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Jeanne L. Weaver[a], Teresa N. Gerber[a], Peter A. Hancock[a] & H.C. Neil Ganey[a]

[a] University of Central Florida, Orlando, USA

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Individual Differences in Behavioral Compliance to Warnings Representing Varying Degrees of Threat

Jeanne L. Weaver
Teresa N. Gerber
Peter A. Hancock
H.C. Neil Ganey

University of Central Florida, Orlando, USA

Research regarding warning compliance has often emphasized the physical aspects of the warning itself. Here, we examine the role of the perceiver in sensation seeking and health orientation as individual difference variables that affect behavioral compliance to a health warning. The experiment used a laboratory-based simulation of a chemistry demonstration that has been used in previous warnings research. In addition, however, individual difference effects of sensation seeking and health orientation were investigated. Among the significant findings were a significant interaction between condition assignment and sensation seeking on compliance outcome and a significant interaction between condition and health orientation. These results indicate that individual difference variables represent significant influences on the degree to which persons comply with warnings.

individual differences compliance warning threat
health orientation sensation seeking

1. INTRODUCTION

Warnings have been defined as "specific stimuli that alert a user to the presence of a hazard, thereby triggering the processing of additional information regarding the nature, probability, and magnitude of the hazard" (Lehto & Miller, 1986, p. 16). The literature on warnings and their behavioral effects

Correspondence and requests for offprints should be sent to Jeanne L. Weaver, Department of Psychology, University of Central Florida, Orlando, FL 32816-1390, USA. E-mail: <jweaver@pegasus.cc.ucf.edu>.

has examined warning placement (Wogalter et al., 1987), warning format (Jaynes & Boles, 1990; Otsubo, 1988), border weight or salience (Adams & Edworthy, 1995), and word font size of warnings (Braun, Silver, & Stock, 1992; Silver & Braun, 1993). Signal words and their relationship to the perceptions of risk they command have also been the topic of extensive study (Leonard, Matthews, & Karnes, 1986; Silver & Wogalter, 1989; Wogalter & Silver, 1990). Despite this body of research, the picture concerning warnings remains unclear. For example, although Leonard et al. (1986) found no differences in terms of the degree of risk communicated by signal word, nor size or color of the signal word, the findings of Wogalter and Silver (1990) indicated that different signal words did in fact communicate varying levels of risk. If inconsistencies are not in the stimuli themselves, it is possible that the reason for contradictory findings lie in the differences between perceivers.

Individual differences, or person variables, have received some attention in warnings research (Rogers, Lamson, & Gabriel, 2000). Person variables have been distinguished from warning variables and have been defined as "factors that are specific to the individual(s) who interact with the warning" (Rogers et al., 2000, p. 103). These include factors such as gender, age, experience with the product, control perceptions, and especially crucial for the present work, risk taking style. Risk taking, and its correlate sensation seeking, was identified by Zuckerman and others (Zuckerman, 1979; Zuckerman, Eysenck, & Eysenck, 1978) and defined as "the need for varied, novel, and complex sensations and experiences, and the willingness to take physical and social risks for the sake of such experiences" (Zuckerman, 1979, p. 10). Sensation seeking has previously been found to be related to alcohol use (Schwarz, Burkhart, & Green, 1978), drug use (Satinder & Black, 1984), and dangerous driving (Arnett, 1990). Thus, one purpose of the current research was to determine the degree that differences in sensation seeking moderate warning compliance. Specifically, we sought to determine whether persons high in sensation seeking would require warnings of differing intensity in order to show compliance.

An allied individual variable that has been postulated as influencing compliance is health orientation. Health orientation has been found to be related to such compliance behaviors as sunscreen use (Hillhouse, Stair, & Adler, 1996) and health-related warning compliance (Kaskutas & Greenfield, 1997). Health orientation has been defined as "any behavior performed by a person regardless of his or her perceived or actual health status, in order to protect, promote, or maintain his or her health, whether or not such a behavior is objectively effective toward that end" (Harris & Guten, 1979, p. 18). Thus,

we hypothesized that health orientation would also be related to the intensity of warning required in order to garner warning compliance.

In summary, the purpose of the present work was to investigate the degree to which sensation seeking and health orientation influenced compliance with regard to signal words that convey different degrees of risk. Specifically, we hypothesized that individuals with a higher level of sensation seeking would require stronger signal words to assure compliance in comparison to individuals lower in sensation seeking. Furthermore, we predicted that individuals who differ in their degree of health orientation would likewise respond differently to warnings conveying different degrees of risk. More specifically, it was expected that persons with higher scores on health orientation would be more likely to comply with safety information than those lower in health orientation. The overarching hypothesis was that participants would be more likely to comply when the signal word was warning compared to a notice or a control condition with no warning present.

2. EXPERIMENTAL METHOD

2.1. Participants

One hundred and twelve college students (86 females and 26 males, mean age = 22.1 years) volunteered to participate in this study. The experiment was advertised under the guise of a consumer product testing study in order not to compromise the true nature of the experiment. Participants were recruited via a sign-up sheet and then telephoned and scheduled for an individual appointment to complete the experiment. Some participants received extra credit for their participation and all were treated in accordance with the "Ethical Principles of Psychologists and Code of Conduct" (American Psychological Association, 1992).

2.1. Materials and Apparatus

2.1.1. Experimental procedure

The experimental approach selected for this study was fundamentally a replication of the method pioneered by Wogalter, Fontenelle, and Laughery's (1985) earlier experimental investigation of warning compliance. In this pro-

cedure, a laboratory task was presented that simulated a chemistry demonstration in which participants were required to handle and mix several different inert substances. The equipment used for the present experiment included the following: one 500-g analog scale, two graduated cylinders (100 and 500 ml), one large beaker (400 ml), one volumetric flask (250 ml), one glass stirring rod, weighing paper, three large lockable Mason-like canisters, one measuring teaspoon, paper towels, rubber gloves, safety glasses, and molded paper masks. Other glassware was available on the demonstration table, even though its use was not explicitly specified by the instructions. These items included one flask (100 ml), two small beakers (50 ml), and one measuring tablespoon.

The instructions for the task required the handling and mixing of several different inert substances. The actual substances included water, bleached white flour, corn oil, table sugar, and yellow corn flour. These substances were selected for two primary reasons. First, due to their non-hazardous nature, it could be assured that no actual harm would come to the participants. Second, these substances had a somewhat varied consistency and coloring. The instructions to the participant did not name the actual substances except by referring to them by the number or letter label attached to the containers. The substances were disguised by adding green food coloring to the water and red food coloring to the sugar. The actual demonstration instructions for all conditions were as follows.

> Before you are two graduated cylinders, several beakers, canisters, volumetric flasks, and a scale. With these materials you will be asked to measure and combine specified amounts of five substances. The chemical identity of the substances are not revealed in order to avoid any effects of prior knowledge. Instead, they are identified by numbers and letters on the labels. The method for measuring the five substances and the order in which they are to be combined is given below. This demonstration can be performed without any previous laboratory experience. However, these materials and substances are expensive. Please treat them with care.
>
> The five substances before you are to be combined in the order specified below.
>
> (1) Using the scale, place 100 grams of substance A on measuring paper and then add directly to the large composition beaker.
> (2) Pour 150 ml. of liquid #1 from the flask into the large graduated cylinder. Then pour liquid into the composition beaker.

(3) Mix the composition thoroughly.
(4) Pour liquid #2 directly from the small graduated cylinder into the composition beaker.
(5) Measure 4 level teaspoonfuls of substance B. Add to the composition beaker.
(6) Carefully mix these substances to form an even solution.
(7) Finally, using measuring paper and the scale, add 20 grams of substance C to composition beaker. Mix to complete the composition.

Please call the experimenter when you have completed these instructions.

The manipulation of signal word was accomplished by placing either the word *NOTICE* or the word *WARNING* just prior to the beginning of the description of what was to be done with the substances. In both of these conditions, the signal word was bolded and printed in all capital letters in order to increase the salience of the signal word. Additionally, in both conditions, the location of the warning remained consistent with its placement in the middle of the demonstration instructions in order to avoid floor and ceiling effects in behavioral compliance as past studies have demonstrated (cf. Wogalter, Kalsher, & Racicot, 1992). The third condition, or the Control Condition, consisted of the demonstration instructions without the warning or signal word.

2.1.2. Survey instrument

The questionnaire used in this study was a compilation of several measures including demographic information, Zuckerman's Sensation Seeking Scale—Form V (1994), Arnett's Inventory of Sensation Seeking (1994), Bausell's Health Orientation Scale (R.B. Bausell, 1986; C.R. Bausell & Bausell, 1987), and an exit survey adapted from Braun's (1993) study on Color Product Warnings and Behavioral Compliance, and Otsubo's (1988) behavioral study of warning labels for consumer products. This adapted exit survey was aimed at measuring (a) whether or not the participants noticed the protective gear, (b) whether or not they noticed the warning, (c) whether or not they read the warning, and (d) whether or not they recalled the consequences of the hazard. Additional questions on the exit survey served to quantify the participants' perceptions of (a) task familiarity, (b) likelihood of injury associated with the lab task, (c) care used while performing the lab task, (d) level of perceived hazard associated with the lab task, (e) clarity of the demonstration instructions overall, (f) salience of the warning—if applicable, and (g) ease with

which the warning could be read—if applicable. Also, these items were combined with additional distracter questions regarding "product testing" information, such as rating the complexity of the lab task. Ratings were made using a 5-point Likert-type scale ranging from *not at all* (0) to *extremely* (5).

2.2. Design and Procedure

Upon the scheduling of their individual appointments, participants were randomly assigned to one of three experimental conditions based on the manipulation of signal word presentation in the demonstration instructions. The first condition, or Warning Condition, used *WARNING* as the signal word presented. According to previous research, the use of this signal word has been associated with moderate levels of hazard perception and arousal in participants (Wogalter & Silver, 1990). The second condition, or Notice Condition, used *NOTICE* as the signal word in the presentation of the warning. The use of this signal word has been associated with low levels of hazard perception and arousal in participants (Silver & Wogalter, 1989). Both font and font size remained consistent across all three conditions with a 12-point Helvetica font selected for the demonstration instructions in this study. Helvetica font was selected as it has been conventionally used in studies on signal words in warnings (e.g., Loring & Wiklund, 1988), and recent research has indicated that Helvetica has been perceived as more readable than other fonts (Silver & Braun, 1993).

Upon their arrival, participants were asked to read and sign an informed consent form that described the experiment as a consumer product testing study. Again, this deception was necessary so as not to compromise the true nature of the study, and to control for demand characteristics that might be associated with psychological research. Each participant was then provided with the applicable written instructions for the task and directed to the worktable in the laboratory. All materials, including the safety gear, were present on the worktable. For each participant the reusable materials, such as glassware, were cleansed and placed upon the worktable in a consistent manner prior to their arrival. Following each demonstration, safety glasses were wiped down with alcohol, and the gloves and paper masks were disposed of.

During the participant's performance, the door to the laboratory remained completely open with the worktable in full view, and a research assistant indirectly observed the participant for behavioral compliance with the warning by their use of the available safety gear (gloves, mask, and safety glasses). Behavioral compliance was measured by a coding system corresponding to

the number of pieces of safety gear used during the laboratory task. Compliance scores ranged from 0 or *no safety gear used* to 3 or *all three pieces of gear safety used*. Participant compliance was then recorded on a scoring sheet. Upon completion of the task, each participant was asked to complete the composite questionnaire. Following completion of the questionnaire, each participant was thanked for their participation and provided with a debriefing statement that informed them of the true nature of the study and reinforced that at no time during the laboratory task was their health at risk.

3. EXPERIMENTAL RESULTS

In order to test the experimental hypotheses, a $2 \times 2 \times 3$ Sensation Seeking (High vs. Low) by Health Orientation (High vs. Low) by Signal Word (Control, Notice, or Warning) between-subjects ANOVA was performed on behavioral compliance scores. Results revealed a significant interaction between Sensation Seeking and Condition Assignment on behavioral compliance, $F(2, 99) = 3.582$, $p < .05$. As can be seen in Figure 1 and as was confirmed by the Student Newman Keuls (SNK) post hoc test, participants both high and low in sensation seeking in both the *NOTICE* and *WARNING* signal word conditions were more likely to comply than participants of either level of sensation seeking in the Control Condition. Furthermore, post hoc tests (SNK) also revealed that high sensation seeking participants were significantly more likely to comply in the Warning Condition in comparison to the Notice Condition ($M = 2.00$ vs. $M = 2.83$). Finally, high sensation seekers were significantly less likely to comply in the Notice Condition as compared to low sensation seekers ($M = 2.00$ vs. $M = 2.69$).

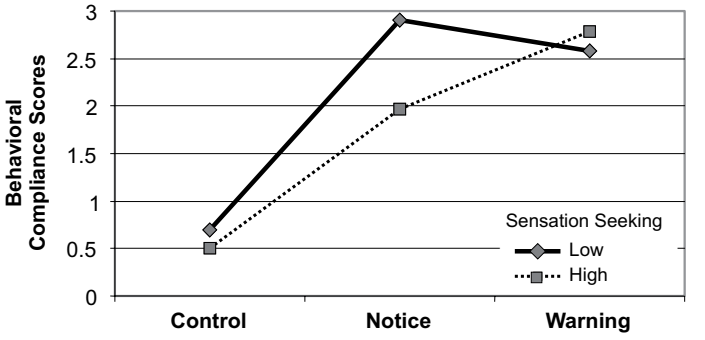

Figure 1. Two-way interaction between sensation seeking and condition assignment.

As depicted in Figure 2, a significant interaction was also found between Health Orientation and Condition Assignment, $F(2, 99) = 4.058$, $p < .05$. In this case, the Student Newman Keuls post hoc test revealed that participants of both health orientation types in the Control Condition were significantly less compliant with regard to donning protective gear than those in the two non-control conditions. Furthermore, within the control group, those with a higher health orientation were significantly more likely to don protective gear, without receiving instructions or a warning to do so, in comparison to those with a lower health orientation ($M = 0.96$ vs. $M = 0.28$). Finally, there was no significant three-way interaction between Sensation Seeking, Health Orientation, and Condition Assignment with regard to compliance, nor did Sensation Seeking interact with Health Orientation.

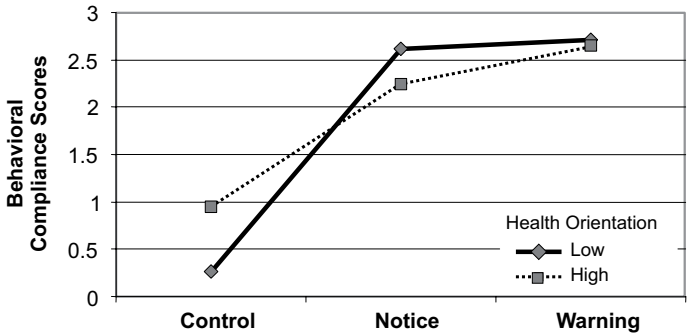

Figure 2. Two-way interaction between health orientation and condition assignment.

A significant main effect of condition was found, $F(2, 99) = 56.08$, $p < .05$, with both Notice and Warning Conditions resulting in higher compliance scores than the Control Condition. However, scores did not differ between Notice and Warning Conditions. No significant differences across the three condition assignments were found for the participants' perceptions of Task Familiarity, Task Complexity, Likelihood of Injury associated with the task, Care Used during the task, Perception of Hazard associated with the task, or Clarity of the Demonstration Instructions.

Approximately 97% of the participants assigned to the two warning conditions reported to have both noticed and read the health warning in the demonstration instructions. One participant in the Notice Condition and one in the Warning Condition reported to have not noticed or read the health warning. As shown in Figure 3, results revealed a significant effect of Signal Word strength on the perceived characteristics of the health warning.

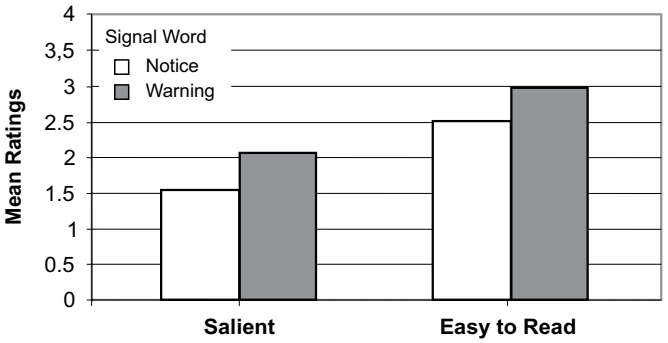

Figure 3. Effects of signal word strength on perceived characteristics of a health warning.

Participants who received *WARNING* as the signal word rated the warning as more Salient, or attention-getting, and Easier to Read than did those who received *NOTICE* as the signal word in the same health warning.

4. DISCUSSION

The present experiment sought to determine the extent that individual difference characteristics (i.e., health orientation and sensation seeking) influenced warning compliance. Specifically, we proposed that one's health orientation and level of sensation seeking would relate significantly to compliance with regard to warnings of different strengths. The results of the study provided support for these hypotheses in that those who were higher in sensation seeking required a stronger signal word to gain compliance. Also of interest was the finding that individuals low in health orientation were less likely to comply in the No Warning condition than those with higher health orientation. This data serves to support the general conception that individual difference factors such as health orientation and sensation seeking require consideration in evaluating the nature of warning compliance.

Our primary finding confirms that individual differences do play a significant role in determining the extent that persons comply with warnings. Such differences may have been responsible for past equivocal results in warning research regarding the manipulation of signal word strength. The mechanism proposed for such modulation concerns the degree of arousal required in order for persons to comply with a warning. Wogalter and Silver (1990), for example, evaluated the degree that certain signal words connoted hazard in their experiment on arousal strength of signal words. Arousal state might also

explain other findings in which those with more experience with a product are typically shown to exhibit lower compliance to warnings presented with that product (Zeitlin, 1994). Indeed, we propose that a certain degree of arousal is necessitated to insure compliance. In Zeitlin's work, anxiety reduction was the main reason given for compliance with safety instructions for users inexperienced with a chainsaw. In contrast, experienced users made offhand comments such as "I've worked with my dad's saw and I haven't been cut yet."

With regard to the current results, it is possible that high sensation seekers are used to a higher degree of arousal than low sensation seekers. Therefore, in order to increase their compliance, it is necessary to increase the strength of the signal word such that more threat is communicated and therefore more arousal is induced. With regard to health orientation, although these findings are less clear, it might be that those with a high health orientation are simply more likely to comply because of health concerns and the avoidance of negative health outcomes. The failure to find a significant difference in the two warning conditions might simply be a ceiling effect artifact in relation to the small ($n = 3$) number of compliance behaviors that could be followed. Future research should, therefore, add more possible compliance behaviors within the context of the experimental paradigm in order to further explore this possibility. By increasing our understanding of the relationship between these variables and compliance, we might be better able to predict and control for such factors. As compliance to warnings is a health behavior, future research regarding the role of health orientation might be warranted as well as attempts to more clearly understand the role of sensation seeking and compliance to signal words of differing strengths. Finally, methods of measuring acute arousal might also be useful in exploring the possibility that arousal is a key underlying mechanism related to warning compliance.

With regard to the application of these findings, it is probable that high sensation seekers are more likely to use tools, sports equipment, and so forth, that those lower in sensation seeking might not even consider. If this were in fact the case, it would seem reasonable given the findings in this study to identify ways to insure that such products communicate a strong, but appropriate, degree of warning. Specifically, the best constellation of warning related factors (e.g., color, font, word strength) for such a sub-group could be identified in order to attempt to optimize compliance in this sub-group. Furthermore, other sub-groups should be identified as well and attempts made to optimize their interactions with potentially hazardous products.

REFERENCES

Adams, A.S., & Edworthy, J. (1995). Quantifying and predicting the effects of basic text display variables on the perceived urgency of warning labels: Tradeoffs involving font size, border weight, and colour. *Ergonomics, 38*, 2221–2237.

American Psychological Association. (1992). Ethical principles of psychologists and code of conduct. *American Psychologist, 47*, 1597–1611.

Arnett, J. (1990). Drunk driving, sensation seeking, and egocentrism among adolescents. *Personality and Individual Differences, 11*, 541–546.

Arnett, J. (1994). Sensation seeking: A new conceptualization and a new scale. *Personality and Individual Differences, 16*, 289–296.

Bausell, C.R., & Bausell, R.B. (1987). The internal structure of health-seeking behavior. *Evaluation and the Health Professions, 10*, 460–475.

Bausell, R.B. (1986). Health-seeking behavior among the elderly. *The Gerontologist, 26*(5), 556–559.

Braun, C.C. (1993). Perceptions of hazard as a function of color and signal word in product warnings. *Dissertation Abstracts International, 54*(11), 5964B. (UMI No. 9409442).

Braun, C.C., Silver, N.C., & Stock, B.R. (1992). Likelihood of reading warnings: The effect of fonts and font sizes. In *Proceedings of the Human Factors Society 36th Annual Meeting* (pp. 926–930). Santa Monica, CA, USA: Human Factors and Ergonomics Society.

Harris, D.M., & Guten, S. (1979). Health-protective behavior: An explanatory study. *Journal of Health and Social Behavior, 20*, 17–29.

Hillhouse, J.J., Stair, A.W., & Adler, C.M. (1996). Predictors of sunbathing and sunscreen use in college undergraduates. *Journal of Behavioral Medicine, 19*, 543–561.

Jaynes, L.S., & Boles, D.B. (1990). The effects of symbols on warning compliance. In *Proceedings of the Human Factors Society 34th Annual Meeting* (pp. 984–987). Santa Monica, CA, USA: Human Factors Society.

Kaskutas, L.A., & Greenfield, T.K. (1994, October/November). *The role of health consciousness in predicting exposure to health warning messages*. Paper presented at the 122nd Annual Meeting of the American Public Health Association, Washington, DC, USA.

Lehto, M.R., & Miller, J.M. (1986). *Warnings, Vol. 1: Fundamentals, design, and evaluation methodologies*. Ann Arbor, MI, USA: Fuller Technical.

Leonard, S.D., Matthews, D., & Karnes, E.W. (1986). How does the population interpret warning signals? In *Proceedings of the Human Factors Society 30th Annual Meeting* (pp. 116–120). Santa Monica, CA, USA: Human Factors and Ergonomics Society.

Loring, B.A., & Wiklund, M.E. (1988). Improving swimming pool warning signs. In *Proceedings of the Human Factors Society 32nd Annual Meeting* (pp. 910–914). Santa Monica, CA, USA: Human Factors and Ergonomics Society.

Otsubo, S.M. (1988). A behavioral study of warning labels for consumer products: Perceived danger and use of pictographs. In *Proceedings of the Human Factors Society 32nd Annual Meeting* (pp. 536–540). Santa Monica, CA, USA: Human Factors and Ergonomics Society.

Rogers, W.A., Lamson, N., & Gabriel, K. (2000). Warning research: An integrative perspective. *Human Factors, 42*, 102–139.

Satinder, K.P., & Black, A. (1984). Cannabis use and sensation seeking orientation. *Journal of Psychology, 116*, 101–105.

Schwartz, R.M., Burkhart, B.R., & Green, B. (1978). Turning on or turning off: Sensation seeking or tension reduction as motivational determinants of alcohol use. *Journal of Consulting and Clinical Psychology, 46*, 1144–1145

Silver, N.C., & Braun, C.C. (1993). Perceived readability of warning labels with varied font sizes and styles. *Safety Science, 16*, 615–625.

Silver, N.C., & Wogalter, M.S. (1989). Broadening the range of signal words. In *Proceedings of the Human Factors Society 33rd Annual Meeting* (pp. 555–559). Santa Monica, CA, USA: Human Factors and Ergonomics Society.

Wogalter, M.S., Fontenelle, G.A., & Laughery, K.R. (1985). Behavioral effectiveness of warnings. In *Proceedings of the Human Factors Society 29th Annual Meeting* (pp. 679–683). Santa Monica, CA, USA: Human Factors and Ergonomics Society.

Wogalter, M.S., Godfrey, S.S., Fontenelle, G.A., Desaulniers, D.R., Rothstein, P.R., & Laughery, K.R., Sr. (1987). Effectiveness of warnings. *Human Factors, 29*, 599–612.

Wogalter, M.S., Kalsher, M.J., & Racicot, B.M. (1992). The influence of location and pictorials on behavioral compliance to warnings. In *Proceedings of the Human Factors Society 36th Annual Meeting* (pp. 1029–1033). Santa Monica, CA, USA: Human Factors and Ergonomics Society.

Wogalter, M.S., & Silver, N.C. (1990). Arousal strength of signal words. *Forensic Reports, 3*, 407–420.

Zeitlin, L.R. (1994). Failure to follow safety instructions: Faulty communication or risky decisions? *Human Factors, 36*(1), 172–181.

Zuckerman, M. (1979). *Sensation seeking: Beyond the optimum level of arousal.* Hillsdale, NJ, USA: Erlbaum.

Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking*. New York, NY, USA: Cambridge University Press.

Zuckerman, M., Eysenck, S.B., & Eysenck, H.J. (1978). Sensation seeking in England and America: Cross-cultural, age, and sex comparisons. *Journal of Consulting and Clinical Psychology, 46*, 139–149.