

Sex Differences in Children's Free Drawings: A Study on Girls with Congenital Adrenal Hyperplasia

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Sex differences are recognized in children's free drawings with respect to motifs, colors, figure compositions, and expression. Boys tend to draw mobile objects and mechanical objects with dark or cold colors and often use bird's-eye-view composition when they draw pictures, whereas girls like to draw human motifs (especially girls and women), flowers, and butterflies with light and warm colors and tend to arrange motifs in a row on the ground. Analyses were made on the drawings of girls with congenital adrenal hyperplasia (CAH) and unaffected boys and girls, using masculine and feminine indexes. Sex difference in masculine and feminine indexes was clear in the drawings by unaffected boys and girls. Their drawings do not or mostly do not contain characteristics typical of the opposite sex. Compared with those of unaffected girls, the pictures of CAH girls more strongly showed masculine characteristics. The feminine index for the pictures of CAH girls was significantly lower than that for unaffected girls, while the masculine index for CAH girls was significantly higher than that for unaffected girls. Furthermore, the masculine index for CAH girls was not significantly different from that of unaffected boys. These results suggest that androgen exposure during fetal life may contribute to shaping masculine characteristics in children's free drawings. © 2001 Academic Press

There is considerable evidence suggesting the presence of sex differences in childhood play behaviors

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between boys and girls (Snow, Jacklin, and Maccoby, 1983). Boys tend to prefer using vehicles and building toys in their play activities, whereas girls tend to prefer dolls (Fagot, 1978; Sutton-Smith, Rosenberg, and Morgan, 1963). Boys also spend more time than girls do in rough-and-tumble play, particularly involving play fighting and overall body contact (DiPietro, 1981; Ehrhardt and Meyer-Bahlburg, 1981). Similar sex differences are observed in infant behaviors of rhesus monkeys (Goy and McEwen, 1980).

It has been reported that prenatal treatment of female rhesus monkeys with androgen has a clear and significant masculinizing effect on their play behaviors. Rough-and-tumble play markedly increases in the females exposed to androgen during fetal life (Goy, Bercovitch, and McBair, 1988a; Goy, Uno, and Scholl, 1988b). Congenital adrenal hyperplasia (CAH) is a genetic disorder that begins prenatally and results in overproduction of adrenal androgen. Interestingly, girls with CAH show a masculine-typical pattern of play behavior, and they play with boy-preferred toys (Berenbaum and Hines, 1992; Hines, 1993, 1999). These findings suggest that prenatal exposure of their brains to androgen may play a key role in the differentiation of sex-typical play patterns of childhood behaviors.

It is also known that there are differences between drawings made by boys and those by girls (Kershensteiner, 1905). Especially, such differences are noted in the motifs and colors which appear in their drawings. Boys choose to draw moving objects and to use cold colors, while girls like to use warm colors to draw

TABLE 1
Motifs in Children's Drawings

Motif	Boy (%)	Girl (%)
Moving objects (vehicle, train, aircraft, etc.)	92.4***	4.6
Person	26.5	96.6***
Flower	7.2	57.0***
Butterfly	3.2	23.4***
Sun	50.8	76.5***
Mountain	14.5**	3.1
House and building	17.7	33.5**
Tree	9.6	23.4*
Ground	42.7	57.8*
Cloud	25.0	32.8
Sky	41.9	49.2

*** $P < 0.001$.

** $P < 0.005$.

* $P < 0.05$.

flowers and girls or women (Minamoto, 1985; Mikami, 1995).

In the present article, we examined characteristic differences in children's drawings made by boys and girls. Masculine characteristics in the drawings by girls with CAH were also studied. For statistical analyses, the χ^2 test was performed for the incidence of motifs and figure compositions, and for masculine and feminine indexes, the F test and Student's t test were used.

CHARACTERISTIC FEATURES OF CHILDREN'S DRAWINGS

The motifs which appear in the children's drawings are rich in variety. The drawings of 124 boys and 128 girls of 5–6 years in age from six kindergartens were examined. As shown in Table 1, there is some difference in the incidence of objects chosen by boys and girls. Significant differences are recognized in the incidence of flowers [$\chi^2(1) = 70.51$], butterflies [$\chi^2(1) = 19.22$], and the Sun [$\chi^2(1) = 16.39$]. These motifs are most frequently seen in the drawings by girls (Figs. 1A and 1B), whereas the incidence is low in those by boys.

A similar sex difference is also recognized in human motifs [$\chi^2(1) = 113.10$]. Girls especially like to draw girls and/or women. The appearance of human motifs is less frequent in boys' drawings.

In contrast, boys like to draw mobile objects, such as vehicles, trains, aircrafts, and rockets [$\chi^2(1) = 192.13$, Fig. 1C]. These motifs are quite rare in girl's drawings.

Figure 2 shows the consumed amount of each color

of crayon by 143 boys and 146 girls of 5–6 years of age, respectively, measured for 6 months. Girls use more colors per drawing compared to boys. Boys use one or specific color(s) in one area, whereas girls use each color rather diffusely.

The only colors which boys use more frequently than girls are gray and blue. Sex difference in color is most marked in the color pink. Girls decidedly prefer



FIG. 1. (A) Picture drawn by a 5-year-old girl; (B) picture drawn by a 6-year-old girl; (C) picture drawn by a 5-year-old boy.

Consumed amounts of each color of crayons

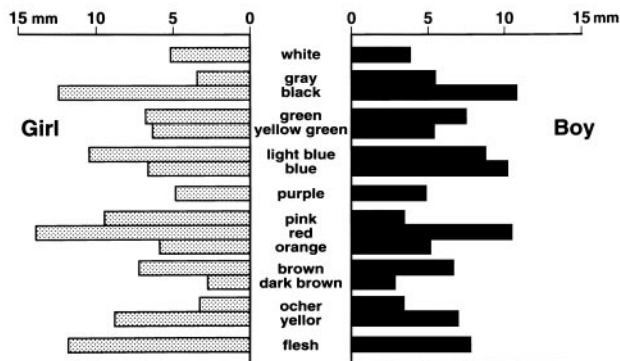


FIG. 2. Consumed amount of each color of crayons (mm).

pink and flesh colors. In general, girls use warm colors very often, whereas boys prefer to use cold colors.

The figure compositions in free drawings by children were examined in 168 boys and 160 girls of 5–6 years of age. The most common figure composition in a row on the same plane. One example is shown in Fig. 1A. A girl standing with a dog and flowers is drawn in a line on the ground, and the Sun and butterflies are in the sky.

Row arrangement composition is seen in 74.4% of girl's drawings, while it appears in only 20.4% of boy's drawings [$\chi^2(1) = 94.34$]. Although the row arrangement composition is not rare in boy's drawings, boys often draw motifs in piles. In pile or bird's-eye figure composition, the motifs are arranged three dimensionally. The incidence of this type of composition is 24.4% in boys, while in girls it is only 1.9% [$\chi^2(1) = 15.92$]. Pile or crane-view drawings seem to be exceptional in girl's drawings. Figures 3A and 3B are examples of bird's-eye-view and pile drawings by boys. In addition, boys often draw magnify and/or emphasize a main motif in the central position. Fig. 1C is such example. Girls tend to draw each motif rather equally.

MALE AND FEMALE CHARACTERISTICS IN DRAWINGS BY GIRLS WITH CAH

Analysis of male and female characteristics in children's drawings was performed on four aspects: motif, color, composition, and expression. As shown in Table 2, items are classified into masculine or feminine in each category, based on the results of Table 1 and

Fig. 2 and other observations described above. For estimation, 1 point is given in each category if the picture contains one or more items. If not, the score is 0. Masculine and feminine indexes are indicated as a total score of the four categories.

Four or five pictures per child were subjected to estimation for masculine and feminine indexes. The drawings of 8 CAH girls of 5 years in age and 12 unaffected boys and 17 unaffected girls of the same age were estimated. All patients with CAH had undergone clitoroplasty and vaginoplasty by 3 years of age. They were diagnosed as the salt-waster type of CAH and had been receiving gluco- and mineralocorticoids.

Clear sexual dimorphism in masculine and feminine indexes is recognized between boys and girls. As shown in Table 3, the drawings by unaffected children do not or mostly do not contain characteristics typical of the opposite sex. The pictures by CAH girls showed

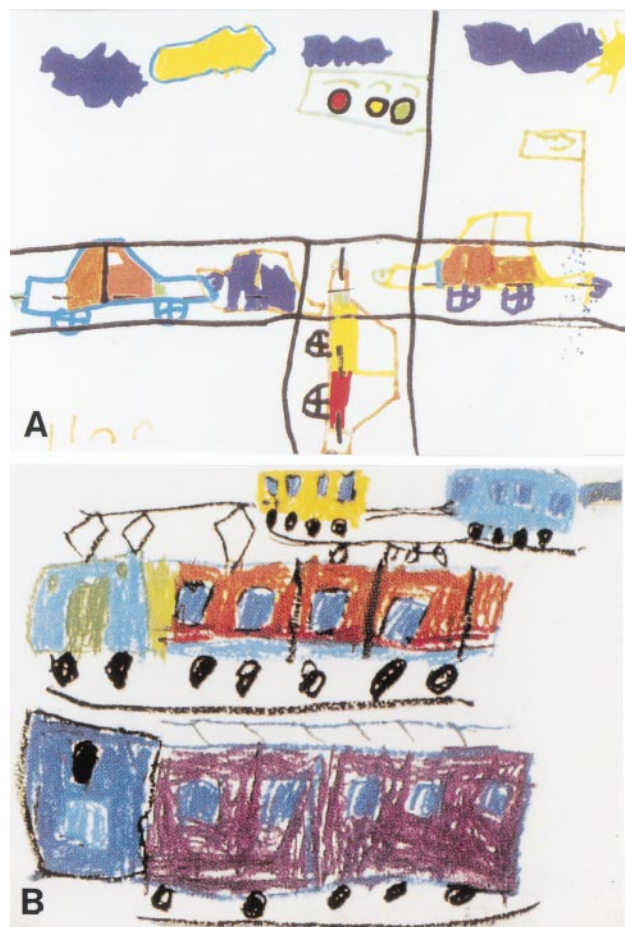


FIG. 3. (A) Bird's-eye view of an intersection drawn by 6-year-old boy. (B) Trains are drawn in a pile by a 5-year-old boy.

TABLE 2
 Characteristics in Children's Drawings—Items for Masculine and Feminine Indexes

Category	Item	
	Masculine	Feminine
Motif	Vehicle (cars, trains, planes, ships, rockets, etc.) Weapons, fighting scenes	Persons (especially girls and women) Flowers, butterflies, small animals (pets) Ground–tree–house
Color	Dark or cold colors Less than 6 colors Using one or specific color(s) in one area	Light or warm colors More than 10 colors Using each color diffusely
Composition	Magnifying, emphasizing, and centralization Pile or bird'-eye view Three-dimensional arrangement	Drawing each motif rather equally Row arrangement
Expression	Realistic, attempting reproduction of actual objects Dynamic	Not realistic Peaceful Decorative

bisexual characteristics. However, they showed more strongly masculine characteristics in motif, color, and figure composition, such as scanty delineation of persons, dark-colored drawing, stacking, bird's-eye view, and mobile objects.

The feminine index for the pictures of CAH girls is significantly lower than that for unaffected girls ($P < 0.001$), while the masculine index for CAH girls is significantly greater than that for unaffected girls ($P < 0.001$). Furthermore, the masculine index for CAH girls is not significantly different from that for boys. Male-oriented trends are quite evident in the drawings of CAH girls. In Fig. 4A, a drawing of a CAH girl, a blue car is drawn in the center of the picture. Magnification and centralization of the motif, as in Figs. 1C and 4A, indicates masculine characteristic features.

Similar tendencies are also recognized in drawings by 6- to 8-year-old CAH girls. Figure 4B shows an example, a picture titled "Whale Swallows a Town," drawn by a 7-year-old CAH girl. This picture contains considerable evidence for masculine characteristics.

There are many cars and buses in the pictures. The colors are dark and cold. The composition uses an overhead air view. Only two persons are drawn in the picture, whereas usually in girl's pictures, many human motifs can be seen. Arranging many stars at regular intervals may indicate some decorative expression which is one of the feminine characteristics.

DISCUSSION

Sex differences in children's free drawings, particularly in motif and color choice, figure composition, and liveliness of motion may indicate that boys and girls have different feelings and ways of perceiving objects when they draw pictures.

Row arrangement composition is most common in girls' drawings, whereas the incidence of bird's-eye-view composition is significantly higher in boys' drawings. Since, on average, men perform better than women on the measure of visuospatial abilities

TABLE 3
 Masculine and Feminine Indexes in the Drawings of Girls with CAH

Subjects (5 years old)	Number	Masculine	Feminine
CAH girls	8	1.7 + 0.2	1.0 + 0.3
Unaffected girls	17	0.1 + 0.0	3.4 + 0.2
Unaffected boys	12	2.2 + 0.2	0.0

$P < 0.05$

$P < 0.001$

$P < 0.001$

ns

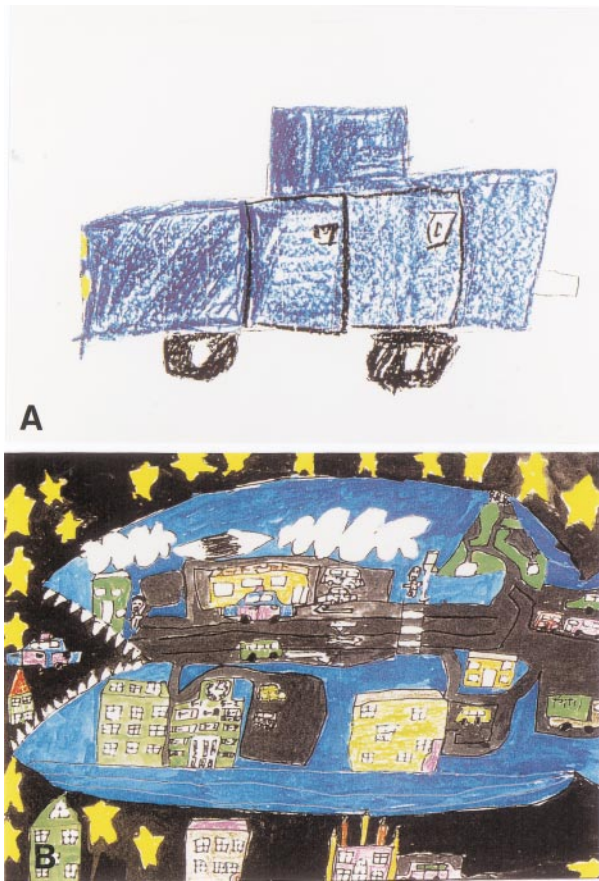


FIG. 4. (A) A car drawn by a 5-year-old CAH girl. (B) Bird's-eye view picture drawn by a 7-year-old CAH girl.

(Hampson, 1999), the difference can be interpreted as correlating with some difference in spatial perception between boys and girls.

It has been reported that girls exposed to high levels of androgen prenatally, either because of CAH or because their mothers were prescribed androgenic progestins during pregnancy, show an increase in masculine-typical play behaviors, including toy preference (Ehrhardt and Money, 1967; Ehrhardt and Meyer-Bahlburg, 1981; Hines and Kaufman, 1994). There is also evidence suggesting better spatial ability in CAH girls, compared to unaffected girls, especially better performance in mental rotation tests (Resnick, Berenbaum, Gottesman, and Bouchard, 1986; Grimshaw, Sitarenios, and Finegan, 1995; Hampson, 1999).

Our patients received plastic surgery on their external genitalia by 3 years of age and have been receiving supplemental therapy. They have gender identity as girls and are reared as girls. Under these circumstances, the drawings of CAH girls are still found to

bear bisexual characteristics. Furthermore, the masculine characteristics in drawings are significantly increased. In contrast, according to our preliminary observations (Iijima, Yamashiro, and Arisaka, unpublished observations), feminine trends are found in the drawings of XY patients with Prader's disease, a genetic disorder of steroid synthesis. These results again suggest that adrenal androgen during fetal life may contribute to the shaping of masculine characteristics in CAH girl's pictures.

Free drawings by children are thought to be some expression of their psychological state. However, it is not known at present to what extent these characteristics in children's drawings are correlated with psychological and behavioral functions in adulthood. There is evidence suggesting that, as in "sissy boy syndrome" (Green, 1987), childhood traits are to some extent predictive of a person's sexual orientation (Bell, Weinberg, and Hammersmith, 1981; Green, 1985; Friedman, 1988). Therefore, sex-typical or -atypical traits in childhood which are possibly dependent on prenatal hormone environment are of interest to the study of the development of sexually dimorphic psychological functions in adulthood.

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