Child-Centered Safety Research Issues

Tonya L. Smith-Jackson, Ph.D.

Virginia Polytechnic Institute and State University
Blacksburg, Virginia, USA 24061

Abstract. This paper is an overview of the important factors researchers should consider when conducting safety-related research that involves children. Important considerations derived from developmental psychology are discussed in terms of their application to efforts to elicit the needs, preferences, attitudes, and perceptions of children.

INTRODUCTION

Products and educational tools to enhance the safety of children have been available for decades. Interactive games, workstations, and automated learning systems have been used to influence children's knowledge and performance. Most of the products for children have not been engineered with usability principles extending from empirical, child-centered research. Designers often rely on the opinions of adults to determine the usability and safety of products designed for children, or superficially assess young users' needs and preferences by employing methods with no underlying empirical or theoretical foundations. Fleming, Morrissey, & Kinghorn (1997) identified several weaknesses in usability engineering when the targeted users are excluded, including hazards that ultimately place the user at risk for injury.

Usability engineering emphasizes two important strategies to design a usable and safe product: 1) Assess user needs and capabilities and 2) Evaluate the extent to which the product/system matches user needs and capabilities (Wickens, Gordon, & Liu, 1998). Although some preliminary child-centered usability concepts are emerging in human-computer interface design (Klusell & Pousette, 2000), health education (Hillier & Morrongiello, 1998), and risk analysis (Harden, 2000), no systematic usability engineering process and no efficient tools have been developed that are appropriate to use with children. This paper discusses important considerations when conducting child-centered safety evaluation. The participant pool is restricted to younger users who are between 5 and 11 years of age.

The 5 – 11 year age group reflects the middle childhood stages. Products designed to educate young children about safety target this age range, because these children are exposed to events and contexts that require them to rely on their own reasoning and behaviors for protection. Thus, this age group is more likely to use potentially hazardous products with little or no adult supervision. In addition, Gralinski & Kopp (1993) found that the teaching of safety rules declines drastically after age 3, and parents often overestimate their children's knowledge of safety, especially in the middle childhood stages (Peterson, Mori, & Scissors, 1986). Children 5 – 11 years of age are more verbal, capable of reasoning on a concrete basis, fundamentally aware of and capable of expressing their needs and preferences (identity construct), and capable of categorizing and organizing information. Categorization abilities facilitate the identification of 'what is safe/helpful/useful/usable' and 'what is not safe/helpful/useful/usable' (Hall, 1994; Waxman, Shipley, & Shepperson, 1991). Likewise, the

cognitive constructs and attitudes formulated within this age range are accessible to the extent that techniques to assess knowledge transfer and risk-related constructs can be easily developed (Jacobs & Potenza, 1991; Kail, 1992).

METHODOLOGICAL CONSIDERATIONS

When to Include Children

An important consideration for researchers and/or product designers is the extent to which child users are required for a specific research project or design effort. In some cases, questions can be answered using adults or subject matter experts, even for products that are designed for child users. For example, the installation of booster seats requires only a safety evaluation from the parents' perspective, since the parents are most likely to install a booster seat. However, there are some instances that require the use of children in research. In 1998, the National Institutes of Health released guidelines for inclusion of children in research. These guidelines provide a list of considerations that can be applied to any research environment, including those outside of the USA. The guidelines are derived from the Code of Federal Regulations, Title 45, Part 6, which communicates the Department of Health and Human Services (DHHS) regulations on the inclusion of children in research. The DHHS defines children as "…persons who have not attained the legal age for consent to treatments or procedures involved in the research, under the applicable law of the jurisdiction in which the research will be conducted (DHHS, 2001; subpart 46.102)." Table 1 summarizes the important points to consider. Note that the NIH guidelines provide justification for exclusion of children. The information has been modified to communicate justification for inclusion.

Table 1: Considerations to Include Children in Research

NIH Inclusion Justification
The research topic is relevant to children.
The research provides direct benefit to children.
There are no laws or regulations that bar children from participation.
The information the researcher is seeking is not currently available for children.
No other studies can be conducted using adults to acquire the necessary information.
In the absence of adult studies, the nature and seriousness of the hazard for children requires their participation in research.
The research can be conducted in a manner that protects the dignity and self-esteem of the child users? (i.e., protecting confidentiality and welfare).

When it has been determined that the research will require participation of child users, researchers are responsible for complying with all applicable requirements for review by compliance groups such as Institutional Review Boards or internal review boards or legal departments within a company. Participation of children in research parallels many of the ethical guidelines for adults, with a few exceptions. First, for the 5 – 11 year age group, children must give verbal consent to participate. This consent is referred to as a "child's assent". S researcher cannot involve the child unless they have clearly expressed a desire to participate in the research. Second, an informed consent must also be

obtained from at least one parent or legal guardian. If a parent gives consent, but the child does not assent, then the child cannot be included in the research.

Information on how to communicate to children to acquire consent is scarce. One of the major requirements is to communicate the information to children in a language they can understand, and maintain equivalent meaning when communicating to the parent. Hurley & Underwood (2002) found that children who were 8 and 10 years of age did not understand assent information as well as children who were 12 years of age. So, the challenge to provide appropriate information to both 8 – 10 year olds and those less than 8 is a serious one. Every effort must be made to simplify the language, while still providing the critical information. Figures 1, 2, and 3 contain informed assent, videotaping, and confidentiality statements for parent participants. Equivalent statements for the children ages 5 – 11 years are the items marked with a "b".

a. In this session, we will ask you to place your child in a booster seat (show seat). We will then ask your child what they liked or did not like about the booster seat. Do you have any objections at this point?

b. We are going to ask your Mom/Dad to put you in a booster seat (show seat). Then, we are going to ask you to tell us what you like and what you don't like about the booster seat. Is this okay with you?

Figure 1: Information used in an informed consent (a.) and informed assent (b.)

a. Sessions will be video-taped. We will use the tapes to gather important information you provide during the session.

b. We are also going to use this camera so we can get a picture of you when all of this is happening. The camera will help us to understand how the booster seats are used.

Figure 2: Videotape information for parental consent (a.) and the equivalent information to acquire the child's assent (b.)

a. The information gained in this research project will be kept strictly confidential.

b. When we get answers from people, we make sure we don't let anyone else know their names or what they told us. We are going to do the same thing here.

Figure 3: Confidentiality statement for parent participant (a.) and the equivalent confidentiality statement for the child participant (b.)

Effective Ways to Elicit Information from Children

There is a whole body of knowledge that develops strategies to elicit information from adults. In Human Factors Engineering, knowledge acquisition specialists are committed to developing ways to get useful and non-biased information from adult participants. The method used to acquire information from users is called "knowledge elicitation" and includes such methods as think-aloud and cognitive walk-throughs. No analogous effort in human factors exists for child users. However, legal experts and child psychologists have focused a great deal of attention on the elicitation of information from children.

For the 5 – 11 year age group, several developmental issues should be considered when designing questions or tasks to acquire information. In any product safety evaluation, there should always be an opportunity for the participant to provide feedback or responses to questions. Subjective data will be acquired in the form of interviews, focus groups, questionnaires, and verbal reporting while

using or examining a product. There are a number of developmental characteristics of children that will impact their understanding and responses to questions in a safety evaluation, and consequently, impact the validity of the data. Three to be discussed in this paper are: social cognition, risk appraisal, and propensity toward acquiescence.

Social cognition is the ability to understand what others are feeling or thinking. According to developmental researchers (Arsenio & Kramer, 1992; Miller & Aloise, 1989), children gradually develop the ability to understand other people's opinions or points-of-view over several years. Children between the ages of 6 and 8 are not likely to understand that a person's actions toward an object may not show their real thoughts and feelings about the object. In the context of safety evaluations, a researcher who may be evaluating a toy, for example, may inadvertently cause a 6 – 8 year old to automatically provide positive feedback about the safety of the toy. This is known as response bias. Typically, researchers will hold an object of focus to explain or describe the type of feedback needed from the child. In applying social cognitive theory, a 6 – 8 year old who sees an experimenter holding a toy and smiling when presenting it will think the experimenter likes the toy. In an attempt to be agreeable, a child may then be hesitant to give any negative feedback or express their fears. To reduce the chances of introducing bias, an experimenter should point to the object of evaluation, rather than hold the object, and should be very careful to present a neutral facial expression and tone of voice. Children 8 – 10 years of age, however, may be less likely to likely to be influenced by the manner in which the object is presented.

Risk appraisal is the assignment of risk or hazardousness to an object or event. Risk perception is a consequence of risk appraisal. Children consider information differently compared to adults when making decisions about risk. For example, some aspects of risk appraisal require some degree of hypothetical reasoning. To determine the possibility of injury, an individual must entertain a hypothetical event. Contemplation must involve reasoning such as "If I used that" or "If I did this", "then this could happen" or "then this will follow". This type of reasoning requires rather abstract thinking, which is difficult for children less than 11 years of age. Most children in the 5 – 11 year age group are in Piaget's stage of concrete operations. In this cognitive developmental stage, reasoning is grounded in reality, such that thoughts must center on actual events, rather than possibilities (Rice, 1998).

Currently, risk perception is measured by using either carefulness ratings such as "How careful would you be if" (Drake, Conzola, & Wogalter, 1998) or participants are asked to rate a list of items in terms of their riskiness, even if they have not been experienced. Both of these measures require hypothetical thinking. Questionnaires eliciting carefulness or risk ratings from children will have low construct validity. There are other more effective approaches to overcome this challenge. Children in the concrete operations stage are particularly adept at classifying or categorizing ideas and objects. If given the opportunity to classify objects into "good" and "bad" or "dangerous" and "not dangerous" or even "will hurt you" or "will not hurt you", children can make reasonable judgments that reflect their risk perception. It is best to use either the objects of focus or pictures of the objects. One example of a recent study using a concrete approach to assess children's knowledge of home safety rules was conducted by Morrongiello, Midget, & Shields (2001). Using a game strategy, children were asked to put colored tokens into containers if they were aware of safety rules for an item (e.g., kitchen items, matches and cigarette lighters, carrying things down the stairs). Items in which no safety rules were associated were placed in a white garbage pail. Even with a good design to elicit information from a child, the response bias caused by acquiescence can undermine even the best intentions.

Acquiescence is a tendency to agree or be overly agreeable, which in turn, can increase suggestibility. Children may be prone to acquiesce, particularly when the researcher is perceived as having high status (Ceci & Bruck, 1993). Child participants who acquiesce in safety research are likely to agree with any statements made by the interviewer, rather than express their own attitudes, feelings, or beliefs about the product or situation that is being evaluated. But, interviewers can present themselves in a manner that reduces the likelihood of acquiescence. For example, interviewers who are supportive are more likely to elicit accurate information or are, at a minimum, not likely to increase acquiescence in children compared to interviewers who were neutral or non-supportive (Goodman, Bottoms, & Schwartz-Kenney, 1991; Imhoff & Baker-Ward, 1999). Children will also acquiesce if they do not understand what is being asked. Therefore, it is important to make questions very simple (avoid compound questions) and use simple, single-syllable words (Saywitz, 1995; Sawitz, Nathanson, & Snyder, 1993).

CONCLUSIONS

Product safety research involving children is a necessity, given the large number of hazardous products that are either designed for children or within reach of children. Human factors researchers should work toward developing knowledge tools to design elicit accurate information from child users.

REFERENCES

1. Fleming, T. E., Morrissey, S. J., & Kinghorn, R. A. (1997). Subjects in human factors: Who should they be? In W. A. Rogers (Ed.). *Designing for an Aging Population: Ten Years of Human Factors/Ergonomics Research.* Santa Monica, CA: Human Factors and Ergonomics Society.
2. Wickens, C.D., Gordon, S. E., & Liu, Y. (1998). *An Introduction to Human Factors Engineering.* New York: Longman.
3. Klusell, B. T. & Pousette, S. (2000). Usability evaluation of a multimedia program for school children, grade k – 6. *Proceedings of the 14th Triennial Conference of the IEA/HFES, 685 – 687.*
4. Hillier, L. M. & Morrongiello, B.A. (1998). Age and gender differences in school-age children's appraisals of injury risk. *J. of Pediatric Psychology, 23,* 229 – 238.
5. Harden, J. (2000). There's no place like home: The public/private distinction in children's theorizing of risk and safety. *Childhood, 7,* 43 – 59.
6. Gralinski, J. H. & Kopp, C. B. (1993). Everyday rules for behavior: Mothers' requests to young children. *Developmental Psychology, 29,* 573 – 584.
7. Peterson, L., Mori, L, & Scissors, S. (1986). Mom or dad says I shouldn't: Supervised and unsupervised children's knowledge of their parents' rules for home safety. *J. of Pediatric Psychology, 11,* 177 – 188.
8. Hall, D. G. (1994). Semantic constraints on word learning: Proper names and adjectives. *Child Development, 65,* 1299 – 1317.
9. Waxman, S.R., Shipley, E.F., & Shepperson, B. (1991). Establishing new subcategories: The role of category labels and existing knowledge. *Child Development, 62,* 127 – 138.

10. Jacobs, J.E. & Potenza, M. (1991). The use of judgment heuristics to make social and object decisions: A developmental perspective. *Child Development, 62,* 166 – 178.
11. Kail, R. (1992). Processing speed, speech rate, and memory. *Developmental Psychology, 28,* 899 – 904.
12. Department of Health and Human Services (November 2001). Code of Federal Regulations, Title 45: Public Welfare, Part 46: Protection of Human Subjects [http://ohrp.osophs.dhhs.gov/humansubjects/guidance/45cfr46.htm#subpartd]
13. Arsenio, W. F. & Kramer, R. (1992). Victimizers and their victims: Children's conceptiosn of the mixed emotional consequences of moral transgressions. *Child Development, 63,* 915 – 927.
14. Miller, P. H. and Aloise, P.A. (1989). Young children's understanding of the psychological causes of behavior: A review. *Child Development, 60,* 257 – 285.
15. Rice, F. P. (1998). Human Development, 3rd Ed. Upper Saddle River, NJ: Prentice Hall.
16. Drake, K.L., Conzola, V.C., Wogalter, M.S., 1996. Signal words: Do definitions correspond to connoted hazard? In *Proceedings of the Human Factors and Erognomics Society 40th Annual Meeting*. Santa Monica, CA: Human Factors and Ergonomics Society, p. 1281.
17. Morrongiello, B. A., Midgett, C., & Shields, B.A. (2001). Don't run with scissors: Young children's knowledge of home safety rules. *J. of Pediatric Psychology, 26,* 105 – 115.
18. Ceci, S. J. & Bruck, M. (1993). The suggestibility of the child witness: A historical review and synthesis. *Psychological Bulletin, 113,* 403 – 439.
19. Goodman, G.S., Bottoms, B.L. and Schwartz-Kenney, B.M. (1991). Children's testimony about a stressful event: Improving children's reports. *J. of Narrative and Life History, 1,* 69 – 99.
20. Imhoff, Molly Carter; Baker-Ward, Lynne (1999). Preschoolers' suggestibility: Effects of developmentally appropriate language and interviewer supportiveness. J. of Applied *Developmental Psychology, 20,* 407-429.
21. Saywitz, K. (1995). The question, the answer, and the environment. In M. Zaragoza, J.R. Graham, G.C.N. Hall, and Ben-Porath (Eds.). *Memory and Testimony in the Child Witness*, pp. 113 – 140. Thousand Oaks, CA: Sage Publications.
22. Saywitz, K., Nathanson, R., & Snyder, L. (1993). Credibility of child witnesses: The role of communicative competence. *Topics in Language Disorders, 13,* 59 – 78.