A Perceptual Analysis of Standard Safety, Fluorescent, and Neon Colors

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Twenty-six standard safety colors specified by the American National Standards Institute (ANSI), International Standards Organization (ISO), and the Federal Highway Association (FHWA) were compared to seven fluorescent and neon colors on perceived hazard and perceived importance. Results indicated that the fluorescent orange, ANSI red, fluorescent yellow, FHWA red, fluorescent yellow green, and ISO red were the highest rated colors on perceived hazard. ANSI red, FHWA red, ISO red, fluorescent orange, fluorescent yellow, and fluorescent yellow green were rated the highest on perceived importance. The implications of these findings and the potential use of fluorescent colors in product warnings are discussed.

INTRODUCTION

Color is frequently used to alert, aid comprehension, and increase the visibility of warnings (Wogalter & Vigilante, 2006). Using various participant groups, researchers have found that the color red consistently rated as the highest perceived hazard compared with other colors using various participant groups (Griffith & Leonard, 1997; Wogalter et al, 1998; Dunalp, Granda, & Kustas, 1986; Borade, Bansod, & Gandhewar, 2008; Smith-Jackson & Wogalter, 2000). Yellow, orange, and black are rated the next highest on perceived hazard (Smith-Jackson & Wogalter, 2000; Wogalter et al., 1998).

Fluorescent colors are starting to be used in environmental sign warnings. Fluorescent colors interact with ultraviolet (UV) light making them appear brighter, and thus more conspicuous, than non-fluorescents (Burns & Pavelka, 1995). However, little is known about their hazard connotation, or perceived hazard.

Only one study has compared the hazard connoted by standard safety colors to fluorescent colors. Tomkinson and Stammers (2000) investigated the perceived hazard of fluorescent colors and how they compared to non-fluorescent colors. Undergraduates rated fluorescent red the highest in connoted hazard followed by fluorescent orange, fluorescent yellow, and orange, which were equal in ratings, and then by red, fluorescent green, yellow, and green. Similar results were found using office workers except for them orange ranked below red.

Additionally ratings of perceived urgency produced similar results as perceived hazard. This study, however, did not fully specify the characteristics of the colors used. Without measured qualities of the stimuli it is difficult to compare findings or make specific recommendations for use.

More recently, Scheiber, Willan, and Schlorholtz (2006) compared fluorescent yellow-green to standard color on measures of attention capture and maintenance (Wogalter & Vigilante, 2006). They found that fluorescent yellow-green sign captured participants' first glances and had the longest total glance time compared to the traditional non-fluorescent colors of red, green, yellow, and orange. This study, however, used only one fluorescent color (yellow-green) and evaluated attention-related measures, but not hazard connotation.

The Scheiber et al. (2006) study suggests, fluorescent colors may aid in attention, probably because they are brighter than other colors in the surrounding context. Another potential benefit of fluorescent colors is that objects in fluorescent colors may be perceived as having greater importance than objects in standard colors. If so, then this attribute could be useful in drawing and maintaining attention to warning signs and labels. No research to date has evaluated perceived importance of standard safety or alternative (e.g., fluorescent) colors (see a review in Wogalter, Mayhorn & Zielinska, 2015). Potentially, some colors may be evaluated as high in importance but low in hazard, or vice versa.

The present study evaluated perceived hazard and perceived importance for standard (non-fluorescent) and fluorescent colors.

METHOD

Colors

A total of 33 colors were used. Colors were chosen from those promulgated by the American National Standard Institute (ANSI Z535.1), International Organization for Standardization (ISO 3864-4), United States Department of Transportation Federal Highway Administration (FHWA), Pantone neon colors, and 3M Company.

ANSI Z535.1 (2012) defines a set of safety colors for use in warning signs, labels, and tags. Munsell Color (Grand Rapids, Michigan) produces 22 x 28 cm (8.5 x 11 inch) sheets of the ANSI safety colors. The colors safety red, safety orange, safety yellow, safety green, safety blue, safety purple, safety brown, safety gray, safety black, and safety white were used.

The safety colors in ISO 3864-4 (Graphical Symbols – Safety Colours and Safety Signs (2011) standard lists RAL, Munsell, BS 5252, and NCS color equivalents for its safety colors. RAL, Munsell, BS 5252, and NCS are referenced to accurately print the colors. While the safety colors can be printed using any of these "equivalent" methods, in this study RAL color sheets were used: RAL 3001, RAL 1003, RAL 6032, RAL 5005, RAL 9003, RAL 9004 for red, yellow, green, blue, white, and black, respectively. Although it is not listed in the ISO standard, RAL 2010 (signal orange), was also included in the set tested.

The Federal Highway Administration (FHWA) lists color specifications on their *Manual on Uniform Traffic Control Devices* webpage (2013). FHWA provides Pantone® (Pantone LLC, Carlstadt, NJ) specifications for printing colors to accurately produce colors used in sign-sheeting and pavement-marking materials. The FHWA colors were printed by a Pantone certified printer in the North Carolina State University (NCSU) Design School. FHWA color names and Pantone shades used were: red (187), orange (152), yellow (116), green (342), blue (294), pink (198), purple (259), yellow-green (382), and brown (469). Color matches were confirmed with official Pantone Formula Guide obtained from the NCSU Design Library.

Pantone LLC previously produced a set of fluorescent colors identified within the Fluorescents and Metallic category. In 2010, Pantone released the Pantone Plus Collection transferring and renaming the previously identified fluorescent colors into the Neons and Pastels Collection. For the purpose of this study, the Pantone colors will be referred to as neon colors. The color names and shades of the Neons and Pastels Collection tested were green (802), blue (801), purple (814), and yellow green (809). These were printed by a Pantone Certified printer in the NCSU Design School. Color accuracy was confirmed using a Pantone Formula Guide.

Finally, the 3M Company (St. Paul, Minnesota) provided 10 x 15 cm (4 x 6 inch) samples of colors for use in this study. The 3M colors used were: fluorescent orange, fluorescent yellow and fluorescent yellow-green.

For each of the 33 colors that were used two 10 x 15 cm (4 x 6 inch) cards were produced (66 total). One set of colors was placed on white cardstock, and a second set of colors was placed on black cardstock. The black and white cardstock were used as neutral backgrounds for the colors to control for any biasing effect of color contrast. The cardstocks were cut to 12 x 17 cm (4.5 x 6.5 inch), providing a 1 cm (0.25 inch) overall border for each color. Cardstock was used so that all colors had the same firmness and consistency when handled and viewed by the participants. Participants were either shown all the colors with a black border or all the colors with a white border. For tracking purposes, each color was labeled with a letter and number.

Procedure

Eighty-nine participants were recruited from the NCSU participant pool operated by the psychology department. The participants consisted of 49 females and 40 males with a mean age = 19.4, *SD* = 1.75). For their participation, students were awarded research credit in their undergraduate psychology courses.

Participants were escorted into a quiet closed office that had fluorescent ambient lighting. Specifically, the 356 cm x 356 cm room had two Philips Day-Brite Fluorescent Parabolic Troffer Lights, with three Philips 32-Watt 700 Series Alto Fluorescent Tubes in each light. A Sekonic L-358 flash meter indicated that this lighting approximated 320 lux of light. The survey collection software, Qualtrics (Version 12.018, Provo, Utah), was used to record participants' responses. Initially, participants completed an informed consent form, followed by answering a set of demographic questions asking age, sex, education level, marital status, occupational status, race, and primary language. After these questions, the participants' color vision were evaluated using the Ishihara test for color

Table 1

*Colors used in the study for each standard, along with their color system, color system name, and color system reference number. Note: * indicates no color name.*

	ANSI (Munsell)	**ISO (RAL)**	**FHWA (Pantone)***	**Neon (Pantone)***	**3M**
Red	Safety Red 7.5R 4/14	Signal Red 3001	187	--	--
Orange	Safety Orange 5YR 6/15	Signal Orange 2010	152	--	Fluorescent Orange 4084
Yellow	Safety Yellow 5Y 8/12	Signal Yellow 1003	116	--	Fluorescent Yellow 4081
Green	Safety Green 7.5G 4/9	Signal Green 6032	342	802	--
Blue	Safety Blue 2.5PB 3.5/10	Signal Blue 5005	294	801	--
Pink	--	--	198	--	--
Purple	Safety Purple 10P 4.5/10	--	259	814	--
Yellow Green	--	--	382	809	Fluorescent Yellow Green 4083
Brown	Safety Brown 5YR 2.75/5	--	469	--	--
Gray	Safety Gray N 5/	--	--	--	--
Black	Safety Black N 1.5/	Signal Black 9004	--	--	--
White	Safety White N 9/	Signal White 9003	--	--	--

blindness. No participants were excluded due to color blindness.

For the color ratings, participants indicated the level of perceived hazard and perceived importance. Perceived hazard was defined as "being risky or dangerous." Ratings were made on a scale from 1 to 10. Anchors were given at the endpoints where 1 was labeled as "not at all hazardous" and 10 was labeled as "extremely hazardous." The other measure, perceived importance, was defined as having "great significance or value." Ratings were made on a scale with anchors at 1 and 10 with 1 indicating that the color was "not at all important" and 10 indicating that the color was "extremely important."

Participants either rated all the colors on perceived hazard and then on perceived importance or rated all the colors on perceived importance and then perceived hazard. The presentation of the colors within each rated dimension was randomized for each participant. In the rating task, the participant was handed color cards one at a time by a research assistant for examination and rating.

Following the ratings, students were asked to do a set of rank orderings of the colors. These data and associated analyses are not reported here. Once completing this procedure, they were debriefed and thanked for their participation.

RESULTS

The results section is divided into two main sections (perceived hazard and perceived importance). In each section, an analysis of variance (ANOVA) was conducted to compare the mean ratings of the colors contained in each color system. A second ANOVA analysis compared the mean ratings of each color system by color, creating a total of four subsections (perceived hazard rating by color system, perceived hazard rating by color name, perceived importance rating by color system, and perceived importance rating by color name). Table 2 contains the means and standard deviations for perceived hazard and perceived importance for each color.

Perceived Hazard

Perceived Hazard by Color System. An ANOVA analysis was conducted for each color system by color. Tukey's Honestly Significant Difference (HSD) test was used to further analyze significant effects ($p < .05$). For the ANSI set, there was a significant effect of color on hazard ratings, $F(9, 880) = 66.51$, $MSe = 5.02$, $p < .001$. Red was rated significantly higher than all of the other colors. Orange and yellow were rated the next highest with no significant difference between them, and both were significantly higher than the remaining colors. Black was the next highest and was significantly different than the remaining colors. Purple, brown, green, blue, gray, and white were the lowest rated with no significant difference among them.

The ISO color set showed a significant effect of perceived hazard, $F(6, 616) = 54.52$, $MSe = 5.70$, $p < .001$. Tukey's HSD indicated that red was rated significantly higher than all of the other colors. Orange and yellow were next highest and there was no significant difference between them but both were significantly higher than the remaining colors. Black was next highest and was significantly higher than the remaining colors. Blue, green, and white were rated the lowest and did not differ.

The FHWA set showed a significant effect of color on perceived hazard, $F(8, 792) = 49.12$, $MSe = 5.17$, $p < .001$. Red was rated the highest and was significantly higher than the other colors. Orange and yellow were rated the next highest on perceived hazard and did not differ. Orange was significantly higher than the other lower-rated colors. Yellow did not significantly differ from yellow-green. Yellow-green was higher than the remaining colors, except for pink. Pink was not significantly different from purple, but was rated significantly higher than the remaining colors. Purple was not significantly different from blue, brown, and green, which were rated the lowest colors, which among them yielded no significant difference.

For the Pantone neon color set, there was a significant effect of color on perceived hazard, $F(3,352) = 35.29$, $MSe =$

Table 2

Mean perceived hazard and importance ratings of each color by color system (standard deviation in the parentheses)

	Mean Perceived Hazard						Mean Perceived Importance				
	ANSI *M (SD)*	ISO *M (SD)*	FHWA *M (SD)*	Neon *M (SD)*	3M *M (SD)*		ANSI *M (SD)*	ISO *M (SD)*	FHWA *M (SD)*	Neon *M (SD)*	3M *M (SD)*
Red	7.5 (2.7)	7.0 (2.9)	7.3 (2.7)	—	—	Red	8.3 (1.9)	7.7 (2.2)	7.8 (2.1)	—	—
Orange	6.1 (2.5)	5.7 (2.5)	6.0 (2.4)	—	7.9 (2.4)	Orange	6.0 (2.2)	5.5 (2.4)	6.1 (2.3)	—	7.6 (2.4)
Yellow	5.7 (2.3)	5.3 (2.3)	5.4 (2.3)	—	7.3 (2.3)	Yellow	6.3 (2.2)	6.0 (2.5)	6.5 (2.2)	—	7.3 (2.4)
Green	2.5 (1.6)	2.5 (1.7)	2.5 (1.7)	3.8 (2.5)	—	Green	5.8 (2.5)	5.9 (2.6)	5.8 (2.7)	4.8 (2.4)	—
Blue	2.4 (1.6)	2.4 (1.5)	2.7 (1.6)	2.5 (1.6)	—	Blue	4.8 (2.3)	5.0 (2.5)	4.7 (2.4)	4.3 (2.5)	—
Pink	—	—	4.0 (2.5)	-	—	Pink	—	—	4.0 (2.4)	—	—
Purple	2.7 (1.9)	—	3.2 (2.3)	3.1 (2.2)	—	Purple	3.5 (2.0)	—	3.5 (2.1)	3.5 (2.1)	—
Yellow-Green	—	—	4.4 (2.5)	5.7 (2.4)	7.1 (2.3)	Yellow-Green	—	—	4.2 (2.4)	5.3 (2.3)	7.1 (2.6)
Brown	2.5 (2.1)	—	2.6 (2.1)	—	—	Brown	3.6 (2.4)	—	3.5 (2.4)	—	—
Gray	2.3 (2.0)	—	—	—	—	Gray	3.7 (2.5)	—	—	—	—
Black	3.9 (3.2)	4.2 (3.2)	—	—	—	Black	5.8 (3.1)	5.8 (2.9)	—	—	—
White	2.1 (2.0)	2.3 (2.2)	—	—	—	White	5.1 (3.1)	4.9 (3.1)	—	—	—

4.80, $p < .001$. Yellow-green was the highest rated and it was significantly higher than the other three colors. Green was next and was significantly higher the other two colors, purple and blue, which did not differ.

Finally, the 3M color set did not show a significant effect, $F(2,264) = 2.57$, $MSe = 5.65$, $p = .078$. While there were no differences among the three colors, it should be noted, and as Table 2 indicates, that the 3M colors were among the highest rated in the study.

Perceived Hazard by Color Name. ANOVAs were also conducted across groups for color of the same hue (e.g., all colors named as a type of "red") on perceived hazard. The analysis of the three reds failed to show a significant effect, $F(2, 264) = .78$, $MSe = 7.65$, $p < .10$, but it should be noted that all of the reds were among the highest on perceived hazard in the study. The analysis of the four oranges was significant, $F(3, 352) = 14.81$, $MSe = 6.01$, $p < .001$. The 3M fluorescent orange was significantly higher than the other orange versions from ANSI, ISO, and FHWA, which did not differ. Yellow showed a significant effect of color systems, $F(3, 352) = 14.74$, $MSe = 5.34$, $p < .001$. The 3M fluorescent yellow was higher than the yellows of ANSI, ISO, and FHWA, which did not differ among themselves. Green showed a significant effect, $F(3,352) = 11.06$, $MSe = 3.64$, $p < .001$. Pantone neon green was significantly higher than the other greens from ANSI, ISO, and FHWA, which did not differ. Yellow-green showed a significant effect, $F(2, 264) = 28.89$, $MSe = 5.89$, $p < .001$. The 3M fluorescent yellow-green was rated higher than Pantone neon yellow-green, which in turn was significantly higher than FHWA yellow-green. The remaining colors, blue, purple, brown, black, and white did not show any significant differences across color systems.

Perceived Importance

A similar set of analyses were conducted using the importance ratings.

Perceived Importance by Color System. The ratings of importance for colors were analyzed within each color system. For the ANSI set, the ANOVA was significant, $F(9, 880) = 32.19$, $MSe = 6.10$, $p<.001$. Red was rated significantly higher than all of the other colors on perceived importance. Yellow was rated next highest and significantly different from the remaining colors, with the exception of orange, black, and green. Orange was significantly different than the remaining colors, but was not significantly higher than black, green, and white. Black, green, and white were rated significantly more important than the remaining colors, with the exception of blue. Blue and gray were rated the next highest on perceived importance. Blue was significantly higher than brown and purple, which were the lowest rated on perceived importance. There was no significant difference among gray, brown, and purple.

The ISO set of colors showed a significant effect of perceived importance, $F(6, 616) = 11.49$, $MSe = 6.81$, $p < .001$. Red was rated significantly higher than all of the other colors. There were no significant differences among the other ISO colors.

The FHWA color set showed a significant effect, $F(8,792) = 36.04$, $MSe = 5.49$, $p < .001$. Red was rated significantly higher than the remaining colors. Yellow, orange and green were significantly different from the remaining colors, with the exception that green was not significantly different from blue. Blue, yellow-green, and pink did not differ. Blue was significantly higher in perceived importance ratings than purple and brown, which were the lowest. Yellow-green and pink did not differ from purple and brown.

The Pantone neon colors showed a significant effect, $F(3, 352) = 9.04$, $MSe = 5.46$, $p < .001$. Yellow-green and green were highest and did not differ. Both were rated higher than the remaining colors, except that green was not significantly different from blue. Blue and purple were not significantly different from one another.

The 3M fluorescent color set did not show a significant effect, $F(2, 264) = 1.27$, $MSe = 6.13$, $p > .10$, yet all three colors were among the highest rated.

Perceived Importance by Color Name. ANOVA analyses were also conducted for colors of the same name on rated importance. The three red colors did not show an effect, $F(2, 264) = 1.83$, $MSe = 4.24$, $p > .10$. The oranges produced a significant effect, $F(3, 352) = 14.23$, $MSe = 5.35$, $p < .001$. Fluorescent orange was rated significantly higher than the oranges of the ANSI, ISO, and FHWA systems, which did not differ among themselves. The yellows showed a significant effect, $F(3, 352) = 4.66$, $MSe = 5.54$, $p < .01$. Fluorescent yellow and FHWA yellow were the highest numerically and they did not significantly differ. Fluorescent yellow was significantly higher than ANSI and ISO yellows. There was no significant difference among the FHWA, ANSI, and ISO yellows. The greens produced a significant effect, $F(3, 352) = 3.91$, $MSe = 6.44$, $p < .01$. The ISO, FHWA, and ANSI greens were all rated significantly higher than Pantone neon green. There were no statistically significant differences among the ISO, FHWA, and ANSI versions. Yellow-green showed a significant effect, $F(2, 264) = 30.12$, $MSe = 5.99$, $p < .001$. The 3M fluorescent yellow-green was significantly higher than the Pantone neon yellow-green, which in turn was significantly higher than FHWA yellow-green. Finally, blue, purple, brown, black, and white did not show any significant differences among the color systems.

Top Rated Colors

The colors listed in Table 3 are the highest in perceived hazard and importance ratings. According to the preceding analyses there are no statistical differences among these colors and they are ordered from highest to lowest. Note the presence of fluorescent colors and the red colors in this table.

Table 3
Colors with the highest perceived hazard and perceived importance.

Perceived Hazard Rating	Perceived Importance Rating
Fluorescent Orange	ANSI Red
ANSI Red	FHWA Red
Fluorescent Yellow	ISO Red
FHWA Red	Fluorescent Orange
Fluorescent Yellow Green	Fluorescent Yellow
ISO Red	Fluorescent Yellow Green

DISCUSSION

From the summary in Table 3, it can be seen that the color red and fluorescent colors are judged to have high hazard connotation and high perceived importance. Red has been previously described in the literature as being the highest hazard connoting color (Smith-Jackson & Wogalter, 2000; Wogalter et al., 1998). This study confirms that traditional safety red has the highest perceived hazard compared to other traditional safety colors. The results also show that red is perceived to convey high importance compared to the other traditional safety colors. Additionally, the results show that the 3M fluorescent colors are perceived as being as high in hazard and importance as traditional safety red.

Yellow and orange were the second-highest tier of colors in perceived hazard, confirming previous studies involving traditional safety colors (Smith-Jackson & Wogalter, 2000; Wogalter et al., 1998). Interestingly, when yellow and orange were shown in a fluorescent version, they were higher in perceived hazard than the traditional safety color version. Tomkinson and Stammers (2000) found that fluorescent orange was rated higher than both fluorescent yellow and safety orange, which did not differ. The present study concurs with this, finding that fluorescent orange is perceived as connoting higher hazard than safety orange, and that fluorescent yellow is rated higher on perceived hazard than safety yellow; however, no difference was found in the perceived hazard ratings among the three fluorescent colors used in this study (fluorescent orange, fluorescent yellow, and fluorescent yellow-green).

A limitation of this study was exclusive use of undergraduates as participants. Future research ought to compare these results with those using other populations groups. It is an empirical question whether the findings generalize to other populations, some research suggests that they might. For example, Wogalter et al. (1998) found a similar pattern of color ratings by adult community volunteers and industrial workers in comparison to undergraduates. Likewise Tomkinson and Stammers (2000) found a similar pattern of color ratings as between office workers and students.

Another limitation of the study is that a fluorescent red was unavailable at the time the study was conducted and was not included in the set that was rated. The rendering of fluorescent red is apparently difficult and often looks pink and as a result, likely would not garner high hazard ratings. Although fluorescent red received the highest hazard and urgency ratings in Tomkinson and Stammers (2000), details of how they obtained or produced the color sample are not specified, and thus making it difficult to reproduce the color stimulus and replicate their findings. Further research on fluorescent red would be informative.

Fluorescent colors have been shown to be more conspicuous in environmental signs than standard safety colors (Burns & Pavelka, 1995; Schieber et al., 2006); however, that research concerned outdoor signs. The present research shows that fluorescent colors produce high hazard and importance ratings in an office/laboratory setting with artificial lighting. Future work could include examining the effect of fluorescent colors in other indoor contexts, and in particular as part of product warning labels in comparison to standard (non-fluorescent) colors.

ACKNOWLEDGMENTS

The authors wish to thank Rebecca McNulty for her assistance in this research.

REFERENCES

American National Standard for Product Safety Signs and Labels, ANSI Z535.1-2012, Washington, DC.
Borade, A. B., Bansod, S.V. & Gandhewar, V.R. (2008). Hazard perception based on safety words and colors: An Indian perspective. International Journal of Occupational Safety and Ergonomics, 14(4), 407-416.
Burns, D. M., & Pavelka, L. A. (1995). Visibility of durable fluorescent materials for signing applications. Color Research & Application, 20(2), 108-116.
Dunlap, G., Granda, R., & Kustas, M. (1996). Observer perceptions of implied hazard: Safety signal words and color words (Technical Report TR 00.3428). Poughkeepsie, NY: IBM.
International Organization for Standardization for Graphical Symbols – Safety Colours and Safety Signs. ISO 3864-4-2011. Switzerland
Griffith, L. J., & Leonard, S. D. (1997). Association of colors with warning signal words. International Journal of Industrial Ergonomics, 20, 317-325.
MUTCD Color Specifications (2013) http://mutcd.fhwa.dot.gov/kno-colorspec.htm Accessed: 9/19/2013
Pantone Formula Guide Solid Coated (2002) Carlstadt, New Jersey
Pantone Solid Chips Coated (2000) Carlstadt, New Jersey
Schieber, F., Willan, N., & Schlorholtz, B. (2006). Fluorescent colored stimuli automatically attract visual attention: An eye movement study. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 50*, 1634. doi:10.1177/154193120605001625
Smith-Jackson, T. L., & Wogalter, M. S. (2000). Users' hazard perceptions of warning components: An examination of colors and symbols. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 44*, 6-55. doi:10.1177/154193120004403215
Tomkinson, E. J., & Stammers, R. B. (2000). The perceived hazardousness, urgency and attention-gettingness of fluorescent and non-fluorescent colours. In P. T. McCabe, M. A. Hanson & S. A. Robertson (Eds.), *Contemporary ergonomics* (pp. 443-447) Taylor & Francis.
Wogalter, M. S., Kalsher, M. J., Frederick, L. J., Magurno, A. B., & Brewster, B. M. (1998). Hazard level perceptions of warning components and configurations. *International Journal of Cognitive Ergonomics, 2*(1-2), 123-143.
Wogalter, M.S., Mayhorn, C. B., & Zielinska, O. (2015). Use of color in warnings. To appear in A. J. Elliot, M. Fairchild, and A. Franklin (Eds.), Handbook of Color Psychology, Cambridge University Press, in press.
Wogalter, M. S., & Vigilante, W. J. (2006). Attention switch and maintenance. *Handbook of warnings* (pp. 245-265), Boca Raton, FL Mahwah, NJ: Erlbaum.