Preferences for Pink and Blue:

The Development of Color Preferences as a Distinct Gender-typed Behavior in Toddlers

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ABSTRACT

Many gender differences are thought to result from interactions between inborn factors and sociocognitive processes that occur after birth. There is controversy, however, over the causes of gender-typed preferences for the colors pink and blue, with some viewing these preferences as arising solely from sociocognitive processes of gender development. We evaluated preferences for gender-typed colors, and compared them to gender-typed toy and activity preferences in 126 toddlers on two occasions separated by 6 to 8 months (at time point one, age range = 20-40 months, mean = 29 months). Color preferences were assessed using color cards and neutral toys in gender-typed colors. Gender-typed toy and activity preferences were assessed using a parent-report questionnaire, the Preschool Activities Inventory. Color preferences were also assessed for the toddlers' parents using color cards. A gender difference in color preferences was present between 2 and 3 years of age and strengthened near the third birthday, at which time it was large ($d > 1$). In contrast to their parents, toddlers' gender-typed color preferences were stronger and unstable. Gender-typed color preferences also appeared to establish later and were less stable than gender-typed toy and activity preferences. Gender-typed color preferences were largely uncorrelated with gender-typed toy and activity preferences. These results suggest that the factors influencing gender-typed color preferences and gender-typed toy and activity preferences differ in some respects. Our findings suggest that sociocognitive influences and play with gender-typed toys that happen to be made in gender-typed colors contribute to toddlers' gender-typed color preferences.

Keywords: gender-typing, gender development, color preferences, toy and activity preferences, sociocognitive influences

INTRODUCTION

Much research discusses why males and females differ behaviorally. The current consensus is that most, if not all, such gender differences are shaped by both inborn and experiential factors, i.e., there are inborn predispositions for males and females to behave differently, and postnatal experiences modify these predispositions (for reviews, see Hines, 2011; Maccoby & Jacklin, 1974). For example, gender-typed toy and activity preferences are influenced by prenatal androgen exposure (Berenbaum & Hines, 1992; Hines et al., 2002; Nordenstrom, Servin, Bohlin, Larsson, & Wedell, 2002; for a review, see Hines, 2011), as well as by postnatal socialization by parents, peers, and others (Smetana & Letourneau, 1984; Turner & Gervai, 1995), and self-socialization based on gender-related cognitive processes (Fagot & Leinbach, 1989; Ruble et al., 2007; Zosuls et al., 2009). Whether gender-typed preferences for pink and blue are also subject to inborn influences is more controversial. Some have suggested that gender-typed color preferences are arbitrary, and caused entirely by the influences of social and cognitive processes associated with gender development (e.g., Fine, 2010; Leinbach, Hort, & Fagot, 1997; Paoletti, 1987; Ruble, Lurye, & Zosuls, 2010).

Sociocognitive Influences on Gender-typed Color Preferences

Both adults (Cohen, 2013; Ellis & Ficek, 2001; Hurlbert & Ling, 2007; Silver & Ferrante, 1995) and children (Boyatzis & Varghese, 1994; Chiu et al., 2006; LoBue & DeLoache, 2011; Picariello, Greenberg, & Pillemer, 1990) show gender differences in preferences for pink and blue, with females preferring pink more than males do and males preferring blue more than females do. These gender differences are reflected in everyday choices from an early age. For example, young children consider color when choosing their clothing (Halim et al., 2014). Interestingly, however, the gender association of the colors pink and blue appears to have changed historically. Specifically, although in modern Westernized societies, pink is consistently associated with girls and blue with boys (Pomerleau, Bolduc, Malcuit, & Cossette, 1990), in the early 1900s, pink, viewed as strong and decided, was sometimes considered the more masculine color while blue, viewed as delicate and dainty, was sometimes considered the more feminine color (Paoletti, 1987). These findings are often interpreted to show a reversal of gender-typed colors some time during the 20th century and, thus, that gender-typed color stereotyping and preferences are socially assigned. Although a recent analysis of books published between 1880 and 1980 (Del Giudice, 2012) questioned the reversal in pink and blue for boys and girls, the analysis showed that the current gender-typing of colors (e.g., “pink for girls,” “blue for boys”) clearly intensified during the middle of the 20th century.

There is less empirical information on gender-typed color preferences than on other gender-typed childhood behaviors, such as toy and activity preferences, but there is evidence that the development of gender-typed color preferences differs from that of gender-typed toy and activity preferences. For instance, boys and girls show gender-typed toy preferences prior to the emergence of gender-typed color preferences (Jadva, Golombok, & Hines, 2010).

Gender-related cognitive processes have been implicated in the acquisition of gender-typed color preferences. Specifically, gender-typed behaviors may be acquired through self-socialization after children have developed gender identity (Marcus & Overton, 1978; Ruble et al., 2007; Slaby & Frey, 1975), and become self-motivated to adopt gender norms (Kohlberg, 1966; Martin & Halverson, 1981; Martin, Ruble, & Szkrybalo, 2002; Zosuls, et al, 2009). In line with cognitive developmental and gender schema theories, the gender difference in preferences for pink and blue in 3- to 12-year-old boys and girls with gender identity disorder (GID) is reversed (Chiu et al., 2006). Also, for otherwise gender-neutral colors, gender-typed preferences have been found when gender labels are applied to those colors. For instance, 4- and 5-year-old boys and girls prefer yellow or brown balloons and red or white xylophones depending on the gender label given to toys of these colors (Masters, Ford, Arend, Grotevant, & Clark, 1979).

Inborn Influences on Gender-typed Color Preferences

Some researchers have suggested that gender-typed color preferences, like many other gender-typed behaviors, are related, in part, to inborn factors (e.g., Alexander, 2003; Hurlbert & Ling, 2007). Specifically, it has been hypothesized that the female preference for pink evolved from the female role of picking reddish fruits and infant caretaking, and the male preference for blue from the male role of hunting and associating blue with clear skies and good water sources (Alexander, 2003; Hurlbert, 2007; Hurlbert & Ling, 2007).

One study (Hurlbert & Ling, 2007) also claimed to have found cross-cultural evidence that gender-typed color preferences are inborn by showing that both British and Chinese females showed the expected greater liking than males for pinker shades. However, the Chinese individuals were adults residing in Britain, so inborn and experiential influences cannot be disentangled. In a follow-up study of 4- to 5-month-old infants (Franklin, Bevis, Ling, & Hurlbert, 2010), no significant gender difference in color preferences was found. A study of 12- to 24-month-old infants also found no significant gender difference in preferences for pink or blue (Jadva et al., 2010). These results argue against the idea that humans are born with gender-typed color preferences, although the possibility of inborn influences on color preferences that emerge some years after birth cannot be ruled out.

In sum, the causes of gender-typed color preferences have been debated. Gender-typed color preferences have been viewed by some as an unusual gendered behavior, in having no inborn component, but others have suggested an inborn contribution, resulting from different evolutionary pressures on males and females. Further investigation is required to evaluate these competing viewpoints.

Developmental Characteristics of Gender-typed Color Preferences

Developmental characteristics, such as time of emergence and temporal stability, are relevant to understanding the origins of gender differences in behavior. Although gender socialization begins from birth or perhaps even earlier (Newcombe, 2007), findings of early emergence can be consistent with inborn influences whereas late emergence provides more scope for social and cognitive influences (e.g., Maccoby & Jacklin, 1974). For instance, the early emergence of the gender difference in mental rotations ability in infants as young as 3 to 5 months old has been interpreted to suggest a role of prenatal androgen exposure in the gender difference (Moore & Johnson, 2008; Quinn & Liben, 2008). Moreover, the flexibility and change in spatial ability before and after brief periods of training has been interpreted to suggest a role of experience in the gender difference in spatial ability (e.g., Feng, Spence, & Pratt, 2007).

Two prior studies examined the developmental characteristics of gender-typed color preferences. Jadva et al. (2010) measured 12-, 18- and 24-month-old infants' looking times at pairs of pictures of pink and blue dolls and cars and did not find any significant gender difference in preferences for the colors, suggesting that the gender difference in preferences for pink and blue is not apparent before the second birthday. Another study presented 8 pairs of objects, one pink and one not pink, to children aged 7 months, 1, 2, 3, 4, and 5 years of age, and found that girls showed greater preference for pink than boys beginning at age 2 years, but not before (LoBue & DeLoache, 2011). There is substantial evidence that gender-typed preferences for specific toys are apparent in the second year of life (e.g., Serbin, Poulin-Dubois, Colburne, Sen, & Eichstedt, 2001; Snow, Jacklin, & Maccoby, 1983; Zosuls et al., 2009) and one preferential looking study suggested that they may be measurable as early as the first year of life for dolls and trucks (Alexander, Wilcox, & Woods, 2009). Also, infants can perceive colors as early as 3 months of age (Bornstein, 1985), so the emergence of gender-typed color preferences around age 2 years may be considered late. Taken together, the late emergence and age-related changes in gender-typed color preferences suggest that sociocognitive influences are involved in these preferences.

However, apart from its time of emergence and developmental differences across the preschool years, other developmental characteristics of gender-typed color preferences are largely unknown. For instance, it is unknown whether gender-typed color preferences show individual stability over time or if these preferences grow larger in groups of girls and boys across childhood and adolescence, as do children's gender-typed toy and activity preferences (Campbell, Shirley, Heywood, & Cook, 2000; Golombok et al., 2008, 2012; Serbin & Sprafkin, 1986). Children's preference for blue increases with age (Boyatzis & Varghese, 1994; Holden & Bosse, 1900), and so gender differences in preferences for pink and blue may reduce across childhood and adolescence instead of increase. It would also be useful to compare the developmental characteristics of gender-typed color preferences with those of gender-typed behaviors for which inborn influences have been found, such as toy and activity preferences. If gender-typed color preferences are subject to similar causal influences as are gender-typed toy and activity preferences, one might expect these two aspects of gender-typed behavior to show similar developmental characteristics and to correlate with one another.

The Current Study

This study examined the developmental characteristics of gender-typed color preferences, including their: (1) age of emergence, (2) effect sizes at different ages, and (3) stability over two time points separated by 6 to 8 months. In addition, we compared children's color preferences to those of their parents and also compared the characteristics of gender-typed color preferences in children to those of gender-typed toy and activity preferences assessed using the Preschool Activities Inventory (PSAI) (Golombok & Rust, 1993a, 1993b).

METHOD

Participants

A total of 126 children from a university town in the United Kingdom took part (56 boys, 70 girls). Mean ages in months were: boys, 28.52 (*SD* = 5.79); girls, 29.22 (*SD* = 5.51). Children were tested on two occasions. For the purpose of analysis, we grouped the children into three age groups based on their age at the initial test occasion (T1). Those aged 20 to 26 months (25 boys, 25 girls) formed the youngest group, those aged 27 to 33 months (17 boys, 28 girls) formed the middle group, and those aged 34 to 40 months (14 boys, 17 girls) formed the oldest group. A total of 99 children (40 boys, 59 girls) were tested on the second occasion (T2), 6 to 8 months after T1. Of these children, 16 boys and 22 girls belonged to the youngest group, 15 boys and 22 girls belonged to the middle group, and 9 boys and 15 girls belonged to the oldest group. At T2, the children were aged 26 to 47 months. Mean ages in months were: boys, 35.40 (*SD* = 5.42); girls, 36.10 (*SD* = 5.78). A total of 126 parents took part at T1 (113 mothers, 13 fathers) and 99 parents took part at T2 (88 mothers, 11 fathers). Average ages in years at T1 were: mothers, 35.31 (*SD* = 4.94); fathers, 40.92 (*SD* = 9.30). More than 80 % of the fathers and mothers had completed university.

Measures

Color preferences

We assessed parents' color preferences with a card task. To increase reliability of the measure for children, we assessed children’s color preferences with an additional task, the toy task. For the children, scores from the card task and the toy task correlated positively at T1, $r(107) = .39$, $p < .001$, and T2, $r(94) = .52$, $p < .001$. The standardized scores (*z*-scores) of these two tasks were averaged to form a color composite score for the children. For all participants, higher scores indicated greater preference for pink over blue and lower scores indicated greater preference for blue over pink.

Card task. For the card task, we used three shades of pink and three shades of blue. To determine the exact hues to be used, a range of pink hues (ranging from 178 to 239) and blue hues (ranging from 86 to 170) were created with 2-point intervals, uniform in luminance level (140) and saturation (240). The resulting 31 shades of pink and 42 shades of blue were presented to 10 adults, who picked the shades they perceived as most representative of greenish blue, navy blue, the most typical blue for little boys, purplish pink, reddish pink, and the most typical pink for little girls. Their responses were then averaged to determine the hues of the final color stimuli—Greenish Blue (112), Navy Blue (159), Gender-typical Blue (142), Purplish Pink (197), Reddish Pink (227), and Gender-typical Pink (212). The six colors formed nine pink-blue pairs.

Each color occupied a 14 cm x 16 cm area and was juxtaposed to the other color for presentation. The cards were stapled in a preset order, but each participant started with a random card. Since 5 pink cards and 4 blue cards appeared on the right, a data point from a pink card that appeared on the right was randomly removed for each participant to equalize the number of times each color appeared on the right versus the left.

For the children, the researcher presented the cards and asked them to indicate their preferences by pointing at their preferred colors (e.g., “*Look at the colors. Which color do you like? Can you point to it?*”), though verbal answers were also accepted. Parents completed this card task on their own by checking boxes to indicate their own preferred colors. A point was given if pink was chosen, with a maximum of 8 points possible.

Toy task. The toy task included 3 pink-blue pairs of neutral toys, namely, felt pigs, balloons, and star stickers. These toys had been used in previous research as gender-neutral toys (e.g., Arthur, Bigler, & Ruble, 2009; Masters et al., 1979; Picariello et al., 1990). Each pair was identical except that one was blue and the other pink. The order of presentation and the left-right position of the pink and the blue items were random for each child. As for the card task, children were asked to indicate which item they preferred in each pair. A point was given if pink was chosen, with a maximum of 3 points possible.

For the card task, 114 children provided data at T1. Of these children, 106 completed the entire card task. For 8 children who completed more than half, but not the entire, task, their score was adjusted to reflect the number of items completed. At T2, 96 children completed the entire card task. The remaining children failed to complete at least half of the card task, so their scores were regarded as missing. For the toy task, 119 children completed the entire task at T1. Scores for the other 7 children were regarded as missing. All children completed the entire toy task at T2. In total, 109 children at T1 and 96 children at T2 provided data for the color composite.

Preschool Activities Inventory

We used the Preschool Activities Inventory (PSAI) (Golombok & Rust, 1993a, 1993b) to assess children's gender-typed toy and activity preferences. The PSAI consists of 24 items assessing frequency of play in regard to a variety of toys and activities rated on a 5-point scale ranging from "1 - *never*" to "5 - *very often*." Parents completed the inventory based on how their children behaved in the past month. Higher scores reflect more male-typical behavior and lower scores reflect more female-typical behavior. The measure has been standardized and validated for young children in several countries (Golombok & Rust, 1993a, 1993b). The PSAI score of one child at T1 was missing due to incomplete responses. Scores for the PSAI are calculated using the formula:

Score = 48.25 +1.1 x (the sum of "male" items – the sum of "female" items) (Golombok & Rust, 1993a, 1993b).

Statistical Analysis

At both time points, the boys and girls did not differ in age, birth order, parental education or parental age. Children who took part at follow-up were similar to those who did not in age, birth order, parental education, and parental age. Missing values were unrelated to these characteristics (Little's MCAR = χ^2 = 135.72) and were estimated with maximum likelihood using Expectation Maximization with 2500 iterations and a convergence criterion of .0001. This method of replacement is considered one of the best modern model-based methods superior to traditional methods such as mean substitution (Do & Batzoglou, 2008; Rubin, Witkiewitz, St. Andre, & Reilly, 2007) and is compatible with our analysis (Allison, 2001). We first present results of a Sex x Age group x Time ANOVA, one-sample *t*-tests, and correlation analysis to evaluate children's gender-typed color preferences, including time of emergence of the gender difference, effect sizes, age differences, and stability over time. Then, we present results of similar analyses to evaluate parents' gender-typed color preferences and compare these to children's. We examined the hypotheses that females liked pink more (and liked blue less) than males did, that children liked the gender-typical color more than the gender-atypical color, that color preferences were more gender-typed in older than in younger children, and less so in adults than in children, and that the scores of individuals were stable over time. Based on prior studies (Jadva et al., 2010; LoBue & DeLoache, 2011), we also hypothesized that the gender difference in color preferences would emerge shortly after age two, with older children being more likely to show the gender difference than younger children. Regarding PSAI scores, we used a Sex x Age group x Time ANOVA and correlation analysis to evaluate the hypotheses that parents reported boys as scoring higher (in a more male-typical direction) than girls, that this gender difference was more pronounced in older than in younger children, that the scores of individuals were stable over time, and that more gender-typed PSAI scores correlated with more gender-typed color preferences.

RESULTS

Children's Color Preferences

We conducted a Sex x Age group x Time ANOVA for children's color preferences as reflected in color composite scores (*z*-scores averaged across the card task and the toy task) and a Sex x Time ANOVA for their parents' color preferences as reflected by the number of times they chose pink in the card task. Table 1 shows the descriptive statistics and Cohen's effect sizes (*d*) for each time point. For the children, there was a main effect of Sex, $F(1, 120) = 77.55$, $p < .001$, $\eta^2 = .377$. There were also a Sex x Time interaction, $F(1, 120) = 3.45$, $p = .033$, $\eta^2 = .026$, and a Sex x Age group interaction, $F(2, 120) = 2.84$, $p = .031$, $\eta^2 = .028$. Finally, there was a three-way, Sex x Age group x Time interaction, $F(2, 120) = 2.57$, $p = .041$, $\eta^2 = ..038$. To explore this interaction, we first conducted separate Sex x Age group ANOVAs for each time point (see Fig. 1a). At T1, there was a Sex x Age group interaction, $F(2, 120) = 4.49$, $p = .007$, $\eta^2 = .059$. Simple main effects analysis for T1 showed that the gender difference was significant and largest in the oldest group, $F(1, 120) = 22.58$, $p < .001$, $\eta^2 = .158$, $d = -1.53$, but only approaching significance in the youngest group, $F(1, 120) = 2.73$, $p = .052$, $\eta^2 = .022$, $d = -.55$, and the middle group, $F(1, 120) = 2.29$, $p = .067$, $\eta^2 = .019$, $d = -.44$. At T2, there was no significant Sex x Age group interaction. Then we conducted separate one-way Time ANOVAs for each age group of boys and of girls to further explore the Sex x Age group x Time interaction (see Fig. 1b). This analysis showed no significant changes over time in any of the three age groups for girls. In boys, however, color preferences became significantly more gender-typed over time for the youngest group, $F(1, 24) = 6.81$, $p = .008$, $\eta^2 = .221$, mean difference = .56, $SE = .22$, and for the middle group, $F(1, 16) = 6.02$, $p = .013$, $\eta^2 = ..273$, mean difference = .53, $SE = .22$, but not for the oldest group.

To see whether boys and girls had absolute preferences for pink versus blue, one-sample *t*-tests were conducted for each sex to see whether the average preference for pink across the card task and the toy task was significantly different from .5. Boys did not have a preference for either pink or blue at T1, $M = .46$, $SD = .27$, but they preferred blue significantly to pink at T2, $M = .36$, $SD = .22$, $t(55) = 4.64$, $p < .001$. Girls preferred pink significantly to blue at both T1, $M = .64$, $SD = .21$, $t(69) = 5.54$, $p < .001$, and T2, $M = .70$, $SD = .22$, $t(69) = 7.34$, $p < .001$.

We then explored correlations between children's T1 and T2 color composite scores (see Fig. 2a). There was no individual stability in color preferences over time either for boys, $r(54) = -.06$, or for girls, $r(68) = .16$. Results were similar when children 30 months or older at T1 were analyzed separately from children younger than 30 months at T1. For the younger group of boys, $r(30) = -.05$, for the older group of boys, $r(22) = -.06$, for the younger group of girls, $r(35) = .22$, and for the older group of girls, $r(31) = .10$. All *p*s > .050.

Comparing Children's Color Preferences and Parents' Color Preferences

For parents (see Table 1), as expected, there was a main effect of Sex showing that fathers preferred blue more/pink less than mothers did, $F(1, 124) = 3.43$, $p = .033$, $\eta^2 = .027$, mean difference = .96, $SE = .52$. There was no main effect of Time and no Sex x Time interaction. To see whether mothers and fathers had absolute preferences for pink versus blue, one-sample *t*-tests were conducted within each sex to see whether the average preference for pink was significantly different from .5. Fathers significantly preferred blue to pink at T1, $t(12) = 3.15$, $p = .004$, $d = .88$, and at T2, $t(12) = 5.33$, $p < .001$, $d = 1.48$. Mothers also significantly preferred blue to pink at T1, $t(113) = 4.32$, $p < .001$, $d = .40$, and at T2, $t(113) = 5.13$, $p < .001$, $d = .49$. Color preferences showed high temporal stability in fathers, $r(11) = .84$, $p < .001$, and mothers, $r(111) = .65$, $p < .001$ (see Fig. 2b).

To ensure that any differences between children and their parents were not due to the use of different measures, we also compared children's and parents' color preferences, excluding children's scores on the toy task. These analyses produced results very similar to those using the color composite scores for children.

Comparing Children's Color Preferences and Gender-typed Toy and Activity Preferences

We conducted a Sex x Age group x Time ANOVA for children's PSAI scores based on parents' reports of their children's behavior and Table 2 shows the descriptive statistics and Cohen's effect sizes (*d*) for each time point. There was a main effect of Sex with boys scoring higher (in a more male-typical direction) on the PSAI than girls, $F(1, 120) = 181.86$, $p < .001$, $\eta^2 = .588$, mean difference = 20.93, $SE = 1.55$. There were no main effects of Time or Age group. There were, however, Sex x Time, $F(1, 120) = 5.23$, $p = .012$, $\eta^2 = .040$, and Sex x Age group interactions, $F(2, 120) = 3.65$, $p = .015$, $\eta^2 = .024$. For the Sex x Time interaction (see Fig. 3a), simple main effects analysis showed that boys had higher (more male-typical) PSAI scores than girls at both time points but more so at T2, $F(1, 120) = 171.73$, $p < .001$, $\eta^2 = .589$, mean difference = 22.34, $SE = 1.70$, than at T1, $F(1, 120) = 143.10$, $p < .001$, $\eta^2 = .544$, mean difference = 19.53, $SE = 1.63$. For the Sex x Age group interaction (see Fig. 3b), simple main effects analysis showed that for the two time points combined, the gender difference was significant in all three age groups but was larger in older age groups–for the youngest group, $F(1, 120) = 44.44$, $p < .001$, $\eta^2 = .270$, mean difference = 15.91, $SE = 2.39$, for the middle group, $F(1, 120) = 62.99$, $p < .001$, $\eta^2 = .344$, mean difference = 20.58, $SE = 2.59$, and for the oldest group, $F(1, 120) = 74.70$, $p < .001$, $\eta^2 = .384$, mean difference = 26.31, $SE = 3.04$.

PSAI scores were highly stable over time for boys, $r(54) = .72$, $p < .001$, and for girls, $r(68) = .74$, $p < .001$ (see Fig. 2c). For boys, PSAI scores at T1 or T2 did not correlate significantly with color preferences at T1 or T2. For girls, PSAI scores at T1 did not correlate with color preferences at T1, but higher (more boy-typical) PSAI scores at T2 correlated significantly with lower (less girl-typical) color preference scores at T2, $r(68) = -.20$, $p = .023$.

DISCUSSION

We studied the developmental characteristics of gender-typed color preferences by examining their age of emergence, effect sizes at different ages, temporal stability, and relationship to gender-typed toy and activity preferences in toddlerhood. We also compared children's gender-typed color preferences to those of parents. Results generally supported sociocognitive influences on gender-typed color preferences. We found a significant gender difference in preferences for pink versus blue between 2 and 3 years of age and results at T1 suggested that it began to emerge around 2 years of age and became strong and established towards the third birthday, at which time it was large ($d > 1$). Both cross-sectional and longitudinal analysis also showed age-related increases in gender-typed color preferences during toddlerhood. These findings are largely consistent with those from another study that used a different method (pink versus not pink) (LoBue & DeLoache, 2011). Our study assessed preferences using a forced choice method involving two gender-typed colors (pink versus blue) and our results suggest a sharp increase in the gender difference towards the third birthday.

Our study also extended past findings by providing information on the effect size for the gender difference in toddlers' gender-typed color preferences. The effect size for the gender difference in color preferences in children nearing their third birthday ($d > 1.0$) is larger than that of most psychological gender differences. For example, although PSAI scores show large gender differences ($d > 2.5$), most gender differences have effect sizes smaller than $d = 1$ (Hines, 2010); also, meta-analyzed effect sizes for gender differences in groups described as "children" by Hyde (2005) were generally small, ranging from $d = .11$ to .26. Given that human infants can perceive different colors as early as 3 months of age (Bornstein, 1985), the establishment of gender-typed color preferences after 2 years of age may be considered late and unsupportive of an inborn origin, although inborn influences could become apparent later in life.

We also found that, although gender-typed color preferences were present in groups of toddlers, they were temporally unstable at the individual level in these young children, as shown by the non-significant temporal correlation coefficients. This instability contrasts with toddlers' parent-reported gender-typed toy and activity preferences, as reflected in PSAI scores, which were highly stable. Others also have reported stability in toy and activity preferences at very early ages—from age 9 to 18 months using looking time and gender-typed toys (Campbell et al., 2000) and from 2.5 to 12 years of age using the PSAI in a large national sample (Golombok et al., 2008, 2012). Our finding that gender-typed color preferences were unstable at the individual level until at least age 4 years suggests that gender-typed color preferences change in response to short term experiences across early childhood.

Comparisons of children and their parents revealed apparent developmental differences as well. First, correlation coefficients suggested that parents' color preferences were more stable than their children's. In addition, both mothers and fathers preferred blue to pink whereas both girls and boys showed gender-typed color preferences, with girls, in particular, preferring pink over blue. The gender difference in parents' color preferences was also smaller (d = -.37 at T1 and d = -.64 at T2) than the gender difference in children's color preferences. Our data thus suggest an initial increase in gender-typed color preferences across toddlerhood and a later decrease, producing an inverted U-shaped developmental curve. Also, the difference in stability of color preferences in children (unstable) versus parents (stable) suggests that it takes time for socialization to consolidate gender-typed color preferences and our results suggest that such consolidation happens after age 4 years.

Comparisons of gender-typed color preferences and PSAI scores suggest that these two aspects of gender-typed behavior differ in important ways. Gender-typed toy and activity preferences as reported by parents on the PSAI appeared to be similar to gender-typed color preferences in that both increased with age in young children, perhaps reflecting cumulative socialization influences (Fagot & Leinbach, 1989; Ruble et al., 2007; Smetana & Letourneau, 1984; Turner & Gervai, 1995; Zosuls et al., 2009). However, the two aspects of behavior differed in that gender-typed toy and activity preferences were established earlier, and were stable, even at this young age. Also, PSAI scores generally did not correlate significantly with color preferences, although in girls stronger preferences for pink at T2 correlated with more female-typical PSAI scores.

The developmental differences and discordance between gender-typed color preferences and gender-typed toy and activity preferences suggest that the factors affecting these two aspects of gender-typed behavior differ to some extent. In line with this suggestion, gender-typed toy and activity preferences are thought to be caused, in part, by organizational influences of prenatal or neonatal androgen exposure on the developing brain (Hines, 2011). There is currently insufficient evidence to evaluate similar inborn influences on gender-typed color preferences. However, whereas early androgen exposure affects gender-typed toy and activity preferences, it may not influence color preferences in a similar way. It is possible, however, that androgen could have less direct effects on gender-typed color preferences, for example, by predisposing children to play with gender-typed toys that happen to be made in gender-typed colors.

Gender-related cognitive development also could contribute to the emergence of gender-typed color preferences. Recent evidence suggests that rudimentary understanding of gender identity can be measured as early as 2 years of age or younger (Zosuls et al., 2009), and children show clear evidence of gender identity understanding by 2 to 3 years of age (Campbell, Shirley, & Caygill, 2002; Marcus & Overton, 1978; Ruble et al., 2007; Slaby & Frey, 1975). Similarly, gender-typed color preferences appear to emerge between 2 and 3 years of age. Once children understand that they are girls or boys, they attend to gender-related information. Clusters of related information then form gender schemas that guide behavior as children strive to behave consistently with their gender schemas (Martin & Halverson, 1981; Martin & Ruble, 2004). The color gender stereotype may be one aspect of such gender-related information that is assimilated into children's gender schemas and then guides children's behavior. The use of gender-typed colors for gender-typed toys and other items for children may allow the colors to function as gender labels. Children who are aware of their gender may adopt the gender-appropriate color and avoid the gender-inappropriate color to consolidate their developing gender identity and to avoid social disapproval associated with violating gender norms (Chiu et al., 2006; Ruble et al., 2007). Gender-dysphoric children appear to have a weaker attraction to same-gender stimuli and less avoidance of cross-gender stimuli when choosing toys (Doering, Zucker, Bradley, &

MacIntyre, 1989) and colors (Chiu et al., 2006) in comparison with typically-developing children, substantiating a relationship between gender identity and gender-typed preferences or avoidances. Processes involved in the acquisition of gender identity during early childhood may thus explain our finding that the gender difference in color preferences increased sharply around the third birthday.

Gender-typed preferences continue to become more rigid through the stage after gender identity, gender stability, when children understand that gender is stable over time (e.g., Halim et al., 2014). At the third and final stage of gender understanding, gender constancy, when children understand that their gender will not change even if they engage in cross-gender behavior, their gender-typed behavior becomes more flexible (Ruble et al., 2007; Trautner et al., 2005). Our findings that the gender difference in color preference was larger in older than in younger toddlers but smaller in adults than in young children may reflect a similar effect of cognitive understanding of gender on color preferences. Alternatively, color as a gender-typed attribute may carry less weight or importance for adults than for children for other reasons.

Gender-typed color preferences in children also may be acquired, in part, in a manner similar to adult color preferences, including by associating certain colors with things liked or disliked (Palmer & Schloss, 2010). In adults, color preferences can arise from affective responses to color-associated objects; adults like colors associated with objects they like and dislike colors associated with objects they dislike. These object-color associations have been found to explain as much as 80% of the variance in adult color preferences (Palmer & Schloss, 2010). If similar processes occur in children, girls may learn to like pink, in part because they like playing with toys that happen to be pink, and boys may learn to like blue, in part because they like playing with toys that happen to be blue. The correlation we observed at T2 in girls between preference for pink and more girl-typical toy and activity preferences may reflect this type of effect. Boys and girls also are likely to receive different patterns of reward for engaging with pink and blue objects from parents and peers, and this too would contribute to their acquisition of gender-typed color preferences.

The influences of social factors and cognitive understanding of gender may also explain the instability of color preferences in young children. Cognitive understanding of gender is developing rapidly during early childhood and children at the ages we studied would still be revising their gender schemas and progressing through different stages of gender understanding. In addition, their toys change rapidly as they develop new capabilities. Anecdotal information from participating parents suggested that some children’s color preferences related to the color of their most recent favorite toy. Future studies could test specific social and cognitive factors and examine their possible relation to the instability of children’s preferences more systematically.

Limitations

Although the current findings suggest that social and cognitive factors contribute to children’s gender-typed color preferences, inborn influences cannot be ruled out. For instance, late emergence does not rule out inborn influences, because some inborn influences may only become apparent late in development (Newcombe, 2007). In fact, it may be difficult for any data to rule out inborn influences, but it would be interesting to determine if non-human primates, who do not experience color gender-stereotyping or play with gender-typed toys, also show sex differences in preferences for pink and blue. If so, arguments that these preferences are rooted in our evolutionary history would be strengthened.

A second limitation is that, although an expected Sex x Age group interaction was found at T1 indicating larger gender difference in older children, this interaction was not present at T2.

One possibility is that taking part at T1 affected children's later gender-typed color preferences, making color preferences measured at T2 less reliable than those at T1. These findings are limited by small sample sizes when the data were broken down by age group and sex, however. Overall, findings showed that gender differences in color preferences were well-established by age 3 years and grew larger with age in early childhood, consistent with previous findings (LoBue & DeLoache, 2011).

Another limitation of our study was the small size of the sample of fathers, which may limit the generalizability of our findings for parents. We also cannot be completely confident that the differences in color preferences between children and their parents reflect developmental as opposed to generational differences. A longitudinal follow-up of children into adulthood would be required to address this question. A prior cross-sectional study found that girls' preference for pink over other colors was significant at ages 3 and 4 years but not at age 5 years (LoBue & DeLoache, 2011). It would be interesting to assess older children to determine whether children's preference for gender-typed colors declines significantly after age 3 to 4 years, and how it develops across later childhood and into adolescence.

A final limitation is that we tested children in the presence of a parent due to the young age of the children. We told parents not to influence the children's responses and the researcher did not see parents do so. Findings regarding the influence of the mere presence of others (including the researcher) are inconsistent, however. For example, gender-dysphoric boys' toy play appeared to be more cross-gendered (more girl-typical) when they were alone than when they were with an adult (Rekers, 1975), but others have found inconsistent effects of another person's presence on typically-developing children's toy play (e.g., Pasterski et al., 2005). Future studies could address this question by comparing children's color preferences under different test settings.

Conclusion

Most gender-typed behaviors appear to result from interactions among inborn influences, such as early androgen exposure, postnatal socialization, and gender-related cognitive development. Gender-typed color preferences have been suggested to be different, however, and to result entirely from social and cognitive processes involved in gender development. Our findings do not rule out the possibility of inborn influences on gender-typed color preferences, but they are more consistent with social and cognitive influences. For instance, the findings of a relatively late establishment, age differences, and lack of stability in early childhood suggest that factors such as gender-related cognitions and play with gender-typed toys are influential at the time when gender-typed color preferences are being acquired and stabilized. We also found that gender differences in PSAI scores, which reflect gender-typed toy and activity interests as reported by parents, and which relate to early androgen exposure (Hines et al., 2002; Lamminmaki et al., 2012), are established earlier than gender-typed color preferences and are highly stable in toddlers. PSAI scores and gender-typed color preferences also did not correlate in boys, and correlated in girls only at T2. These findings suggest that gender-typed color preferences and gender-typed toy and activity preferences have different developmental characteristics, and that the factors influencing these two aspects of childhood gender-typed behavior differ in some respects. The flexibility in gender-typed color preferences in individual toddlers is also more compatible with changing social or cognitive influences than with inborn influences.

Our findings also call for consideration of the value of using gender-typed colors for boys' and girls' toys. Although a prior study found no effect of gender-typed colors on gender-typed toy preferences in infants under 2 years of age (Jadva et al., 2010), our findings suggest that such an effect is more likely to be seen from around 3 years of age, when the gender difference in color preferences becomes well established. For girls at T2, greater preference for pink correlated with more girl-typical toy and activity preferences reported by parents. This finding suggests that gender-typed color preferences and other gender-typed behaviors may begin to affect each other around this time. Gender-typed color preferences may reinforce gender-typed toy play, and in turn influence the development of cognitive and social skills (Block, 1983; Caldera, Huston, & O'Brien, 1989).

REFERENCES

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

Alexander, G. M., Wilcox, T., & Woods, R. (2009). Sex differences in infants' visual interest in toys. *Archives of Sexual Behavior, 38*, 427-433.

Allison, P. D. (2001). *Missing data*. Thousand Oaks, CA: Sage.

Arthur, A. E., Bigler, R. S., & Ruble, D. N. (2009). An experimental test of the effects of gender constancy on sex typing. *Journal of Experimental Child Psychology, 104*, 427-446.

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

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

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

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

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

Campbell, A., Shirley, L., & Caygill, L. (2002). Sex-typed preferences in three domains: Do two-year-olds need cognitive variables? *British Journal of Psychology, 93*, 203-217.

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

Developmental Psychology, 18, 479-498.

Chiu, S. W., Gervan, S., Fairbrother, C., Johnson, L. L., Owen-Anderson, A. F. H., Bradley, S. J., & Zucker, K. J. (2006). Sex-dimorphic color preference in children with gender identity disorder: A comparison to clinical and community controls. *Sex Roles, 55,* 385-395.

Cohen, P. N. (2013). Children's Gender and Parents' Color Preferences. *Archives of Sexual Behavior, 42*, 393-397.

Del Giudice, M. (2012). The 20th century reversal of pink-blue gender coding: A scientific urban legend? [Letter to the Editor]. *Archives of Sexual Behavior, 41*, 1321-1323.

Do, C. B., & Batzoglou, S. (2008). What is the expectation maximization algorithm? *Nature Biotechnology, 26*, 897-899.

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

Ellis, L., & Ficek, C. (2001). Color preferences according to gender and sexual orientation. *Personality and Individual Differences, 31*, 1375-1379.

Fagot, B. I., & Leinbach, M. D. (1989). The young child’s gender schema: Environmental input, internal organization. *Child Development, 60*, 663-672.

Feng, J., Spence, I., & Pratt, J. (2007). Playing an action video game reduces gender differences in spatial cognition. *Psychological Science, 18,* 850-855.

Fine, C. (2010). *Delusions of gender*. London, UK: Icon Books.

Franklin, A., Bevis, L., Ling, Y., & Hurlbert, A. (2010). Biological components of colour preference in infancy. *Developmental Science, 13*, 346-354.

Golombok, S., & Rust, J. (1993a). The measurement of gender role behavior in pre-school behavior. A research note. *Journal of Child Psychology and Psychiatry, 34*, 805–811.

Golombok, S., & Rust, J. (1993b). The pre-school activities inventory: A standardized assessment of gender role in children. *Psychological Assessment, 5*, 131-136.

Golombok, S., Rust, J., Zervoulis, K., Croudace, T., Golding, J., Hines, M. (2008) Developmental trajectories of sex-typed behavior in boys and girls: A longitudinal general population study of children aged 2.5–8 years. *Child Development, 79*, 1583-1593.

Golombok, S., Rust, J., Zervoulis, K., Croudace, T., Golding, J., & Hines, M. (2012). Continuity in sex-typed behavior from preschool to adolescence: A longitudinal population study of boys and girls aged 3-13 years. *Archives of Sexual Behavior, 41*, 591-597.

Halim, M. L., Ruble, D. N., Tamis-LeMonda, C. S., Zosuls, K. M., Lyrye, L. E., & Greulich, F. K. (2014). Pink frilly dresses and the avoidance of all things “girly”: Children’s Appearance rigidity and cognitive theories of gender development. *Developmental Psychology, 50*, 1091-1101.

Hines, M. (2010). Sex-related variation in human behavior and the brain. *Trends in Cognitive Sciences*, *14*, 448-456.

Hines, M. (2011). Gender development and the human brain. *Annual Review of Neuroscience*, *34*, 67-86.

Hines, M., Golombok, S., Rust, J., Johnston, K.J., Golding, J., & The Avon Longitudinal Study of Parents and Children Study Team. (2002). Testosterone during pregnancy and gender role behavior of preschool children: A longitudinal, population study. *Child Development, 73*, 1678-1687.

Holden, M. D., & Bosse, K. K. (1900). The order of development of color perception and of color preferences in the child. *Archives of Ophthalmology, 29*, 261-278.

Hurlbert, A. C. (20 August 2007). *Girls prefer pink-or at least a redder shade of blue.* Retrieved from http://www.ncl.ac.uk/press.office/press.release/item/?ref=1187625608

Hurlbert, A. C., & Ling, Y. (2007). Biological components of sex differences in color preference. *Current Biology, 17,* 623-625.

Hyde, J. (2005). The gender similarities hypothesis. *American Psychologist*, *60*, 581-592.

Jadva, V., Golombok, S., & Hines, M. (2010). Infants' preferences for toys, colors and shapes: Sex differences and similarities. *Archives of Sexual Behavior*, *39*, 1261-1273.

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

Lamminmaki, A., Hines, M., Kuiri-Hänninen, T., Kilpeläinen, L., Dunkel, L., & Sankilampi, U. (2012). Testosterone measured in infancy predicts subsequent sex-typed behavior in boys and in girls. *Hormones and Behavior, 61*, 611-616.

Leinbach, M. D., Hort, B. E., & Fagot, B. I. (1997). Bears are for boys*:* Metaphorical associations in young children's gender stereotypes. *Cognitive Development, 12*, 107-130.

LoBue, V., & DeLoache, J. S. (2011). Pretty in pink: The early development of gender-stereotyped colour preferences. *British Journal of Developmental Psychology*, *29*, 656-667.

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

Marcus, D. E., & Overton, W. F. (1978). The development of cognitive gender constancy and sex role preferences. *Child Development, 49,* 434-444.

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

Martin, C. L., & Ruble, D. (2004). Children's search for gender cues: Cognitive perspectives on gender development. *Current Directions in Psychological Science*, *13*, 67-70.

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

Masters, J. C., Ford, M. E., Arend, R., Grotevant, H. D., & Clark, L. V. (1979). Modeling and labeling as integrated determinants of children's sex-typed imitative behavior. *Child Development, 50,* 364-371.

Moore, D. S., & Johnson, S. P. (2008). Mental rotation in human infants: A sex difference. *Psychological Science*, *19*, 1063-1066.

Newcombe, N. S. (2007). Taking science seriously: Straight thinking about spatial sex differences. In S. Ceci & W. Williams (Eds.), *Why aren't more women in science?: Top researchers debate the evidence* (pp. 69-78). Washington, DC: American Psychological Association.

Nordenstrom, A., Servin, A., Bohlin, G., Larsson, A., & Wedell, A. (2002). Sex-typed toy play behavior correlates with the degree of prenatal androgen exposure assessed by CYP21 genotype in girls with congenital adrenal hyperplasia. *Journal of Clinical Endocrinology and Metabolism, 87*, 5119-5124.

Palmer, S. E., & Schloss, K. B. (2010). An ecological valence theory of color preferences. *Proceedings of the National Academy of Sciences, 107,* 8877-8882.

Paoletti, J. B. (1987). Clothing and gender in America: Children's fashions, 1890–1920. *Signs, 13,* 136-143.

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

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

Pomerleau, A., Bolduc, D., Malcuit, G., & Cossette, L. (1990). Pink or blue: Environmental gender stereotypes in the first two years of life. *Sex Roles*, *22*, 359-367.

Quinn, P. C., & Liben, L. S. (2008). A sex difference in mental rotation in young infants. *Psychological Science*, *19*, 1067-1070.

Rekers, G. A. (1975). Stimulus control over sex-typed play in cross-gender identified boys. *Journal of Experimental Child Psychology*, 20, 136-148.

Rubin, L. H., Witkiewitz, K., St. Andre, J., & Reilly, S. (2007). Methods for handling missing data in the behavioral neurosciences: Don't throw the baby rat out with the bath water. *Journal of Undergraduate Neuroscience Education, 5*, A71-A77.

Ruble, D. N., Lurye, L. E., & Zosuls, K. M. (2010, Oct 27). Pink frilly dresses and early gender identity. *Princeton Report on Knowledge, Vol. 2,* issue 2. Retrieved from http://www.princeton.edu/prok/issues/2-2/pink_frilly.xml

Ruble, D. N., Taylor, L. J., Cyphers, L., Greulich, F. K., Lurye, L. E., & Shrout , P. E. (2007). Effect of gender constancy on age-related changes in gender beliefs. *Child Development, 78*, 1121-1136.

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

Serbin, L. A., & Sprafkin, C. (1986). The salience of gender and the process of sex-typing in three- to seven-year-old children. *Child Development*, *57,* 1188-1199.

Silver, N. C., & Ferrante, R. (1995). Sex differences in color preferences among an elderly sample. *Perceptual and Motor Skills, 80*, 920-922.

Slaby, R. G., & Frey, K. S. (1975). Development of gender constancy and selective attention to same-sex models. *Child Development, 46*, 849-856.

Smetana, J. G., & Letourneau, K. J. (1984). Development of gender constancy and children's sex-typed free play behavior. *Developmental Psychology, 20*, 691-696.

Snow, M. E., Jacklin, C. N., & Maccoby, E. E. (1983). Sex-of-child differences in father-child interaction at one year of age. *Child Development*, *54*, 227-232.

Trautner, H. M., Ruble, D. N., Cyphers, L., Kirsten, B., Behrendt, R., & Hartmann, P. (2005). Rigidity and flexibility of gender stereotypes in childhood: Developmental or differential? *Infant and Child Development*, *14*, 365-381.

Turner, P. J., & Gervai, J. (1995). A multidimensional study of gender typing in preschool children and their parents: Personality, attitudes, preferences, behavior, and cultural differences. *Developmental Psychology, 31*, 759-772.

Zosuls, K. M., Ruble, D. N., Tamis-LeMonda, C. S., Shrout, P. E., Bornstein, M. H., & Greulich, F. K. (2009). The acquisition of gender labels in infancy: Implications for gender-typed play. *Developmental Psychology*. *45*, 688-701.

Table 1

Descriptive statistics and effect sizes for children's and parents' color preferences

	Boys (N = 56)			Girls (N = 70)			
	M	*SD*	*n*	*M*	*SD*	*n*	*d*
			T1				
Overall	-.27	.84	56	.30	.67	70	-.76
Youngest group	-.13	.79	25	.22	.43	25	-.55
Middle group	-.14	.76	17	.20	.78	28	-.44
Oldest group	-.66	.94	14	.60	.72	17	-1.53
			T2				
Overall	-.60	.66	56	.37	.66	70	-1.47
Youngest group	-.69	.66	25	.39	.61	25	-1.70
Middle group	-.67	.58	17	.16	.78	28	-1.17
Oldest group	-.35	.71	14	.67	.38	17	-1.84

	Fathers (N = 13)		Mothers (N = 113)		
	M	*SD*	*M*	*SD*	*d*
T1					
	2.38	1.85	3.15	2.10	-.37
T2					
	1.96	1.38	3.11	1.83	-.64

Note. For children, scores were color composite scores (*z*-scores averaged across the card task and the toy task). For parents, scores were the number of times pink was chosen in the card task (range = 0-8). Higher score = greater preference for pink/less preference for blue.

Table 2

Descriptive statistics and effect sizes for PSAI scores

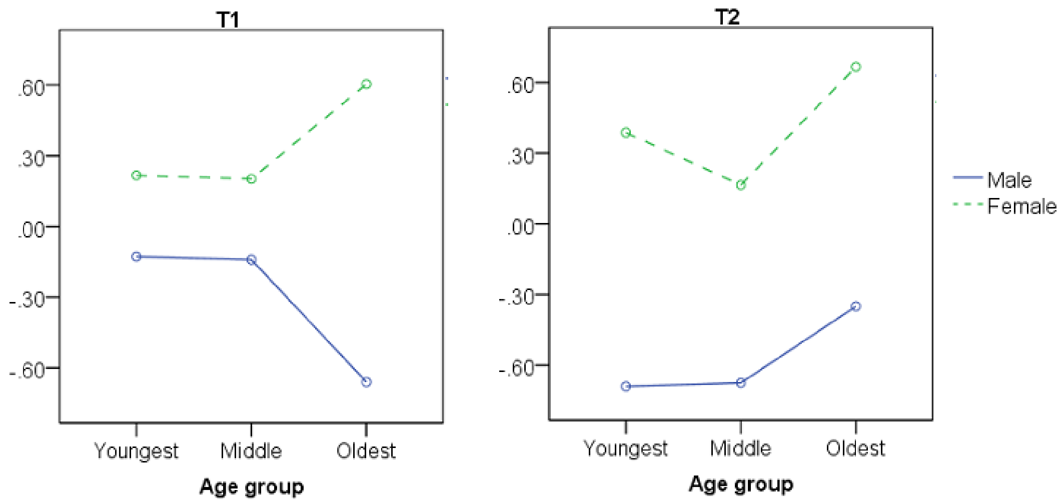
	Boys (*N* = 56)				Girls (*N* = 70)				
	M	*SD*	*n*	Range	*M*	*SD*	*n*	Range	*d*
					T1				
Overall	58.80	8.62	56	38.35-75.75	40.20	9.53	70	10.85-60.35	2.04
Youngest group	57.14	8.36	25	38.35-75.75	43.67	9.25	25	21.85-60.35	1.53
Middle group	58.28	9.71	17	40.55-74.65	39.84	7.40	28	27.35-58.15	2.21
Oldest group	62.39	7.05	14	48.25-72.45	35.70	11.41	17	10.85-52.65	2.75
					T2				
Overall	60.52	8.06	56	43.85-73.55	38.83	10.09	70	6.45-62.55	2.35
Youngest group	58.71	8.42	25	43.85-72.89	40.36	10.76	25	11-95-62.55	1.90
Middle group	61.58	8.24	17	44.95-73.55	38.85	8.03	28	27.35-59.25	2.80
Oldest group	62.45	6.97	14	47.15-73.22	36.52	12.13	17	6.45-59.25	2.56

Table 3

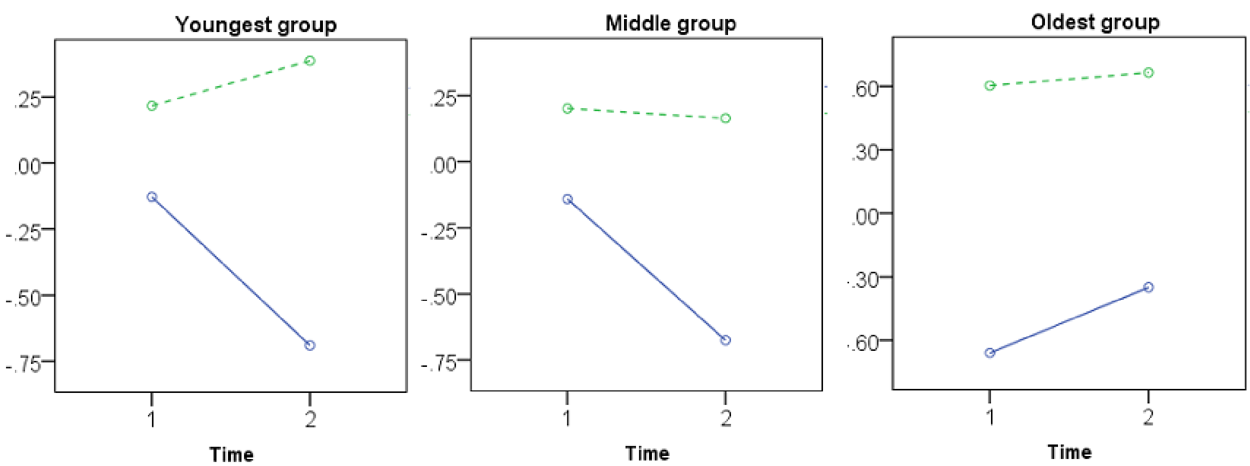
Correlation between PSAI scores and children's color preferences

	Boys (*df* = 54)	Girls (*df* = 68)
T1	.080	-.123
T2	.083	-.202*

Data are correlation coefficients. * = $p < .05$.

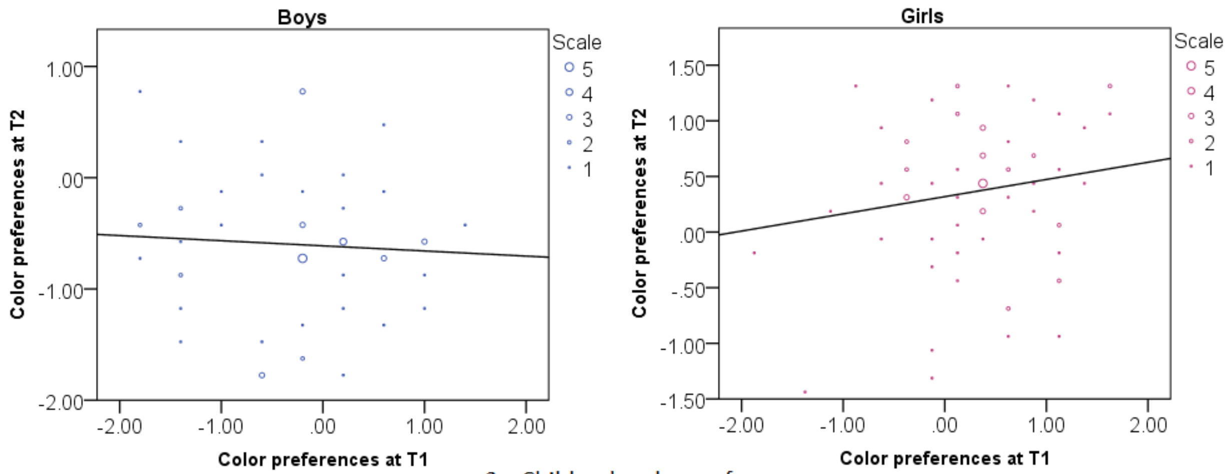


1a. Sex x Age group interaction at each time point

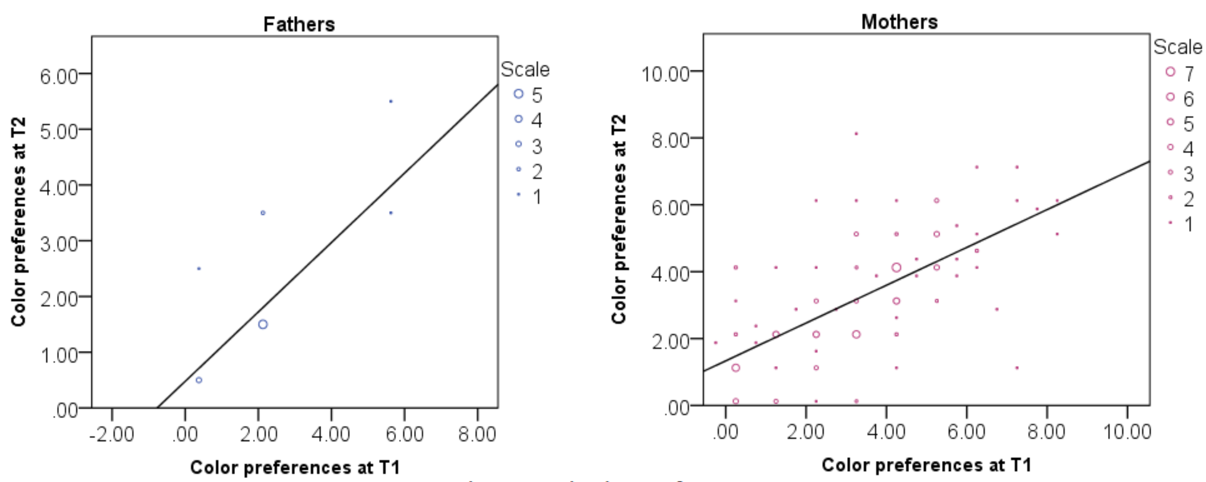


1b. Sex x Age group x Time interaction

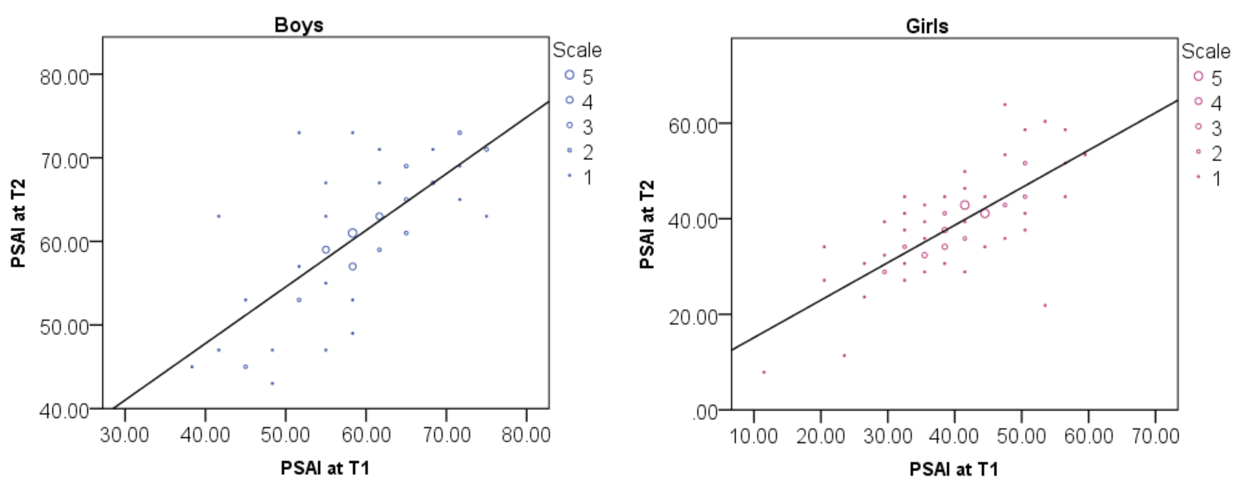
Figure 1. Plots illustrating the interactions of the Sex x Age group x Time ANOVA for the color composite score (higher score = greater preference for pink/less preference for blue)



2a. Children's color preferences

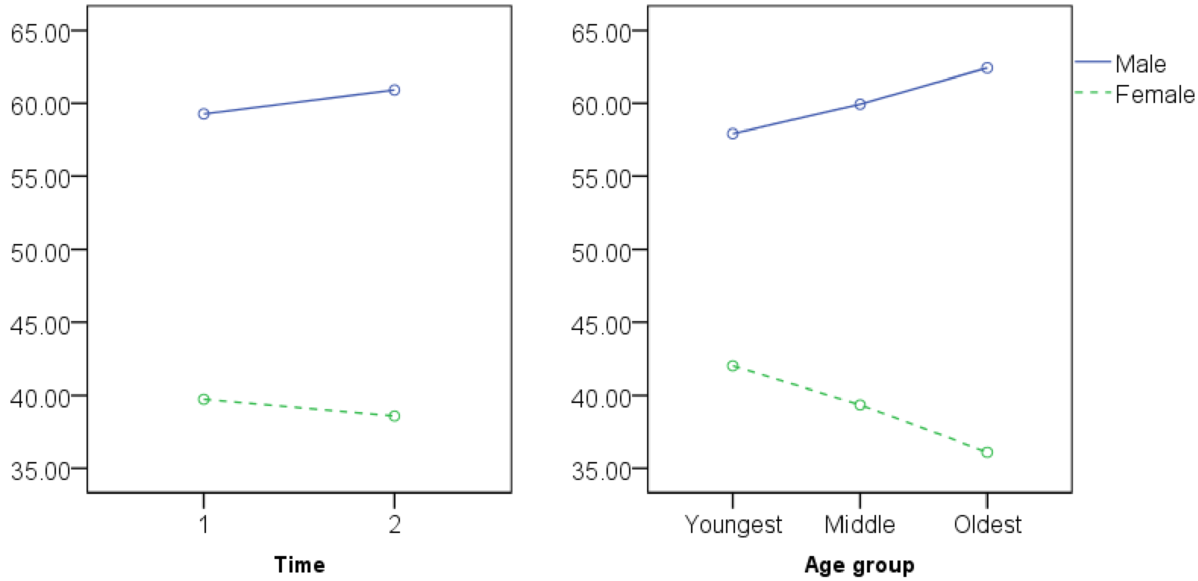


2b. Parents' color preferences



2c. Children's PSAI scores

Figure 2. Scatter plots (binned) and best fit lines showing stability over time



3a. Sex x Time interaction

3b. Sex x Age group interaction

Figure 3. Plots illustrating the interactions of the Sex x Age group x Time ANOVA for PSAI scores (higher score = more male-typical)