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Gender Differences in Children's Use of Colors in Designing Safety Signs

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Abstract

Gender differences exist in color preference. However, most sign designs and research on signs nowadays seldom consider the issues of color preference and the gender differences. This paper serves as a preliminary study and explores children's use of colors on designing signs and examines the differences of boys and girls in choosing colors for different signs. In this study, thirty-two boys and girls were invited to draw twelve chosen signs with six colored felt-tip pens. After collecting and analyzing children's drawings, it is found that girls are keener to use more colors, and it can be argued that colorful signs are more effective for them. However, the factors affecting girls' choices of colors in drawing the signs are still unexplored, and further investigations have to be conducted in this regard. Nevertheless, it is hoped that this paper is able to provide a children's perspective on the choices of signs' colors and thus shed some lights on using different colors in sign design for children.

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1. Introduction

Differences between genders exist. Gurian [1] suggested that different genders process and perceive information differently. Boys and girls also approach problems in different ways that girls tend to be more theoretic and boys are keener on experimental approach [2]. The differences may also exist in the topic of color. Ellis and Fieck [3]

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suggested that males and females have different color preferences. Greene and Gynther [4] concluded from the literature that females are more sensitive to colors, and they tend to give more names for colors in color naming. Because of the gender differences, it is unsurprising to find that many products and designs are designed according to the gender of the users. For instance, boys may prefer a bedroom with a car-like bed. They may prefer toys and photos of helicopters, fire truck and trains. Girls may prefer a princess room with a lot of fluffy toys. It is nearly effortless to imagine that boys prefer a blue or light blue room, and girls prefer a pink one. Although the difference of the children's color preference may be caused by the gender stereotype that adults reinforce, it is undeniable that the differences exist, and it seems natural to consider using different colors for different genders in designing products for children.

Surprisingly, in the context of sign design, such consideration is not observed. Most signs are unisex and monotone. The use of signs' colors and its designs often do not show gender preference (see Figure 1). It is thus questionable whether it is necessary to consider gender difference of color preferences in sign designing. Undoubtedly, designing unisex signs are effective and economic for the production of signs. However, considering the use of different colors for different genders may also increase children's compliance, as children can easily be attracted and thus imitate the behaviors guided in the signs. The choice of colors also affects comprehensibility and noticeability of the signs, and memory of warning messages [5, 6].

Little has been done on how children prefer colors of signs [7]. It is still undiscovered whether children may have preferences on the colors used in signs. Consequently, the paper explores children's use of colors on designing signs and examines the differences of boys and girls in choosing colors for different signs. It is hoped that the paper is able to provide a children's perspective on the choices of signs' colors and thus shed some lights on using different colors in sign design for children.



Fig. 1 an example of safety sign (the pictogram) showing no gender preference.

2. Method

Sixteen boys and sixteen girls from primary two to six were involved in the study. There were six children from primary two, four and six respectively, and seven children from primary three and five respectively. Before collecting data from these children, they were asked to do the Ishibara color test, and two of the sixteen boys failed to score full marks. Although they were also involved in the data collection process, their data were thus omitted in the findings presented in this paper. After finishing the color test, the participating children were then given the referent of the signs (in Chinese, their mother tongue) and asked to design and draw twelve safety signs extracted from the ISO 7010:2011(E) Graphical symbols – Safety colors and safety signs – Registered safety signs [8]. These referents are chosen because they are close to children's everyday life, and it is expected that children are able to understand these referent. Besides, as the signs are related to safety issues, it is easier for children to imagine the

scenes described in the signs and visualize the contexts using their drawings. Signs which convey abstract messages are not chosen in this study. The twelve chosen referents given to the children are:

1. Wash your hands
2. Warning: Slippery surface
3. Use footbridge
4. Warning: Drop/fall
5. Not drinking water
6. No pushing
7. No sitting
8. Warning: Toxic materials
9. Use handrail
10. Warning: Floor-level obstacle
11. Use this walkway
12. Do not touch

Children were required to draw each sign in a 7cm x 7cm square, and they were only provided with six color felt-tip pen (black, blue, green, yellow, orange, and red) to make the drawings (see Figure 2). They were allowed to finish the drawings at their own pace and pick the colors they wanted. No pressure was given to the children in the data collection process. Children's drawings were then collected, scanned, and analyzed. There were 357 colored and three blank drawings collected. The findings are organized and presented in the next section.

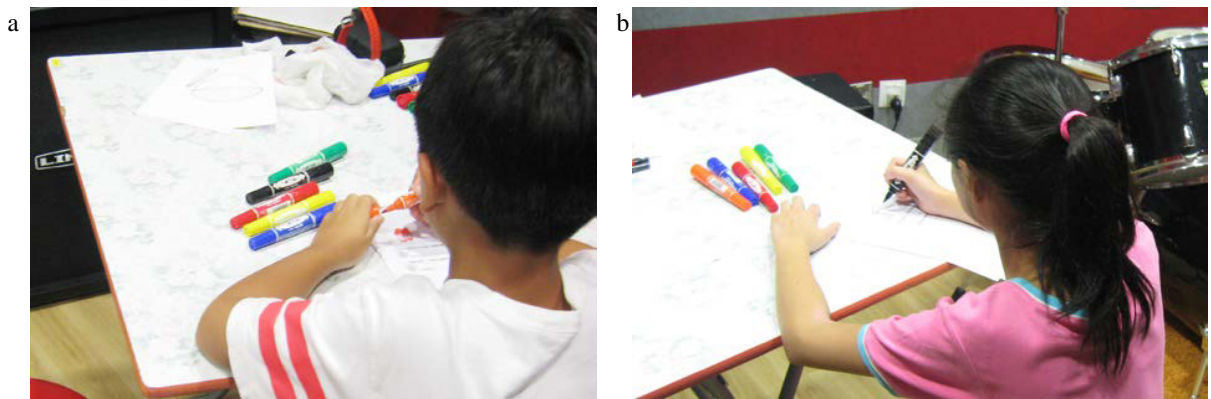


Fig. 2 a boy (a) and a girl (b) using color felt-tip pens to draw the signs.

3. Findings

3.1. Children's choices of colors (by different genders and primary levels)

After analyzing the drawings and examining the colors used by the children, it can be found that boys had used the six colors for 277 times and girls for 325 times in drawing the signs. Black and blue are more popular than other colors that about half of the frequencies are contributed to black and blue. Green is the least popular color among others (17 times for boys and 39 times for girls). Figure 3 below shows boys' and girls' preference of choosing the six colors.

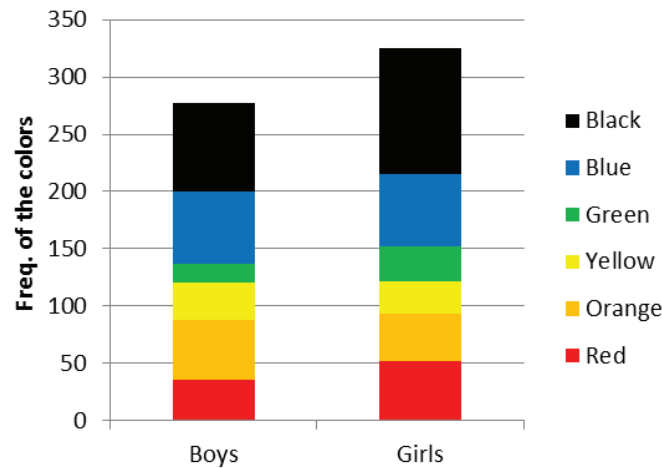


Fig. 3 Boys' and girls' choices of colors among different primary levels.

By splitting the data set according different primary levels, the differences between the patterns of boys' and girls' preferences can be observed (Figure 4). The older girls tended to use more black and blue than the younger girls did, but boys of different primary levels kept using black and blue with similar frequencies. Besides, the frequencies of the colors used by girls from different primary levels were quite steady, while the frequencies of the colors used by boys increased from primary two to four and dropped from primary four to six. All drawings of primary six boys used blue or black colors. The finding would be clearer when the numbers of colors used by boys and girls at different primary level are compared (see Figure 5).

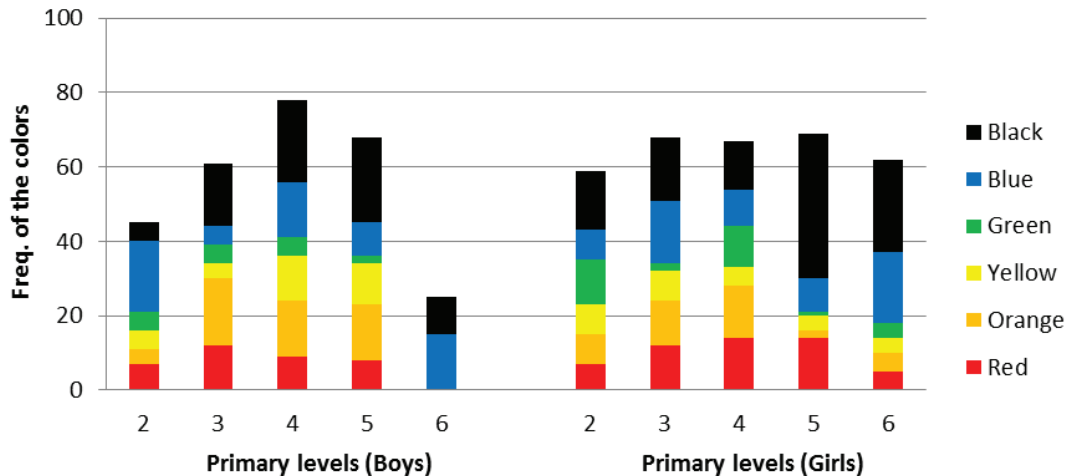


Fig. 4 Boys' and girls' choice of colors among different primary levels

3.2. Number of colors chosen (by children of different genders and primary levels)

In Figure 5, it is clear that most drawings of primary 6 boys have one color only (94.4%). Combining the findings in Figure 4, it can be concluded that most of the drawings of primary 6 boys contain one color and the color is either blue or black. In addition, it is interesting to note that while primary 6 boys tend to use fewer colors than boys at

other primary levels, girls does not show the similar pattern. Instead, most of the drawings of primary 2 girls (87.9%) contain one color only. Unlike primary 6 boys, primary 2 girls not only used blue and black but also other colors as the only color in the drawings (see Fig. 4).

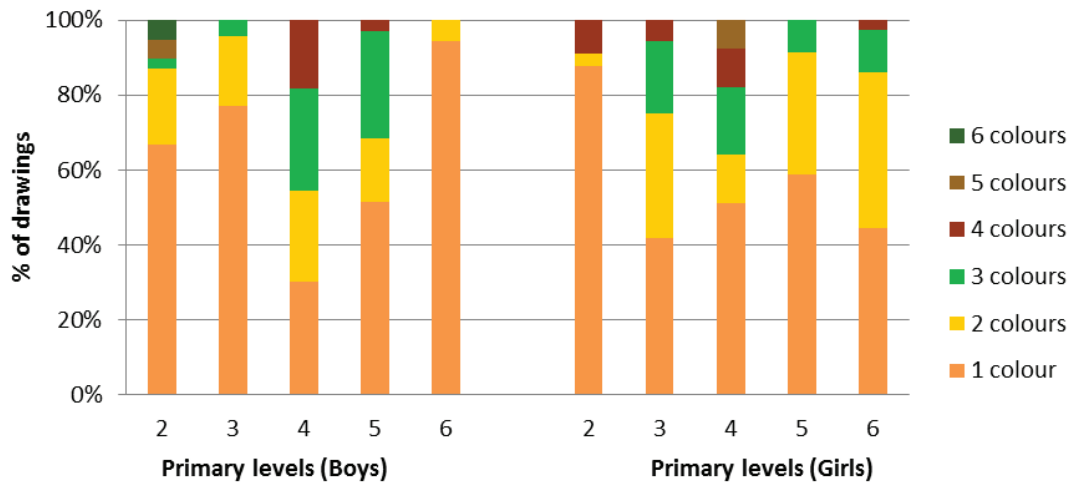


Fig. 5 Number of colors used by boys and girls among different primary levels

3.3. Children's choices of colors in different signs

The findings of children's choice of colors are interesting when the frequencies of the colors used by boys and girls in drawing the twelve signs are examined. From Fig. 6, it can be observed that the frequencies of colors used by boys are quite steady among different signs. Black is the steadiest color that the frequencies are within four to seven. Blue is the most fluctuating color, with frequencies ranged from three to ten. Nevertheless, the fluctuation is still more stable than the data obtained from girls' drawings.

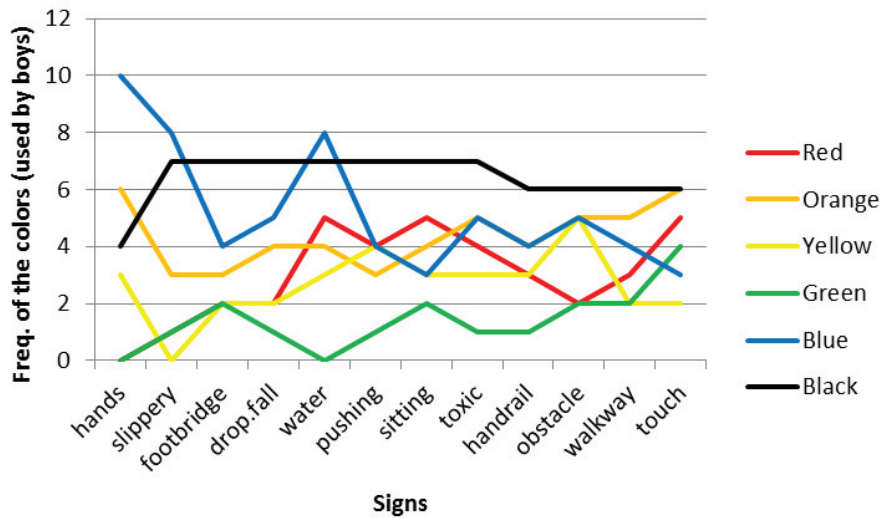


Fig. 6 Frequencies of the colors used by boys in drawing the twelve signs

Fig. 7 shows data obtained from girls' drawings. Compared with the data obtained from boys in Fig. 6, it is clear that the frequencies are more fluctuating. The most fluctuating color is from blue, with frequencies ranging from 2 to 11. The steadiest color is red, with frequencies ranging from one to five. The two charts (Figs. 6 and 7) may suggest that boys and girls had different considerations in choosing colors while drawing the signs.

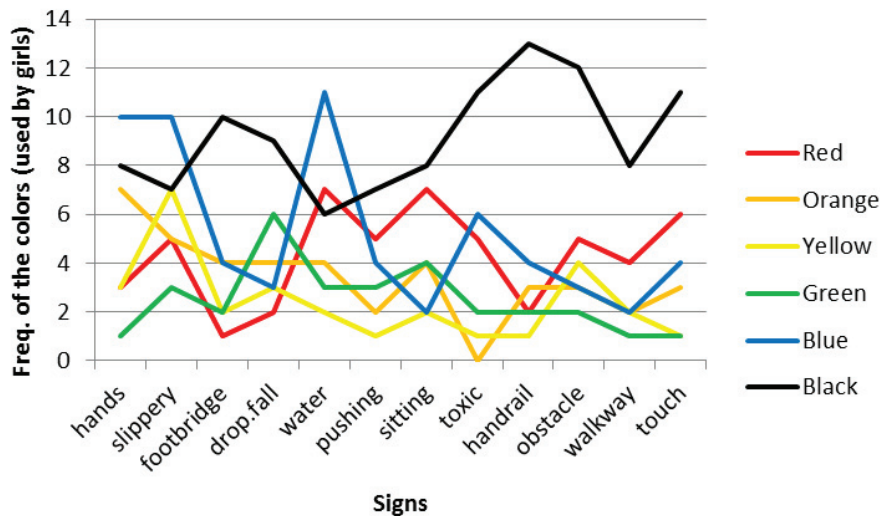


Fig. 7 Frequencies of the colors used by girls in drawing the twelve signs

3.4. Number of colors chosen in different signs

In order to understand more about children's considerations, the average numbers of colors chosen by boys and girls are examined (see Figs. 8 and 9). It is interesting to find that the patterns of the boys' data of different signs are

similar to each other (see Fig. 8), while the patterns of the girls' are very different from each other (see Fig. 9). The findings here are also coherent with the findings illustrated in Figs. 6 and 7 that the data obtained from boys are steadier and that from girls are more fluctuating. The finding may also allow designers and researchers understanding children's choice of colors more effectively.

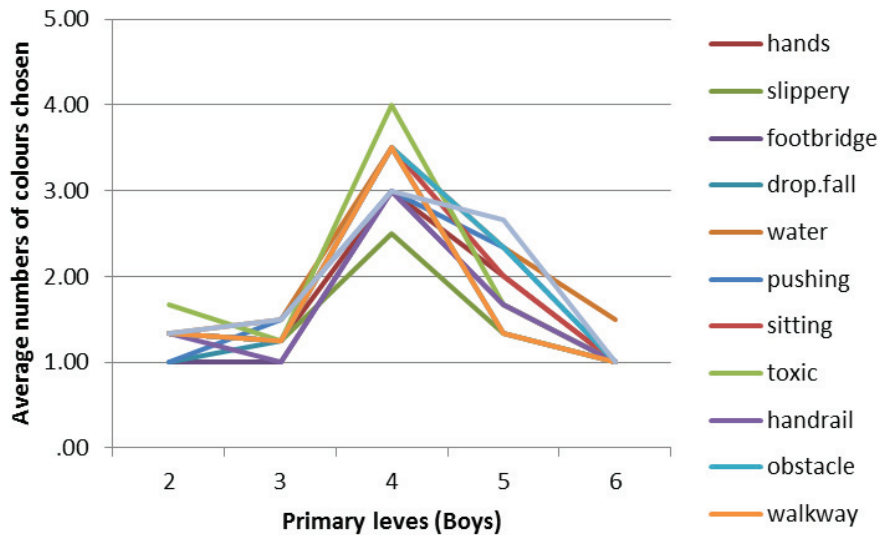


Fig. 8 Average numbers of colors chosen by boys among different primary levels

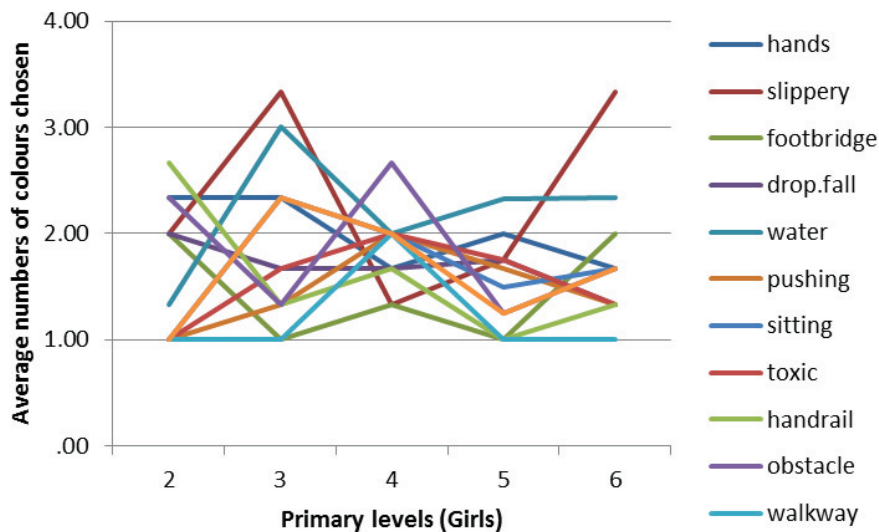


Fig. 9 Average numbers of colors chosen by girls among different primary levels

In Fig. 8, similar patterns of data of the twelve safety signs can be observed. The similar patterns suggest that the average number of colors used by the boys at a particular primary school levels remained the same or similar

regardless of what the safety sign is. It seems that the contents and the meanings of the safety signs are not the factors affecting the boys' choices of color. On the contrary, girls' choices of color are dependent on numerous factors that no pattern can be observed from Fig. 9. Girls' choices seem to be more arbitrary in choosing the colors, or there were some hidden patterns that the analysis of this paper is unable to cover.

4. Conclusions

This paper has examined the gender differences of the choice of colors in designing the twelve chosen safety signs. Concluding from the findings above, it is found that:

1. Girls tended to use more colors than boys, and this practice remains unchanged across different primary levels.
2. Older boys used fewer colors, and most of the times they only used black or blue.
3. Girls may have other considerations when choosing colors to draw the signs.
4. It seems that boys' choice of colors did not depend on the contents and the meanings of the safety signs.

Based on the findings of the study, it can be argued that the use of different colors in sign designing may be influential for girls but less likely for boys in general. Girls are more sensitive to colors, while boys are not. Therefore, in the settings which are only specific for girls, colored signs may be more effective than monotone signs or signs with fewer colors. Besides, colorful signs may also be more effective for young boys that they chose more colors to design and draw their signs. Yet, the findings in this paper are limited by the small sample size and type. More children and adults have to be involved in order to obtain a more generalized finding. Further investigations and qualitative research are also needed to understand the factors affecting children's choices of colors, so that more concrete and contributive suggestions can be made for designers to design colorful signs for children.

Acknowledgements

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References

- [1] M. Gurian. Boys and Girls Learn Differently: A Guide for Teachers and Parents, Jossey-Bass, San Francisco, 2001.
- [2] E. M. Staberg. Gender and science in Swedish compulsory school. *Gender & Education* 1994; 6: 35-46.
- [3] L. Ellis, C. Fick. Color preferences according to gender and sexual orientation. *Personality and Individual Differences* 2001; 31: 1375-9.
- [4] K. S. Greene, M. Gynther. Blue versus periwinkle: Color identification and gender, *Perceptual and Motor Skills* 1995; 80: 27-32.
- [5] S. L. Young, S. L. Increasing the noticeability of warnings: Effects of pictorial, color, signal icon and border, in: *Proceedings of the Human Factor Society 35th Annual Meeting*, Human Factors Society, Santa Monica, 1991, pp. 580-84.
- [6] C. C. Braun, N. C. Silver. Interaction of signal word and colour on warning labels: Differences in perceived hazard and behavioral compliance, *Ergonomics* 1995; 38: 2207-20.
- [7] K. W. M. Siu, Y. L. Wong, M. S. Lam, A. W. Y. Ng. Children's Misinterpretation of Today's Designs: A Case Study of How Children Interpret the Registered Safety Signs. *International Journal of Creativity and Problem Solving* 2014, 24(2): 61-73.
- [8] International Organization for Standardization. ISO 7010:2011(E) Graphical Symbols – Safety Colors and Safety Signs – Registered Safety Signs, 2011.