Human Factors Assessment of Multimedia Products and Systems

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THE IMPORTANCE OF HUMAN FACTORS ASSESSMENT

Human factors assessment is a set of methods that are employed in order to determine if a product, service, or system meets the needs of the end users. These needs are measured along the dimensions of effectiveness (can the user actually accomplish the task at hand?), efficiency (can the user accomplish the task with a minimum of effort?), and satisfaction (is the user satisfied with his or her interaction with the product?). Multimedia technology requires significantly more attention to human factors and usability because the mode interactions create a more complex operating environment for the end user. This complexity can make these systems difficult for consumers to learn and use, reducing both the satisfaction of the users and their willingness to purchase or use similar systems in the future.

It is critically important to assess the usability of a product from the onset of the project. Although it is common to perform a summative human factors assessment of the product at the end of development, it is typically too late to do anything meaningful with the results at this point because of the cost of changing a complete or nearly complete design. It is most beneficial to engage in a full human factors assessment during the concept generation phases, so that fundamental limitations of human perception and cognition can be considered *before* designs have already been established. Human factors assessment should continue throughout the project lifecycle. Rigorous application of these methods helps insure that the resulting end product will have high user acceptance because of superior ease of use.

METHODS OF HUMAN FACTORS ASSESSMENT

There are three major methods for gathering data for the assessment of a product:

1. Inquiry methods
2. Inspection methods
3. Observation methods

Each method has certain unique advantages and disadvantages that require that they be employed carefully during the project lifecycle. Specific submethods within each of these major categories are described in the following sections.

METHODS OF INQUIRY

Inquiry methods are those in which users of a product are asked about their experiences. If the product is already available, then inquiry methods tend to focus on the users' previous experience with the product, especially areas in which the user feels that there are deficiencies. Ideally, however, inquiry methods are employed early in the concept design phase in order to gauge what users want and need in a particular product, as well as what they may dislike in similar or competing products. Four commonly used inquiry methods include contextual inquiry, interviews, surveys, and self-report.

In contextual inquiry, the participant is observed using the product in its normal context of use, and the experimenter interacts with the user by asking questions that are generated based on that use. It is important to let the participant "tell the story" and ask questions only to clarify or expand on behaviors of interest. Ideally, data collection takes place with the product in the environment in which the participant would be actually using it so that other relevant connections (i.e., the context of use) can be made. Bailey, Konstan, and Carlis (2001) performed a study in which they used contextual inquiry to assess a tool that was being used by multimedia designers in their day-to-day development work. Their contextual inquiry assessment found that the current tools did not support multimedia designers in the way they actually worked. Applying the lessons learned thorough this analysis, they developed special-

ized software specifically for multimedia designers. For a complete description of the general method, see Beyer and Holtzblatt (1998).

Interviews are a popular method of obtaining information from a set of users. Interviews are best done when contextual inquiry is impractical or cost-prohibitive. For example, it's difficult to perform contextual inquiry with a participant who is immersed in a fast-paced multimedia game. In this case, pre-use and post-use interviews would be a better choice. Additional information about interview techniques can be found in Weiss (1995).

Verbal inquiry methods have the advantage of leaving open the chance for opportunistic data discovery. As the interviewer interacts with the user, specific behaviors or comments of interest can be further explored. These techniques also allow the interviewer to gather nonverbal data that might otherwise be missed. For example, if the participant rolls his eyes while giving a "yes" answer to an ease of use question, the interviewer can interpret the intent of the answer and follow up with additional questions. Verbal inquiry is also a good technique for gathering information from both experts and novices without significant additional preparation. Verbal inquiry can be done relatively quickly, in groups or one-on-one, and is especially well suited for gathering information before product specifics are available.

Unfortunately, verbal inquiry methods tend to be expensive and time consuming to perform on a large scale. There is a fairly low limit to the number of questions that can be asked in a given session and the data can be copious and difficult to quantify for analysis. A coding scheme must be developed if quantitative data is required from the interviews. Inquiry methods can be prone to interviewer bias, so care should be taken to guard against it. Finally, the user may not be telling the truth, as users may report behaviors that they do not actually engage in or fail to report ones in which they do.

Surveys are a form of written inquiry and are an extremely cost effective method of collecting data. In self-report, data is collected from users through the use of verbal or written diaries. The users can be instructed to post in the diary based on specific interactions with a product, or they can be instructed to write more generally, allowing the self-report to capture general user behavior across a wider variety of activities.

Written inquiry methods are relatively easy to administer and have the advantage of being able to be administered remotely through mail or Web distribution. Users are usually able to complete a large number of questions. It is also practical to construct multiple surveys to account for specific user populations. If multiple-choice or Likert-type scales are used in the surveys, data coding can be simple and quick. Self-report inquiry can yield a vast amount of information, provided the user is willing to take the time to share it.

For all the advantages of written inquiry, it suffers from the simple fact that the researcher must know beforehand what the relevant questions are that need to be asked. If open-ended questions are used, the responses to them can be highly variable and difficult to code. Self-report tends to suffer from significant decreases in participation over time unless the participants are properly incented. While it is difficult to construct and validate a good survey instrument, Czaja and Blair (2004) provide valuable guidance.

METHODS OF INSPECTION

Inspection methods involve an assessment of the human factors of a product by a qualified human factors expert. These reviews can either decompose the details and sequence of how the product could be used in the course of its normal operation, or they can evaluate any potential usability defects in the device or its operation. Four common inspection methods include heuristic evaluations, cognitive walkthroughs, task analysis, and checklists.

Heuristic evaluation involves the assessment of a product to see if it is in compliance with a known set of fundamental usability principles, or heuristics. It involves one or more experts systematically evaluating the interface, and comparing all of the operations and interface elements against the known set of generally accepted usability principles. As demonstrated by Nielsen and Molich (1990), multiple evaluators should be used to accurately capture interface deficiencies. See Nielsen (1994) for a complete review of the heuristic evaluation technique.

Cognitive walkthroughs are similar to heuristic evaluations, except that they are performed within the framework of the completion of specific tasks. In a cognitive walkthrough, a specific task goal is established and the expert then reviews any human factors issues