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The Emergence of Sex-Typed Toy Knowledge in Infancy

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Abstract

The Emergence of Sex-Typed Toy Knowledge in Infancy

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Sex-typed toy preferences have been clearly established by 18 months of age, while knowledge about the sex-typed aspects of toys has not been reported before approximately 35 months of age. However, previous studies are methodologically limited because procedures used to display sex-typed toy knowledge have required specific motor and verbal abilities (e.g., pointing, labelling) as well as child compliance. In the present study the sex-typed toy knowledge of fifty-eight 18- and 24-month-old infants was assessed using the preferential-looking paradigm, a more sensitive measure of knowledge in infancy with minimal task demands. Infants were seated in front of two computer screens. During the target trials, an identical picture of a sex-typed toy would appear on each screen for 5 seconds, accompanied by a gender neutral voice saying, "See my car (doll, truck, etc.)? That's my car!". Subsequently, pictures of a boy and a girl appeared with a gender neutral voice saying, "Look at me!". Control trials consisted of pictures of the children's faces without the preceding toys. Duration of looking time on the child faces was coded, with time at the child's face that 'matched' the preceding toy greater than the time on the face not associated with the toy indicating an awareness of the association of sex-typed

toys with gender. Results showed that as a group, the girls "correctly" associated the sex-typed toys with male and female faces by 18 months of age, while sex-typed toy knowledge was not evident for the boys in either age group. Individual classification of infants revealed that more than half of the girls displayed sex-typed toy knowledge, while this knowledge appeared to be emerging in the boys.

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Introduction

Gender is one of the most salient aspects of a child's social environment (Maccoby, 1988). While the fundamental means of determining gender is by looking at primary sex characteristics, children need not understand these primary differences to recognize that there are separate and distinct categories of male and female. The categories of male and female are defined largely by sex-role stereotypes, the culturally shared assumptions and expectations about sex differences in ability, personality, activities and roles (Weinraub & Brown, 1983). From birth, many boys and girls are adorned in 'gender appropriate' styles and colors. The fact that there are separate washrooms for boys and girls, that boys and girls are often instructed to line up separately, and that boys and girls may be encouraged to participate or engage in different activities, increases the saliency of gender as a social category. This male/female dichotomy that is conveyed by society inevitably influences young children as they develop an understanding of what it means to be a boy or a girl.

The motivation behind this cultural emphasis on discriminating between sexes is understandable if the adoption of sex-typed behavior, behavior that conforms to sex-role stereotypes, is healthy and beneficial to the child. However, the saliency of gender in our culture may also perpetuate sex-role stereotypes that are detrimental

and limiting to a child's development. What may be lacking from the developing child's increasing repertoire regarding gender is the knowledge that it is not so much behavior, hairstyle, and clothing, but biology that ultimately defines gender (Bem, 1989).

At one time, understanding the antecedents of sex-typed behavior was considered necessary information for the optimal socialization of boys and girls. It was assumed that the adoption of sex-typed behaviors was the mark of a psychologically healthy individual (Kagan, 1964). There has been a fundamental shift in value placed on the outcome in this process with the acknowledgement of possible cognitive and behavioral limitations associated with strict adherence to "appropriate" sex roles (e.g., Connor, Schackman, & Serbin, 1978). The impetus for this shift derives from the discovery of some negative consequences of sex typing, particularly for women (e.g., Bem, 1974; Broverman, Broverman, Clarkson, Rosenkrantz, & Vogel, 1970). It is probable that continuous participation in sex-typed activities may foster or maintain differences in skills and behaviors (Carpenter & Huston-Stein, 1980). For example, boys' superior abilities in visual spatial tasks have been linked, in part, to their greater exposure to toys that enhance these skills, such as building blocks. In fact, when both boys and girls in a first grade class were provided with training in visual spatial tasks, the superior

ability of the boys was no longer found (Connor, Schackman, & Serbin, 1978). Thus, regardless of the origin of boys' superior abilities in visual spatial tasks, given the opportunity to learn, girls performed equally as well as boys on the visual spatial tasks taught in the classroom.

Further support that early sex-typed activities may, in part, produce sex differences, is that females with "masculine" personality characteristics such as achievement orientation and independence frequently report playing with boys' toys and games in childhood (Crandall & Battle, 1970; Huston-Stein & Higgins-Trenk, 1978). These "masculine" personality traits are more highly valued than are stereotypically feminine attributes (Rosenkrantz, Vogel, Bee, Broverman, & Broverman, 1968). For example, in a study by Broverman et al. (1970) healthy women were rated by clinicians as differing from healthy men by being more emotional, less competitive, less adventurous, more easily influenced, less independent and more submissive. These "feminine" traits are generally less socially desirable than are the stereotypical male traits such as independence and assertiveness (Rosenkrantz et al., 1968).

With the accumulation of evidence in support of the possible detrimental effects of strict adherence to sex-role stereotypes, the study of the origin and timing of infants' sex-typed behaviors and knowledge are all the more important. Rudimentary ideas about the sex-typing of toys,

clothing, and activities develop sometime between 2 and 4 years of age (Weinraub & Brown, 1983; Weinraub, Clemens, Sockloff, Etheridge, Gracely, & Myers, 1984; Kuhn, Nash, & Brucken, 1978). Kuhn et al. (1978) found that as young as 2 years of age, children possessed knowledge of sex-role stereotypes. Some of the beliefs shared amongst this nursery school sample were that girls like to play with dolls, help mother, cook dinner, clean house, talk a lot, never hit, and say "I need some help." The children believed that boys like to play with cars, help father, build things and say, "I can hit you."

While research has shown the early emergence of sex-typed behavior and knowledge, an understanding of the relationship between the knowledge of sex-role stereotypes and behaviors, and the infant's enactment or preference for sex-typed activities is lacking. Sex differences in toy preferences have been regarded as one of the first expressions of gender roles in young children, making the study of the emergence of sex-typed toy knowledge an appropriate starting point in tracing the origins of sex-typed behavior (O'Brien & Huston, 1985). The earliest reported finding of sex-typed toy preference was in 10-month-old girls, but the ability had not yet emerged in boys (Roopnarine, 1986). However, notable is the fact that there were very few subjects in this study (i.e., only 4 boys and 6 girls in the 10 month old age group). The bulk of

research regarding toy preferences has shown that preferences emerge sometime before the second year of life. Serbin, Poulin-Dubois, Colburne and Stoll (1994) found no evidence of sex-typed toy preferences at 12 months of age, but at 18 months, these preferences were very strong. O'Brien and Huston (1985) also found that by 18 months of age, toddlers showed sex-typed toy preferences. Thus, based on these two recent studies, it would appear that the preference for sex-typed toys emerges reliably somewhere between 12 and 18 months of age.

With toy preferences occurring this early, the question arises as to when sex-typed toy knowledge emerges. Weinraub et al. (1984), using a task requiring children to sort pictures of sex-typed toys, found that although children showed sex-typed toy play in their youngest age group, 26 months, they did not seem to possess the knowledge that some toys are considered more appropriate for one gender than another. In fact, even at 36 months of age, only 29% (6/21) of the children in their sample indicated an awareness of sex-typed associations in children's toys. Likewise, Martin and Little (1990) found that less than half of the children in their sample at 35-45 months of age were able to correctly place a picture of a sex-typed toy with the picture of the child most likely to play with the toy. It was not until 45-52 months of age that the majority of children (73%) displayed sex-typed toy knowledge.

With sex-typed toy preferences evident at 18 months and sex-typed toy knowledge emerging around 36 months of age, it appears that the knowledge of the sex-typed characteristics of toys, as measured in past research, is not the initiator of sex-typed toy preferences. Previous research suggests that engaging in sex-typed toy play or displaying sex-typed toy preferences may be a distinct and separate aspect of sex-role development apart from the actual knowledge of sex-role stereotypes. Perhaps sex-typed toy play initially develops independently of the cognitive awareness of the sex-typing of toys (O'Brien & Huston, 1985). To date, the developmental course of sex-typed play behavior and sex-typed knowledge remains unclear.

Within the area of sex-role development, there is no universal consensus as to the relationship and impact of gender knowledge on sex-typed behavior. There are three main theories that attempt to account for the acquisition of sex-typed behavior, each emphasizing to differing degrees the sophistication of gender understanding required to result in sex-typed behavior: the 1) social learning 2) cognitive-developmental and 3) information processing theories.

In social learning theory (Mischel, 1970) the acquisition of gender knowledge is understood as a learning process based on operant conditioning and observational learning. A child's behavior becomes sex-typed based on the

reinforcement contingencies encountered, which vary depending on the gender of the child (Huston, 1983). For instance, a girl may be discouraged from 'rough-housing' with playmates, whereas a boy may be encouraged in this type of play.

Gender identity, a child's self categorization of himself/herself as male or female, and sex-typed behavior and characteristics are the outcomes of this learning process. In other words, gender-related knowledge is not required for the development of sex-typed preferences and the acquisition of sex-typed behaviors. Rather, this knowledge emerges after these sex-typed behaviors are already a part of a child's behavioral repertoire as a result of reinforcement contingencies.

According to social learning theory, sex-typed toy knowledge is the outcome of sex-typed toy play that originated from the shaping and reinforcement of 'appropriate' toy selection and activities. An infant's parent(s) play a primary role in the determination of the toys and opportunities to which he/she is exposed in the earliest months of life. Rheingold and Cook (1975) itemized the contents of boys' and girls' rooms with the assumption that differences in content would signify parental ideas about the appropriateness of toys and activities for each gender. Significant differences were found with boys' rooms containing more animal furnishings, education-art materials,

spatial temporal toys, and sports equipment, whereas the girls' rooms contained more dolls, doll houses and domestic objects. These findings concur with the results from a recent study which found that even before children can express their own preferences for play materials, sex-typed toys are generally selected by caretakers for their children (Pomerleau, Bolduc, Malcuit, & Cossette, 1990).

Parents play a role not only in the toys they choose to purchase for their infants, but also in their encouragement and reinforcement of sex-typed play. In an in-home study of 24 families (Fagot, 1978), parents rated rough and tumble play and aggressive behavior as more appropriate for boys, and doll play, dress up, and dance as more appropriate for girls. Boys were given significantly more positive responses when they played with blocks than girls, and parents gave more positive responses to girls than boys for play with dolls.

Yet, although parental influence and environmental factors undoubtedly serve to reinforce and thus punctuate the adoption of sex-typed behaviors, social learning theories provide little consideration to the child's own developing conceptualization of gender. The information a child receives from his/her environment regarding gender appropriate behavior may not always be consistent, yet it appears that children develop a concept of gender which allows them to classify and categorize gender-related

information (Fagot, 1985).

Essentially, in social learning theory, the adoption of sex-typed behavior is conceptualized as a set of behavioral responses. This mechanistic view of a child's developing concept of gender discredits what may be a more active role on the part of the infant in his/her gender role development. As a result, many social learning theorists have expanded this fundamentally behavioral approach to employ constructs representing the internal mental processes that mediate learning and behavior (Mischel, 1973; Bandura, 1977). Although the addition of cognitive components to social learning theory is a vital step forward, the mechanistic view of the infant espoused by social learning theorists continues to be unsatisfactory to a growing number of researchers who believe infants play a more active role in their gender-role development.

As a result, cognitive-developmental conceptions of gender-role understanding have become increasingly popular. Proponents of cognitive-developmental theory view behavior as secondary to thought in the acquisition of sex-typed behaviors. Gender identity and sex-role stereotypes are not the outcome, but preliminary and causal factors of sex-typed behavior. One of the main contributors to the cognitive view was Kohlberg (1966). Kohlberg believed that before children are aware of their own sex, they will not be particularly aware of gender-related information. It is

only when children recognize their own sex and are aware of its permanency, that they become motivated to determine the behaviors and activities appropriate for their particular gender. That is, an understanding of one's gender is the driving motivational force that initiates gender-role learning.

Although this cognitive-developmental approach to gender understanding has contributed greatly to contemporary approaches, it is not well supported empirically. According to Kohlberg (1966), gender constancy, the child's ability to maintain his/her gender in the face of transformations, is a prerequisite for gender knowledge. There is no clear evidence that this is the case. Some studies have found the attainment of gender constancy to be related to children's sex-typed preferences (Kuhn, Nash, & Brucken, 1978; Smetana & Letourneau, 1984), while others have not (Emmerich & Shepard, 1984; Fagot, 1985; Marcus & Overton, 1978). The relationship between gender constancy and the development of sex-role knowledge is also unclear, with studies both confirming and disconfirming any type of relationship (Kuhn et al., 1978; Levy & Carter, 1989).

As a result of the requirement of gender constancy as a prerequisite for gender knowledge, cognitive-developmental theories do not satisfactorily explain the emergence of sex-typed toy preferences. Kohlberg (1966) proposed that a complete understanding of gender as an unchangeable

attribute emerges gradually between the ages of 2 to 7 years, and that this understanding is necessary before a child is motivated to engage in 'gender appropriate' behavior. However, sex-typed toy preferences emerge within the second year of life, before infants have attained the sophisticated knowledge that their gender is constant.

The contemporary information processing theories of sex-role development appear to provide a more accurate account of infants' acquisition of sex-typed behavior and preferences as these theories are based on the reasoning that only a rudimentary understanding of gender is needed for the development of sex-typed preferences and behavior (Bem, 1981; Martin & Halverson, 1981). Information processing theories are linked to Kohlberg's cognitive development accounts in that both underline the importance of cognitive and motivational factors in early gender-role development. The difference lies in the fact that in Kohlberg's theory, children must first attain gender constancy before they become motivated to learn and master gender-appropriate roles. In information processing theories, collectively known as gender schema theory, the attainment of any one particular level of cognitive development is not a prerequisite to gender knowledge. The emphasis is on the child's readiness to respond to and categorize culturally sex-typed and prevalent behaviors and characteristics (Levy & Carter, 1989).

Children become increasingly aware that there are two categories of people, male and female, and that they fit into one of these categories. The primary construct used to organize incoming information is the schema, defined as a "cognitive structure consisting of a set of expectations or a network of associations that guide and organize an individual's perception" (Huston, 1983, p. 399). As the child's gender schema develops, he/she becomes aware of the characteristics that differentiate individuals in the male and female categories; which behaviors, clothes and activities are designated for girls and for boys. The child in turn becomes motivated to seek out and acquire those characteristics that characterize him/herself on the basis of category membership.

Rudimentary categories of male and female, as demonstrated by the ability to perceptually discriminate between the sexes, are apparent within the first year of life. It would appear, therefore, that infants develop gender schemata that are initially based on very basic gender-related concepts such as physical appearance. For example, research using the familiarization-novelty procedure has shown that infants can discriminate between male and female faces by 7 months of age (Cornell, 1974; Fagan, 1976; Fagan & Singer, 1979). Seven-month-olds have also been shown to habituate to faces of one gender, and continue to show the same response to other faces of the

same gender, but dishabituate to faces of the opposite gender (Leinbach & Fagot, 1986).

Levy and Haaf (in press) found that 10-month-olds formed categories based on objects that were associated with a particular gender. Infants were habituated to male faces paired with "masculine items" (e.g., hammer) and female faces paired with "feminine items" (e.g., frying pan). Looking times on novel male and female faces paired with the same items did not differ from the habituation trials, indicating that the infants had generalized the association between the faces and objects to new faces of the same gender. However, when a novel male or female face was paired with an object previously associated with the opposite gender, infants showed a novelty response (longer looking times) that did not differ from their response to completely unique test stimuli. Levy and Haaf concluded that 10-month-old infants are able to detect associations among attributes of social information based on gender-related categories.

If children form rudimentary male/female categories that serve to organize incoming information regarding gender within the first year of life, the question arises as to the impact of the increasingly sophisticated gender schemata on the infant's own behavior. What is evident from the review of the theories of sex-role development is that there is no universal consensus as to the relation between gender

knowledge and an infant's acquisition of sex-typed behavior. Yet, if an infant can form gender categories within the first year of life, and is developing a schema that organizes his/her conception of male/female categories, the question remains at what point would this schema begin to guide behavior.

Martin and Little (1990) found that only a rudimentary understanding of gender is needed before children begin to acquire sex-typed behavior and preferences, but that knowledge of these sex-typed preferences emerged much later. They had children place pictures of sex-typed toys beside the picture of a child who would be most likely to play with it, a boy or a girl. The criterion for passing was to correctly place the picture of the 4 masculine and 4 feminine toys on 7 out of eight trials. Forty percent of children in their youngest age group (35-45 months; N=16) passed this task. Children performed progressively better on this task with age, with 73% of children at 45-52 months of age (N=22) and 95% of children at 53-65 months of age (N=20) passing the task. According to these results, at around 3 years of age, less than half of the children in this study showed any sex-typed toy knowledge on this task.

Similarly, Etaugh and Duits (1990) found that the children in their study could not appropriately identify "boy's toys" and "girl's toys" until a mean age of over 31 months. While sex-typed toy preferences are clearly

established by 18 months of age, knowledge of the sex-typing of toys has not been shown to emerge until around 3 years of age. As a result, it appears that sex-typed toy knowledge, as measured in past research, cannot motivate or influence infants' sex-typed toy play as it has not been shown until more than a year after sex-typed toy preference emerges.

However, previous research assessing infants' sex-typed toy knowledge has used tasks involving labelling, pointing or sorting of stimuli. The measurement of infants' understanding of gender is therefore constrained by the infant's ability to label or display that knowledge within the methodology of a particular study. Indeed, infants may have gender-related knowledge at an early age, but lack both the knowledge of that knowledge themselves, as well as the ability to display that knowledge within the typical gender discrimination tasks (Fagot, Leinbach, & Hagan, 1986; Lewis & Weinraub, 1979). There are at least two plausible explanations for the discrepancy in past research between sex-typed toy preference and the acquisition of sex-typed toy knowledge. First, it may be that sex-typed toy knowledge has not yet been adequately assessed due to previous methodological constraints. Alternatively, while sex-typed toy knowledge may eventually influence the behavior, activity choices and preferences of children, it may be that these two aspects of sex-role development initially develop independently. The former explanation

must be explored before conclusions can be reached regarding the relationship between sex-typed toy play and sex-typed toy knowledge.

Methodological Limitations of Previous Research

One significant problem with previous research investigating infants' sex-typed toy knowledge is the understanding and compliance to directions required to perform most of the gender discrimination tasks correctly. In a study by Kuhn, Nash and Brucken (1978) children aged 2 - 3 years had to place either a male or a female doll into a sketched scene in response to a statement by the experimenter such as, "I like to play dolls". The scene would depict a doll and a doll house, and the child was to put either the male or female doll into the picture. In the study by Weinraub et al. (1984) children aged 26 - 36 months had to sort pictures of sex-typed toys into boxes labelled either 'men and boys' or 'ladies and girls'. Martin and Little (1990) had children place pictures of sex-typed toys beside the picture of a child to which the toy most likely belonged, a boy or a girl.

All of the above studies used tasks which involve motor ability and comprehension of instructions, thus precluding the investigation of sex-typed toy knowledge in younger infants. Likewise, discriminating between two pictures, and pointing to the picture as requested by the experimenter (i.e., boy's toy) requires cooperation and

motor ability on the part of the infant (Etaugh & Duits, 1990; Leinbach & Fagot, 1986).

What is needed are methods of investigating infants' gender related knowledge with minimum task demands, so that certain developmental abilities of the infant are not prerequisites for demonstration of gender knowledge. One such method used in the study of infant development is the preferential-looking method (Fantz, 1963). The rationale behind the use of this paradigm is that stable and reliable visual preferences are manifest in young children. Looking preferences emerge early relative to other behaviors. For example, although infants in the first few months of life cannot independently move themselves around a room, they can show systematic patterns of looking (Spelke, 1985). Observing infants' looking time at visual displays as a measure of preference and understanding keeps task demands to a minimum, and can be used as a means to assess infants' knowledge at ages not yet adequately assessed due to methodological limitations. Essentially, the only requirement is that the infant look at the displays, but no verbal or motor response such as pointing is required.

The concept of visual attention as a meaningful measure in infancy was first introduced by Fantz in the study of infant perception and visual acuity (Fantz, 1963; 1964). Fantz observed that infants would decrease attention to familiar patterns relative to novel ones. Use of

preferential-looking has since been implicated in infancy research in a wide variety of domains. Spelke (1976) adapted the use of visual preferences to study infant cognition in an intermodal task combining visual and auditory cues. Infants were presented with side by side visual displays accompanied by an auditory sound track corresponding with only one of the images. If the infants were capable of determining which visual display corresponded to the sound track, it was presumed that they would spend more time looking at that display. Infants as young as 4 months spent significantly more time looking at the film that corresponded to the sound than at the film that did not (Spelke, 1985).

The preferential-looking paradigm has also been utilized in the study of infants' word comprehension. Infants' abilities to follow instructions to look at a screen depicting a particular noun or verb has been shown reliably by 16 months of age (Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987; Reznick, 1990).

The use of the preferential-looking paradigm has recently been applied to the study of infants' understanding of gender categories (Poulin-Dubois, Serbin, Kenyon, & Derbyshire, 1994). Such an understanding would be demonstrated if infants reliably match male or female voices with corresponding male or female pictures. Infants in the Poulin-Dubois et al. study were seated in front of two

computer screens, and presented with computer digitized pictures of men's and women's faces. Either a man's or a woman's voice was presented simultaneously with the pictures. Over a series of trials, the looking times of each infant were recorded for the male and female faces. If the infant spent more time looking at the male faces when the male voice was presented, and the female faces when the female voice was used, it was believed to demonstrate the infant's understanding of the relation between the auditory and visual gender cues. This was found in 70% of the 9-month-olds and 83% of the 12-month-olds for the female pictures, and 50% of the 9-month-olds and 62% of the 12-month-olds for the male pictures.

Derbyshire (1992) expanded this study with a group of 18-month-olds, and included a labelling task whereby infants' abilities to match the labels 'lady' and 'man' with pictures of men's and women's faces was assessed. Results showed that the ability to match voices and faces precedes the ability to understand gender labels, as a significant proportion of 18-month-old infants were able to perform the matching task but not the labelling task. Thus it appears that infants acquire intermodal knowledge about gender before they are able to understand gender labels. This study adds further support to gender schema theory, as it appears that rudimentary gender categories are formed and guide behavior before gender labels are understood.

The application of the preferential-looking paradigm to various aspects of research on infant development, and the recent adaptation of this paradigm to the study of gender suggests that the preferential-looking paradigm is a promising tool to investigate infants' sex-typed toy knowledge. As previously described, past research has shown that toy preferences emerge before the second year of life, but sex-typed toy knowledge does not appear until around the third year of life. However, due to methodological limitations, sex-typed toy knowledge has not yet been adequately assessed in infancy. It may be that there is a smaller gap between sex-typed toy preferences and the acquisition of sex-typed toy knowledge. If children are forming a gender schema, it is probable that they would organize incoming information around what is considered gender-appropriate behavior (i.e., dolls are for girls; cars are for boys).

In a recent study, the preferential-looking paradigm was applied to the study of sex-typed toy knowledge in infancy in an attempt to clarify the relationship between sex-typed toy preferences and the knowledge of the sex-typed aspects of toys (Serbin et al., 1994). With minimal task demands, the preferential-looking paradigm should be a more sensitive means of assessing gender knowledge than methods used previously. Twelve, 18- and 24-month-old infants were presented with pictures of a boy or a girl and a

corresponding male or female voice saying, "Where's my toy? Find my toy!". These stimuli were followed by paired pictures of sex-typed toys (i.e., vehicles and dolls). Control trials were pictures of the toy pairs without the child photos or voice, and were used to determine infants' mean looking times at the sex-typed toys without the instructions. All stimuli were presented side-by-side on computer screens. Amount of time spent looking at each screen was used as an index of the infants' ability to "match" male and female sex-typed toys with the preceding faces and voices.

Results from this study showed that at 12 months, infants had a preference for looking at the dolls. This may be a manifestation of infants' interest and propensity toward the human face. At 18 months, there was a sex-typed toy preference, with the boys preferring the vehicles and the girls preferring the dolls. This sex-typed toy preference was still evident at 24 months. Infants did not however, show any association between sex-typed toys and the gender of the children "asking for" the toys in any of the three age groups. Infants' strong sex-typed preferences for the toys may have interfered with their scanning and matching of the toys to voices and children's faces. As a result, it is probable that the presentation of the sex-typed toys simultaneously resulted in the infants' own sex-typed toy preferences overriding their ability to display

the matching of the children's faces to the 'appropriate' sex-typed toys. Because of the strong sex-typed toy preferences, sex-typed toy knowledge at these ages could not be adequately assessed. An alternative method of presenting the stimuli was required in order to determine whether lack of knowledge at younger ages in previous studies was the result of methodological constraints, or an indicator that sex-typed toy preferences initially develop independently from and prior to sex-typed toy knowledge.

The Present Study

The main goal of the present study was to overcome the potential confound of strong sex-typed toy preferences that may have interfered with infants' display of sex-typed toy knowledge in the Serbin et al. study (1994). By altering the presentation sequence of sex-typed toys and children's faces, the sex-typed toys were no longer presented simultaneously. The same sex-typed toy appeared on both screens (doll or vehicle) with a 'gender neutral' voice saying, "That's my toy!" Following were pictures of a boy and girl on separate screens, with the same gender neutral voice saying, "Look at me!". Amount of looking time at the boy and girl faces was used as an index of the infant's ability to "match" the preceding sex-typed toy with the girl or boy face. If, in fact, infants' own sex-typed toy preferences had interfered with their display of sex-typed toy knowledge in the initial Serbin et al. study, then

with this new presentation of stimuli, display of sex-typed toy knowledge would be more probable. Without the pairing of masculine and feminine sex-typed toys simultaneously, infants' own sex-typed toy preferences could not interfere with their display of sex-typed toy knowledge.

The main purpose of the study was to clarify the relation between sex-typed toy preference and knowledge, thus two age groups, 18 and 24 months, were selected as they fall at and shortly after the time that sex-typed toy preferences are evident. While sex-typed toy preferences emerge by 18 months of age, sex-typed toy knowledge has not been documented until around 3 years of age. It was hypothesized that by using the preferential-looking paradigm, a more sensitive paradigm for infants with minimal task demands, gender knowledge would be found earlier than previously documented.

Method

Subjects

Subjects were recruited from birth lists provided by the Conseil de la Santé et des Services Sociaux du Montréal Métropolitain and from birth announcements in the Montreal Gazette. There were two requirements for subject participation: (1) no visual and/or hearing impairment; and (2) exposure to the English language as assessed by asking parents whether their children heard English on a consistent basis (i.e., at home or in day care).

A total of sixty-eight 18- and 24-month-olds participated in the study. Of the thirty-three 18-month-old infants who originally participated in the study, 5 subjects were eliminated due to side bias (n=4) and losing too many trials (n=1)(see criteria for subject elimination below). Of the thirty-five 24-month olds who participated in the study, 5 subjects were eliminated due to side bias (n=1), losing too many trials (n=3) and a multi-variate outlier (n=1). Thus, the final sample consisted of twenty-eight 18-month-olds who were designated as the younger age group (mean age = 18.8 months; age range = 17.15 months - 19.15 months), and thirty 24-month-olds who were designated as the older age group (mean age = 24.9 months; age range = 23.16 months - 25.5 months), equally divided into boys and girls.

The final sample consisted of fifty-eight infants from the two age groups. Ninety-five percent of the final sample

was Caucasian. Additional demographic information gathered revealed that 81% of the infants in the study were in daycare or playgroup at least one day of the week, and 55% of the sample had one or more siblings.

Stimuli

Fifty black and white photographs of 7 and 8 year old children were obtained from a local modelling agency. The photographs displayed the heads and shoulders of the fully clothed children. The children's faces were chosen on the basis of similar facial features, facial expression, hair color, and pose, in order to make the picture pairs equal in saliency and attractiveness. Six pairs of male and female children were selected from the sample of photographs by five adult judges who were familiar with the purposes of the present study. The photographs were then scanned onto a Macintosh II CI computer with an Abaton scanner and Adobe Photoshop software was used to make slight alterations to the photographs to improve clarity and maintain equal saliency within the child pairs.

Toys that were rated in previous studies as stereotypically male or female were chosen as stimuli. O'Brien and Huston (1985) found that out of a selection of feminine, masculine or neutral toys, male and female toddlers differed most in their preference for the doll, the truck and the tools. They suggested that this may be because the doll, truck and tools are the most clearly sex-

typed toys. In an attempt to have toys that would be distinctly masculine or feminine, dolls and vehicles (tractor, train, and cars) were chosen as the sex-typed toys in the present study. Professional photographs of the toys were taken and scanned onto the computer. There were six different dolls and six different vehicles used as stimuli.

Voice recordings were also used. Four children's voices were initially recorded saying the phrases, "Look at me!", and rated by 5 male and 5 female raters for gender neutrality. The MacRecorder Sound System Pro software was used to tape the voices, and the Soundedit program was used to manipulate the pitch of the voices in order to make them sound "gender neutral". Voices were presented in two different orders, with half of the judges hearing one of the orders. The raters heard each voice and indicated the gender of the person speaking (boy, girl, or either). The voice chosen for the experiment was rated as male by 4 of the judges, female by 4, and as 'could be either' by 2 judges (see Appendix A for voice rating protocol).

Apparatus

Infants were seated in a portable infant chair that clamped onto a table, with their caretaker seated directly behind them. A three-sided wooden black portable partition served to conceal the female experimenter and computer equipment from subjects (see Figure 1 for a diagram of the apparatus). The front panel of the partition was located

170 centimetres from the infant and measured 183 cm high and 196 cm wide. Square holes were cut in the panel 19.5 cm in height and 25.5 cm wide for the Macintosh computer screens. The screens were 59 cm apart, and equidistant from the infant, with 99 cm from the bottom of the panel to the bottom of the computer screen. A small hole for the video camera lens was located in the middle between the two computer monitors. Ten centimetres above the video lens was a blue light, used to redirect the infant's attention from any one screen to the centre during inter-trial intervals. Five centimetres below the video camera and 100.5 cm from the floor was another hole covered with black mesh for the speakers, enabling the sound to clearly emanate from behind the panel.

The side panels of the black partition were 183 cm in height and 196 cm in width. These panels were hinged to the front panel, and angled outward from the back wall for stability. These side walls were 196 cm apart at the location of the infant's seat.

All equipment used to run the experiment was concealed behind the black panel. Two Macintosh II VX computers were used with Macspeakers. A Sony video camera with a color monitor enabled the experimenter to view the infant's face clearly while recording. The entire program was run using a custom-designed computer program developed with HyperCard Macintosh software.

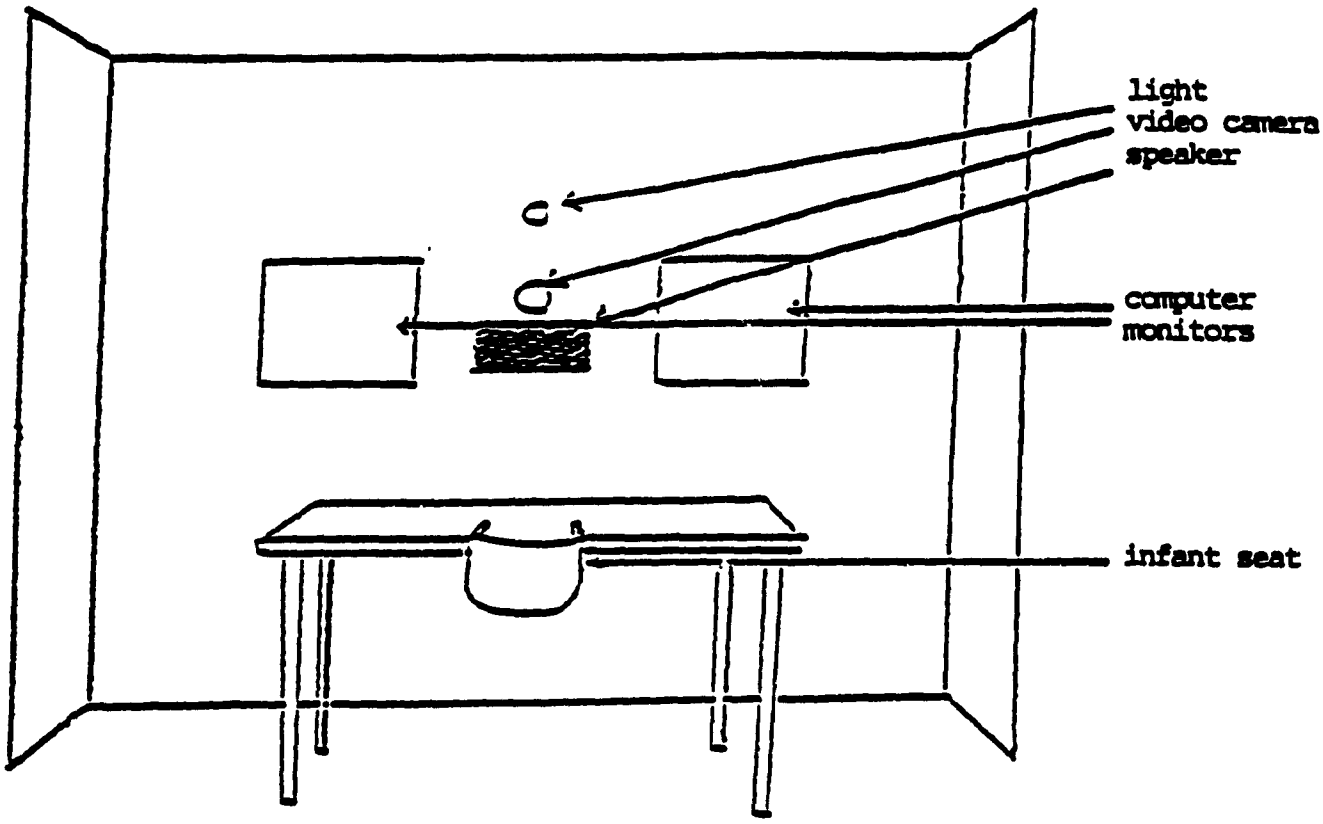

Figure 1 Diagram of the apparatus used for testing subjects

Procedure

The infant and caretaker were greeted by the experimenter and escorted to the waiting room, where the experimental procedure was explained. The caretaker was given a consent form to sign upon his/her visit, prior to participating in the session (see Appendix B). The caretaker was instructed not to direct the infant towards any particular screen, to avoid any possibility of bias. The caretaker was told however, that he/she could direct the infant's attention towards the screens in between trials when the blue light was on, and no pictures were present. An opportunity for clarification of the procedure or any questions was given prior to commencing the experimental session.

Following the explanation of the procedure and signing of the consent form, the infant and caretaker were seated in the testing room and the experiment began. The lights were dimmed throughout the experimental session in order to make the pictures more salient. The trials were presented in two parts, each lasting for approximately 4 minutes, in order to shorten the length of time the infant had to sit. Each part of the experiment commenced with one familiarization trial, a presentation of a chair and a shoe with a voice saying, "Look at the shoe. Find the shoe!". This trial was used to familiarize the infant with the procedure and testing room before commencing the experimental trials. The experimenter

had to reset the computers between the two blocks of trials, which took approximately 1 minute. At this point, caretakers were given the option of taking a short break if their child was restless. There was also a pause button that was used by the experimenter if the infant was particularly restless during the presentation of the trials, allowing time for the infant to reorient to the task before continuing. The pause button was rarely used in the present experiment, as most subjects seemed interested in the task. The entire testing session took approximately 10 minutes.

Design

There were two types of trials in the experiment: target and control trials. In the target trials, two identical pictures would appear of one of the sex-typed toys, one on each screen. These pictures appeared for a total of 5 seconds, and were accompanied by a gender neutral child's voice saying, "See my car (truck, train, dolly, or doll) That's my car!". These pictures were immediately followed by pictures of one of the pairs of children, with a boy appearing on one screen and a girl appearing on the other screen. This set of pictures remained visible for a total of 5 seconds, accompanied by the same gender neutral voice saying, "Look at me!". There were a total of 12 target trials, six trials with the boy as target preceded by a masculine sex-typed toy (vehicle), and six trials with the girl as target preceded by a feminine sex-typed toy (doll).

There were six different vehicles and six different dolls used in the target trials, each appearing only once in the entire experiment.

On control trials, the same pairs of children's faces as used in the target trials appeared for 5 seconds accompanied by a gender neutral voice, "Look at the people!". These control trials were used to provide a baseline looking time for comparison with target trials of the same picture pairs. Each of the six child pairs appeared twice, resulting in a total of twelve control trials.

Each part of the experiment consisted of six target trials alternated with six control trials, for a total of twelve trials per block and twenty-four trials in total. Target and control trials were separated by a five second interval during which the blue light was illuminated midway between the two computer screens. On the target trials each of the six child pairs appeared twice, in order to counterbalance: 1) the side on which the male and female photo appeared 2) the sex of picture that was used as the target for a particular pair. Likewise for the control trials; the six child pairs appeared twice to counterbalance the side of presentation of the girl and boy faces.

The side of presentation of the target picture and the order of boy and girl target trials were randomly assigned within the following criteria: 1) equal number of boy and

girl targets per side over the twelve target trials; 2) no more than two target trials of the same gender could occur sequentially. Appendix C outlines the presentation sequence.

Measures

Looking time at each screen was coded from the videotapes of the testing session. Infants' eye movements were coded using a custom designed coding program called Events (Ground Zero Software), allowing for recording of duration of looking time up to one tenth of a second. Looking times were coded at the right screen, the left screen, or off screen. The coder was not aware of which side the "target" picture was presented for any given trial, as she could only see the infant's face on the video. The dependent measure was the looking time in seconds at the 'boy' and 'girl' faces in the target and control trials.

Inter-Observer agreement

The primary investigator, who was familiar with the coding method prior to this study, coded all of the data. A research assistant then randomly chose 25% of the subjects and coded all of their data to check for reliability. A Pearson Product Moment correlation coefficient was computed for looking time. The correlation coefficient between coders' records of looking time across all trials was .90. This is comparable to previous studies that have utilized this coding program with reliability consistently found

around .90.

Trial and Subject Elimination

Trial Elimination Criteria: A trial was eliminated for an infant if he/she did not look at both screens during the trial. The rationale underlying this criterion is that in order to demonstrate gender knowledge in relation to the sex-typed toys, the infants would at first have to scan both the boy and a girl in order to choose which picture is associated with the preceding toy. Trials where the subject spent less than 1.25 seconds of total time on the left and right screens combined out of the possible five seconds time allotted (less than 25% of total time), were also eliminated. Too much time off screen would make the looking times less reliable. Eighteen percent of all trials were eliminated for the final sample of 18-month-old infants, and 12% of trials were eliminated for the 24-month-old subjects.

Subject Elimination: Infants required a minimum of two out of the six 'boy' and 'girl' target trials, and a minimum of four out of a possible twelve control trials to remain in the study. Subjects were also eliminated for side bias, which was defined as spending over 65% of total looking time across the twenty-four trials on either the left or right side. As described in the Subjects section, ten infants were eliminated from the study, five for side bias, four for losing too many trials, and one subject was a multivariate outlier.

Results

Once subject and trial elimination from the final sample were complete, descriptive statistics were conducted to observe the distribution of the data, and determine skewness and levels of kurtosis as well as the number of significant outliers. The assumptions of Analysis of Variance were not violated, and transformation of the data were not required.

A preliminary analysis was carried out on the data from control trials. The rationale for this analysis emanates from the literature that shows that infants tend to look more at pictures of same-sex than opposite-sex infants (Lewis & Brooks-Gunn, 1979). Because looking time at the boy and girl faces was the dependent measure in this study, it was necessary to ensure that infants' looking times were not influenced by a same-sex peer preference. Infants' visual fixation time on the paired boy and girl faces during control trials were used, where infants were instructed to "Look at the people", but were not expected to fixate preferentially on the male or female face. A 2(Infant Sex) x 2(Infant Age) x 2(Sex of Face) ANOVA with Sex of Face as the repeated measure and Age and Sex of Subject as between factors was used to determine if infants were biased by a same-sex peer preference (source table in Appendix D). No significant preference for the boy or girl faces was found. The mean looking times at the boy and girl faces are

presented in Table 1.

To examine the hypothesis that sex-typed toy knowledge would be shown at an earlier age with the preferential-looking paradigm, the infant's ability to match the sex-typed toys to the children's faces was determined globally among the two age groups, as well as on an individual basis. This allowed for both a perspective of the performance of the infants as a group, as well as an examination of the individual variability within the sample.

Group Patterns

To determine if the infants were able to match the sex-typed toys to the children's faces, a 2(Infant Sex) x 2(Infant Age) x 3(Condition: Match vs. Mismatch vs. Control) x 2(Sex of Face) ANOVA with Condition and Sex of Face as repeated measures and Age and Sex of Infant as between factors was used (source table in Appendix E). The dependent variable was the average looking time on the matched and mismatched faces on target trials and on the children's faces on control trials. Simple effects analyses were used to isolate the source of any significant interactions and t-tests were used as follow up tests.

The analysis revealed a main effect for Condition, F (2,108) = 10.48, p < .000. Infants spent more time on screen for the match and mismatch trials than control trials. An Infant Sex by Condition interaction qualified the condition main effect, F (2,108) = 3.73, p < .027.

Table 1

Infants' Mean Looking Time (in seconds) and Standard Deviations at Boy and Girl Faces on Control Trials.

	Face	
	Boy	Girl
18 Months		
Boy (n = 14)	1.89 (0.40)	1.95 (0.39)
Girl (n = 14)	1.92 (0.38)	1.90 (0.36)
24 Months		
Boy (n = 15)	2.04 (0.40)	2.00 (0.34)
Girl (n = 15)	1.91 (0.31)	2.08 (0.41)
Total (n = 58)	1.94 (0.37)	1.99 (0.37)

A simple effect analysis was used to investigate the nature of the Infant Sex by Condition interaction (source table in Appendix F). The performance of the infants across the match, mismatch and control conditions was assessed separately for each sex. For the boys, the main effect of Condition, F (2,54) = 4.08, $p < .022$, resulted from longer looking times on match and mismatch trials than control trials (match vs. control: $t(28) = 2.61$, $p < .014$; mismatch vs. control: $t(28) = 3.21$, $p < .003$). There was, however, no significant difference in looking times between the match and mismatch trials, $t(28) = -.24$, $p = .813$. For the girls, the main effect for Condition, F (2,54) = 10.53, $p < .000$, resulted from longer looking times on the match than the mismatch trials ($t(28) = 3.24$, $p < .003$), and match vs. control trials ($t(28) = 4.93$, $p < .000$), with no significant difference between the mismatch and control trials, ($t(28) = .59$, $p = .561$).

Due to the unexpected sex difference in ability to match toys with child faces, mean visual fixation time on target trials and across all trials were calculated for the boys and girls to explore the possibility that boys may have been less attentive relative to the girls, spending less time on screen and hence not adhering to the task. Mean looking time on target trials and across all trials (control and target trials combined) were similar regardless of gender. On target trials, boys were on screen for an

average of 2.11 seconds, and girls for an average of 2.09 seconds. For the control trials, boys averaged 1.97 seconds looking time, and girls averaged 1.95 seconds. Average total time on screen across all trials was 2.06 for the boys and 2.04 for the girls. Table 2 presents the means and standard deviations for these data. Furthermore, boys and girls did not differ substantially on the number of target trials that were usable after the trial elimination criteria were applied. The mean number of target trials was 10.76 for the boys and 11.31 for the girls.

There were no age effects, indicating no statistically significant difference in performance between the 18- and 24-month-old age groups. Mean looking times of the 18- and 24-month-old infants separately and combined for the total sample across the match, mismatch, and control conditions are presented in Table 3.

Individual Patterns

To assess individual differences in ability to associate sex-typed toys and children's faces, the data were assessed on a trial by trial basis for each infant. Infants were classified as 'Match' or 'Mismatch' depending on their looking time at the children's faces across the target trials. Infants were considered to reliably associate sex-typed toys with gender if they looked at the child's face that matched the preceding toy for 55% or more of their total time on screen on at least 50% of the target

Table 2

Mean Looking Time (in seconds) and Standard Deviations for the Target and Control Trials as a Function of Sex.

	Target *M* (*SD*)	Control *M* (*SD*)	All Trials *M* (*SD*)
Total Sample			
Boy (*n* = 29)	2.11 (0.25)	1.97 (0.30)	2.06 (0.26)
Girl (*n* = 29)	2.09 (0.25)	1.95 (0.28)	2.04 (0.24)

Table 3

Mean Looking Time (in seconds) and Standard Deviations for the Match, Mismatch and Control Trials.

	Condition		
Age	Match M (SD)	Mismatch M (SD)	Control M (SD)
18 Months			
Boy (n = 14)	2.14 (0.30)	2.13 (0.45)	1.92 (0.34)
Girl (n = 14)	2.12 (0.26)	1.93 (0.38)	1.91 (0.27)
Total (n = 28)	2.13 (0.28)	2.03 (0.42)	1.91 (0.31)
24 Months			
Boy (n = 15)	2.08 (0.29)	2.12 (0.24)	2.02 (0.25)
Girl (n = 15)	2.25 (0.32)	2.03 (0.23)	2.00 (0.28)
Total (n = 30)	2.17 (0.31)	2.08 (0.23)	2.01 (0.26)
Total Sample			
Boy (n = 29)	2.11 (0.29)	2.12 (0.35)	1.97 (0.30)
Girl (n = 29)	2.19 (0.30)	1.98 (0.31)	1.94 (0.28)
Total (n = 58)	2.15 (0.30)	2.05 (0.34)	1.96 (0.29)

trials. These infants were classified as 'Match'. While itwas not expected that infants possessing sex-typed toy knowledge would look reliably longer at the mismatched face, consistent patterns of looking at the mismatched face more than the matched face were also classified. Infants that looked at the mismatched face 55% of the time or more on at least 50% of the target trials were classified as 'Mismatch'. Finally, infants who did not fall into either of these two groups due to approximately equal looking time on screens during target trials were classified as 'Other'. Table 4 presents the percentages of infants falling within these categories as a function of Sex and Age.

The individual patterns revealed that the ability to match the toys and faces was apparent in 59% (17/29) of the sample of girls according to the individual classification criteria. While it appeared from the group analysis that boys lacked sex-typed toy knowledge at 18 and 24 months of age, 38% (11/29) of the boys were classified in the 'Match' category using the individual patterns. The number of infants in the 'Mismatch' category did not vary for each gender; (17% for both boys and girls (5/29)). Forty-five percent of the boys (13/29) and 24% of the girls (7/29) were classified as 'Other', displaying no consistent looking patterns at matched or mismatched faces.

Table 4

Percentage of Infants Spending 55% or More Looking Time on the Matched or Mismatched Face or on Neither Face on 50% or more of the Target Trials.

	Boy			Girl		
	Age (months)			Age (months)		
	18	24	Total	18	24	Total
Match	36% (5)	40% (6)	38% (11)	57% (8)	60% (9)	59% (17)
Mismatch	21% (3)	13% (2)	17% (5)	14% (2)	20% (3)	17% (5)
Other	43% (6)	47% (7)	45% (13)	29% (4)	20% (3)	24% (7)

Discussion

In the present study the hypothesis that sex-typed toy knowledge would be found earlier than previously documented using the preferential-looking paradigm was supported for the girls. More than half of the girls correctly 'matched' sex-typed toys with the child faces by 18 months of age. Previous research had not found any evidence of sex-typed toy knowledge until around the third year of an infant's life (Weinraub et al., 1984; Martin & Little, 1990; Etaugh & Duits, 1990). Toy preferences, however, emerge sometime between 12 and 18 months of age (O'Brien & Huston, 1985; Serbin et al., 1994). The present findings indicate that girls may acquire the knowledge of the sex-typed aspects of toys around the same time as sex-typed toy preferences emerge.

The finding that girls appeared to have made an association between toys and gender by 18 months of age suggests that they are 'assimilating' information about the defining activities and behaviors that characterize maleness and femaleness by the middle of the second year. Sex-differentiated toy play is one of the earliest expressions of gender roles in young children. The current results suggest that the foundations for sex-typed behavior are probably in place by the end of the second year, at least for girls.

Support for the hypothesis that sex-typed toy

knowledge would be found earlier with the preferential-looking paradigm indicates that this paradigm is a promising tool for the study of sex-role development in infancy. The finding that sex-typed toy knowledge is emerging within the second year of life supports a gender schema theory of sex-role development; that sex-typed preferences and behavior are possible with only a rudimentary understanding of gender. Evidence for sex-typed toy knowledge using the preferential-looking paradigm was found more than a year earlier than in past research, indicating that previous methods of assessing sex-typed toy knowledge have underestimated infants' abilities. Application of the preferential-looking paradigm to address different aspects of sex-role development previously assessed may be useful in order to determine the validity of this paradigm within related aspects of gender development, as well as provide infants with the opportunity to display their knowledge using a procedure with minimal task demands.

An unexpected finding from the present data was the sex difference in the acquisition of sex-typed toy knowledge. Unlike the girls, the majority of boys at 18 and 24 months of age were unable to match the sex-typed toys to the gender of the child most likely to possess the toy. However, classification of infants on an individual basis revealed that 59% of the girls and 38% of the boys were consistently looking at the child's face that 'matched' the preceding

sex-typed toy. It appears, therefore, that sex-typed toy knowledge is emerging in both the boys and girls, with more girls in the sample displaying this knowledge. Further research is necessary to substantiate the apparent sex difference in this study; the present findings are based on one sample of a relatively small number of infants and this is not a sufficient basis from which to conclude that boys and girls differ in the rate of acquisition of sex-typed toy knowledge.

At the same time, the present findings suggest that girls may acquire sex-typed toy knowledge earlier than boys, a finding in accord with previous research showing similar patterns of acquisition in gender-related behavior/concepts. For example, Derbyshire (1992) found that at 18 months, half of the girls in her study understood the gender labels 'lady' and 'man' as applied to male and female models, whereas less than one quarter of boys displayed this knowledge. Likewise, Thompson (1975) found a sex difference in gender labelling and early sex-role development. A 'self-sort test' was included in Thompson's study in which the infant was asked to sort two pictures of his/herself and other children into the appropriate boxes for 'boys' or 'girls'. At 24 months of age, boys were sorting randomly whereas girls were not. At 30 months boys were significantly poorer than girls at sorting their own pictures.

Sex differences have also been found in the acquisition of genital knowledge. Bem (1989) assessed genital knowledge and gender constancy in a sample of preschool children aged 3-5 years. She found that the girls in her sample acquired this knowledge prior to boys. Three year old girls had significantly more genital knowledge than boys at age 3, and as much genital knowledge as both boys and girls at age 5. Thus there appears to be a different pattern of acquisition of genital knowledge for girls and boys; girls acquire this knowledge early whereas boys increase in genital knowledge with age. Girls may possess genital knowledge earlier than boys because they have more of an opportunity to learn about boy's genitalia as the penis is external and more visible than the vagina. Even so, the females in this study also understood at an earlier age that when a picture of a boy or a girl toddler was dressed in opposite-sex clothing, the gender of the child remains invariant (i.e., the girls were also capable of "conserving" gender across changes in appearance).

Preference for same-sex peers is another area that differs according to gender. In a study of the emergence of same-sex preferences among preschool children, La Freniere, Strayer, and Gauthier (1984) found that same-sex associations increased as a linear function of age, with girls preferring same-sex peers earlier than boys. Twenty-seven-month-old girls directed over twice as many

affiliative acts toward same-sex peers (68%) than opposite-sex peers (32%). In the age period investigated, from 27 to 66 months of age, this preference did not increase, but plateaued at a fairly constant rate of 65%. In contrast, boys showed a steady increase in same-sex preference over this age range. At 27 months, boys did not show a significant preference for same-sex peers. This preference became increasingly prevalent at 36 and 48 months, and by 66 months, boys directed 75% of their activity towards same-sex peers. Thus, although girls' preferences for same-sex peers emerge earlier, it appears that in the older age group, boys eventually surpass girls in degree of same-sex preference.

The above studies outline patterns of acquisition for gender-related knowledge that differ based on gender. Girls acquire genital knowledge, gender labels, and same-sex peer preference earlier than boys, whereas boys show a somewhat delayed acquisition relative to girls which increases with age. Although these patterns warrant confirmation in further research, it is interesting that over different domains of gender-related knowledge, boys seem to develop this knowledge at a later stage than girls. Perhaps a similar pattern occurs with sex-typed toy knowledge, with girls acquiring this knowledge earlier than boys.

Contrary to what is expected with a developmental progression of knowledge with age, there were no significant age differences in the ability to associate sex-typed toys

with gender from 18 to 24 months of age. Individual classification of infants revealed that the numbers of boys and girls classified as 'Match' from 18 to 24 months differed only by one infant for each gender. A limitation of the present study was that the same infants were not used for both age groups. Information gathered longitudinally would be useful to compare infants' performances on the preferential-looking paradigm across time in order to assess both intra-individual changes and inter-individual variation in sex-role development (Trautner, 1992). It may be that a portion of the infants failing to match toys and faces at 18 months would display this association at 24 months. Determining what factors differentiate those who display knowledge at early ages and those who do not would provide useful insights into the development of gender understanding in infancy.

Age ranges that follow a 'normal' developmental progression are outlined for certain developmental milestones in infancy such as motor development and language acquisition. Variability within these age ranges is expected as part of normal development. Likewise, that not more of the current sample attained the ability to match by 24 months may be due to variability in sex-role development in infancy. It would be highly unlikely that infants in any particular sample would acquire an ability precisely within the same period, especially if that ability is emerging.

For instance, Fagot, Leinbach, and Hagan (1986) found that the ability to apply gender labels by pointing to named pictures varied in onset from as early as 24 months to as late as 40 months.

What accounts for early or late acquisition of gender-related concepts is unclear, but undoubtedly there are multiple factors. Leinbach and Fagot (1986) found that early labellers engaged in more sex-typed toy play, and parents of infants who became early labellers reacted with more positive and negative responses to their children's participation in sex-typed toy play at 18 months of age. By 27-months of age, parents of early and late labellers were both responding similarly in promoting and rewarding 'sex-appropriate' toy play. Results vary, however, as Weinraub et al. (1984) found no relation between various parental attitudes such as parents' sex-typed personality characteristics, attitudes toward women and amount of time spent performing sex-typed behavior within the child's presence and children's sex-role development (Weinraub et al., 1984).

To understand the differences between infants who display sex-typed toy knowledge and those who do not, it would be necessary to systematically gather information which may contribute to earlier acquisition of sex-typed knowledge. Gathering data on infants' exposure to various sex-typed toys, the gender of and amount of contact with

siblings, and a measure of parental attitude toward sex-typed behavior all may be factors that add to our understanding of variability in infants' awareness of sex-typed behaviors. Continued research in the area of sex-role development is necessary to more clearly understand what factors contribute to infants' acquisition of sex-typed toy knowledge.

While there did not appear to be developmental changes in regards to the number of infants who had acquired sex-typed toy knowledge from 18 to 24 months of age, sex-typed knowledge does change both qualitatively and quantitatively with age. The acquisition of sex-typed knowledge should not be conceived as an absolute 'all or none' phenomenon that, once attained, remains invariant. Martin, Wood and Little (1990) recently proposed a three stage model of acquisition of gender stereotyped components. The majority of past research, including the present study, has assessed whether infants associate males or females with various toys, jobs, or physical characteristics. This is the primary level of stereotyped knowledge; the association of a link between gender and specific gender-related information (i.e., boy - plays with cars, woman - wears a dress). The second level of knowledge in this model is the ability to associate information within the domains of "masculinity" and "femininity". By knowing a characteristic about an individual in one content domain, inferences are made to

other aspects within the same domain. For instance, a child may assume a woman wears a dress and wears high heels (clothing), or that a man is assertive and is independent (personality). Finally, the most sophisticated form of stereotyped knowledge involves making associations across different content domains such as knowing a person wears a dress and inferring that they are nurturant and like to cook. The latter two stages of stereotyped knowledge are more cognitively complex as they are based on inferences requiring the integration of multiple pieces of information.

The present study as well as prior research has affirmed that infants at early ages have developed the first level of stereotyped knowledge, rudimentary associations within a content domain (e.g., girl - doll). Martin et al. (1990) found that children in their study began to move to the second stage of stereotyped knowledge between 4 to 6 years of age, but these associations were strongest for a child's own gender. By 8 years of age, children have moved to the third stage where they associate information between content domains as well as learned the associations relevant to the opposite gender.

The Martin et al. (1990) study reveals a developmental progression of the quality of the association between gender and different stereotyped components. That stereotypes also change quantitatively with age has also been established (Martin, 1989). This follows from the developmental

progression in sophistication of sex-role knowledge; as more complex links between and within different domains of "masculinity" and "femininity" are made, sex-role stereotypes increase. Thus as a child's gender schemata become more elaborate with time, more complex associations between gender and behavior and activities are possible. Tracing the development of stereotyped knowledge to more complex levels whereby children infer that boys or girls may not only prefer certain toys, but also possess certain defining personality traits and behaviors is necessary in order to attain a more complete understanding of sex-role development.

It is likely that the preferential-looking paradigm will continue to make important contributions to the understanding of rudimentary levels of sex-typed knowledge. More sophisticated levels of stereotyped knowledge that are acquired in preschool and school age children will require different methodology. The preferential-looking paradigm is most effective in studying infant development as it uses visual fixation as a measure of understanding, whereas verbal and motor responses may more adequately assess sex-typed knowledge of older children. Despite the contributions of the preferential-looking paradigm to the study of gender, there are some limitations in the use of this paradigm to study infant development.

Limitations of the Preferential-Looking Paradigm

This study demonstrates the effectiveness of the preferential-looking paradigm in assessing gender knowledge in infancy. Gender knowledge of sex-typed toys was found in the girls considerably earlier than previously documented. However, there are also limitations to the preferential-looking paradigm. The measure used in the preferential-looking paradigm is duration of looking time at a particular stimulus. Significant results from an infant's pattern of looking over a series of trials indicate that the infant understands or is searching for something in particular, and not randomly gazing at the stimuli. However, interpreting negative results is problematic. It appears that 41% of the girls from this particular sample and 62% of the boys were not displaying sex-typed toy knowledge. One cannot say with certainty that negative results translate into lack of knowledge on behalf of the infant. However, because mean time on screen during target trials as well as number of trials eliminated is virtually equivalent for the male and female infants in this study, sex differences cannot be attributed to differences in attention to the task.

An alternative explanation for the lack of sex-typed toy knowledge as displayed by infants classified individually in the 'Mismatch' and 'Other' categories is that the task was too complex for a certain proportion of infants in each age group. It could be argued that the task

may not be presented in a manner that would allow the infant to demonstrate his/her knowledge. As a result, it appears that while the preferential-looking paradigm is a promising and innovative approach to the study of sex-role development with fewer task demands than previous methods, it may also present task demands that are beyond the abilities of some infants.

It is also difficult to interpret the knowledge of the infants within the 'Mismatch' category. They are showing a systematic pattern of responding, but whether 'Mismatch' is a meaningful category and what it means presents difficulty. It may be that infants falling into the 'Mismatch' category were aware of the sex-typing of toys, and consistently spent more time gazing at the mismatched face because it was 'unexpected' in relation to the preceding toy. Within habituation paradigms, this is indeed the expected response; that infants will look at an object or event that is novel or surprising in preference to a familiar or expected event (e.g., Baillargeon, 1994).

The present task of 'matching' a sex-typed toy with the appropriate face also contains an 'unexpected' event; a picture of a child that does not correspond with the sex-typed toy, accompanied by a picture that matches the toy. However, the task in this study differs from the typical habituation experiment in that there are not a number of identical trials followed by a novel event, but a series of

trials where an infant is to bring his/her own knowledge from previous experience to the task. If the infant adheres to the instructions, "See my car? That's my car. Look at me!", then the infant should look at the face that 'matches' the preceding sex-typed toy. As only 17% of infants were classified as 'Mismatch', it is most likely that this is indicative of a lack of understanding of the task rather than any real demonstration of sex-typed toy knowledge. That the 'Mismatch' category may not be a demonstration of sex-typed knowledge is supported by the fact that when the criteria of looking time at a particular face was set at 55% or more of total time on target as opposed to the more lenient criteria used in past research (50% or more), the majority of trials eliminated for not meeting this criterion were mismatch trials (Poulin-Dubois et al., 1994).

It appears, therefore, that on trials where infants were gazing longer at the mismatched face, looking times were differing by only tenths of a second from time spent on the matched face. With the criteria of 55% or more of total looking time, trials showing only 'marginal' differences in time spent on either the match or mismatch face were eliminated. As a result, looking at the mismatch face on most trials appears to be a similar response to that of infants in the 'Other' category; representative of nearly equal times on matched and mismatched faces showing either lack of understanding of the task, or lack of ability to

associate toys and gender.

Future Directions

As research continues in the area of sex-role development in infancy, it is becoming clearer that different aspects of sex-role development are acquired at different rates, and that these rates may vary depending on the gender of the infant. In the present study, sex-typed toy knowledge was apparent in 18-month-old girls, but not in the majority of boys at either 18 or 24 months of age. While previous studies have also shown a later acquisition of gender-related concepts/behavior in boys, further research is necessary before conclusions can be reached regarding the apparent sex difference in acquisition of sex-typed toy knowledge.

The present study has helped to pinpoint the probable age of onset of sex-typed knowledge, and narrow the gap between sex-typed toy preferences and knowledge. However, the sequence and relation of sex-typed behavior and knowledge is still unclear. A younger age group is required in order to determine exactly how early sex-typed toy knowledge and preference emerge, and to better outline the developmental sequence in acquisition of sex-typed behavior and knowledge. Toy preferences emerge between 12 and 18 months of age, and sex-typed toy knowledge, at least in girls, was evident for more than half of the sample by 18 months of age. Further delineation of the ages of emergence

of toy preferences and knowledge will help in understanding the developmental sequence of these aspects of sex-role development.

Use of the preferential-looking paradigm could be strengthened methodologically in future research by adapting the paradigm for use with multiple responses in addition to visual fixation. While one of the benefits of the preferential-looking paradigm is the minimal task demands, use of multiple responses allow more flexibility for individual differences (Colombo & Mitchell, 1990). By capitalizing on the visual modality, other information may be lost that may enhance or even strengthen infants' responses to the stimuli presented. For instance, facial expression such as smiling, vocalizations such as cooing, or gestures such as pointing all may serve to clarify the infant's response to the stimuli presented. While it may be more difficult to code and quantify these latter responses, multiple response measures are more sensitive to individual variation within infancy, and allow for responses in more than one modality.

If sex-typed toy preferences are clearly shown to emerge before the infant is consciously aware of the sex-typed aspects of toys, this raises the question as to the origin of the sex-typed toy preference in the first place. Many parents are choosing to promote a 'gender neutral' environment for their infants, providing a variety of toys

regardless of gender. However, anecdotal responses from some of the parents that participated in the present study revealed that regardless of the toy selection available, boys seemed to gravitate to the cars and girls to the dolls. It may be that on some level, boys and girls are predisposed to sex-typed toy preferences due to the inherent characteristics of the toys.

Boys may be attracted to the toys that are mobile, and thus more suited to their active play (DiPietro, 1981). Perhaps it is not the toy per se, but the specific characteristics of the toy that motivate an infant's toy selection. There is some support for this speculation. Eisenberg, Murray and Hite (1982) investigated 3 and 4 year old children's reasoning regarding sex-typed toy choices. They found that virtually no sex-role reasoning was used to justify children's own toy choices, but rather they used reasoning relating to what a toy did (action-orientated reasons), specific characteristics of the toy, or association of the toy with a significant other in their life. However, when justifying toy choices for other children, considerable amounts of sex-role reasoning were used. As a result, it can be concluded that a child's own sex-typed toy preference is not necessarily a conscious attempt to engage in 'gender-appropriate' toy play. Indeed, if sex-typed toy preferences emerge before sex-typed toy knowledge, then toy preference and toy knowledge may develop

independently.

With sex-typed toy knowledge emerging prior to 2 years of age, it is clear that Kohlberg's cognitive-developmental theory (1966) requiring the attainment of gender constancy before sex-typed toy knowledge develops is inaccurate. Gender constancy emerges gradually between 2 - 7 years of age, and aspects of sex-typed knowledge are acquired prior to this time. It is likely that predisposition towards certain styles of play, socialization, and cognitive factors may serve to shape a child's sex-typed behavior to varying degrees at different times in a child's development. This being the case, then all theories of sex-role development have a part in explaining the child's acquisition of gender concepts and behaviors. Perhaps predisposition and early socialization result in an infant's selection of sex-typed toys, which is later sustained by continually elaborated gender schemata that serve to categorize male and female behavior and guide infants' activities.

Conclusions

To the extent that the adoption of sex-typed behavior limits or suppresses an infant's individual strengths, abilities, and aspirations, there should be effort towards making gender a less salient and influential aspect of an infant's environment (Weinraub & Brown, 1983). It is precisely because gender is so salient that parents, teachers, and significant others in a child's life often

have very definite views as to what constitutes appropriate behavior, activities and occupations for boys and girls.

The present study has contributed to our understanding of sex-role development by helping to pinpoint the onset of sex-typed toy knowledge through the use of the preferential-looking paradigm. Sex-typed toy knowledge was evident in the majority of girls, and appeared to be emerging among the boys. Sex-typed toy preferences may be multiply determined and develop quite independently of a cognitive awareness of the gender appropriateness of toys, which may influence and guide behavior at a later stage. Future research will help to establish the relative contributions of the biological, social, and cognitive aspects that may initiate and sustain sex-typed behavior, and further delineate the relationship between sex-typed behavior and knowledge.

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Appendix A

Voice Rating Protocol

Appendix A

Gender of Voice Ratings

You will hear a voice say the phrase "look at me". After each voice circle whether you think it is a boy or a girl speaking.

1) Boy Girl Uncertain

2) Boy Girl Uncertain

3) Boy Girl Uncertain

4) Boy Girl Uncertain

Appendix B

Parental Consent Form

PARENTAL CONSENT FORM: TOY STUDY

Infant's name:_____ Birth date:_____
mth/day/yr

Gender: M / F Exact gestational period: _____

Mother's name: _____ Occupation:_____

Father's name: _____ Occupation:_____

Mailing Address:_____

_____

Telephone: Home:_____ Work:_____

Language used at home: _____

Does your child have any siblings? Yes / No

If yes, how many brothers:_____ Ages:_____

sisters:_____ Ages:_____

We are interested in the kinds of toys your child plays with.

What are your child's favourite toys? _____

_____

Is your child exposed to other toys outside of the home? (e.g. play group, day care, playing with friends etc.) Yes / No

If so, how many days a week? _____

The purpose of this research is to examine gender concepts in young children. Your child will be shown pictures of vehicles or dolls and will hear a voice saying, "See my truck (doll, car, etc...). That's my truck (doll,car, etc...)" Then a girl and a boy will appear on screen and your child will hear the voice say "Look at me". We will be videotaping your child's eye movements during the testing session to see how long your child looks at each picture. All data collected will be kept confidential.

_____
Lisa Serbin, Ph.D.
Professor of Psychology

_____
Diane Poulin-Dubois,Ph.D.
Assistant Professor

_____
Christina Anglin
Research Assistant

_____
Karen Colburne, B.A.
Graduate Student

The nature and purpose of this research have been satisfactorily explained to me, and I agree to allow my child to participate. I understand that we are free to discontinue participation at any time, and that the investigator will gladly answer any questions that might arise during the course of the research.

_____ _____

Signature of Parent Date

I would be interested in participating in a later study yes/no

Appendix C
Presentation Sequences

Appendix C

TRIAL#	LEFT SCREEN	RIGHT SCREEN
	v1	v1
1.	G6	**B6**
2.	b2	g2
	d1	d1
3.	**G5**	B5
4.	g6	b6
	v2	v2
5.	G1	**B1**
6.	b5	g5
	d2	d2
7.	**G4**	B4
8.	g1	b1
	d3	d3
9.	B3	**G3**
10.	b4	g4
	v3	v3
11.	**B2**	G2
12.	g3	b3
	BREAK	
	d4	d4
13.	**G2**	B2
14.	g5	b5
	d5	d5
15.	B1	**G1**
16.	g4	b4
	v4	v4
17.	**B5**	G5
18.	g2	b2
	v5	v5
19.	G3	**B3**
20.	b6	g6

TRIAL#	LEFT SCREEN	RIGHT SCREEN
	d6	d6
21.	B6	G6
22.	b3	g3
	v6	v6
23.	B4	G4
24.	b1	g1

Notation:
g=girl
b=boy
d=doll
v=vehicle

even numbers = control trials
odd numbers, capital letters = target trials
Bold capital letters= target child

Appendix D
ANOVA Source Table:Male/Female Faces on Control Trials

Appendix D

ANOVA Source Table: Male/Female Faces on Control Trials

age of subject (Age) -between Ss
sex of subject (Sex)
sex of picture (Face) -within Ss

Source of Variation	SS	DF	MS	F
Between Ss				
Within cells	9.02	54	.17	
Age	.27	1	.27	1.59
Sex	.01	1	.01	.05
Age by Sex	.00	1	.00	.02
Within Ss				
Within cells	6.36	54	.12	
Face	.06	1	.06	.49
Age by Face	.01	1	.01	.10
Sex by Face	.03	1	.03	.28
Age by Sex by Face	.14	1	.14	1.19

* $p < .05$
** $P < .01$

Appendix E

Anova Source Table: Total Sample

Appendix E

ANOVA Source Table for Total Sample

sex of subject (Sex) -between Ss
age of subject (Age) -between Ss
sex of picture (Face) -within Ss
match/mismatch/control (Condition/Cond) -within Ss

Source of Variation	SS	DF	MS	F
Betw Ss				
Within cell	20.47	54	.38	
Age	.32	1	.32	.86
Sex	.06	1	.06	.16
Age by Sex	.19	1	.19	.49
Within Ss				
Within cell	10.18	108	.09	
Cond	1.98	2	.99	10.48**
Age by Cond	.05	2	.03	.28
Sex by Cond	.70	2	.35	3.73*
Age by Sex by Cond	.17	2	.08	.90
Within cell	9.02	54	.17	
Face	.13	1	.13	.79
Age by Face	.19	1	.19	1.16
Sex by Face	.54	1	.54	3.24
Age by Sex by Face	.12	1	.12	.73
Within cell	11.06	108	.10	
Cond by Face	.05	2	.03	.25
Age by Cond by Face	.10	2	.05	.48
Sex by Cond by Face	.11	2	.05	.52
Age by Sex by Cond by Face	.05	2	.03	.26

* $p < .05$
** $p < .01$

Appendix F

Anova Source Table: Simple Effects Analysis

Appendix F

Simple Effect Analysis for Sex by Condition Interaction: Boy

age of subject (Age) -between Ss
sex of picture (Face) -within Ss
match/mismatch/control (Condition/Cond) -within Ss

Source of Variation	SS	DF	MS	F
Between Ss				
Within cells	11.01	27	.41	
Age	.01	1	.01	.02
Within Ss				
Within cells	5.41	54	.10	
Cond	.82	2	.41	4.08*
Age by Cond	.20	2	.10	1.01
Within cells	4.57	27	.17	
Face	.07	1	.07	.41
Age by Face	.00	1	.00	.02
Within cells	4.83	54	.09	
Cond by Face	.06	2	.03	.35
Age by Cond by Face	.14	2	.07	.78

* $p < .05$
** $P < .01$

Simple Effect Analysis for Sex by Condition Interaction: Girl

age of subject (Age) -between Ss
sex of picture (Face) -within Ss
match/mismatch/control (Condition\Cond) -within Ss

Source of Variation	SS	DF	MS	F
Between Ss				
Within cells	9.46	27	.35	
Age	.50	1	.50	1.43
Within Ss				
Within cells	4.77	54	.09	
Cond	1.86	2	.93	10.53**
Age by Cond	.02	2	.01	.11
Within cells	4.45	27	.16	
Face	.60	1	.60	3.66
Age by Face	.31	1	.31	1.89
Within cells	6.23	54	.12	
Cond by Face	.09	2	.05	.41
Age by Cond by Face	.01	2	.01	.06

* $p < .05$
** $p < .01$