



Children's choice: Color associations in children's safety sign design



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ABSTRACT

Color has been more identified as a key consideration in ergonomics. Color conveys messages and is an important element in safety signs, as it provides extra information to users. However, very limited recent research has focused on children and their color association in the context of safety signs. This study thus examined how children use colors in drawing different safety signs and how they associate colors with different concepts and objects that appear in safety signs. Drawing was used to extract children's use of color and the associations they made between signs and colors. The child participants were given 12 referents of different safety signs and were asked to design and draw the signs using different colored felt-tip pens. They were also asked to give reasons for their choices of colors. Significant associations were found between red and 'don't', orange and 'hands', and blue and 'water'. The child participants were only able to attribute the reasons for the use of yellow, green, blue and black through concrete identification and concrete association, and red through abstract association. The children's use of color quite differs from that shown in the ISO registered signs. There is a need to consider the use of colors carefully when designing signs specifically for children. Sign designers should take children's color associations in consideration and be aware if there are any misunderstandings.

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1. Introduction

Increasing numbers of researchers and design professionals recognize that color is a key consideration in ergonomics and in the human factors related to sign design. Research has indicated that color plays a more important role than simple decoration and ornamentation (Burkitt et al., 2011; Jolley, 2010; Luquet, 2001; Zentner, 2001). Color helps people to not only distinguish different objects in two and three dimensions but also to convey messages. For instance, in general, red means 'stop' and yellow means 'danger' on road and traffic signs (Fleyeh, 2004). Different colors represent different meanings, and color also affects display preferences, cognition, behavior and performance (Braun and Silver, 1995). Color stereotypes and color message transfer capability suggest that color is an essential tool that designers can use when the textual message is restricted. Color seems to play an important contextual role in signs, whereas images and pictures serve as the sign's major means of communication. Fig. 1 shows two examples of colored signs found in a children's library and in a children's playgrounds.

Safety signs are messages in which the textual information is less important (Ng et al., 2013). The colors used in signs is thus essential and they may also affect the signs' effectiveness, as the literature (e.g., Braun and Silver, 1995; Young, 1991) suggests that colors affect the noticeability and behavior compliance of signs. Young (1991) suggested that the choice of colors influences the noticeability of signs and found that red warning labels are more noticeable than black signs. Braun and Silver (1995) suggested that color also influences the level of conveyed hazard and compliance behavior. Instead of signs or labels, they used colored words to evaluate the interaction between signal words and colors and behavioral compliance. They found that red and orange were perceived to be significantly more hazardous than black, green and blue and that the perceived level of hazard varied when different colors were used for the same signal word. Behavioral compliance increased for red signal words. However, although the two studies examined the effects of the use of different colors, they only focused on one color in one warning sign or message. The combination of colors on a sign was not considered. Studies have also suggested that appropriate colors should be used to express the different meanings of signs based on findings on color associations (e.g., Ng and Chan, 2008). However, there has been no clear explanation of whether multiple colors are associated with any sign contents.

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Fig. 1. Colored signs of 'No Playing' in a children's library (left) and 'Keep Clear, Danger' in a children's playground (right).

It should also be noted that the subjects of the above studies were all adults, and it is uncertain whether colored signs and messages have similar effects on children. Children's understanding and choices of color differ from those of adults (Zentner, 2001), particularly in the case of young children who have not received much education and who are not yet restricted by social expectations or requirements (Siu and Kwok, 2004), as they tend not to conform to the prevailing color codes and social stereotypes. Children may have different perceptions concerning the use and choice of colors in safety signs. Kalsher and Wogalther (2007) indicated that warnings designed for children should differ from those for adults and noted that practical research regarding the needs of children is lacking. Currently the literature still lacks information on how children associate colors with safety signs and their contents. Information about how they attribute the color association is still in need. The information obtained from children is worthwhile for designers, engineers, researchers and also policy makers to concern. Children should be included in sign design process to address their needs (Ng et al., 2012). Although designers and human factors experts are the final decision makers who determine the design and colors, it is also essential to provide opportunities for children to express their comments and opinions about color association in safety sign designs.

Conducting research with and extracting comments from children is challenging (Waterson and Monk, 2014). Waterson et al. (2012) engaged school children in classroom discussions to obtain their opinions on a number of existing and new safety signs. They had to do careful planning and preparations to guarantee a sensible outcome. Instead of asking children to comment directly, some studies involving children have used drawings to elicit their thoughts (Guha et al., 2005; MacDonald and Gustafson, 2004; MacDonald et al., 2007; Kwok, 2002) because children do not have sufficient language skills and cognitive capacity to express their ideas (Lefevre, 2010). Furthermore, drawing with different colored pens or pencils facilitates children's expression of emotions and ideas (Burkitt, 2004; Ehrlen, 2009; Harrison et al., 2007; Hopperstad, 2008; Jolley, 2010; Jolley et al., 2004; Strauss, 2007). Numerous researchers have provided children with different colored pens for drawing to identify their thoughts. For instance, Jolley et al. (2004) provided a pencil and six colored crayons (black, red, yellow, blue, green and brown) for 4, 6, 9, and 12 year-old children to draw pictures about happy and sad topics. Ehrlen (2009) supplied crayons of different colors in a study that asked 6 to 9 year-old children to draw images of the Earth. Hopperstad (2008) arranged shared crayons on a table for 5 to 6 year-old

children to use in drawing their thoughts about a story they had been told earlier. Harrison et al. (2007) provided a set of 12 colored felt-tip pens for 6 year-old children to draw themselves and their schoolteachers. In addition, some researchers have advocated using drawing as a tool to initiate conversation with children (Guha et al., 2005; Kwok, 2002; MacDonald et al., 2007; Sanoff, 1994, 2007). Overall, drawing helps children to express their views and preferences.

Thus, the aim of this study was to understand how children use colors in drawing different safety signs and how they associate colors with different concepts and objects that appear in the signs. Different combinations of colors were also considered in view of the research gap identified in the literature review. The participating children in the study were required to choose different colors and to design and draw certain signs. This approach avoided giving any information or hints about the choice or stereotypical meanings of the colors. Observing and analyzing the use of color in children's drawings can help researchers to understand children's thoughts about sign design. The results of this study will provide useful data from children's perspective for sign designers in designing signs for children and also other experts who concern children and their color associations.

2. Method

2.1. Participants

Thirty-two Hong Kong primary school children (16 boys and 16 girls) from P2 to P6 (aged 7–11 years) were randomly selected by their teachers to participate in this study. The boys and girls were evenly distributed among the primary school levels. According to Piaget's stages of cognitive development, children between the ages of about 7–11 are in concrete operational stage in which they can solve problems and develop concepts involving objects or other familiar situations (Slavin, 2006). Although the 'stage' theory of Piaget may be controversial, some recent studies involving children still use the theory and the concrete operational stage to understand children's cognitive development (e.g., Kuscevic et al., 2014; Shokouhi et al., 2014). In addition, although the children in this study may have different developmental progresses, the study considers 7–11 year-old children as a group because a majority of children facilities in Hong Kong, for example, playgrounds, is designed for only two age groups: 3–5 years old and 6–12 years old. In other words, only two sets of safety signs are designed for these two age groups. The study conforms to the Piaget's stages of

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