There was also a significant interaction between subject sex and sex-congruence of stimulus ($F(1, 47)=121.27$, $p<.001$) illustrated in Figure 5.3.

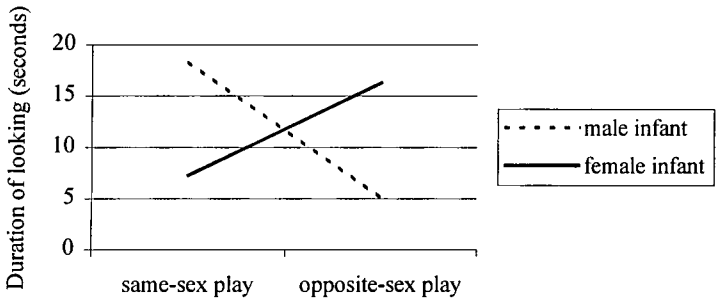


Figure 5.3. *Mean duration of looking at same-/opposite-sex play for male and female infants*

Tests of simple main effects show that the difference between same- and opposite-sex stimuli is significant in both male ($F(1,47)=104.93$, $p<.001$) and female ($F(1,47)=33.68$, $p<.001$) participants. However, the preference is in the same direction for both sexes, with male-type activities receiving more attention than female-type activities. When the mean durations of looking to masculine stimuli was compared for male and female participants, a significantly larger preference emerged for male than for female infants ($F(1,47)=4.34$, $p<.05$).

Toy preference

The infants viewed five presentations of toy stimuli (in male-female pairings). The means (and standard deviations) for duration of looking toward same- and opposite-sex stimuli is presented in Table 5.7.

Table 5.7. *Mean durations (and standard deviations) of looking to same- or other-sex type toys for male and female participants*

	MALE		FEMALE	
	Same-Sex Toy	Opposite-Sex Toy	Same-Sex Toy	Opposite-Sex Toy
Duration of looks (seconds)	6.79 (1.82)	5.37 (1.18)	6.37 (1.77)	5.67 (1.66)

There was a significant main effect of sex-congruence of stimulus (1,54)=11.25, p<.001) but not sex of subject (F(1,54)=0 03, p>.05 n.s.). There was no sex-congruence of stimulus by sex of infant interaction (F(1,54)=1.27, p>.05 n.s.). It would seem that at approximately eighteen months, infants of both sexes are showing sex-typed preferences for toys.

In order to ascertain whether the pairing of the stimuli was influential in these results, a repeated measures Anova was performed on the data, looking at sex of infant, preferred direction of looking (male/female) and toy pairing. The means (and standard deviations) for duration of looking to each stimulus pair is presented in Table 5.8. There was no main effect of toy pairing (F(1, 196)=2.20, p>.05 n.s.) or of preference toward male/female toys (F(1, 49)=1.24, p>.05 n.s.). No main effect of preference was expected in this analysis because, in performing the analysis, the emphasis was changed from sex-congruence of looking duration (same-sex/opposite-sex) to preference for male and female stimuli. We would expect, therefore, the main effect of preference found in the original two-way Anova to be reflected in an interaction of preference to male/female stimuli by sex of infant. There is a significant sex of stimulus by sex of infant interaction (F1,49)=10.72, p<.01). There is a significant pairing by sex of stimulus

interaction ($F(4, 196)=11.93$, $p<.001$) and a three-way pairing by sex of stimulus by sex of infant interaction ($F(4, 196)=2.97$, $p<.05$).

The three-way interaction demonstrates that the specific stimulus pairings differ in the impact they have on the overall sex-congruent preference shown in the two-way Anova. In order to ascertain which of the pairings is responsible for this effect, five separate mixed model Anovas were performed (with a between subjects factor of sex and a within-subjects factor of male-/female-type toy) and tests of simple main effects were calculated in the cases where an interaction occurred. The results of the Anovas are summarised in Table 5.9.

Table 5.8. *Means and standard deviations for duration of looking of male and female infants to pairs of toy stimuli*

Pair	Stimulus	Sex of Baby	Mean Duration (seconds)	Standard Deviation
One	Ball	Male	4.92	2.74
		Female	4.48	2.95
	Doll	Male	7.11	2.30
		Female	7.49	3.45
Two	Steering Wheel	Male	6.12	2.85
		Female	6.01	2.74
	Toaster	Male	5.27	2.56
		Female	5.88	2.75
Three	Train	Male	8.61	3.39
		Female	6.57	2.75
	Cooker	Male	3.40	2.26
		Female	4.37	3.33
Four	Truck	Male	8.93	4.41
		Female	5.55	3.60
	Dustpan and Brush	Male	4.06	2.87
		Female	6.95	3.31
Five	Blocks	Male	5.18	2.49
		Female	5.59	3.84
	Pram	Male	6.50	2.71
		Female	7.17	3.64

Table 5.9. *Summary of significant and non-significant main effects and interactions of two-way analysis of toy pair preference*

Stimulus Pair	Main Effect (preference for one stimulus)	Interaction (sex of infant x stimulus)
Ball Doll	p<.001	n.s
Wheel Toaster	n.s	n.s
Train Cooker	p<.001	p<.05
Truck Brush	n.s	p<.01
Blocks Pram	n.s	n.s

There was no main effect of sex of infant for any of the toy pairings (see Appendix Four for full results). The doll received significantly more attention than the ball ($F(1,53)=17.12$, $p<.001$), while the train received more attention than the cooker ($F(1,53)=44.36$, $p<.001$). However, there was an interaction by sex in the case of the train/cooker pairing ($F(1,53)=6.15$, $p<.05$). Tests of simple main effects show that both male and female infants preferred to attend to the picture of the train over the cooker (male; $F(1, 53)=48.09$, $p<.001$; female; $F(1, 53)=7.79$, $p<.01$). So males were showing a sex-congruent, and females a sex-incongruent preference.

One other pair showed an interaction, though there was no main effect of preference for one stimulus over another. In the brush/truck pairing ($F(1,52)=11.18$, $p<.01$), only males showed a significant preference ($F(1, 52)=13.91$, $p<.001$) which was in a sex-congruent direction. The female infants showed a non-significant preference to attend to the dustpan and brush ($F(1,52)=1.43$, $p>.05$ n.s.). Separating the duration of looking time into individual pairings, and comparing on the basis of sex shows that the

sex-congruent preference found in the original two-way Anova is not a general effect across the pairings or between the participants.

5.3.2. Rouge Test

The participants were assigned to three groups depending on whether they demonstrated self-recognition by attempting to remove the rouge placed on their nose. The criteria for inclusion in each of the categories are described in Chapter Two. They were judged to either have achieved self-recognition, have achieved self-recognition after a prompt (the parent appearing in the mirror next to them with rouge on their own nose and pointing to themselves saying 'Who is this in the mirror?') or not to have achieved self-recognition. Fifty-two children participated in this part of the session. Of these, thirty-five (67%) achieved self-recognition (16 female and 19 males), three (6%) of the children showed self-recognition following the cue provided by their parent (1 female and 2 males), and fourteen (27%) of the children did not demonstrate the ability to recognise their mirror image (7 females and 7 males). Due to the small number of cases in the condition where the child succeeded after being prompted by their parent, these children were re-categorised as being unable to perform the task and the performance of the two groups with chance levels (50%) were compared using the Binomial Test. The levels of success were significantly above chance ($p<.05$).

5.3.3. Gender labelling task

The participants could receive one of three scores for the gender labelling task; correct labelling of the photographs of children and of adults, correct labelling of adults only, and correct labelling in neither category. The scoring criteria is outlined in Chapter Two. Previous research (Fagot, Leinbach and Hagan, 1986) indicates that

children correctly label adults according to sex prior to labelling children according to sex and so no provision was made for recognition of children alone. In the event, none of participants in this study recognised children but not adults on the basis of sex.

Forty-seven of the participants completed the gender labelling task. Of these, five infants correctly labelled children and adults (11%), four infants correctly labelled adults only (8%). The majority of the children (81%, 38 participants) were unable to identify the correct sex of either adults or children portrayed in the photographs.

Four one-way Anovas were performed with the independent variable of labelling ability and dependent variable of duration of preferential looking in each domain (see Chapter Three for calculation of preference score) to ascertain whether the ability to label on the basis of gender affected the children's preferences for their peers, toys or activities, or self-recognition (visual preference task). Anova tables can be found in Appendix Four. There were no significant effects.

5.3.4. Inter-domain comparisons

Self-recognition and sex-congruent preference

To explore the relationship between the infants' ability to recognise themselves, and the same-sex preferences they showed in other domains, the infants were divided into two groups (using the criteria described in Chapter Three): those who looked longer at themselves and those who preferred to attend to the 'other' on the visual preference task. A two-way Anova was performed on the resultant scores where the between-subjects factor was direction of preference (self versus other), and the within-subjects factor was the behavioural domains of play, peer, and toy preference with preferential looking as the dependent variable. There was no significant relationship between preference for the photograph of self or other, and other sex-congruent looking

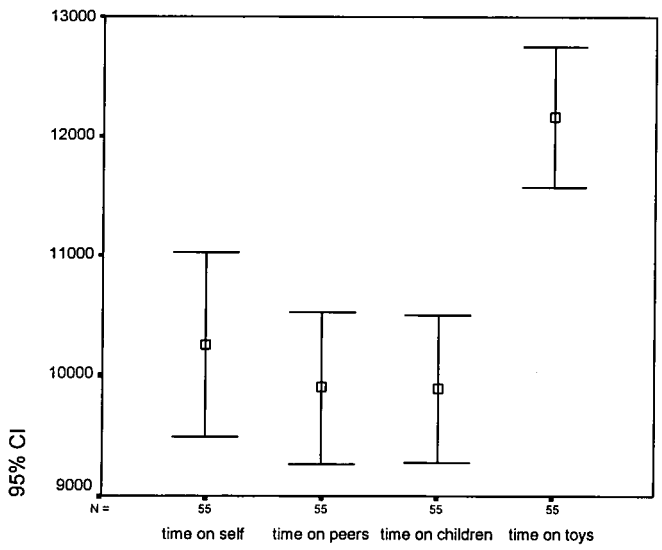
behaviour. (Tables of correlations can be found in the appendices).

It was also possible at this stage of testing to investigate the relationship between featural self-recognition (still photograph) and contingent self-recognition (rouge test). The association between pictorial self-recognition (successful/unsuccessful) and mirror recognition (successful/unsuccessful) was assessed using the contingency co-efficient (C). This analysis revealed that there was no significant relationship between mirror and pictorial self-recognition (C=.02, df=1, p>.05 n.s.).

Cross-domain comparisons

The infants' differential interest to all behavioural domains is not illustrated in this section both because they viewed the static stimuli (15 seconds) for less time than the video footage of play activities (30 seconds) and the method of presentation of still and moving stimuli was different (see Chapter Four). For that reason, the error bar chart in Figure 5.4. shows only duration of attention to the static stimuli.

Figure 5.4. *Error bar to show mean total duration of looking to stimuli in each domain by all participants*



This graph shows a preference by the group of infants to attend longer to the

group of toy stimuli. A one-way Anova performed on this data shows this preference to be significant at $F(3,162)=23.34$, $p<.001$. Comparing the significance of the difference between the pairs using the Bonferroni correction, toys emerged as eliciting significantly more looking than self/other stimuli ($t=5.47$, $df=54$, $p<.001$), peers ($t=7.75$, $df=54$, $p<.001$) and older children ($t=8.46$, $df=54$, $p<.001$). There was no significant difference between looking to older children and peers ($t=-.03$, $df=54$, $p>.05$), between older child and self/other ($t=-1.02$, $df=54$, $p>.05$), or between looking to self/other and peer stimuli ($t=-1.10$, $df=54$, $p>.05$).

It was also of interest to examine stability in preference across domains. A preference score was calculated using the method described in Chapter Three, and the scores were correlated across the domains both for the whole sample, and by sex. For the group as a whole, there was only one significant correlation between preference score for same-sex peer and for sex-congruent play activity ($r=.47$, $p<.05$). This is an interesting finding considering that the preference shown in both areas is in the direction of the male stimuli. In the analysis by sex, the only significant finding was that girls' toy preference score was negatively correlated with their preference for sex-congruent play activities ($r=-.52$, $p<.05$). This finding is not surprising given that both sexes have shown a preference for sex-congruent toy stimuli *and* for masculine-type play. There were no cross-domain correlations between the preference scores of the male infants.

5.3.5. Parental Information

As in previous testing sessions, the parents were asked to provide a list of the last three toys or items their child had been given. A list of all of the answers given by the parents was compiled and given to 50 undergraduate students. The students were asked to indicate whether they would categorise each of the toys as traditionally male,

female, or neutral. The results of this survey is presented in Appendix D. Each of the infants then received a score according to the description of the last toys they had received (see Chapter Two for criteria of categorisation). Table 5.10 lists the possible combinations of toys and the number of infants receiving each combination.

Incomplete questionnaires were returned by nineteen of the participating families, and information regarding toys recently received was given by thirty-eight of the parents. Of these participants, eleven were categorised as having received sex-typed toys. To take into account the possibility that sex-typed toy preference could be a function of toys the infant received, a mixed-model Anova was performed to determine whether there were any differences between the groups of participants. Although in the first two sessions, analysis of the impact of toys received was re-calculated by omitting data from children who had received sex-typed toys recently, this would not be appropriate in this instance when nearly a third of the data would have been lost.

Instead, a mixed model Anova of toys received (consisting of three levels – sex-typed, neutral, or 'no information') by duration of looking to toy stimuli (same-sex/opposite sex) was performed to investigate any possible relationship between these two variables. Neither the main effects of toys received ($F(1, 49)=3.59$, $p>.05$ n.s.), nor the toys received by sex congruent looking interaction was significant ($F(1,49)=2.06$, , $p>.05$ n.s.).

Table 5.10. *Scores allocated to infants receiving various combinations of toys.*

Score allocated to child	combinations of toys received	No. of infants in category
masculine toys received	male, male, female	0
	male, male neutral	7
	male, male, male	2
feminine toys received	female, female, male	0
	female, female, neutral	2
	female, female, female	0
neutral toys received	neutral, neutral, male	10
	neutral, neutral, female	3
	neutral, neutral, neutral	4
	male, female, neutral	0

5.3.6. Order of presentation and demographic details

Preference scores were obtained as described in Chapter Three. One-way Anovas were performed on each resulting score to test for any significant differences in looking behaviour according to (1) the order in which the domains were presented (static stimuli) (2) the order in which the stimuli were presented within domains (separated by static/moving stimuli) (3) variations in parental employment of the participants (4) number and sex of siblings (see Chapter Two for a full description of the levels of each variable). The Anova tables can be found in Appendix Four.

There was no significant difference in preference scores between the groups as a function of domain order, and there was no significant difference in the mean preference scores of males or females in any of the domains as a function of stimulus order or side on which the stimuli were presented. There was no significant difference between groups of participants according to parental employment. However, there was a significant effect of sibling status on the preference scores for the peer stimuli

($F(3,60)=3.50$, $p<.05$). Bonferroni post hoc testing showed no significant differences between the groups, although two groups were approaching significance. Infants with no siblings differed in differential attention to same-and opposite-sex stimuli to those infants who had siblings of both sexes. Infants with no siblings showed significantly greater same-sex preference.

5.4. Discussion

Infants of approximately eighteen months have shown themselves capable of self-recognition in the non-contingent and contingent conditions. Though the effect was strongly led by the female participants in the non-contingent condition (photographic representation of self), there were no apparent sex differences in achievement of self-recognition in the rouge test. There is no significant association between the results of these two tests, and this may lead us to believe that the two tasks measure different phenomenon. The results from the pictorial self-recognition task may suggest that female infants have a more mature understanding of self than male infants of this age. It is also possible that female infants are exposed to photographic images of themselves more frequently than males. Previous studies claiming to find evidence of self-recognition in infants from still-picture presentations did not, however, report differential looking as a function of the infants' sex (Bahrick, Moss and Fadil, 1996). A comparison of methodology between that study and the one being described here highlights a possible problem with the present work. The photographs used to represent the 'other' in the visual preference self-recognition task remained constant between subjects, so it is possible that the results reflected a preference by the group of females on the basis of attraction i.e. the picture representing the 'other' was unattractive to the group of females. Alternatively, the picture of the 'other' for males was so attractive, it

made their own picture seem relatively less interesting. Future study into this phenomenon would benefit from using the 'yoked-control' procedure described by Bahrik et al (1996), where each infant acts as the 'other' for the next infant to be tested.

At eighteen months, there is still no evidence that infants pay preferential attention to same-sex others; there was no main effect to indicate looking to either same-sex infants or to same-sex older children. However, there was a sex of infant by stimulus interaction for looking to peer stimuli. This was a function of a preference by both sexes to attend to male stimuli, led by one pair of photographs in particular. It is possible to speculate that, for this pair, the male stimulus was more attractive in some way either because of the child's attractiveness per se, or some particular feature of the child that attracted interest.

The same-sex preference for play activities can also be attributed to a general preference by the group for male-type stimuli, with both sexes continuing to attend preferentially to the fast-moving 'male' activities. The male infants show a stronger preference than the females at this point, and this may mark the beginning of sex-differentiated activity preferences.

From the results presented to this point, it seems that the achievement of self-recognition may appear before preference for same-sex peers or older children which would satisfy the predicted cognitive development of gender schematic processing theory. However, by eighteen months, children of both sexes are showing a strong sex-typed toy preference. While the longitudinal and cross-domain evidence is sparse, it seems from other research that toy preferences are often the first to appear. Preferences for same-sex toys have been identified in infants between fourteen and eighteen months (Caldera, Huston and O'Brien, 1989), where same-sex peer preference and behavioural sex-typed play preference may not be apparent until later (Fagot, 1985; Hoyenga and

Hoyenga, 1993). The result of the preferential looking task becomes less clear to interpret for toys, however, if one performs a pair-by-pair analysis on the data. Both sexes showed preferential attention to the doll over the ball and the train over the cooker.

Despite the achievement of self-recognition, sex-typed preferences are still not apparent in all of the areas measured in this study. The low attainment on the gender labelling task may indicate that, although 67% of this sample were able to recognise themselves in the rouge test (in line with Lewis and Brooks-Gunn's (1979) work on the emergence of self-recognition) this seems not to have yet translated into any concept of categorical gender of self, thought by Lewis to develop simultaneously with identifying the gender of others. GSP theories would predict the attainment of some level of gender identity (labelling of self and others on the basis of sex) prior to the onset of sex-typed behaviour. Sex-typed preferences were apparent, however, in the domain of toy preference. It may be that infants' early sex-typed toy preferences are the precursor to later sex-typed behaviour, leading them to develop some affinity with others of the same sex through toy play *prior* to understanding their gender category, an idea proposed by proponents of theories of behavioural compatibility (see section 1.3.3). Further research would be necessary to establish the continuing developmental trajectory of sex-typed preferences.

Chapter Six

There are few studies which monitor the development of sex-typed behaviour across time. Those that do tend to use cross-sectional samples (Lewis, 1981; Slaby and Frey, 1975; Blakemore, LaRue and Olejnik, 1979; Bussey and Bandura, 1992.). There are advantages to these studies in the consistency in participant numbers, the possibility of increasing the number of tasks the children can be expected to perform, and the lack of practise effects which might be found from repeated exposure to the experimental paradigm (Cole and Cole, 1992). However, one danger inherent in using such 'snap-shots' of behaviour is that important individual variations across time may be missed. Without longitudinal measurements, it is impossible to discover if a particular behaviour pattern remains constant or changes as the individual child matures. By using the same cohort of infants, it should be possible to identify trends between sessions, and to relate these trends to other, more consistent factors, such as parental occupation or number of siblings in the home. It is hoped that by following a sample of children across time, this study will prove sensitive enough to take such differences into account and provide a more holistic picture of the trajectory of sex-typed behaviour.

GSP theory would predict that sex-typed behaviour should follow from a demonstration of the ability to correctly identify own sex and that of others. Therefore, in this longitudinal analysis, we should expect to find sex-typed preferences emerging sometime after a demonstration of self-recognition and understanding of gender identity. A measure of cognitive understanding of gender - a gender labelling task - was included in the trial at eighteen months. According to GSP theorists, we would not expect to see the emergence of sex-typed behaviour prior, at least, to seeing labelling of adults on the basis of gender, an ability which has been shown to appear before the

identification of children as male/female. If there is some evidence, even in these young infants, of their understanding of gender-related constructs, we could expect to see this beginning to guide their behaviour. Only then would GSP theorists predict the emergence of sex-typed preferences. Although no specific predictions are made regarding sex differences by GSP theorists, sex-typed behaviour is presumed to come from a unitary source - gender identity - and as such, sex differences would not be predicted in their model.

6.1. Longitudinal Results

The expression of preference over time.

In previous analyses, infant preferences have been expressed in terms of the duration (in milliseconds) of time spent looking at same-/opposite-sex stimuli. However, the decrease in exposure time in the third testing session meant that a new score was needed to permit comparison across ages. At this juncture then, the infants' looking scores were transformed into proportion of looking time to each set of stimuli. The mean duration of looking to same-sex stimuli and the mean duration of looking to opposite-sex stimuli were each summed over the five pairs of stimuli and expressed as a proportion of the total amount of time that the stimuli were presented to the infant. In the first two sessions, then, the sum of the means was divided by 150 seconds (30 x 5). In the final session, the summed looking scores for the static stimuli presentations was divided by 75 seconds (15 x 5), and the video scores were divided by 150 seconds. This transformation was performed on the scores of each child for each domain over all three testing periods and gives the proportion of *available looking time* spent looking at each stimulus.

Main effects of age of testing in the longitudinal analysis would have provided some information about the infants' attentional differences between times one, two and three (in terms of total looking times). However, as the exposure time to the stimuli differed at the third time of testing from times one and two, other factors have been introduced which makes this comparison problematic. It is possible that the infants' attentional pattern to the shorter exposure time may have been different. In the third testing period, the decrease in available looking time may have cut short the time the infant would have spent looking at the stimuli given the option. Alternatively, it may simply have guarded against the scoring of an abnormally long fixation (blank stare) as a preferential look (i.e. one which fell just below the cut-off point for exclusion of the data - 30 seconds). The recalculation of looking times in terms of proportional looking has enabled some comparison of *preference* to be maintained, but has complicated the comparison of overall attention to both stimuli as a function of age. In the following analyses there is a significant effect of age of testing in all domains. These effects will be reported but no further inferences will be made. Interactions of preference by age at testing should also be interpreted with caution.

Analysis of the data was performed using 2 x (2 x 3)-way mixed-model Anovas; same/opposite sex preference(2) by male and female infants(2) over the three testing periods(3). Sex of infant was included as a between subjects variable as it seems likely, from previous research and from the cross-sectional results, that there will be different preferences expressed as a function of infant sex.

As in previous chapters, the results will be presented in the following order; self-other recognition, peers, older children, toys and activities. The relevant Anova tables can be found in Appendix Five. Many of the results directly reflect the findings of the

individual testing sessions. However, they will be reiterated here, both for the purposes of clarity of presentation, and because a slightly different data set has been used following the requirement that infants were only included in the longitudinal analysis if they met the criteria for inclusion in all of the three testing sessions.

The pattern of looking behaviour over time and between domains will also be investigated.

6.1.1. Visual preference

Self-recognition

The means and standard deviations for proportion of time spent looking at self/other at each testing period are presented in Table 6.1.

Table 6.1. *The means (and standard deviations) for proportion of looking to self and other across three testing periods*

	Time One		Time Two		Time Three	
	Male	Female	Male	Female	Male	Female
Mean Proportion of Looking to Self	.36 (.27)	.30 (.30)	.35 (17)	.30 (14)	.35 (15)	.43 (.18)
Mean Proportion of Looking to Other	.34 (.27)	.42 (.30)	.25 (11)	.25 (.12)	.34 (.16)	.29 (.14)

There was a significant main effect of age of testing ($F2,82)=84.19$, $p<.05$).There was no significant main effect of sex of infant($F(1,41)=.001$, $p>.05$ n.s.) or of recognition (self versus other) ($F(1,41)=1.74$, $p>.05$ n.s.). This would indicate that there is no evidence for featural self-recognition over time in this sample of infants.

There were no significant two or three way interactions (sex of subject by preference for self/other – $F(1,41)=0.15$, $p>.05$ n.s; age at testing by preference for self/other – $F(2,82)=1.42$, $p>.05$ n.s; age at testing by sex of subject by preference for self/other – $F(2,82)=1.41$, $p>.05$ n.s.).

Peer preference

A mixed-model 2 x (2 x 3) Anova was performed on the longitudinal data for peer preference. The means and standard deviations for proportion of looking to same-/opposite-sex peers across each testing period are presented in Table 6.2.

Table 6.2. *The means (and standard deviations) for proportion of looking to same- and opposite-sex peer across three testing periods*

	Time One		Time Two		Time Three	
	Male	Female	Male	Female	Male	Female
Mean Proportion of Looking to Same-Sex Peer	.51 (.15)	.40 (.19)	.28 (.08)	.25 (.05)	.33 (.11)	.32 (.07)
Mean Proportion of Looking to Opposite-Sex Peer	.40 (.17)	.47 (.18)	.28 (.02)	.27 (.08)	.30 (.08)	.40 (.08)

There was a significant main effect of age of testing ($F(2,94)=36.16$, $p<.0001$). There were no significant main effects of sex of peer ($F(1,47)=0.00$, $p>.05$ n.s.) or sex of infant ($F(1,47)=0.02$, $p>.05$ n.s)), but there was a significant sex of infant by sex of peer photograph interaction ($F(1,47)=25.04$, $p<.0001$). Tests of simple main effects were performed to explore this interaction. As the interaction of interest at this point is not concerned with the age at which the infants were tested, new variables were formed

to reflect the mean attention to the stimuli across the three sessions. These were created by summing the mean proportion of looking to same-sex stimuli and dividing by the number of sessions (3) and repeating the process for the mean proportions of looking to opposite-sex stimuli. This interaction is illustrated in Figure 6.1.

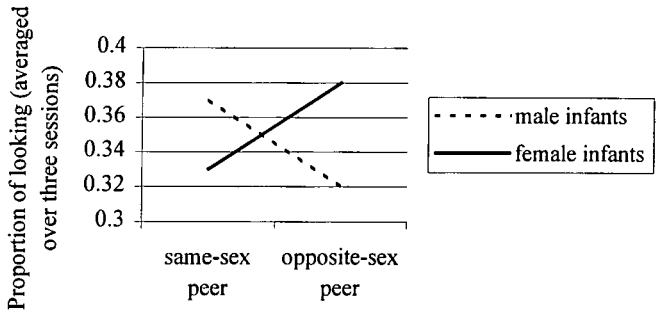


Figure 6.1. *Mean proportion of looking to same-/opposite-sex peers across the three testing sessions for male and female infants*

Tests of simple effects were performed on the resulting two scores (looking to same/opposite sex peers) and show that both male and female infants showed significant preferential looking. Male infants' preference was in the direction of sex-congruent stimuli ($F(1, 48)=10.79$, $p<.05$) while the female infants attended more to sex-incongruent stimuli ($F(1, 48)=6.78$, $p<.05$).

The three-way (age by sex of infant by sex of stimulus) interaction was significant ($F(2,94)=5.85$, $p<.01$) and demonstrates that the scores from the three individual sessions differ in the impact they have on the overall sex of infant by stimulus-congruence interaction. In order to ascertain which of the sessions is responsible for this effect, three separate two-way Anovas (corresponding to the three ages) were performed and tests of simple main effects were calculated in the cases where an interaction occurred. Although the number of participants included in the analysis at this stage was smaller, the tests of simple main effects reflected the results found in the cross-sectional analyses. There was no significant interaction of sex of

stimulus and sex of infant at time two, but sessions one and three showed significant interactions (time 1: $F(1, 55)=8.34$, $p<.005$; time 3: $F(1, 54)=21.58$, $p<.0001$). Tests of simple main effects for each of these sessions separately showed that males significantly preferred to attend to same-sex peers at time one ($F(1,55)=10.57$, $p<.01$). Female infants did not show a significant preference at this time. In the third testing session, males and females showed significantly increased looking toward the male stimuli (male: $F(1,54)=7.39,-02$, $p<.01$); female: $F(1,54)=14.38,-02$, $p<.01$).

Peer preference - older child

A mixed-model 2 x (2 x 3) Anova was performed on the data for preferential looking to older children. The means and standard deviations for proportion of time spent looking at same-/opposite-sex older children at each testing period are presented in Table 6.3.

Table 6.3. *The means (and standard deviations) for proportion of looking to same- and opposite-sex older child across three testing periods*

	Time One		Time Two		Time Three	
	Male	Female	Male	Female	Male	Female
Mean Proportion of Looking to Same-Sex Older Child	.41 (.22)	.42 (.13)	.30 (.08)	.28 (.10)	.31 (.86)	.36 (.07)
Mean Proportion of Looking to Opposite-Sex Older Child	.44 (.22)	.36 (.15)	.30 (.008)	.26 (.08)	.32 (.09)	.36 (.09)

There was a significant main effect of age of testing ($F(2, 90)=14.12$, $p<.0001$). There were no significant main effects of sex of stimulus($F(1,45)=0.41$, $p>.05$ n.s.) or

sex of infant ($F(1,45)=0.07$, $p>.05$n.s.). There were also no two or three-way significant interactions for proportion of time spent looking to the stimulus pairs showing older children (age of testing by sex of subject - $F(2,90)=2.04$, $p>.05$ n.s.; sex of stimulus by sex of subject - $F(1,45)=3.24$, $p>.05$ n.s.; age of testing by sex of stimulus - $F(2,90)=0.24$, $p>.05$ n.s.; age of testing by sex of stimulus by sex of child - $F(2,90)=1.39$, $p>.05$ n.s.)

Toy preference

A 2 x (2 x 3) mixed-model Anova was performed on the infants' scores for proportion of looking to same-/opposite-sex toy stimuli. The means and standard deviations for each testing period are presented in Table 6.4.

Table 6.4. The means (and standard deviation) for proportion of looking to same- and opposite-sex toys across three testing periods

	Time One		Time Two		Time Three	
	Male	Female	Male	Female	Male	Female
Mean Proportion of Looking to Same-Sex Toy	.35 (.12)	.37 (.13)	.32 (.10)	.27 (.09)	.46 (.11)	.43 (.11)
Mean Proportion of Looking to Opposite-Sex Toy	.41 (.11)	.32 (.10)	.26 (.07)	.28 (.09)	.36 (.08)	.42 (.08)

There was a significant main effect of time ($F2,92)=43.91$, $p<.001$). There was also a significant tendency for the infants to attend to sex-congruent toy stimuli ($F(1,46)=3.77$, $p<.05$). There was no significant main effect of sex of infant ($F(1,46)=1.23$, $p>.05$ n.s.). The toy by sex ($F(1,46)=0.26$, $p>.05$ n.s.) and toy by age of

testing interactions ($F(2,92)=2.46$, $p>.05$ n.s.) were also not significant so this effect seems to generalise across the sexes. However, there was a significant age of testing by sex of infant by sex-congruence of stimulus interaction ($F(2,92)=9.10$, $p<.001$).

Three separate two-way Anovas were performed, and tests of simple main effects were carried out where interactions occurred. Significant sex by stimulus interactions occurred in the first and second session (session 1: $F(1, 57)=6.71$, $p<.05$; session 2: $F(1, 55)=5.07$, $p<.05$). Tests of simple main effects showed that males produced this effect at both times and female infants did not show a significant preference (time 1 - $F(1,55)=2.00$, $p>.05$ n.s.); time 2 - $F(1,57)=2.52$, $p>.05$ n.s.). However, the male preference at time one was in the direction of sex-incongruent stimuli ($F(1, 57)=4.60$, $p<.05$) and their preference at time two was in the direction of sex-congruent stimuli ($F(1, 55)=10.02$, $p<.01$).

Activity preference

A mixed model Anova looking at same-sex/opposite-sex play preference(2) over testing periods (3) differentiated by sex (2) was performed on the data. The means and standard deviations for proportion of looking to same-/opposite-sex activities at each testing period are presented in Table 6.5. There was a main effect of age of testing ($F(2,80)=36.76$, $p<.001$). There was no main effect of sex-congruence of stimulus ($F(1,40)=1.53$, $p>.05$ n.s.) or of sex of infant ($F1,40)=0.03$, $p>.05$ n.s.), but there was a significant sex-congruence of activity by sex of infant interaction ($F(1,40)=160$, $p<.0001$). This interaction is illustrated in Figure 6.2.

Table 6.5. *The means (and standard deviations) for proportion of looking to same- and opposite-sex play activities across three testing periods*

	Time One		Time Two		Time Three	
	Male	Female	Male	Female	Male	Female
Mean Proportion of Looking to Same-Sex Activities	.63 (.17)	.35 (.23)	.45 (.15)	.15 (.05)	.62 (.15)	.26 (.19)
Mean Proportion of Looking to Opposite-Sex Activities	.27 (.18)	.61 (.18)	.24 (.10)	.48 (.09)	.16 (.06)	.53 (.17)

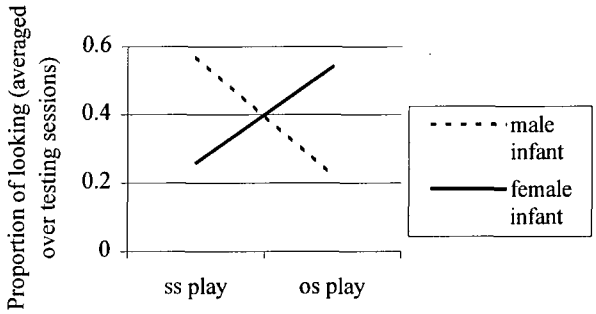


Figure 6.2. *Mean proportion of looking to same-/opposite-sex play across the three testing sessions for male and female infants*

Tests of simple main effects were performed. In order to perform these tests, the mean duration of looking to same- and then opposite-sex stimuli were summed and divided by the number of sessions in which the infant participated (3). Tests of simple effects were performed on the resulting two scores and show that both male and female infants' scores show significant directional preference (male infants – $F(1,40)=126.02$, $p<.001$; female infants – $F(1,40)=52.85$, $p<.001$). However, female infants share the

males' strong preference for watching masculine-type play activities rather than feminine-type activities (i.e the female infants showed a sex-incongruent preference).

There was also an age of testing by sex-congruence of stimulus interaction indicating that there was variation in the preferential looking behaviour of the group as a whole as a function of the age of testing. This was investigated by comparing preference to same-sex and opposite-sex stimuli for the group at each testing period. A series of three one-way Anovas were performed on the mean proportion of looks to same- and opposite-sex play stimuli. The group means did not differ significantly in the first two sessions (Time one – $F(1,54)=2.62.p>.05$ n.s.; Time two – $F(1,57)=0.38$, $p>.05$ n.s.). However, in session three, there was a significant difference between same-sex and opposite-sex looking behaviour (same-sex looking durations were longer than opposite-sex looking durations), reflective of an increased trend by girls to show a greater proportion of same-sex looking ($F(1,48)=4.99$, $p<.05$). This interaction is illustrated in Figure 6.3.

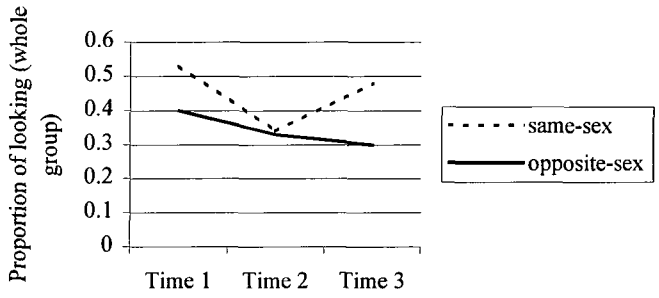


Figure 6.3. *Proportion of looking at same-/opposite-sex stimuli over three testing sessions for all infants*

Given the strength of the preference of the group to attend to the masculine activities at each age, the relative strength of preference toward masculine activities was examined for boys and girls in the group. A two-way Anova was performed (age of

testing x sex of infant) with masculine activity preference as the dependent variable. The main effect of age and main effect of sex of infant were not significant. The age by sex interaction was significant ($F(2, 80)=4.70$, $p<.05$). At eighteen months males' preference for the masculine activities was stronger than the females' ($F(1, 10.81$, $p<.01$). There was no significant difference at three or nine months, although the trend was in the same direction.

6.1.2. Inter/intra-domain comparisons

Temporal stability

In order to test the stability of the infants' preferences over time, a single preference measure was calculated for each infant in each domain at each age of testing. This was calculated as the difference between mean proportion of time spent looking at gender congruent and mean proportion of time spent looking at gender incongruent stimuli. The tables of correlations can be found in Appendix Five. The correlations for each domain over the three testing periods are presented in Table 6.6.

Table 6.6. *Correlations between preference scores across time for looking towards self, peers, children, play activities and toys*

	Self Recognition	Peer Preference	Child Preference	Play Activity Preference	Toy Preference
3 and 9 months	-.11	.06	-.21	.68	.03
9 and 18 months	-.06	.29	.29	.73	.29
3 and 18 months	-.42	.28	.04	.64	.13

Activity preference shows the strongest intradomain stability across the testing sessions. At each level of comparison, there is a highly significant correlation. In order to ascertain whether the correlations were increasing in magnitude over time, indicating a growing stability in preference, the correlations were compared using the method suggested in Clark-Carter (1997, p.525-528). There was no significant difference between the correlation for three and nine months and nine and eighteen months ($t=-.247$, $df=39$, $p>.05$). This finding suggests that, although preference for the play stimuli are stable over time, the relationship between testing sessions is not increasing in strength.

There are significant correlations for testing between nine and eighteen months for older child and toy preference and it may be that this marks the beginning of a stability of sex-typed preference. However, if sex-typed preference were the stable trait proposed by GSP theory, one would not expect to see a relationship between 3 and 18 months in a domain where there is no relationship between 3 and 9 months and this disjunction is apparent for self-recognition and preference for peers. Interpretation of these results should be cautious given the possibility that the data collected at nine months may not be as reliable as that collected at the other sessions as the exposure time of the stimuli may have affected the infants' looking behaviour.

Cross-domain correlations

Using the same preference measure described above, the scores were assessed for their degree of cross-domain consistency. The correlations are shown in Tables 6.7 a,b and c.

Table 6.7a. *Correlations between preference scores between domains for the first testing period*

	Pictorial self-recognition	Same-age peer preference	Older-child preference	Toy preference	Play preference
Pictorial self-recognition	1.00	.254	-.112	-.050	.185
Same-age peer preference		1.00	.031	-.144	.257
Older child preference			1.00	.088	-.225
Toy preference				1.00	-.225
Play preference					1.00

Table 6.7b. *Correlations between preference scores between domains for the second testing period*

	Pictorial self-recognition	Same-age peer preference	Older-child preference	Toy preference	Play preference
Pictorial self-recognition	1.00	.049	.370	.177	-.097
Same-age peer preference		1.00	-.290	-.064	.074
Older child preference			1.00	.088	-.122
Toy preference				1.00	.189
Play preference					1.00

Table 6.7c. *Correlations between preference scores between domains for the third testing period*

	Pictorial self-recognition	Same-age peer preference	Older-child preference	Toy preference	Play preference
Pictorial self-recognition	1.00	.028	.026	.068	-.183
Same-age peer preference		1.00	.151	.065	.471
Older child preference			1.00	-.001	-.005
Toy preference				1.00	-.074
Play preference					1.00

The preference score for each of the domains was correlated with others from the same testing age, restricting the number of correlations to ten for each session. The significance of the relationships between variables was calculated by converting the r scores to t scores (see Clark-Carter (1997, p. 590) and applying Bonferroni corrections. At three months, there was one negative, significant relationship between preference for older child and self-recognition ($t=-4.02$, $p<.05$). At nine months, there were no significant correlations, and at eighteen months there was one significant positive correlation between preference for play and peer preference ($t=4.04$, $p<.05$). The small number of correlations indicates a low degree of cross-domain consistency at each age of testing.

Sequence of development

Gender schematic processing theory suggests an orderly progression toward sex-congruent preference over age. The infants in this study were classified at each age as showing either a sex-congruent preference (1) i.e. greater duration to same-sex stimuli, or a sex-incongruent preference (0) i.e. greater duration to opposite-sex stimuli, in each domain. These scores were used to establish the number of children who showed an orderly sequence across the three testing sessions (000, 001, 011, 111) and those who showed a disorderly sequence. A one-way chi-square was computed to compare the frequency of 'orderly/disorderly' infants in each domain. The results of this analysis can be found in Appendix Five. There was no significant tendency for infants to follow an orderly sequence for self-recognition, same-age peer and older child preference, but the frequency for infants to follow an orderly sequence for toy and activity preference was significantly above chance.

6.2. Discussion and Summary

The results presented above give a longitudinal picture of how sex-typed preferences are expressed. In most of the investigated areas, infants from three to eighteen months do not show sex-typed preferences, though in one behavioural domain, that of toy preference, there is a main effect of sex of stimulus. Table 6.8 gives a summary of the significant results found at each stage of testing the infants as well as the final longitudinal analysis. Some of the significant findings that appear in the cross-sectional analyses fail to produce significant results when included in a longitudinal analysis. This may be in part due to some subject loss in the longitudinal analysis. Infants' scores were only included in the longitudinal analysis if they participated in each of the three sessions, and were attentive to at least three of the five pairs of stimuli presented to them in each domain for each of the sessions. Unfortunately, this meant that subject numbers fell when the longitudinal results were being calculated.
In this section, results from cross-sectional analyses which were not reproduced in the analysis of the full data set, are subject to retrospective effect size calculations in order to examine the possibility that these results are due to subject loss

At eighteen months, a significant number of infants indicated self-recognition on the visual preference task. However, results from the longitudinal analysis indicate only a main effect of the infant's age at testing and no self-other preference, or age by self-other interaction. Seventeen infants did not meet the requirements of the longitudinal analysis of self-other preferential looking data, so an estimation was made of the number of participants that would have been required for this effect to have shown significance. Effect size was calculated using the equation given on page 81. The effect size associated with a main effect of preference for self in the longitudinal analysis was found to be .36

Table 6.8. *Summary of results from each testing period and longitudinal analysis*

	Time One	**Time Two**	**Time Three**	**Longitudinal**
Self	n.s	n.s	Main effect (self-other) <.03 (self)	Main effect (age) <.002
Peer	Main effect n.s Interaction (peer*sex)<.002 M - .01 (ss) F – n.s	n.s	Main effect n.s Interaction (peer*sex)<.0001 M - <.01 (ss) F - <.001 (os)	Main effect (age) <.001 Interaction (peer*sex)<.001 M – <.05 (ss) F - <.05 (os) (age*peer*sex)<.004 Time 1 M - <.01 (ss) Time 3 M - <.01 (ss) F - <.01 (os)
Child	n.s	n.s	n.s	Main effect (age) <.0001
Play	Main effect n.s Interaction (play*sex)<.0001) M - <.001 (ss) F - <.001 (os)	Main effect n.s Interaction (play*sex)<.0001) M - <.001 (ss) F - <.001 (os)	Main effect n.s Interaction (play*sex)<.0001) M - <.001 (ss) F - <.001 (os)	Main effect (age) <.0001 Interaction (play*sex) <.0001 M<.001 (ss) F<.001 (os) (age*play) <.02) Time 3 ss>os - p<.03
Toys	Main effect n.s Interaction (toy*sex)<.02 M – n.s F – n.s	Main effect n.s Interaction (toy*sex)<.03 M – .001 (ss) F – n.s	Main effect (toy)<.001	Main effect (age) <.0001 Main effect (toy) <.05 - (ss) Interaction (age*toys*sex) <.0001 Time 1 M - <.05 (os) Time 2 M - <.01 (ss)

m – male infants ss - same-sex preference
f – female infants os - opposite-sex preference
n.s – not significant

In order to achieve power of .80, a sample size of between 70 and 80 infants would have been required to fully complete the task across all three sessions. It would be desirable to rerun this experiment with the sample increased by a third to a half in order to control for the possibility of mistakenly rejecting the hypothesis that self-recognition is apparent at 18 months using this task.

In the cross-sectional data, at three months and nine months, there were sex of infant by sex-congruence of toy interactions. This was not apparent at eighteen months, and there were no age by stimulus interaction effects shown in the longitudinal analysis. A test of simple effects was performed on the toy preference data in the longitudinal data set to obtain separate F-values for male and female participants. This enabled the estimation of magnitude of effect for both sexes. In order to perform the tests of simple effects, new variables were formed which reflected mean attention to the stimuli across the three sessions. These were created as described for peer preference earlier in this chapter (see Section 6.1.2.). There was no significant same-sex preference for male ($F(1,47)=3.84$, $p>.05$ n.s.) or female ($F(1,47)=0.86$, $p>.05$ n.s.) toys. Estimation of magnitude of effect showed that the effect size for male infants was large ($d=3.75$), male same-sex toy preference was much more robust over time than any similar effect in female infants who reached an effect size of only 1.25. This discrepancy becomes clearer when this finding is expressed in terms of the number of subjects estimated to be necessary for the results to be significant at the .05 level. A repetition of this study achieving a power of .80 would require approximately 80 boys for results to reach significance levels, but around 1200 girls would be required to show the same sex-congruent preferences. The longitudinal analysis, therefore, reflects the previous cross-sectional findings that males show an early sex-congruent preference for toys, but female infants do not.

The use of longitudinal analysis of the data described in previous chapters has allowed for some insight into the stability of individual preference over time and between behavioural domains. In both of these areas, it appears that infants are not consistent in their preferences, although some consistency does appear to be emerging between the latter two testing periods. This lack of consistency has implications for the use of cross-sectional analysis in infant study. The significant findings at each period of testing do not form any logical, Guttman-like pattern in all domains and suggest that either the infants being tested in this study have not yet established stable preferences in all of the areas investigated, or their true preferences are left untapped by this paradigm.

Although some subject loss was encountered, this did not affect the results to any great extent, with many of the findings from the individual sessions emerging as two- or three-way interactions. When these interactions were investigated no real pattern emerged across the three sessions, and it seems likely, given the number of tests being performed on the data in any one analysis, that some results should be interpreted as chance findings. Longitudinal analysis has enabled some potential Type I errors, i.e. the attribution of preference where it probably does not exist, to be reconsidered

Chapter Seven

7.1. Review of the aims of the study

A number of problems have been noted with current schematic theories of the development of sex-typing during early childhood. In brief, it has been suggested that infants come to identify their own sex and the sex of others concurrently, and that this identification is the catalyst to a subsequent organisation of information into gender-typed categories. Infants are predicted to show an attentional bias toward their own sex. Their preference for in-group members is expected to lead to a preference for objects and activities associated with same-sex others (Martin and Halverson, 1981).

There is evidence, though, that some sex-typed behaviours occur earlier than infants are able to label themselves and others as male or female, and there is equivocal evidence that infants are even able to recognise themselves prior to behaving in a sex-typed way. It has also been shown that sex-typed behaviours do not emerge simultaneously and may differ in their developmental trajectory between males and females. These factors are not adequately explained by GSP theory that posits a unitary basis for the development of sex-typed behaviour without explaining sex differences and differences between domains. The current study intended to extend the evidence in the debate on GSP theory by measuring the onset of sex-typed behaviour in the context of the infants' developing self-awareness. The study used a measurement tool which allowed preferences to be gauged from three domains (peers, play activities and toys) and from infants as young as three-months-old.

By following infants from 3 months to 18 months, it was hoped to establish the earliest age at which sex-typed behaviour and sex differences in that behaviour occurred. Specifically, this investigation intended to:

1. Establish the developmental trajectory for sex-typed preference.
2. Measure sex-typed preference in pre-verbal infants using duration of looking to simultaneously presented sex-typed stimuli.
3. Take longitudinal data in order to monitor the expression of individual preferences over time.
4. Investigate the relationship between measures of social influence, cognitive ability and the expression of sex-typed behaviour.
5. Provide a comparison of individual preferences across three behavioural domains (peers, play activities, and toys).
6. Monitor for sex differences in the onset and development of sex-typed behaviour.
7. Investigate the relationship between sex-typed behaviour and self-recognition.

This chapter will address these issues by (1) briefly summarising the results in each behavioural domain and the relationships between domains and testing periods. (2) The following section will discuss the possible explanations for these results and suggest improvements for future research. The method of choice was a visual preference paradigm. This technique has the advantage of being able to elicit preference measures from all age groups despite the varying level of maturity in each. It was also possible, using this method, to incorporate a test of self-recognition for even the youngest infants. However, there were some shortfalls inherent in this choice of technique. This section will also critically discuss the practicalities of the visual preference technique for the purposes of measuring sex-typed behaviour. (3) Finally, the findings of this study will be related back to the wider picture of research into the development of sex typing in children. Gender schematic processing theory, currently the most popular way of conceptualising sex typing, would predict a particular sequence

of events in the development of sex-typed behaviour. The infant will recognise itself as a separate and gendered individual and will categorise the rest of the population as 'like-me' and 'not like me.' They will attend selectively to others of the same sex as themselves and learn which behaviours are appropriate to their own gender. The results from this study bring into question the validity of these predictions. In this chapter, some possible explanations for these contradictory findings will be discussed.

The results will be summarised cross-sectionally and longitudinally. Although the information obtained longitudinally is important in terms of general trends and distinguishing development between domains, it is relevant to continue to note that cross-sectional results give more information about sex differences, and allow for some comparisons to be made between stimulus pairings.

7.2. Summary of results

7.2.1. Peer Preference

At three months, there was no evidence for same-sex preference by the *group* of infants. However, the male participants showed a significant same-sex preference, and the female infants did show a preference for opposite-sex peers (non-significant). The same pattern was found at eighteen months, with both males and females significantly preferring male faces. There was no significant difference at nine months. These results suggest that, by eighteen months, the infants as a group are not showing a *sex-typed* peer preference. There was no indication of preferential attention to the photographs of older children by either sex in the cross-sectional or longitudinal analyses.

7.2.2. Activity preference

Preferential looking toward masculine play activities achieved the highest levels of significance (never below $p<.001$). Both male and female infants strongly preferred

to attend to masculine-type activities. Cross-sectional post hoc analyses showed that males preferred to attend to masculine-type activities *more strongly* than female infants by eighteen months and longitudinal results suggest this trend is apparent at three months.

7.2.3. Toy preference

Although there was no preference for sex-typed toys found in the first two testing sessions, by eighteen months, the group of infants showed a highly significant preference for attending to sex-congruent toys. At three months and nine months, there were significant sex-of-infant by sex-of-toy interactions led by the male participants (though only reaching significance in the second session). At three months, the boys showed a preference for sex-*in*congruent stimuli (specifically the pram paired against a set of blocks) and a preference for sex congruent stimuli at nine months that remained stable at eighteen months. The girls did not show significant differences in duration of attention to either set of stimuli until eighteen months when they contributed to the significant preference of the group to attend to same-sex toys. Calculation of magnitude of effect show that this finding was not a function of sample size. The computerised presentations of stimulus pairings remained the same across all three sessions, but the analysis of preference as a function of toy pairing demonstrated that infants showed a different pattern of preference toward the toys each time.

7.2.4. Self-recognition

There was no evidence of self-recognition from the rouge test during the first two testing periods. At three months, infants showed no visible reaction to their mirror image, and at nine months, they tended to respond to the mirror image either by licking/kissing the reflection both before and after the application of rouge, or showed no noticeable change in behaviour. By eighteen months, a large proportion of the

participants showed signs of self-recognition (they attempted to remove rouge that had been applied to their nose out of view of the mirror). Similar results emerge from the visual preference task where the infants viewed pictures of themselves alongside a same-sex infant. There was no significant preference to look either at the photograph of self or other peer during the first two sessions, but the sample significantly preferred to look at themselves when presented with self-other pictures at eighteen months.

7.2.5. Sex-congruent preferences and self-recognition

At the time that the first preference for sex-congruent stimuli was shown by the group as a whole (toys) at eighteen months, the infants were able to recognise themselves in the non-contingent test of self-recognition and recognised their own reflection.

7.2.6. Sex differences in attention to sex-congruent stimuli

When a significant preference was found, male infants seem to be showing preference for same-sex peers from the first time they were tested. Female infants prefer to look at male infants' faces over those of their own sex. There were no sex differences in preferential attention to older children.

The trajectory for developing the sex-typed response to toys by eighteen months seems to be different for male and female infants. Males show a non-significant preference for sex-incongruent toys from three months, and reach significant preference for sex-congruent toys at nine months. Female infants do not differentiate until eighteen months. This sex-differentiated trajectory was not in evidence from the longitudinal analysis of data (there was no sex of infant by sex-congruence of stimulus interaction), and calculation of effect size did not suggest that a possible Type II error had been committed.

Male infants preferred sex-congruent play activities while female infants preferred sex-incongruent activities. The preference was equally strong until the third period of testing when boys showed a significantly stronger same-sex preference than the girls showed opposite-sex preference.

7.2.7. Relationship between domains and between sessions

There was a low degree of cross-domain consistency at each age of testing. At three months, there was one negative, significant relationship between preference for older child and self-recognition. At nine months, there were no significant correlations, and at eighteen months there was one significant positive correlation between preference for play and peer preference

The correlations within domains but between testing sessions also proved to be low, suggesting that different infants contributed to significant results at each session.

7.3. Discussion

Each sub-section of results will be discussed separately, introducing possible explanations for the findings, discussing methodological shortcomings, and suggesting possible avenues for future research. Some overlap may occur when the methodological problems are common to the paradigm as a whole and not just to the domain under discussion.

7.3.1. Peer preference – same age peer

Studies using visual preference techniques contend that infants show preferential looking on the basis of either attractiveness or familiarity/novelty of the stimuli. The present study controlled for the latter as efforts were made from the outset to use photographs of groups of peers who came from different geographical areas than the

sample group of infants. It is unlikely that actual recognition would have occurred. Indeed, none was mentioned by the parents of the participants. It seems, then, that the infants are discriminating the pairs of pictures because they find one of the pair more attractive in some way than the other. The findings from the present study raise two possibilities. Either there is evidence here for the expression of an early sex-typed preference by the male infants, or the infants are basing their decision on some factor other than sex of the infant in the photograph. There are problems with both of these proposals. The former does not explain the existence of the sex differences found. If males are responding in a sex-typed way, why do females show a cross-sex preference? Neither does it explain why this phenomenon is not present at nine months. The latter proposal requires us to speculate as to what the dimension of attraction was that determined the infants' looking behaviour to this group of stimuli. Before discussing these points, the results will be discussed in terms of the methodology used to assess the infants' peer preferences.

Methodology

The general preference for male peers found at times one and three are conspicuous in their absence in the data produced from the second session. There are two methodological factors which need to be considered in the light of these results (1) the duration of attention to the stimuli may have been a function of the amount of the time the stimuli were presented on the screens, and (2) the stimuli viewed by the infants may have differed in their attractiveness between testing sessions.

At sessions one and two, the infants saw the stimuli on the screen for thirty seconds at a time. The exposure time was reduced for the third session after there was found to be a marked decrease in mean looking times between the first two sessions (see method section in Chapter Five). Given the decreased attention to the screens in the

second session, it is possible that the length of exposure time was inappropriate to the infant's attention span at nine months. It is unclear reviewing the current literature what the implications for this study are as most of the work on infant attention and processing is concerned with individual differences. It is suggested that infants who look longer encode stimuli on the basis of their local visual properties where briefer look durations reflect more of a global or 'global-to-local' processing sequence (Stoecker and Colombo, 1998). Also, longer-looking infants are slower than shorter looking ones in shifting their focus of attention (Frick, Colombo and Saxon, 1999). However, the experimental paradigms used in reaching these conclusions differ substantially to the one described in the current work and attempting to apply these findings to a task where the infant is simultaneously presented with two interesting stimuli is problematic. The implications of the decrease in attention to stimuli remains speculative, but as it pervades the results for the second testing session, the questions it raises are common to all the domains of testing. Clarification of the infants' interest might have been possible by using an additional and alternative measure of preference such as heart rate deceleration (McCall and Kagan, 1967).

Any problems caused by a change in stimuli between testing sessions is peculiar to photographs of same-age peers as the stimuli in other domains of testing remained constant. There was a difference in the stimuli shown to the infants at each testing period. Each set of photographs used reflected the age of the participants' peer group, so the pictures at time one were of three-month-old infants, nine-month-olds at time two, and eighteen months at time three. It was hoped that each set used provided fairly standard examples of boys and girls in the age range being tested. However, it is possible that significant results were not obtained at the second time of testing as a function of the stimulus set used. Either this set of pictures, unlike sets one and three,

did not accord with the prototypical representation the infants' held of males and females, and were, therefore, not recognisable on the basis of sex, or, there was another dimension of attraction to the other sets of pictures which was not reproduced in this set. The general lack of significant results in the second period of testing, however, may indicate the more general methodological problem surrounding viewing time available to the infant, as noted above.

Explanation of results

Both the existence of a group preference for male faces, demonstrating sex difference in same-sex preference, and the lack of effect at nine months appear to be well explained by the possibility that the photographs were attractive to the infants on some dimension other than sex. Further, male and female infants showed the same pattern of looking toward the stimuli in that there was no significant effect of pairing for either sex. At time three, despite the preference for pictures of the males being confined to particular stimulus pairings, the strength of this preference was common to both sexes. This leaves us with the problem of establishing what, if not the gender of the infants in the pictures, caused this pattern of preferential looking.

In this section so far, I have talked about attraction quite loosely as meaning a stimulus that elicits more looking. There are, however, several possible dimensions on which the stimuli could be preferred. Previous chapters have mentioned the work of Langlois, Roggman, Casey, Ritter, Rieser-Danner, Loretta and Jenkins (1987) and Samuels and Ewys (1988). These researchers found that the infants in their study seemed to be basing their preferential looking on conventional rules (defined in terms of adult ratings) of 'attractiveness' which have often been thought to develop as a consequence of societal pressure and cultural norms. Langlois et al speculate that the arrangement of facial features in 'attractive' faces may be more concentric or may be

more prototypic or 'face-like'. They found a preference for attractive faces in infants as young as 2-3 months. These authors believe that information about health and fitness is relayed through a person's face and so the ability to perceive such information would be adaptive and may be present, at least in rudimentary form, early in life. It is possible that the male faces at times one and three could have been more attractive than the female faces.

In order to test for the possibility that the same-sex preference in males and cross-sex preference for females was the result of the use of more attractive male pictures, the peer-face stimuli used in the testing sessions were shown (in their original pairs) to a group of sixty undergraduate students. The students were asked to indicate both which of the children was male, and which of the pictures they found most attractive. Anovas comparing the number of attractiveness scores given to male and female pictures showed that three-month-old males were not found to be significantly more attractive than three-month-old females ($F(1,4)=0.15$, $p>.05$ n.s.). Nine-month-old males and females received almost equal mean ratings of attractiveness ($F(1,4)=0.01$, $p>.05$ n.s.), but the photographs of eighteen-month-old males received a significantly higher attractiveness rating ($F(1,4)=15.81$, $p<.05$). The students were accurate in judging the sex of the photographs at three months (88% correct) and eighteen months (98% correct), but were less accurate at nine months (65% correct). The test described here used to establish adult ratings of attractiveness is similar to that used by Langlois et al (1987) and was thought by them to provide information about 'conventional rules' of attractiveness. If the infants in this study were basing their preference for the pictures on 'attractiveness' of the faces, they were not judging the photographs at three or nine months using the same rules as adults although they may be starting to adopt these rules at eighteen months.

The variability of the results obtained across testing sessions, suggest that, either there was something about the stimuli shown to the infants which did not make it easy for them to make judgements on the basis of sex or they were able to make judgements but did not have a preference between the stimuli. The greater difficulty found by our adult raters in identifying the gender of the pictures of the nine-month-olds may go some way to explaining why there was no significant preference in either direction at this time. However, the non-significant preference by female infants for male peers at three months means that an interpretation of preference in terms of gender is still problematic. The most obvious explanation for the lack of significant findings at nine months would be that infants require more social cues to help them to categorise people by gender at this age. Indeed, work by Leinbach and Fagot (1993) into infants' ability to categorise on the basis of gender suggests that hair and clothing cues are extremely important to infants making decisions on gender category. However, as has already been noted in previous chapters, the infants did not differentiate between the pictures of older children in which no attempt was made to hide social gender cues so it is unlikely that cues of this kind would have helped differentiation between babies of between three and eighteen months. Another possibility might be that it was another type of information the infants required which was not present – perhaps that carried in the actors' movement rather than their style of dress. Bower (1989) recognised the strength of hair and clothing cues in one study and attempted to re-examine the question of same-sex preference in children using point-light displays. In this paradigm, the only information the infant received was relayed to them by the actor's movement. Strong same-sex preferences were still found and Bower concludes that a salient characteristic defining a person's gender is their comportment.

Future research

The ecological validity of this paradigm could be enhanced through the use of video footage allowing the child to observe movement cues.

7.3.2. Peer preference – older child

The lack of discrimination between the photographs of older children by this sample of infants suggest either the participants recognise the different genders of the children in the photos but do not have same-sex preferences in this domain or they did not recognise gender differences and the photographs did not differ significantly in terms of attractiveness.

Methodology

As noted in the previous section on preferential looking to same-sex peers, a decrement in looking time between sessions should alert us to the possibility that the infants are not processing the information at each testing session or between each domain in the same way.

Explanation of results

We might have expected infants to show a same-sex preference for the pictures of older children containing more gender information than those of the infants. The fact that infants did not express a same-sex preference toward the photographs of the older children might increase scepticism that attraction to same-age peers for boys was on the basis of sex. However, it is possible that the infants would use different criteria in their preferential attention to older rather than younger children and it may not be appropriate for us to consider these two possibly distinct groups of stimuli as different facets of the same domain. A series of studies by Lewis and Brooks-Gunn (1979) showed that there were some differences in looking behaviour as a function of the age of the face

presented in a series of photographs to infants in the age ranges 9-12 months, 15-18 months, and 21-24 months. They conclude that the age of person represented in the stimulus is also a salient and important category for infants of both sexes. Lewis found that babies were responded to more positively than children or adults and children slightly more positively than adults (measured by postural and facial cues) but that adults and babies were *looked at longer*. Lewis speculates that the difference in looking behaviour may be attributable to the older children being in an 'intermediate position, eliciting less interest than the other strangers and less affect than the babies' (Lewis and Brooks-Gunn, 1979, p.136). He suggests that children are more difficult to categorise than babies or adults as they may share features of both. In any case, the pictures of children in the Lewis studies were attended to for less time than those of adults or babies and this could have implications for the measurement of sex-typed preference when using duration of looking as a measure.

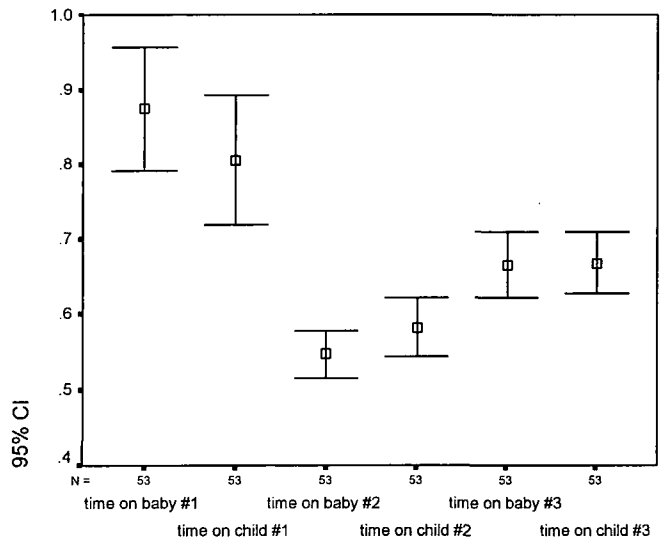
This possibility is investigated in this section by a post-hoc analysis of the difference between the duration of looking to peer photographs and duration of looking to photographs of older children. Calculations for the post hoc analysis used mean duration of total looking time (to male stimulus plus female stimulus) divided by the number of milliseconds the stimuli were presented for each trial (either 30000 milliseconds or 15000 milliseconds). The scores were calculated in this way in order to be able to provide a meaningful comparison between testing sessions as well as by domain. These scores were entered into a repeated measures Anova looking for a main effect of duration of attention. The means and standard deviations of each score are presented in Table 7.1.

Table 7.1. *The means (and standard deviations) for mean looking score (total mean duration /exposure time) to peers and older children across three testing periods*

	Time One	Time Two	Time Three
Looking Score to Peer Photographs	.87 (.30)	.55 (.32)	.67 (.16)
Looking Score to Older Children	.81 (.32)	.58 (.14)	.67 (.15)

There was a main effect of age ($F(2,104)=33.43$, $p<.001$) but no effect of looking preference between duration of looking time to child and baby stimuli ($F(1,52)=.33$, $p>.05$ n.s.). There was a significant age by preference interaction ($F(2,104)=3.48$, $p<.05$) demonstrating variability in preference as a function of age. The error bar chart in Figure 7.1 shows the differences in looking duration across the sessions.

Figure 7.1. *Error bar to show the mean duration of looking to child and peer stimuli across the sessions*



The findings of Lewis and Brooks-Gunn were not replicated across the testing sessions. At time one there was a non-significant difference between the duration of looking to the peer and older child stimuli ($F(1,63)=2.71$, $p>.05$ n.s.). However, in the second testing session, the photographs of the older children were attended to more than those of same-age peers. This preference approached significance ($F(1,57)=3.35$, $p<.07$). When the infants were approximately eighteen months, the attention duration to pictures of eighteen month-old infants and older children was not significantly different ($F(1,54)=0.001$, $p>.05$ n.s.). There is no evidence from these results that a general preference exists in infants for the faces of babies over older children. The variability in the pattern of responses shown by the graph indicates stable differences in attention duration, independent of stimulus, as a function of age. Interestingly, the relative importance of same-age peers seems to be greatest at three months and least influential at 18 months. It is possible that, by eighteen months, the infants recognise a shared category membership with the older children and so do not differentiate between pictures of their peer group and the older children.

There is additional evidence that the lack of significant preference for older children reflects an inability to differentiate these stimuli on the basis of gender. The photographs used in the visual preference paradigm were the same as those used in the gender-labelling task at eighteen months when 81% of the infants were unable to identify the photographs on the basis of sex when asked to do so by their parents. It seems likely that the gendered information contained in these photographs is not of preferential interest to the cohort between three and eighteen months. It is also important to note that there was no difference in preferential looking behaviour between the few children who succeeded at the gender labelling task and the majority who did not. Certainly on the strength of this task, cognitive abilities do not seem to have an

influence on the looking behaviour of the infant. Those children who, at eighteen months were able to identify adults and/children on the basis of sex were no more likely to be showing same-sex preferences for other children than those who were not.

For whatever reason, it appears that none of the infants in any of the three stages of development measured in this study were basing their attention to older children's photographs on the basis of sex. This lack of preference implies that same-age peer stimuli were judged in terms of a dimension (unknown) other than gender and the pairs of older children did not differ along this dimension.

Future research

Clarification of the speculations expressed in the two sections on peer preference could be achieved from further research into the aspects of facial stimuli that prompt infants to attend longer to them. Research on infant gaze to date has tended to confine itself to measuring patterns of saccadic movement leading to speculation about age-related changes in feature recognition (Haith, Berman, and Moore, 1977; Maurer and Barrera, 1981). Establishing particular facial configurations that prompt more attention would ensure that studies into gender preference in infancy could control for extraneous factors, and so ensure greater validity.

7.3.3. Toy preference

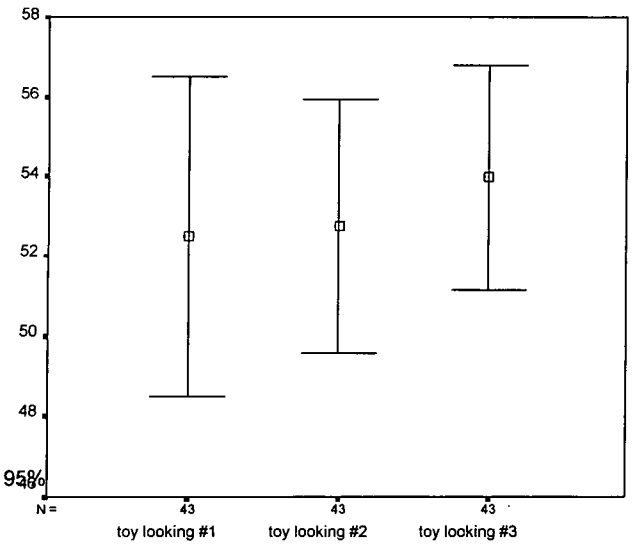
Methodology

An issue regarding methodology which is pertinent to the group's preference for sex-typed toys is the usefulness of the demographic and toy-giving information gathered from parents. The purpose of the questionnaire was to elicit from the parents information which might give insight into the socialisation processes at work in the infants' homes. Although there were no significant correlations reported between the

infants' looking behaviour in any of the domains and information on parental employment, day-time care, or siblings (see Chapters Three, Four and Five), the literature suggests that infants at eighteen months are already being socialised in terms of toy preference (Rheingold and Cook, 1975). It is possible that a more searching questionnaire might have tapped into some aspects of this socialisation.

One of the extra measures taken at all stages of the study was how many of the child's recent toy acquisitions were sex-typed. This was intended to tap into the degree of sex-typing behaviour shown by the infants' family and friends. At time one, there was only one child (2% of the sample) who received a greater number of sex-typed than neutral toys. By nine months, that number had doubled to 22% of those for whom information was given. At 18 months, eleven out of twenty-eight (39%) of the sample who completed this part of the questionnaire had received sex-typed toys. There was no significant effect of toys received when the analysis was repeated for the first two sessions omitting the data from infants receiving sex-typed toys, or when the looking behaviour of those receiving sex-typed toys was compared with those not receiving sex-typed toys in the third session. It is interesting to note that this increase in the sex-typed nature of toy giving is reflected in a non-significant ($F(2,84)=0.23$, $p>.05$ n.s.) increase in sex-typed behaviour (in terms of proportion of preferential looking) between the sessions (although lack of any correlation between the children's looking times and toys received would suggest that different infants are leading the two findings). The increase in preferential looking to sex-typed toys across testing sessions is illustrated by the error bar chart in Figure 7.2.

Figure 7.2. *Error bar representing the proportion of looking time given to sex-congruent toys across the testing sessions*



It is likely that, in asking for the last three items given to their child, the questionnaire did not elicit sufficient information to provide a representative sample of the child's toy ownership and thus, their exposure to same-sex toys.

Explanation of results

The results from this study suggest that, by eighteen months, infants attend to toys in a sex-typed way, and, that male and female infants develop these preferences at different rates. This is of interest for a number of reasons. Firstly, this sex-typed behaviour has emerged prior to the ability to label males and females correctly on the basis of gender and consequently has implications for theories based on relating behaviour to cognitive functioning. Secondly, this preference was found through an investigation that used pictures of toys viewed by the infant in isolation. They were not given the opportunity to play with the toy or to interact with other infants while choosing which toy they preferred. This negates any suggestion that the child is being directly reinforced by either sensational feedback from handling the toy, or by directly

associating the toy with a child of one or other sex by virtue of seeing them play with it. This finding brings into question the mechanism by which the infant makes a preferential choice. Given that the child is unable to label on the basis of gender and, therefore, is unlikely to be using established gender schema to make a sex-typed judgement, there seem to be two possibilities. (1) Either the child makes a judgement of preference for the toy on the basis of the activities the toy affords or (2) the infant has a history of differential exposure to and/or reinforcement for the types of toys shown in the study.

1. Affordance of toys

In the introductory chapter, it was suggested that children might show a preference for particular toys by virtue of the activities that toy affords. This process involves both the toy exhibiting certain properties (affordances) and children being differentially attuned to attend to these properties by virtue of their sex. Differential attunement to the toy stimuli (demonstrated by preferential looking) could be the result of an attentional bias to low-level stimuli between male and female infants as suggested by McGuinness and Pribram (1979). These processes are difficult to disentangle both theoretically and in terms of experimental design. The former has been investigated by ascertaining the behaviour elicited by the toy (observing male and female infants playing with the same toy and with different toys), and the latter by observing children's preference for particular toys. The study described in this thesis has attempted to monitor the latter process which is assumed to be manifest in infants' early visual preference for toys which have been identified as generally sex-typed and which seem to possess different 'clusters' of properties (Miller, 1987).

It is difficult to reach conclusions about affordance and attunement mediating preference in this study for two reasons. Firstly, the lack of research on early infant

preference for lower-level stimulus properties such as texture, shape, or colour means it is too soon to associate preferences for toys with these basic attentional biases. Also, if preferential toy choice is a result of toy affordance, we might expect that the first signs of preference would be in the direction of sex-congruent stimuli. The results found in the present study would indicate that a sex-typed toy preference is something that is gradually acquired, and is not in place until infants are approximately eighteen months old. It seems likely that the affordance of the toys become more apparent when children have more opportunity to interact with them and the gradual onset of toy preference would imply the requirement of some extra cognitive machinery or social reinforcement to mediate the attunement.

2. Socialisation of child

One of the other possibilities, less reliant on cognition than GSP and less reliant on innate predisposition than ecological psychology, is that preferential toy choice at eighteen months is the result of differential and strong socialisation of boys and girls in this area. Although no measure was taken of familiarity with the particular toy stimuli shown to the infants, some attempt was made to elicit information about the kinds of toys the child might generally come into contact with. In the previous section, it was noted that the questionnaire completed by the parents of the participants may not have asked for enough information to tap in on the various agents of socialisation young infants experience. Social factors may have an early impact on the behaviour of young children's play. Some of these factors will be mentioned here, namely: the influence of family with regards to the toys they buy and their behaviour toward the child's play, the influence of peers and siblings, and the portrayal of sex-typed toy information in the media.

Family influence

Toy ownership: Other studies have carried out more thorough investigations into the toy ownership of young children. Rheingold and Cook (1975) took an inventory of the toys found in the rooms of 96 children between 1 and 71.6-months of age and found the room contents to be highly sex-typed. The types of toys found in the rooms of boys were 'vehicles, educational-art materials, sports equipment, toy animals, depots, machines, fauna and military toys' and those found in the rooms of girls were 'dolls, dolls houses, and domestic toys' (Rheingold and Cook, 1975, p.462). They assumed that these differences were indicative of parental ideas about sex-appropriateness. Although accepting that parents may have been guided to some extent by their children's observed preference of play thing, Rheingold and Cook believed that this would not account for the large proportion of sex-congruent toys (particularly baby dolls for girls and vehicles for boys) relative to the dearth of sex-incongruent items in the children's rooms. They had previously found, in a laboratory play session they held with eighteen-month-old infants, that girls spent as much time with the truck as the boys did. The link between toy ownership and sex-typed behaviour on the evidence of the present study, however, remains speculative.

Differential play experiences: There have been reported differences between the way parents interact with sons and daughters even with the same toy. For example, Caldera, Huston, and O'Brien (1989) found that parents' initial responses to toys were more positive when the toys were stereotyped for the child's and the parent's gender than when they were not. Idle, Wood and Desmarais (1993), however, found that parents' play behaviour was not sex-typed despite displaying sex-typed attitudes to toys when their views were obtained via a questionnaire. A measure of sex-typed toy giving

may not elicit accurate information about parental attitude towards their child's toys, and some measure of this might be useful for future research.

It is important to note that it is unlikely that one single variable can be identified as the major sex-typing agent in the child's life, as was demonstrated in Cole, Zucker and Bradley's (1982) study of gender -role behaviour in traditional and non-traditional day-care. Despite the non-sexist attitudes implicit in their day-care, and their parents' attitudes (inferred from their decision to use this type of day-care), children continued to show sex-typed toy preferences.

Peers and siblings

Peer influence: It seems likely that the effect of peers on the preferences of the very young infants in this study would be weak, as infants of this age usually have minimal experience of close peer contact as well as minimal experience with toys. For this reason, the infants' contact with other children was not examined in the questionnaire in this study. However, by the age of eighteen months, toddlers have much more contact with other children, often attending play groups or nurseries. Peer influence is thought by Bruce-Carter (1987) to take the form of four sets of information provided by the peers. Peers are thought to provide information about sex role standards by (1) providing information about sex-role norms through play activities and toys (2) providing information by their reactions of play to others (reinforcement/punishment) (3) verbally endorsing stereotypes (4) by indicating through their own behaviour what behaviour is likely to be accepted by other group members. Many of the children participating in the present study were just demonstrating the beginnings of verbalisation at eighteen months. Their lack of success at identifying the sex of others on the gender-labelling task would seem to indicate little likelihood that they would remonstrate with a peer about the appropriateness of a toy. However, some research has

shown that the simple presence of one's peers around a toy can encourage play with that toy. Shell and Eisenberg (1990) found that contemporaneous same-sex peer involvement was significantly associated with children's play with that toy. The direction of causality for this finding, though, is unclear, and an assumption of peer socialisation would involve some recognition of sex of peers.

Siblings: There was no difference between infants' looking behaviour to toys as a function of them having same-, opposite-sex or no siblings. If the results found in the present study were indicative of some process of socialisation, it seems likely that the existence of a same-sex sibling would have prompted the child to show a preference for same-sex toy through processes of both modelling, and exposure to same-sex toys. The analysis did not, however, take the age of the infants' siblings into account which could have a bearing on the extent of the opportunity the infant has to experience their toys.

Media

Liss (1977) found that kindergarteners of both sexes tended to imitate same-sex-televised models in preferences for both sex-typed and non-sex-typed toys. They suggest that media models are important in the development of toy sex-typing. The extent of sex-typing portrayed in toy advertising was investigated by Schwartz and Markham (1989) who found strong reinforcement of conventional sex-roles. The age at which sex-typed preferences emerge in the present study would accord with the probability of infants of eighteen months watching more television and having access to more printed advertisements than at previous testing periods.

Not only do the present results suggest a sex-differentiated trajectory to the development of same-sex preference for toys, but the stronger preferences found for the male infants at times one and two were in different directions. The boys showed a

preference for female-type toys at time one, but sex-congruent toys at the second testing session. It is difficult to incorporate this finding into any current theory of sex-typing when sex-typing is described in terms of a preference for same-sex people and sex-congruent objects. There may, however, be another way to conceptualise the development of sex-typed behaviour. Standard measurements of sex-typing do not take into account the phenomenon (noted by, amongst others, Muller and Goldberg, 1980) of an early developmental trend toward the *avoidance of opposite-sex* others and things. An early study into this was carried out by Hartup, Moore and Sager (1963) [cited in Doering, Zucker, Bradley, and MacIntyre (1989)] who studied avoidance by presenting toy attractiveness and gender appropriateness as competing dimensions to children aged between 3 and 8 years. This study and others (Ross and Ross, 1972; Viera and Miller, 1978) found that for both sexes, but more uniformly in boys, avoidance of cross-sexed toys increased with age. A similar phenomenon is the avoidance of opposite-sex others as illustrated by Shell and Eisenberg's (1990) study into the effect of peer presence on preference for playing with non-sex-typed toys. They found that the boys in their study (but not girls) ceased attending to toys they had previously been playing with when there were more opposite-sex peers present than when they arrived. It is possible that the finding in the present study that the group of males found opposite sex toys attractive at three months, but preferred to attend to same-sex toys at nine months and eighteen months is a reflection of this phenomenon. The change in attention from opposite to same-sex toys between three and nine months may indicate the beginning of the development from avoidance behaviour to preferential approach/attention. However, at time one, the preferential looking was most affected by a group preference for the pram over the blocks, and it may be that the difference in attractiveness between the pram and the blocks was due to some factor other than sex-congruence – possibly

familiarity of the pram, or the pram being a more complex input. Correlations between the male infants' responses to the toy stimuli between each session shows that different infants are leading the preferential looking at each testing period (preference between times one and two r=.03, p>.05 n.s., between times two and three r=.27, p>.05 n.s., and between times one and three r=.00, p>.05 n.s.). However, lack of temporal stability may simply indicate that toy preference should be considered more as an indication of a group phenomenon than a stable individual trait (Maccoby, 1998). This is considered further in Section 7.3.7.

Future research

One of the possibilities in explaining sex differences in the acquisition of sex-typed behaviour might be that males evidence a stronger avoidance of opposite-sex stimuli, though their same-sex preference might not show a significant difference from girls. In order to examine this possibility, it would be possible to show the infant some toy pairings containing same-sex and opposite-sex toys paired with a neutral toy. If the development of sex-typing involved a greater degree of opposite-sex avoidance, than same-sex preference, the infant would be expected to show a bigger difference in attention to same versus opposite-sex stimuli than same versus neutral.

Further, in order to argue more convincingly for the presence of same-sex preference or opposite-sex avoidance, it would be helpful to establish some objective measure of the low-level properties of the stimulus pairings as well as controlling for the infants' previous exposure to the toys used as stimuli.

7.3.4. Play

It is particularly difficult to make conclusive comments about this domain of testing. In retrospect there are a number of methodological assumptions and

practicalities quite separate from preference for gender congruent or incongruent stimuli which could have led to the result found in this study. Consequently, this section follows a different format to previous sections in that explanations for results and suggestions for future research are raised alongside methodological issues.

Two basic assumptions were made during the design stage of this project in the decision to measure sex-typed preferences using this technique and these stimuli. Firstly, that the activities being depicted captured the essence of the difference between male and female-type activities. Secondly, it was assumed that the children would attend to the stimuli on the basis of preferred activity. In the light of the overwhelming preference for both sexes to attend to the 'masculine' activities, it seems appropriate to review these assumptions and discuss the possible reasons behind the results obtained.

A. Stimuli

1. Masculinity/femininity of activities portrayed

The activities depicting male and female activities were chosen with reference to previous research on sex-typed play activities (Pitcher and Schutz, 1983; Pellegrini and Smith, 1998), and were (in their pairings) - chasing - drawing, wrestling – pat-a-cake, whispering - climbing, doll-play – cowboys, jumping – phoning. It is possible that these activities did not tap into the essence of what makes activities of interest to male and female children. Benenson, Liroff, Pascall and Della Coppa (1997) tried to define an underlying construct tapping 'masculinity' in the activity of children by attempting to establish a characteristic of male movement which was pervasive through their behaviour i.e. positively correlated with other measures of 'masculinity.' They theorised that male movement was characterised by 'propulsion' a 'forceful, forward motion' and suggested that propulsion can be seen in – 'fighting behaviour, sexual behaviour, activity… (and also in) transportation vehicles and tools, rough and tumble play, and

(other) displays of dominance' (Benenson et al, 1997, p.39). In their study, they staged a game of 'tag' between children and some puppets, and the degree of arm acceleration that was measured as the child caught the puppet was taken as a measure of propulsion.

For boys, Benenson et al found a strong positive correlation between force of propulsion and teacher masculinity ratings made seven months later, and a significant relationship between toy preference and level of propulsion. The authors noted some difficulties in their study, namely, (1) the child's expressed toy preference might be a function of the child's 'current level of propulsion' and (2) it was unclear whether their test (measured through observations of the child playing with a limited number of toys rated along a continuum of masculinity/femininity) was reflective of the actual toy choice the child would make. They conclude that it is unclear whether motor behaviour is 'still another example of sexually dimorphic behaviour or is an underlying dimension linking seemingly disparate behaviour patterns.' A more detailed analysis into the properties of those activities that males and females seem drawn towards is necessary in order to speculate on the development of these preferences.

The complexity of this problem is increased by the possibility that the properties differentiating male and female activity (and preference for that activity) may change over time. Just as studies of preference for human faces have demonstrated a change in interest from the preference for contour of the new-born to preference for facial features in the 4-month-old (Maurer and Barrera, 1981), it is possible that different activities interest children at different stages of their development. Pellegrini and Smith (1998) have recently studied this phenomenon. In their study, they investigate the development and function of vigorous play. They identify three kinds of physically active play that are predominant at different developmental stages. The stage associated with infancy has been characterised by 'rhythmic stereotypies' (e.g. body rocking and foot kicking),

during pre-school years vigorous play is predominantly 'exercise play' and rough-and-tumble play peaks in middle childhood. Pellegrini and Smith make two particularly interesting points. Firstly, it was only the latter two stages which were shown to be gender differentiated, and second, while much research on play in children views play activities as precursors of adult behaviour, providing the child with practise or social roles and competencies (Bateson, 1981), Pellegrini and Smith suggest that play does not have 'deferred benefits,' but serves primarily immediate developmental functions.

With regard to the first point, the fact that the present study did not find a same-sex preference for activity could be because the two sexes have the same developmental needs in infancy i.e. improving control of their bodies. Lewis and Brooks (1975) suggest that, prior to acting on the basis of 'self-as-categorical' (when gender identity and gender categorisation of others begin to develop concurrently and the infant begins to display sex-typed behaviour), the infant experiences 'self-as-existential.' At this point, reafferent feedback is thought by Lewis to form the basis of self-concept. If, as postulated by Pellegrini and Smith, reafferent feedback in the early stages of infancy is not sex-differentiated in terms of the physical environment the infants encounter, it is unsurprising that they are not discerning the movements of others on the basis of sex-congruence.

Secondly, there is some discussion on the function of play in infancy. Bateson (1981) distinguishes between the 'scaffolding' view of play where 'play functions in skill assembly, and then is disassembled when the skill is mastered' and the 'metamorphic' view where 'play and its consequences are unique to the niche of childhood' and discussions of later benefits are unnecessary [cited in Pellegrini and Smith, 1998, p. 581]. Pellegrini and Smith express the metamorphic view - that the activity shown through most of the first year (the rhythmic stereotypies), primarily

functions to achieve the immediate benefits of improving control of specific motor patterns. The infants in the study described in this thesis were shown play activities portrayed by actors between eight and ten years old. Predicting a preference for attending to sex-congruent play activities such as those carried out by older children assumes a prospective preference i.e. that infants will show this preference as a precursor to later behavioural preferences. The suggestions of Pellegrini and Smith, that their current level of play serves an entirely different function, bring this assumption into question. By the time the cohort is eighteen months-old, the girls' preference for masculine-type activities is significantly weaker than the preference shown by the boys. This is also the time when infants have achieved mobility. Further longitudinal study might indicate whether this is marks the onset of differential play experiences.

2. Activity level.

In the present study, much of the activity portrayed as masculine was not specifically rough and tumble but high in levels of activity such as chasing, jumping, and climbing. The stimuli shown seem to have tapped into a feature of play that appeals to both sexes. Pellegrini and Smith differentiate between two similar types of play prevalent in pre-school and early childhood respectively. Exercise play has already been operationalised in Chapter One as 'gross locomotor movements in the context of play' such as running, jumping and climbing. Rough and tumble play has a much stronger social element to it and includes activities such as wrestling, grappling, kicking and tumbling. Although a meta-analysis by Eaton and Enns (1986) of gender differences in motor activity level found sex differences in participation in both of these types of play (males participating at a significantly higher rate), Pellegrini and Smith point out it is likely that this was a function of the inclusion of some rough and tumble activities in the definition of exercise play. As indicated by the DiPietro study, the increased propensity

of boys to engage in rough and tumble play can deceptively elevate the significance of sex differences in gross motor movements and the possibility that exercise play as defined by Pelligrini and Smith is sex differentiated would require some further meta-analytic testing. The preference by the girls to watch the 'masculine' activities could simply be an unsurprising expression of interest in 'exercise play.'

If the element that differentiates boys' play as masculine, then, is social rough and tumble play, what might differentiate girls' play? One of the differences in play-styles between girls and boys that has been suggested is that girls prefer dyads or triads than large-group play (Benenson, 1990; Ladd, 1983). However, as the videos shown to the boys and girls depicted only two same-sex actors pretending to play male-/female-type games, the size of the group involved was not a factor in this instance. Researchers have also noted that in same-sex groups of children, girls and boys are different in the way they establish dominance over one another. Where boys tend to participate in rough and tumble to establish status and settle disagreements, girls prefer to talk (Maccoby, 1998). Many girl-type activities and games are characterised by vocalisation (make-believe, whispering secrets, playing telephones) and in mixed-groups of children, girls continue to assert themselves through vocalising, reasoning and referring to rules. In the video tapes shown to the infants in this study, there was no sound and infants were required to respond to the stimuli on the basis of movement alone. Given the preference for girls towards vocalisation, a vital element in what goes into making a girl-type game attractive to girls (or boys) may have been neglected.

3. Relationship with setting

Levy (1994) notes that sex-differentiated patterns of development occur in different contexts or settings, with boys tending to spend more time out of doors (in active play) and girls spending more time indoors (engaged in more static types of

play). Levy theorised that the children's familiarity with a setting would have implications for their ability to process information about things from those settings. In his study of 44-81 month-old children, he looked at the children's ability to recall gender-typed indoor and outdoor toys. He concludes from his data that children demonstrated more accurate classification of toys 'from contexts they were presumably more familiar with.' (Levy, 1994, p.402). This finding has some implications for the presentation of stimuli in this study. The videos shown to the infants of both 'masculine' and 'feminine' play activities were filmed indoors and the films show two actors of the same sex as the participant performing all activities. This was a deliberate attempt to exclude any extraneous variables by keeping the background to the activities constant but it may be that these are the very variables that form a strong part of the attractiveness of the activity to the child. Whereas an infant might normally process information on more than one dimension e.g. surroundings, play-mates, and movement, in this study some specific associations were removed. Setting 'masculine' activities indoors may have made them more attractive to the female infants. However, the possible incongruity of setting did not seem to affect the boys' preferential attention and it would seem that a dimension which was not controlled – degree of movement – was the strongest in eliciting looking.

B. Infants' attention to stimuli

1. Patterns of fixation

A number of researchers have noted problems with the visual preference paradigm (Cohen, 1976; Olson and Sherman, 1983), one of the most commonly noted being that it is not possible, by measures of fixation duration alone, to tell when an infant attending to the screen or is simply gazing blankly. There has been some

suggestion that measurement of cardiac deceleration is a more reliable indicator of attention when used alone or alongside visual preference (McCall and Kagan, 1967). The choice of simultaneous presentation of the stimulus brought other problems to this form of measurement. The problem of interpretation is exacerbated by the need to assess *relative* degree of attraction for one stimulus over another. Lewis, Kagan and Kalafat (1966) noted that prolonged attention to one stimulus over another might be a function of a young infant's inability to remove its' attention from an interesting target, rather than a preference for that target.

In the present study, there is evidence to believe that the infant was demonstrating a reticence or inability to shift attention away from one screen to the other - namely from the 'masculine-type' activity to the 'feminine-type' activity. Subject loss in the longitudinal calculations was due to the criteria for inclusion which required that the infant fixate on *both* stimuli during the 30 second exposure for at least three of the five video presentations. Frick, Colombo and Saxon (1999) found that the youngest infants in their study (3 months) showed slower latencies in disengaging fixation from a visual stimulus and it is possible that the relative decrement in interest in 'masculine' activities in girls by 18 months is partially due to maturation in the infants' ability to disengage/inhibit visual fixation. The information gathered about the infants' attention to the stimuli did not include a calculation of number and order of fixations (same-sex then opposite-sex or vice versa). A more stringent criteria for inclusion in the data analysis might have been to exclude any subjects who did not fixate each stimulus more than once. This would alleviate the possibility that the infant glanced at one stimulus and was then drawn to and unable to shift from the other.

As has been noted, differing patterns of fixation to stimuli may be a function of different modes of visual intake and encoding (Stoecker and Colombo, 1998). As there

was no between subjects information gathered on the infants' baseline speed of processing, the conclusions drawn from this study are on the basis that mean duration of looking is reflective of the extent to which the infant is interested in the stimulus.

2. Preference for high velocity movement

One of the major differences between the two types of activities portrayed in the videos is the amount of movement involved in the action. As described above, this was thought to relay some information about the 'masculine' nature of the activity. Unfortunately, this increased movement was probably also the main reason for unnaturally long fixations on the male stimuli. Infants have been shown to have a preference for moving over static stimuli (Carpenter, 1974; Volkmann and Dobson, 1976; McKenzie and Day, 1976) [cited in Slater, 1985]. Movement is particularly successful in attention-getting (Slater, 1987). Given the relatively static nature of the female-type activities watched by the infants, it is unsurprising that their focus of interest remained the moving stimuli.

7.3.5. Knowledge of self

Methodology

The emergence of self-recognition in the present study was stronger in the group of girls. This may have been a function of the peer photograph that was paired with that of the 'self.' The same (male/female) peer photograph was used as the pair for each infant at each session (but varied over age). If the photographs of the male peers were particularly attractive, this could have made the decision regarding preference less clear for the infant.

Explanation for results

The inclusion of two tests of self-recognition is reflective of other research identifying techniques suitable for various age groups (Gallup, 1968; Amsterdam, 1972;, Lewis and Brooks-Gunn, 1979; Bahrick Moss and Fadil, 1996). In the present study neither of the two tests of self-recognition showed infants demonstrating the ability to recognise themselves until the age of eighteen months (N.B. infants were not tested at fifteen months which is the age Lewis and Brooks-Gunn claim to have first found success in performing the rouge test). This is contrary to reports by Lewis and Brooks-Gunn (1979) who found recognition at nine months both in a study presenting the infants with a series of photographs including their own, and by applying less stringent criteria to the rouge test paradigm (see Section 4.3.2.). Lewis (1981) suggests that the success achieved by the infants in the former study might have been due to the infant having extra information about the stimuli on which to differentiate self. 'Early self-other differentiation may require additional perceptual-support structures ... the ability to differentiate early self from other may require differences that have categorical qualities such as age or gender' (Lewis, 1981, p. 403). However, providing the infant with a pair of photographs which differ on more than one dimension (e.g. self/other and age or sex) would have made it even more problematic to establish the reason for preferential attention.

Future research

In the third session, the girls led the effect for looking to self/other. In order to control for the possibility that this result was due to the relative attractiveness of the stimuli used for each group, different peer pictures could be provided for each participant. This was achieved effectively in the Bahrick, Moss and Fadil study (1996) which used the photograph of the preceding participant as the peer at the next session.

This study claims to have been successful at finding self-recognition in infants as young as three months indexed by increased attention to the photograph of the other.

7.3.6. Knowledge of other – gender labelling

Explanation for results

When the children were tested on their gender labelling ability by their parents at eighteen months, we did not find substantial success at labelling on the basis of gender even for adult pictures (8% were able to identify adults only, and 11 % were able to identify adults and children) although Lewis and Brooks-Gunn (1979) found that by 18 months, 90% of infants label adults correctly on the basis of gender. Other research on young toddlers has produced similar results to Lewis and Brooks-Gunn. Lloyd and Duveen (1989) tested children from 18 months to 23 months. They showed a photograph of a man and a woman or a boy and a girl and the children were asked to select pictures corresponding to the gender marked nouns of man, lady, mummy, daddy, boy, girl. Lloyd and Duveen report 60 % success at this task across the age range.

Other studies, however, have not found this degree of success. Martin and Little (1990) did not find success at gender labelling tasks until 35 months, and it was not until 45 months that they found the ability to correctly associate one picture of a male-female pair with a target picture depicting a man or woman. The most likely explanation for these discrepant findings between studies is the criterion used to judge success at the task. These criterion differ between studies; for example, Martin and Little required that the child point correctly for each of the four male-female picture pairs where Leinbach and Fagot (1986) require success on 10 out of 12 trials. The criteria for subject inclusion in the data analysis may also differ between studies. Lewis and Brooks-Gunn (1979) found that 'of the infants *who had labels* for boy and girl' (italics added), 80 % applied

these labels correctly. Also, Ruble and Martin, in their review article (1997) suggest that the phrasing of question to the child can make a difference and that some studies might also be more stringent than others in requiring the child to explain their choice (Emmerich, 1982; Szrybalo and Ruble, 1997). The task used in the study reported here was based on the work by Leinbach and Fagot (1986) which relies on a simple instruction to point either to the man or the woman, or the boy or the girl. Passing the test required correct discrimination on 10 out of 12 pairs of pictures. They used this task in order to ascertain a relationship between children who labelled early, those who labelled late, parental behaviour toward the children, and the children's sex-typed behaviour. The first time they gave the children the task, the cohort was aged around 18 months though they did not achieve success until 27 months. The present study, modelling Leinbach and Fagot's task, did not achieve results similar to Lewis and Brooks-Gunn, and probably resulted from the inclusion of all participants in the data analysis. A lack of response was scored as incorrect.

Future research

Given that sex congruent toy preference is the first to be shown in this study, it would have been interesting to incorporate a task requiring the infants to identify toys on the basis of a gender label.

7.3.7. Preference over time

Explanation for results

The low stability in scores across testing sessions in each domain indicates that different infants lead the effects found at each age of testing. Maccoby (1998) notes that to expect children to differ stably among themselves with respect to strength of same-sex preference, is to attribute same-sex preference the same characteristics as a

personality dimension. She points to a study by herself and Jacklin (Maccoby and Jacklin, 1987) in which playmate preferences observed in a playground showed no individual stability between four-and-a-half and six-and-a-half years. Also, Lloyd and Duveen (1992) examined stability of same-sex preference over a year in a British infant school and found a low correlation between testing periods. Maccoby suggests that, rather than a personality dimension, same-sex preference should be viewed as something that distinguishes the two sexes from one another 'on the basis of their membership in one of two categories: male and female.' (Maccoby, 1998, p. 82-84) If playmate preference is a group phenomenon, other sex-differentiated behaviours may also be described in group rather than individual terms. If this is the case, a lack of individual stability over time is not surprising or difficult to explain.

7.4. Present results and current theory

The results from the present study indicate that infants show sex-typed preferences for toys from around eighteen months. Further, the cross-sectional analyses demonstrate differing trajectories leading to this preference as a function of sex. A similar picture is seen for preference for the faces of peers, though the female infants had still not shown a same-sex preference by eighteen months, and there were no significant results for male or female infants at the second time of testing. Reaching any conclusions about play preference based on the videos that were shown to the children depicting play-style is problematic due to a number of theoretical and practical explanations that have already been discussed.

At the time that the first sex-typed preference (toys) was identified, the infants were able to recognise themselves in the non-contingent test of self-recognition (an effect strongly led by the girls), a necessary precursor to self-gender identity. However,

the ability to identify oneself and others in terms of gender category is expected by GSP theorists to occur roughly simultaneously through a process of interaction of the infant with their social environment and the lack of success of this group at the gender labelling task indicates that it would be too early to connect self-recognition to labelling ability. This is unsurprising given that it is not until well into their second year that children show cross-modal associations by reliably demonstrating the ability to connect faces and voices on the basis of gender (Poulin-Dubois, Serbin, and Derbyshire, 1994) Work has already been done to establish the possible multidimensional nature of the development of sex-typed behaviour (Hort, Leinbach and Fagot, 1991; Downs and Langlois, 1988). In particular, the latter authors subdivide the sex-typing process into three distinct factors which they identify as 'preferences and behaviours, identification and affect, and cognition,' and look at the correlations between these areas. In their study, they correlate children's toy preferences (measured through observation, picture choice, and teacher ratings) with projective measures of sex-typed identification (the Brown It Scale for children) and a measure of gender constancy. Downs and Langlois summarise that there is no close linkage between these three areas, and feel that 'great caution (ought to be) exercised in generalising from results derived from single measures of sex-typing to conclusions about sex-typing as a global unitary process.' (Downs and Langlois, 1988, p.96). However, whereas in their study, Downs and Langlois demonstrate how measures of sex-typing in preferences and activities correlate with one another by presenting three different behavioural measures of sex-typing in toy choice, results from the present study would suggest that even within the dimension of preferences and activities, it is necessary to investigate the differences between behavioural domains.

7.4.1. Implications for Gender Schematic Processing Theory

This section of the final chapter will discuss the findings of this study in relation to gender schematic processing theory, identifying areas in which GSP successfully describes the data and areas in which a revision of the model would be needed to explain the current findings.

This study aimed to investigate particular areas of the gender schematic processing theory that have not been satisfactorily demonstrated (or investigated) in research to date. The predictions (and omissions) under scrutiny are (1) whether self-recognition will predate the onset of sex-typed behaviour (2) whether longitudinal analysis will endorse the GSP model (3) if the emergence of gender-based cognitions signals the onset of sex-typed behaviour across behavioural domains, and (4) whether the development of sex-typing occurs simultaneously in girls and boys.

(1) The role of self-recognition

The predictions of GSP theory that sex-typed behaviour will not emerge prior to self-recognition have been partially borne out. The present study did not find any significant sex-congruent preferences prior to the infants demonstrating the ability to recognise pictorial images of themselves suggesting that the emergence of these abilities could be linked. Although self-recognition does not guarantee knowledge of one's own sex, combined with gender-labelling ability, it strongly suggests it. One of the aims of this study was to use multiple measures of self-recognition, as the criteria for self-recognition has not yet been empirically firmly established. The most commonly used technique for the measurement of self-recognition, the rouge test, was completed by the infants at eighteen months as well as a test of pictorial self-recognition. A significant number of infants were successful at both tasks but correlations between the two tests of self-recognition at eighteen months showed a lack of correspondence between

individual scores on the two tasks, demonstrating that different infants were leading the effect in each case. It would seem, then that one or other (or both) of these tests of recognition is unreliable or that the tasks, conventionally taken as indicative of self-recognition, may actually be measuring something different from one another. The current investigation also intended to uncover any sex differences in the trajectory of sex-typed preference. Although there was a main effect of preference for photograph of self over other in the third testing session, this was strongly led by the girls in the sample.

(2) Longitudinal results

There are few correlations between testing periods in terms of the infants' visual preference within domains. Neither was there a consistent significant tendency for individual infants to follow an orderly sequence of sex-typed responses. This would initially seem out of place in a theory that provides an overall model for the development of preference. However, Martin's revised 'Dynamic Schematic Processing' model (1993) suggests that infants will demonstrate differing levels of sex-typing depending on the salience to each individual child of the domain being tested. According to this theory, the individual will gradually develop a complete network of sex-typed associations that will form their gender schema. This achievement of a complete associative network is the expected outcome for each child. The nature of the analyses performed in this study meant that the investigation concentrated on the emergence of a common developmental pattern as tested by classifying the infants' sequences of development (see Section 6.1.2.). The implication of Martin's model is that such a pattern would not be found until after the group as a whole has developed sufficiently to have formed complete gender-knowledge networks. A stable trajectory for same-sex preference was not found at either the group or individual level.

(3) Gender-based cognitions

As has already been noted, although the infants showed some evidence of self-recognition before demonstrating sex-congruent behavioural preference in looking at toys, success in a test of self-recognition does not mean that the infants have an awareness of their own sex. Some other measure would have to be included to demonstrate this ability, though unlikely to be successful given that the infants were unable to identify others on the basis of sex and the two abilities are thought to develop simultaneously (Lewis, 1981). GSP theory would also predict that children's preference for same-sex others would not appear until they demonstrate the ability to differentiate between the sexes. This ability has been tested in both previous research (Fagot, Leinbach and Hagan, 1986) and in this study through the use of a gender labelling task which requires only limited verbal abilities. In the study reported here, the infants were largely unsuccessful at this task, and also showed no overall preference for same-sex contemporaries or same-sex older children. However, correspondence in null findings in these areas is not sufficient to act as positive evidence for the GSP model and the trajectory of development in these two areas requires continued longitudinal investigation. The use of longitudinal analysis to measure the trajectory of the development of sex-typing may only be of use following the acquisition by the infant of a 'complete associative network' of gender-based knowledge (Martin, 1993). However, there does not seem to be a satisfactory way of measuring the complexity of this network in order to ascertain when one might expect to find the beginnings of continuity in development.

Another problem in discussing the model of development suggested by GSP on the basis of the findings of this study is that the current study was limited in the cognitive tests it could apply due to the age of the cohort. For example, the only test

made of the infants' gender awareness was a gender labelling task. This was used with the assumption that it would tap into the earliest gender-based cognitions available to the infant. A more thorough investigation of the utility of this model would have used a battery of cognitive testing. Other studies that have given more emphasis to the relationship between cognitive processes, however, have found a lack of correspondence between cognitive measures (Trautner, 1992).

(4) Sex differences

One of the most problematic areas for GSP theory is the difference between the sexes in the development of preference. A number of studies have shown behavioural sex differences (Turner, Gervai and Hinde, 1993; Blakemore, LaRue and Olejnik, 1979; Calder, Huston, and O'Brien, 1989; O'Brien and Huston, 1985). Most have demonstrated stronger and earlier sex-typed behaviour in boys than girls and this is not predicted by GSP theory. However, it seems that gender-related cognitions are not significantly differentiated as a function of sex. Trautner (1992) notes that while the behavioural domains investigated in his longitudinal study showed marked sex differences, there were no sex differences in gender related cognitions. Other studies investigating gender-related cognitions have also reported no differences as a function of sex (e.g. Fagot, Leinbach and Hagan, 1986). However, GSP theory posits that gender cognitions provide the 'cognitive underpinnings' for sex-typed behaviour. This is problematic unless some other variable is admitted into the model to explain why males and females with similar 'underpinnings' develop sex-typed behaviour at different rates and with differing enthusiasm. In this study, not only did the final longitudinal analysis reveal a number of interactions across time and between sex-congruent and incongruent preferences as a function of sex, but the main significant finding of sex-congruent

preference in the domain of toy preference was characterised by sex differentiated trajectories.

7.4.2. Sex-typed toy preference

Sex-congruent toy choice emerged prior to definite proof of self-recognition, demonstration of gender labelling ability or preference for same-sex peers. There is also no correlation between sex-typed toy choice, self-recognition and gender-labelling ability, and there does not seem to be a common trend in the development of toy choice. This finding directly contradicts GSP predictions and poses the most serious threat to the theory. The results from this study reflect cross-sectional data provided by Blakemore, LaRue and Olejnik (1979) who found, at least for boys, that behavioural preference emerged some time before they were able to identify the toys as belonging to girls or boys. Given that toy preference has emerged sooner than evidence of even the most basic gender-related knowledge, it seems pertinent to conclude that there is some other process driving infants' toy choices, even at eighteen months. Some possibilities have already been proposed by Bussey and Bandura (1992) who emphasise the salience of cultural reinforcement while conceding a place for self-reinforcement through processes aimed at alleviating cognitive dissonance (see section 1.1 for fuller discussion of this work). However, this approach still needs to be treated with some caution. Bussey and Bandura suggest that, because of the importance placed on describing others in terms of gender in Western culture, cognition concerning gender of others should precede sex-typed behaviour. The measurements of sex-typed toy behaviour used in their study to illustrate the onset of this behaviour, however, was restricted in its inclusion of children of 30 months. Several studies, including the one described in this thesis have found sex-typed toy preference well before this time and before children

label others according to sex. The emergence of sex-congruent toy choice in such young infants is problematic for GSP theory because it opens up questions concerning directions of causality in the development of sex-typing. If sex-typing is not the result of an increasing understanding of gender and gender-related values, it needs to be explained in some other way. The early appearance of sex-congruent toy choice might strengthen the case for theories of behavioural compatibility leading same-sex preference (see 1.3.3).

7.5. Conclusion and suggestions for future research

Some possible explanations for the development of sex-typing have been described in the first chapter and will be reiterated here in light of the results of this study. Following discussion of alternative explanations for the current findings, suggestions for future research will be made. It would be possible to extend or replicate this study to improve its methodology or map the development of one cohort. There are also implications for the wider field of research into sex differences and the development of sex-typing.

7.5.1. Explaining the development of sex typed behaviour

Social learning theory

Cognitive social learning theory has been described in previous chapters and some problems with this theory noted. However, in this study, two factors indicate a role for direct/indirect reinforcement in the formation of sex-typed preferences. Firstly, the emergence of toy choice has been shown to be sex differentiated. Previous research has suggested that boys are more strongly socialised into playing with same-sex toys than girls (Langlois and Downs, 1980), and the results from the present study reflect this

possibility. A preference for same-sex toys appears in male infants at the second time of testing, when girls are still not showing a significant preference. Individual scores begin to show a positive correlation between the second and third testing sessions. By the third testing session, a same-sex preference is apparent across the group as a whole. Secondly, the information collected from parents, although not providing significant evidence of a relationship between toys received by the infant and the infant's subsequent preferences, shows a marked increase in the sex-typed nature of toys given to the infants between the second and third testing session. As noted earlier, this measure of social influence was rather a crude one and unlikely to tap into the direction of influence in the toy giving/receiving behaviour of the family. Further, there is no correlation between infant toy choices and the sex of their siblings. It was suggested in Section 7.3.3. that sibling influence might manifest itself as a consistent pattern of toy choice as a function of the child's sibling status. Also, this study did not gather detailed information on the infants' family attitudes. Consequently, firm evidence for the effect of socialisation is lacking in this study.

Biological influences

In the introductory chapter, it was suggested that biologically-based theories, particularly considerations of attentional bias in infancy, might provide a useful way of conceptualising the development of sex-typed behaviour. A common criticism of biologically-based theories of development, though, is the emphasis on genetic or evolutionary history at the expense of environmental factors. Consequently, the importance of biological factors is often overlooked. One theory which allows consideration of both of these aspects of human development is the concept of epigenesis - an interaction of genetic and environmental influence on behaviour.

Genetic influence is thought to prepare the infant to attend differentially to the stimuli they encounter as part of their culture. There are several ways in which this 'metatheory' (Hoyenga and Hoyenga, 1993) can be helpful in interpreting the evidence discussed in this thesis.

Proponents of epigenesis suggest that genes are influential in a person's behaviour by restricting the number of responses they can make in a given situation. Gallistel, Brown, Carey, Gelman, and Keil, (1991) refer to this as a 'privileged relationship' and give an example from ethological studies which have found that a behaviour can only be increased if a relationship already exists between a stimulus and a response (for example, a pigeon can be trained to fly, but not peck in response to a shock). Gallistel et al deliberately choose this term over the more prescriptive term 'constraints' in order to emphasise the degree of differentiation which can occur among individuals with the same basic propensities, but also because 'constraints' implies a domain specific learning process. Instead, they propose that there are multiple mechanisms for learning which may have differential influence amongst different domains of behaviour.

The concept of domain specific learning mechanisms may usefully allow for incorporating a number of different theoretical stances on the development of sex-typed behaviour, as each may describe the prevailing process in different domains. For example, GSP theory seems to usefully describe the development of sex-typed cognitions, even if it does not fully explain the concurrent behaviour.

GSP theory has been questioned in terms of consistency in the development of sex-typed behaviour across behavioural domains. The study described in this thesis has demonstrated a lack of correlation between the domains being tested and this is another area which might benefit from epigenetic emphasis. Epigenetic theory predicts that sex-

typed behaviour will develop at different paces and in different ways between behavioural domains as a function of the infants' stage of development (for example, sex differences in preference for activity may not be apparent until the infant has achieved some mobility and begins to experience their environment) and the importance placed on separation of males and females within that domain (for example, infants in the West are rarely segregated until they reach school age and may not show a sex-typed peer preference prior to this time). A genetic and cultural emphasis on certain traits and attitudes may provide a good explanation for the differing paces in development in each area of behavioural preference. Further evidence for this possibility would come from monitoring the onset of sex-typing in each domain and relating this to maturational and cultural influences.

To investigate the possibility that sex-typed behaviour occurs earlier than conventional preference testing has established, the present cohort of infants was monitored from three to eighteen months. There was no evidence until the last testing session of stable sex-typed preferences across the group and it seems on the evidence from previous research and the findings here, that theories of socialisation may provide good explanations for this sex-typed behaviour. Epigenetic theory, then, is currently unable to describe the actual trajectory of the development of sex-typed behaviour, but it remains a useful way of conceptualising differences across the sexes and between individuals.

7.5.2. Future research

There are a number of possible areas in which it would be possible to improve on the current study, and to benefit investigations into the development of sex-typed

behaviour. Particular issues of methodology have been discussed earlier in this chapter and will not be reiterated here.

Although the results obtained in this study may lead to speculation about the possibility of socialisation in the early emergence of sex-typed toy preference, this possibility cannot be discussed with any confidence without some further detail regarding the differential socialisation of this cohort of infants. Future study should incorporate some more reliable measure of the nature of the toys parents preferred their children to own or play with. Another possible explanation for sex-typed toy preference in such a young group was speculatively provided by Campbell (1996) in considering the sex-differentiated play possibilities in the toys as perceived by the infants. The possibility of sex differences in attunement may be investigated further by trying to discover which particular toy properties differentially appeal to the sexes. Some indication of these properties has been provided by Miller (1987) (see section on gender labelling in 1.3.3) from the responses of a group of adults to questions about toy categories, but systematic investigation of abstract properties appealing to infants of either sex is missing from current literature.

It has already been noted that this study was not intended to investigate the cognitive component to the development of sex-typing as this has been adequately documented elsewhere, and rich data continues to be provided. The study reported here used a measure of the most basic gender knowledge - the ability to differentiate between the sexes. It is thought by Fagot (1985) that the ability to label by sex is sufficient for the child to begin forming categories on the basis of gender and so begin formation of a working gender schema. Also, Martin's revised model (1993) suggests that children's knowledge can be seen as consisting of components of gender-related information. The earliest component to emerge is thought to be the 'vertical-label' component where the

child associates various traits or objects to males or females, but does not inter-relate them to one another. GSP theory, then, relies heavily on the child's demonstration of the ability to produce these vertical-label components. The current study required the infants to carry out a gender-labelling task at which almost all were unsuccessful. However, the true utility of labelling to the development of sex-typed preference cannot be ascertained until the child has been asked to show awareness of gender labels for stimuli in all the domains being tested. It was possible that the present study could have found an ability to label toys on the basis of sex even before the infant could identify boys and girls or men and women.

Finally, in terms of this study, it would be useful to continue mapping the developmental trajectory of sex-typed preferences in the domains where these preferences have yet to emerge. As the infants mature, there would be more opportunity to establish particular behavioural preferences, and the growth in their verbal abilities would enable more information to be gathered about the relationship between gender cognitions and sex-typed behaviour. Despite the lack of temporal stability of the results achieved so far, the relationships which have emerged between nine and eighteen months in some areas may indicate the possibility that some individual patterns of sex-typed preferences are beginning to emerge around this time. Continuation of this research with the same cohort should provide evidence to support this.

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Appendix One

A. Pairs of toy stimuli

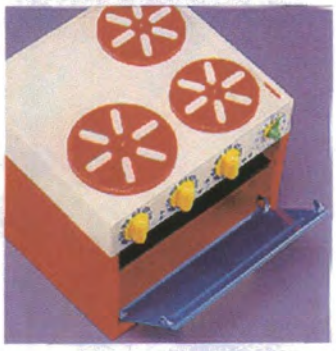
B. Developmental laboratory – room diagram

B. Questionnaire given to parents at each testing session

A. Pairs of toy stimuli

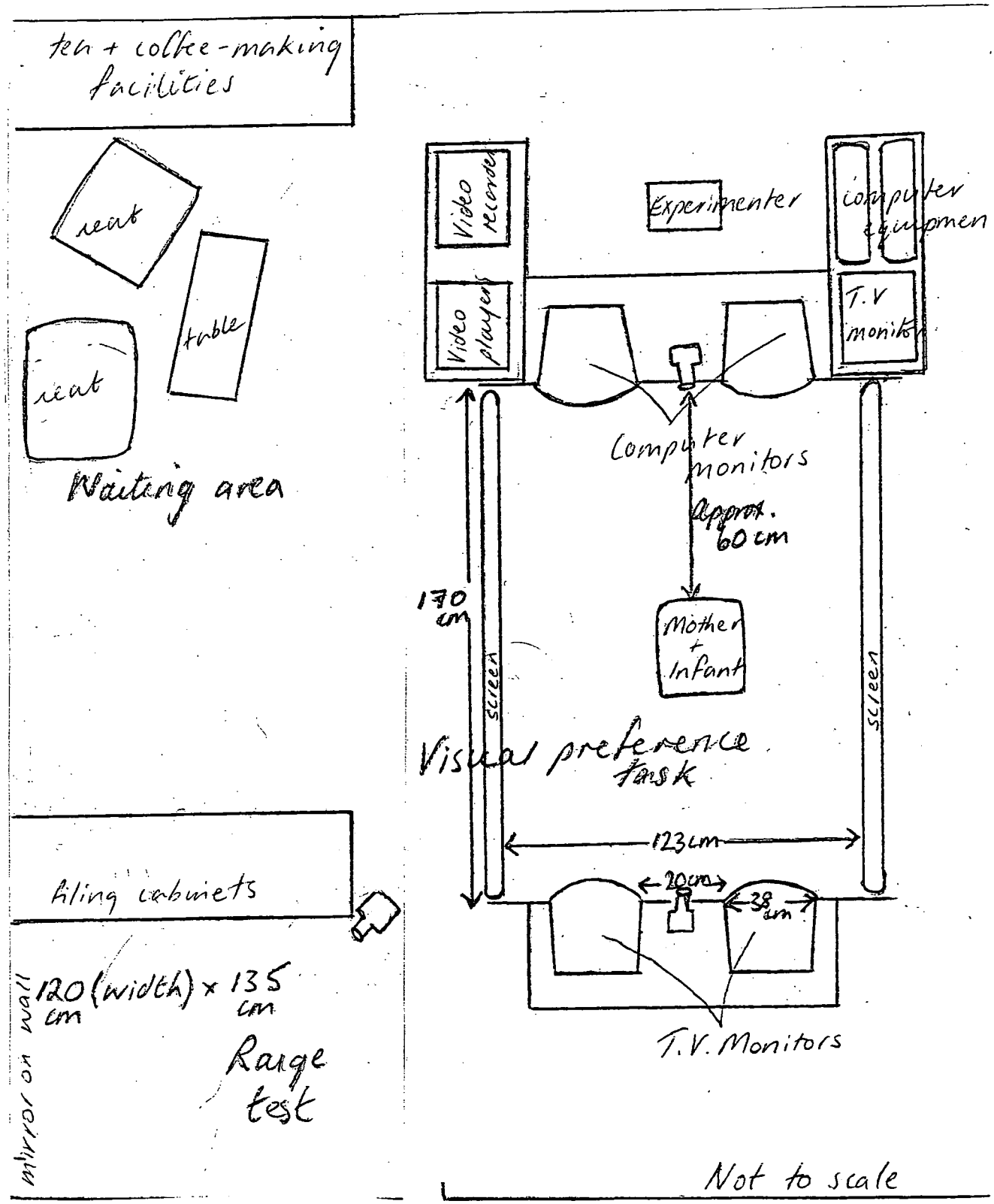








B. Developmental laboratory – room diagram



C. Questionnaire given to parents at each testing session

Other information

(This information is for use only in connection with the research. It allows us to state e.g. "The majority of the babies who took part in our study had one or more brothers or sisters." Your details will not be disclosed to anybody without your permission)

Mother's name _____
Baby's name_____
Baby's sex_____
Baby's date-of-birth _____
Address_____
_____

Post code_____
Telephone number _____
Number of adults in the house _____
Occupation of adults in the household (and whether full-/part-time)
_____
_____

Main carer will be (please tick) **mother**
father
other female
other male

Number of brothers _____
Number of sisters_____

Is your baby attending a nursery/day care centre or childminder?
Yes/No
If yes, how many hours per week?
_____

What three toys does your baby seem to enjoy looking at or playing with?
1._____
2._____
3._____

Can you remember the last three toys bought for your child?
1._____
2._____
3._____

Appendix Two

(Chapter Three)

A. Main Annova summary tables

B.Correlation matrix – cross domain stability

C. Annova summary tables – demographic variables and order effects

A. Analysis of variance summary tables

Table 1. Preferential looking to self/other as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Self/other	1.4E+07	1	1.4E+07	0.141	.71
Self/other*sex	2.4E+8	1	2.4E+8	2.50	.12
Error	4.8E+09	49	9.7E+07		

Table 2. Preferential looking to self/other.. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1.1E+10	1	1.1E+10	317.29	.00
Sex	1.0E+07	1	1.0E+07	0.31	.58
Error	1.6E+09	49	3.4E+07		

Table 3. Preferential looking to same-/opposite-sex peers as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Peerpref	2.0E+07	1	2.0E+07	1.43	.24
Peerpref*sex	1.5E+08	1	1.5E+08	10.93	.002
Error	7.5E+08	55	1.4E+07		

Table 4. Preferential looking to same-opposite-sex peers. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1.9E+10	1	1.9E+10	487.03	.00
Sex	2731576	1	2731576	0.07	.79
Error	2.1E+09	55	3.9E+07		

Table 5. Preferential looking to same-/opposite-sex peers as a function of sex and peer-picture pairing. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Pairing	1875289	4	468822	0.03	.99
Pairing*sex	1.2E+07	4	2953516	0.17	.95
Error	3.6E+09	208	1.7E+07		
Peerpref	5.6E+-8	1	5.6E+08	6.99	.01
Peerpref*sex	3.8E+07	1	3.8E+07	0.47	.50
Error	4.2E+09	52	8.1E+07		
Pairing*peerpref	1.1E+09	4	2.7E+08	1.63	.17
Pairing*peerpref*sex	2.6E+08	4	6.5E+07	0.39	.81
Error	3.5E+10	208	1.7E+08		

Table 6. Preferential looking to same-opposite-sex older child as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Childpref	1.4E+07	1	1.4E+07	0.96	.33
Childpref*sex	4.8E+07	1	4.8E+07	3.33	.07
Error	8.0E+08	55	1.4E+07		

Table 7. Preferential looking to same-/opposite-sex older child. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1.6E+10	1	1.6E+10	337.21	.00
Sex	2.5E+07	1	2.5E+07	0.51	.48
Error	2.7E+09	55	4.8E+07		

Table 8. Preferential looking to same-/opposite-sex toys as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Toypref	187727	1	187727	0.02	.89
Toypref*sex	5.9E+07	1	5.9E+07	6.71	.01
Error	5.0E+08	57	8817155		

Table 9. Preferential looking to same-/opposite-sex toys. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1.3E+10	1	1.3E+10	813.85	.00
Sex	7668426	1	7668426	0.48	.49
Error	9.2E+07	57	1.6E+07		

Table 10. Preferential looking to same-/opposite-sex toys as a function of sex and pairing of toy stimuli. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Pairing	1.7E+07	4	420502	0.37	.83
Pairing*sex	1.2E+08	4	2.9E+07	2.56	.04
Error	1.5E+09	132	1.1E+07		
Toypref	2.3E+08	1	2.3E+08	5.60	.02
Toypref*sex	1.6E+08	1	1.6E+08	3.93	.05
Error	1.4E+09	33	4.1E+07		
Pairing*toypref	7.8E+08	4	2.0E+08	3.18	.02
Pairing*toypref *sex	1.7E+08	4	4.4E+07	0.71	.59
Error	8.1E+09	132	6.1E+07		

Table 11. Preferential looking to same-/opposite-sex activities as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Playpref	7.9E+07	1	7.9E+07	1.80	.19
Playpref*sex	2.8E+09	1	2.8E+09	62.87	.00
Error	2.3E+09	53	4.4E+07		

Table 12. Preferential looking to same-/opposite-sex activities. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2.0E+10	1	2.0E+10	1454.71	.00
Sex	2.2E+07	1	2.2E+07	1.60	.21
Error	7.3E+08	53	1.4E+07		

B. Correlation matrix – cross domain stability (Pearson's Correlation Coeffcient)

	Pictorial self-recognition	Same-age peer preference	Older-child preference	Toy preference	Play preference
Pictorial self-recognition	1.00	.271	-.077	-.018	.213
Same-age peer preference	.271	1.00	.052	-.129	.274
Older child preference	-.077	.052	1.00	.010	-.117
Toy preference	-.018	-.129	.010	1.00	-.178
Play preference	.213	.274	-.117	-.178	1.00

C. Annova summary tables – demographic variables and order effects

Table 13. Preferential looking as a function of parental employment

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	1.1E+09	4	2.8E+08	1.37	.26
	Within	9.0E+09	44	2.0E+08		
	Total	1.0E+10	48			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	1.7E+08	4	4.2E+07	1.65	.18
	Within	1.4E+09	56	2.5E+07		
	Total	1.6E+09	60			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	7.0E+07	4	1.7E+07	0.61	.66
	Within	1.6E+09	56	2.8E+07		
	Total	1.7E+09	60			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	8.7E+07	4	2.2E+07	1.17	.33
	Within	1.0E+09	56	1.9E+07		
	Total	1.1E+09	60			

Source		Sum of Squares	df	Mean square	F	Sig.
Play pref	Between	8.2E+08	4	2.1E+08	1.22	.31
	Within	9.4E+09	56	1.7E+08		
	Total	1.0E+10	60			

Table 14. Preferential looking as a function of the number and sex of siblings

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	9.4E+08	3	3.1E+08	1.58	.21
	Within	9.5E+09	48	2.0E+08		
	Total	1.0E+10	51			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	4.9E+07	3	1.6E+07	0.55	.65
	Within	1.8E+09	52			
	Total	1.8E+09	55			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	9.5E+07	3	3.2E+07	1.18	.33
	Within	1.6E+09	56	2.7E+07		
	Total	1.7E+09	59			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	8.0E+07	3	2.7E+08	1.50	.22
	Within	1.1E+09	55	1.7E+07		
	Total	1.1E+09	58			

Source		Sum of Squares	df	Mean square	F	Sig.
Play pref	Between	5.0E+08	3	1.7E+08	0.97	.41
	Within	1.0E+10	54	1.7E+08		
	Total	1.1E+10	57			

Table 15. Preferential looking as a function of order of presentation of domains

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	7.2E+08	2	3.6E+08	1.87	.17
	Within	9.3E+09	48	1.9E+08		
	Total	1.0E+10	50			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	6.2E+07	2	3.1E+07	0.99	.38
	Within	1.8E+09	56	3.1E+07		
	Total	1.8E+09	58			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	4.2E+07	2	2.1E+07	0.73	.49
	Within	1.6E+09	56	2.9E+07		
	Total	1.7E+09	58			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	5523772	2	2761886	0.14	.87
	Within	1.1E+09	56	2.0E+07		
	Total	1.1E+09	58			

Table 16. Preferential looking to static stimuli as a function of stimulus order (boys)

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	1.0E+09	4	2.5E+08	1.41	.26
	Within	4.4E+09	25	1.8E+08		
	Total	5.4E+09	29			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	1.4E+08	4	3.5E+07	1.23	.32
	Within	8.7E+08	30	2.9E+07		
	Total	1.0E+09	34			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	1.6E+08	4	4.0E+07	1.10	.38
	Within	1.1E+09	30	3.6E+07		
	Total	1.2E+09	34			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	2.2E+07	4	5415542	0.22	.93
	Within	7.4E+08	30	2.5E+07		
	Total	7.6E+08	34			

Table 17. Preferential looking to moving stimuli as a function of stimulus order (boys)

Source		Sum of Squares	df	Mean Square	F	Sig.
Play pref	Between	2.8E+08	3	9.4E+07	1.17	.34
	Within	2.2E+09	28	8.0E+07		
	Total	2.5E+09	31			

Table 18. Preferential looking to static stimuli as a function of stimulus order (girls)

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	1.4E+09	4	3.4E+08	1.87	.17
	Within	2.9E+09	16	1.8E+08		
	Total	4.3E+09	20			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	1.1E+08	4	2.8E+07	1.13	.38
	Within	4.6E+08	19	2.4E+07		
	Total	5.7E+08	23			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	6.5E+07	4	1.6E+07	1.32	.30
	Within	2.3E+08	19	1.2E+07		
	Total	3.0E+08	23			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	4.5E+07	4	1.1E+07	1.07	.40
	Within	2.0E+07	19	1.1E+07		
	Total	2.5E+08	23			

Table 19. Preferential looking to moving stimuli as a function of stimulus order (girls)

Source		Sum of Squares	df	Mean Square	F	Sig.
Play pref	Between	3.9E+08	4	9.9E+07	0.99	.44
	Within	1.9E+09	19	9.9E+07		
	Total	2.3E+09	23			

Appendix Three

(Chapter Four)

A. Main Annova summary tables

B. Correlation matrix – cross-domain stability

C. Annova summary tables – demographic information and order effects

A. Analysis of variance summary tables

Table 1. Preferential looking to self/other as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Self/other	3.1E+07	1	3.1E+07	1.63	.21
Self/other*sex	890561	1	890561	0.05	.83
Error	1.0E+09	54	1.9E+07		

Table 2. Preferential looking to self/other.. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	6.9E+09	1	6.9E+09	439.97	.00
Sex	3866881	1	3866881	0.25	.62
Error	8.5E+08	54	1.6E+07		

Table 3. Preferential looking to same-/opposite-sex peers as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Peerpref	2095265	1	2095265	0.71	.40
Peerpref*sex	3308968	1	3308968	1.12	.29
Error	1.7E+08	56	2953013		

Table 4. Preferential looking to same-opposite-sex peers. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	7.0E+09	1	7.0E+09	1091.02	.00
Sex	4199926	1	41999926	0.66	.42
Error	3.6E+08	56	6411576		

Table 5. Preferential looking to same-opposite-sex older child as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Childpref	2042670	1	2042670	0.50	.49
Childpref*sex	3561399	1	3561399	0.86	.36
Error	2.4E+08	58	4127501		

Table 6. Preferential looking to same-/opposite-sex older child. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	8.1E+09	1	8.1E+09	747.61	.00
Sex	2825264	1	2825264	0.26	.61
Error	6.3E+08	58	1.1E+07		

Table 7. Preferential looking to same-/opposite-sex toys as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Toypref	1.3E+07	1	1.3E+07	2.44	.12
Toypref*sex	2.7E+07	1	2.7E+07	5.06	.03
Error	3.0E+08	55	5376141		

Table 8. Preferential looking to same-/opposite-sex toys. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	7.8E+09	1	7.8E+09	936.68	.00
Sex	4545224	1	4545224	0.54	.46
Error	4.6E+08	55	8357853		

Table 9. Preferential looking to same-/opposite-sex toys as a function of sex and pairing of toy stimuli. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Pairing	5.2E+07	4	1.3E+07	1.25	.29
Pairing*sex	2.0E+07	4	5058002	0.49	.74
Error	2.1E+09	204	1.0E+07		
Toypref	1.5E+08	1	1.5E+08	5.35	.03
Toypref*sex	4.6E+07	1	4.6E+07	1.62	.21
Error	1.5E+09	51	2.9E+07		
Pairing*toypref	1.1E+09	4	2.7E+08	9.43	.00
Pairing*toypref *sex	9209991	4	2302498	0.08	.99
Error	5.8E+09	204	2.9E+07		

Table 10. Preferential looking to same-/opposite-sex activities as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Playpref	3.9E+07	1	3.9E+07	3.77	.06
Playpref*sex	1.8E+09	1	1.8E+09	166.88	.00
Error	5.9E+08	56	1.1E+07		

Table 11. Preferential looking to same-/opposite-sex activities. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1.1E+10	1	1.1E+10	882.97	.00
Sex	4895563	1	0.40	.53	.21
Error	6.9E+08	56	1.2E+07		

B. Correlation matrix – cross domain stability (Pearson's Correlation Coeffcient)

	Pictorial self-recognition	Same-age peer preference	Older-child preference	Toy preference	Play preference
Pictorial self-recognition	1.00	.049	.370	.177	-.097
Same-age peer preference	.049	1.00	-.290	-.064	.074
Older child preference	.370	-.290	1.00	.088	-.122
Toy preference	.177	-.064	.088	1.00	.189
Play preference	-.097	.074	-.112	.189	1.00

C. Annova summary tables – demographic information and order effects

Table 12. Preferential looking as a function of parental employment

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	5.2E+07	4	1.3E+07	0.33	.85
	Within	2.0E+09	50	3.9E+07		
	Total	2.0E+09	54			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	2.8E+07	4	6909413	1.17	.33
	Within	3.0E+-8	51	5887984		
	Total	3.3E+08	55			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	3.9E+07	4	9731836	1.25	.30
	Within	4.1E+08	53	7801641		
	Total	4.5E+08	57			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	2.0E+07	4	5041893	0.41	.80
	Within	6.2E+08	50	1.2E+07		
	Total	6.4E+08	54			

Source		Sum of Squares	df	Mean square	F	Sig.
Play pref	Between	2.7E+08	4	6.9+07	0.83	.51
	Within	4.2E+09	51	8.3E+07		
	Total	4.5E+09	55			

Table 13. Preferential looking as a function of the number and sex of siblings

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	2.1E+07	3	7013297	0.18	.91
	Within	2.0E+09	52	3.9E+07		
	Total	2.0E+09	55			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	2.8E+07	3	9457912	1.65	.19
	Within	3.1E+08	54	5721882		
	Total	3.4E+08	57			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	4.0E+07	3	1.3E+07	1.67	.18
	Within	4.5E+08	53	7963280		
	Total	4.9E+08	56			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	2.3E+07	3	7705244	0.66	.58
	Within	6.2E+08	53	1.2E+07		
	Total	6.5E+08	56			

Source		Sum of Squares	df	Mean square	F	Sig.
Play pref	Between	6.6E+07	3	2.2E+07	0.26	.86
	Within	4.6E+09	54	8.6E+07		
	Total	4.7E+09	57			

Table 14. Preferential looking as a function of order of presentation of domains

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	5429366	2	2714683	0.07	.93
	Within	2.0E+09	53	3.8E+07		
	Total	2.0E+09	55			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	1.5E+07	2	7288158	1.24	.30
	Within	3.2E+08	55	5868710		
	Total	3.4E+08	57			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	1.6E+07	2	7776426	0.94	.40
	Within	4.7E+08	57	8251931		
	Total	4.9E+08	59			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	826942	2	413471	0.04	.97
	Within	6.5E+08	54	1.2E+07		
	Total	6.5E+08	56			

Table 15. Preferential looking to static stimuli as a function of stimulus order (boys)

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	2.1E+08	3	7.1E+07	1.67	.20
	Within	1.3E+09	31	4.2E+07		
	Total	1.5E+09	34			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	1.1E+-7	3	3759346	0.52	.67
	Within	2.2E+08	31	7209489		
	Total	2.3E+08	34			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	1.3E+07	3	4477017	0.48	.70
	Within	3.0E+08	32	9321004		
	Total	3.1E+08	35			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	1.3E+-7	3	4197129	0.35	.79
	Within	3.6E+08	30	1.2E+07		
	Total	3.7E+08	33			

Table 16. Preferential looking to moving stimuli as a function of stimulus order (boys)

Source		Sum of Squares	df	Mean Square	F	Sig.
Play pref	Between	8.6E+07	4	2.1E+07	0.72	.59
	Within	9.2E+08	31	3.0E+07		
	Total	1.0E+09	35			

Table 18. Preferential looking to static stimuli as a function of stimulus order (girls)

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	1.3E+08	3	4.3E+07	1.93	.16
	Within	3.8E+08	17	2.3E+07		
	Total	5.1E+08	20			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	6940019	3	2313340	0.49	.69
	Within	8.9E+07	19	4685538		
	Total	9.6E+07	22			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	1.9E+07	3	6307297	0.85	.48
	Within	1.5E+08	20	7408253		
	Total	1.7E+08	23			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	2.5E+07	3	8223306	0.81	.50
	Within	1.9E+08	19	1.0E+07		
	Total	2.2E+08	22			

Table 18. Preferential looking to moving stimuli as a function of stimulus order (girls)

Source		Sum of Squares	df	Mean Square	F	Sig.
Play pref	Between	2.4E+07	3	7903768	0.97	.43
	Within	1.5E+08	18	8122025		
	Total	1.7E+08	21			

Appendix Four

(Chapter Five)

A. Main Annova summary tables

B. Annova summary tables – the effect of successful gender labelling on preferential looking

C. Annova summary table – the effect of recognition of self on preferential looking

D. Correlation matrix – cross-domain stability

E. Annova summary tables – demographic details and order effects

A. Analysis of variance summary tables

Table 1. Preferential looking to self/other as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Self/other	3.5E+07	1	3.5E+07	5.10	.03
Self/other*sex	3.3E+07	1	3.3E+07	4.75	.03
Error	3.7E+08	54	6936310		

Table 2. Preferential looking to self/other.. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2.9E+09	1	2.9E+09	701.05	.00
Sex	21696	1	21696	0.01	.94
Error	2.2E+08	54	4097075		

Table 3. Preferential looking to same-/opposite-sex peers as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Peerpref	1007816	1	1007816	1.18	.28
Peerpref*sex	1.8E+07	1	1.8E+07	21.58	.00
Error	4.6E+07	54	852030		

Table 4. Preferential looking to same-opposite-sex peers. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2.7E+09	1	2.7E+09	985.19	.00
Sex	3354442	1	3354442	1.22	.27
Error	1.5E+08	54	2729802		

Table 5. Preferential looking to same-/opposite-sex peers as a function of sex and peer-picture pairing. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Pairing	2.3E+07	4	5654169	1.58	.18
Pairing*sex	2.0E+07	4	4909338	1.37	.24
Error	7.0E+08	196	3572776		
Peerpref	7.5E+07	1	7.5E+07	18.74	.00
Peerpref*sex	1.1E+07	1	1.1E+07	2.77	.10
Error	2.0E+08	49	3988893		
Pairing*peerpref	7.6E+07	4	1.9E+07	2.71	.03
Pairing*peerpref* sex	2.1E+07	4	5318913	.76	.55
Error	1.4E+09	196	6968473		

Table 6. Preferential looking to same-opposite-sex older child as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Childpref	34697	1	34697	0.04	.84
Childpref*sex	4242	1	4242	0.005	.95
Error	4.7E+07	53	878322		

Table 7. Preferential looking to same-/opposite-sex older child. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2.7E+09	1	2.7E+09	1076.87	.00
Sex	7604402	1	7604402	3.05	.09
Error	1.3E+08	53	2490352		

Table 8. Preferential looking to same-/opposite-sex toys as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Toypref	3.1E+07	1	3.1E+07	11.25	.001
Toypref*sex	3502112	1	3502112	1.27	.26
Error	1.5E+08	54	2750882		

Table 9. Preferential looking to same-/opposite-sex toys. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	4.0E+09	1	4.0E+09	1636.4	.00
Sex	77982	1	77982	0.03	.86
Error	1.3E+08	54	2453140		

Table 10. Preferential looking to same-/opposite-sex toys as a function of sex and pairing of toy stimuli. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Pairing	2.5E+07	4	6359832	2.20	.07
Pairing*sex	1.8E+07	4	4458231	1.54	.19
Error	5.7E+08	196	2891952		
Toypref	1.8E+07	1	1.8E+07	1.24	.27
Toypref*sex	1.5E+08	1	1.5E+08	10.72	.002
Error	7.0E+08	49	1.4E+07		
Pairing*toypref	6.4E+08	4	1.6E+08	11.93	.00
Pairing*toypref *sex	1.6E+08	4	4.0E+07	2.97	.02
Error	2.6E+09	196	1.3E+07		

Table 11. Preferential looking to same-/opposite-sex activities as a function of sex. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Playpref	1.0E+08	1	1.0E+08	4.34	.04
Playpref*sex	2.9E+09	1	2.9E+09	121.27	.00
Error	1.1E+09	53	4.4E+07		

Table 12. Preferential looking to same-/opposite-sex activities. Between subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1.3E+10	1	1.3E+10	1284.4	.00
Sex	205595	1	205595	0.02	.89
Error	4.8E+08	47	1.0E+07		

B.

Table 13. Preferential looking as a function of gender-labelling ability

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	1.9E+07	2	9578963	0.67	.52
	Within	6.2E+08	43	1.4E+07		
	Total	6.3E+08	45			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	7378285	2	3689143	1.75	.19
	Within	9.3E+07	44	2114055		
	Total	1.0E+08	46			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	1124372	2	562186	0.32	.73
	Within	7.5E+08	43	1749558		
	Total	7.6E+07	45			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	719777	2	359888	0.06	.94
	Within	2.6E+08	44	5911175		
	Total	2.6E+08	46			

Source		Sum of Squares	df	Mean square	F	Sig.
Play pref	Between	7.5E+08	2	3.8E+08	2.49	0.96
	Within	6.3E+09	42	1.5E+08		
	Total	7.1E+09	44			

C. Table 14. Preferential looking as a function of mirror self-recognition

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	2.6E+07	2	1.3E+07	0.83	.44
	Within	7.5E+08	48	1.6E+07		
	Total	7.8E+08	50			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	1751382	2	875691	0.37	.69
	Within	1.2E+08	49	2357399		
	Total	1.2E+08	51			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	972899	2	486450	0.29	.75
	Within	7.9E+07	47	1673489		
	Total	8.0E+07	49			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	4037233	2	2018616	0.37	.70
	Within	2.7E+08	49	5520420		
	Total	2.7E+08	51			

Source		Sum of Squares	df	Mean square	F	Sig.
Play pref	Between	1.8E+08	2	8.8E+07	0.57	.57
	Within	6.9E+09	45	1.5E+08		
	Total	7.1E+09	47			

D. Correlation matrix – cross domain stability (Pearson's Correlation Coeffcient)

	Pictorial self-recognition	Same-age peer preference	Older-child preference	Toy preference	Play preference
Pictorial self-recognition	1.00	.271	-.077	-.018	.213
Same-age peer preference	.271	1.00	.052	-.129	.274
Older child preference	-.077	.052	1.00	.010	-.117
Toy preference	-.018	-.129	.010	1.00	-.178
Play preference	.213	.274	-.117	-.178	1.00

E. Anova Summary Tables - demographic details and order effects

Table 15. Preferential looking as a function of parental employment

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	2.0E+07	4	4947356	0.31	.87
	Within	8.0E+08	50	1.6E+07		
	Total	8.2E+08	54			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	7328991	4	1832248	0.85	.50
	Within	1.2E+08	56			
	Total	1.3E+08	60			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	3296415	4	823854	0.46	.77
	Within	8.8E+07	49	1796428		
	Total	9.1E+07	53			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	2.6E+07	4	6476294	1.28	.29
	Within	2.8E+08	56	5072405		
	Total	3.1E+08	60			

Source		Sum of Squares	df	Mean square	F	Sig.
Play pref	Between	5.3E+08	4	1.3E+08	0.91	.47
	Within	7.6E+09	52	1.5E+08		
	Total	8.1E+09	56			

Table 16. Preferential looking as a function of the number and sex of siblings

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	3.9E+07	3	1.3E+07	0.87	.47
	Within	7.8E+09	52	1.5E+07		
	Total	8.2E+08	55			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	1.9E+07	3	6399993	3.51	.02
	Within	1.1E+08	57	1827197		
	Total	1.3E+08	60			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	4954380	3	1651460	0.96	.42
	Within	8.8E+07	51	1728554		
	Total	9.3E+07	54			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	4296966	3	1432322	0.28	.84
	Within	3.1E+08	57	5141289		
	Total	3.1E+08	60			

Source		Sum of Squares	df	Mean square	F	Sig.
Play pref	Between	5.7E+07	3	1.9E+07	0.13	.94
	Within	8.2E+09	56	1.5E+08		
	Total	8.3E+09	59			

Table 17. Preferential looking as a function of order of presentation of domains

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	3.3E+07	2	1.6E+07	1.11	.34
	Within	7.8E+08	53	1.5E+07		
	Total	8.2E+08	55			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	6799320	2	3399660	1.51	.23
	Within	1.2E+08	54	2259238		
	Total	1.3E+08	56			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	410000	2	205000	0.12	.89
	Within	9.3E+07	52	1782704		
	Total	9.3E+07	54			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	2.6E+07	2	1.3E+07	2.57	.09
	Within	2.8E+08	54	5163430		
	Total	3.1E+08	56			

Table 18. Preferential looking to static stimuli as a function of stimulus order (boys)

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	1.9E+07	3	6269208	0.40	.76
	Within	4.4E+08	28	1.6E+07		
	Total	4.6E+08	31			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	1.2E+07	3	3979735	2.77	.06
	Within	4.0E+07	28	1436903		
	Total	5.2E+07	31			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	8563153	3	2854384	1.39	.27
	Within	5.5E+07	27	2050874		
	Total	6.4E+07	30			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	1.8E+07	3	6002296	1.31	.29
	Within	1.3E+08	28	5499800		
	Total	1.5E+08	31			

Table 19. Preferential looking to moving stimuli as a function of stimulus order (boys)

Source		Sum of Squares	df	Mean Square	F	Sig.
Play pref	Between	1.0E+08	3	3.3E+07	0.93	.44
	Within	9.4E+08	26	3.6E+07		
	Total	1.0E+09	29			

Table 20. Preferential looking to static stimuli as a function of stimulus order (girls)

Source		Sum of Squares	df	Mean square	F	Sig.
Self-recogn	Between	1.8E+07	3	5980351	0.44	.73
	Within	2.7E+08	20	1.4E+07		
	Total	2.9E+08	23			

Source		Sum of Squares	df	Mean square	F	Sig.
Same-age peer pref	Between	2491506	3	830502	0.46	.72
	Within	3.8E+07	21	1825497		
	Total	4.1E+07	24			

Source		Sum of Squares	df	Mean square	F	Sig.
Older-child pref	Between	7332305	3	2444102	2.34	.12
	Within	2.2E+07	20	1091653		
	Total	2.9E+07	23			

Source		Sum of Squares	df	Mean square	F	Sig.
Toy pref	Between	3.6E+07	3	1.2E+07	2.18	.12
	Within	1.2E+08	21	5477788		
	Total	1.5E+08	24			

Table 21. Preferential looking to moving stimuli as a function of stimulus order (girls)

Source		Sum of Squares	df	Mean Square	F	Sig.
Play pref	Between	8.9E+07	3	3.0E+07	0.37	.78
	Within	1.5E+09	19	8.0E+07		
	Total	1.6E+09	22			

Appendix Five

(Chapter Six)

A. Main Annova summary tables

B. Sequence of development - summary information

A. Main Annova summary tables

Table 1. Preferential looking to self/other over time. Within subjects effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Age	.244	2	.122	6.71	.002
Age*sex	1.88E-02	2	9.42E-03	0.51	.60
Error	82	1.82E-02			
Selfrecogn	6.69E-02	1	6.69E-02	1.74	.19
Selfrecogn*sex	5.64E-03	1	5.64E-03	0.15	.70
Error	1.58	41	3.84E-02		
Age*selfrecogn	.20	2	9.99E-02	1.42	.25
Age*selfrecogn *sex	.20	2	9.92E-02	1.41	.25
Error	5.75	82	7.01E-02		

Table 2. Preferential looking to same-/opposite-sex same-age peers over time. Within subjects effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Age	1.46	2	.73	36.16	.00
Age*sex	5.50E-02	2	2.75E-02	1.37	.26
Error	1.89	94	2.01E-02		
Peerpref	1.02E-06	1	1.02E-02	0.00	.99
Peerpref*sex	.18	1	.18	25.04	.00
Error	.34	47	7.33E-03		
Age*peerpref	2.55E-02	2	1.27E-02	2.10	.13
Age*peerpref* sex	7.09E-02	2	3.54E-02	5.85	.00
Error	.57	94	6.05E-03		

Table 3. Preferential looking to same-/opposite-sex older children over time. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Age	.65	2	14.113	.00	.002
Age*sex	9.37E-03	2	4.68E-02	2.04	1.4
Error	2.06	90	2.29E-02		
Child pref	3.24E-03	1	3.24E-03	0.41	.52
Childpref*sex	2.54E-02	1	2.54E-02	3.24	.08
Error	.35	45	7.83E-03		
Age*childpref	4.20E-03	2	2.10E-03	0.24	.79
Age*childpref* sex	2.41E-02	2	1.21E-02	1.39	.26
Error	.78	90	8.69E-03		

Table 4. Preferential looking to same-/opposite-sex toys over time. Within subjects effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Age	.81	2	.41	43.91	.00
Age*sex	3.44E-02	2	1.72E-02	1.87	.16
Error	.85	92	9.22E-03		
Toypref	4.49E-02	1	4.49E-02	3.77	.05
Toypref*sex	3.08E-03	1	3.08E-03	0.26	.61
Error	.55	46	1.19E-02		
Age*toypref	3.85E-02	2	1.92E-02	2.46	.09
Age*toypref *sex	.14	2	7.12E-02	9.10	.00
Error	.72	92	7.83E-03		

Table 5. Preferential looking to same-/opposite-sex play activities over time. Within subjects effects.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Age	.74	2	.37	36.76	.00
Age*sex	2.94E-02	2	1.47E-02	1.46	.24
Error	.80	80	1.00E-02		
Playpref	5.61E-02	1	5.61E-02	1.53	.22
Playpref*sex	5.90	1	5.90	160.26	.00
Error	.1.47	40	3.68E-02		
Age*playpref	.24	2	.12	4.09	.02
Age*playpref *sex	.11	2	5.46E-02	1.90	.15
Error	2.3	80	2.88E-02		

B. Sequence of development - summary information

Domain	Sequence				Ordered cases	Disordered cases	Chi square
	000	001	011	111			
Self	2	4	13	6	25	19	n.s.
Baby faces	9	2	6	11	28	21	n.s.
Child faces	5	3	5	6	19	29	n.s.
Play	4	6	14	11	35	13	11.08 (p<.01)
Toys	12	2	1	22	37	5	24.38 (p<.01)