Usability Barriers

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INTRODUCTION

Numerous technical, cognitive, social, and organizational constraints and biases can reduce the quality of usability data, preventing optimal responses to a system's usability deficiencies. Detecting and appropriately responding to a system's usability deficiencies requires powerful collection methods and tools, skilled analysts, and successful interaction amongst usability specialists, developers, and other stakeholders in applying available resources to producing an improved system design. The detection of usability deficiencies is largely a matter of analyzing a system's characteristics and observing its performance in use. Appropriate response involves the translation of collected data into usability problem descriptions, the production of potential design solutions, and the prioritization of these solutions to account for pressures orthogonal to usability improvements. These activities are constrained by the effectiveness and availability of methods, tools, and organizational support for user-centered design processes. The quality of data used to inform system design can, for example, be limited by a collection tool's ability to record user and system performance, an end user's ability to accurately recall past interactions with a system, an analyst's ability to persuade developers to implement changes, and an organization's commitment to devoting resources to user-centered design processes.

The remainder of this article (a) briefly reviews basic usability concepts, (b) discusses common barriers to successfully collecting, analyzing, and reacting to usability data, and (c) suggests future trends in usability research.

BACKGROUND

Usability barriers hinder data collection processes, reduce the quality of usability data, and therefore hinder the detection of and response to a system's deficiencies. Barriers to system usability are necessarily barriers to one or more dimensions of usability. Usability dimensions are commonly taken to include at least user efficiency, effectiveness, and subjective satisfaction with a system in performing a specified task in a specified context (ISO 9241-11, 1998), and frequently also include system memorability and learnability (Nielsen, 1993).

Usability data are defined by Hilbert and Redmiles (2000) as any information used to measure or identify factors affecting the usability of a system being evaluated. Such data are collected via *usability evaluation methods* (UEMs), methods or techniques that can assign values to usability dimensions (J. Karat, 1997) and/or indicate usability deficiencies in a system (Hartson, Andre, & Williges, 2003). Usability evaluation may be analytic (based on interface design attributes, independent of actual usage) or empirical (based on observations of system performance in actual use; Hix & Hartson, 1993), and may be formative (employed during system development) or summative (employed after system deployment; Scriven, 1967).

Usability data quality refers to the extent to which the data efficiently and effectively predicts system usability in actual usage, can be efficiently and effectively analyzed, and can be efficiently and effectively reacted to. High-quality usability data indicate real system deficiencies (validity) that will be repeatedly encountered by individual users (reliability) and by a wide range of users (representativeness); represent deficiencies in their entirety (completeness); can be easily translated by usability analysts into problem descriptions that accurately represent the underlying deficiencies (communicative effectiveness and efficiency); indicate problems that seriously influence the quality of users' experiences with the system (severity); and persuade developers and other stakeholders to implement design changes (downstream utility) that verifiably improve system usability (impact) at low cost (cost effectiveness). (For a discussion of each

of these dimensions, see the article titled "Usability Data Quality" in this encyclopedia.)

BARRIERS TO USABILITY-DATA QUALITY

The successful collection, analysis, and reaction to usability data are hindered in practice by numerous constraints and biases. Far more empirical work identifying barriers to data quality has focused on collection than analysis and reaction for the obvious reasons: Collection processes are more amenable to experimental control and more accessible to researchers (i.e., easier to simulate or observe in entirety). Nonetheless, in recent years, barriers throughout the development process have been identified, as discussed in this section.

Resource Constraints

If representative customers and end users are distributed (especially internationally), costs become the primary barrier to (empirical) collection, which will tend to drive the selection of methods (Englefield, 2003; Stanton & Baber, 1996; Vasalou, Ng, Wiemer-Hastings, & Oshlyansky, 2004) and affect data quality. As a result, informal data-collection methods are more frequently employed in practice than formal methods (Vredenberg, Mao, Smith, & Carey, 2002).

Perhaps the most common constraint arises from the timing of data collection in the development cycle. Not surprisingly, the general finding is that the later usability data are collected, the less likely they are to result in design changes (Bias & Mayhew, 1994). This problem can be exacerbated when a short development cycle is demanded by concerns orthogonal to usability.

When data collection is performed at low cost (for example, by using nonintrusive remote collection methods), the resource burden is often not avoided but rather shifted to analysis since such methods can result in more data than are possible to translate into problem descriptions within the development cycle.

User Ability and Motivation

One of the most widely employed collection methods, think-aloud usability testing, requires users to engage in a highly unnatural activity, namely, verbally unloading a stream of consciousness while interacting with a system (Nielsen, 1993). Lin, Choong, and Salvendy (1997) point out that many users have difficulty in keeping cognitive processes verbalized while performing tasks, and that expert users in particular find it difficult to verbalize their (often automatic) processes. When activities are routine or would not normally require attention, concurrent verbalization is not only difficult, but can affect cognitive processes (Birns, Joffre, Leclerc, & Paulsen, 2002; Ericsson & Simon, 1980) and therefore hinder the validity of behavioral observations made during testing.

Remote methods in which the setting of data collection is more realistic do not avoid these barriers. Fundamentally, data collection is limited by the ease of use of the collection instrument (Hartson & Castillo, 1998) and users' ability to notice usability problems as they occur (Galdes & Halgren, 2001), ability to evaluate incomplete prototypes with missing functionality, ability to remember and articulate the context of a previously encountered problem (J. Karat, 1997), and willingness to accept the cost of providing feedback.

Selective Feedback and Feedback Bias

Under many circumstances, usability data that could drive system improvements are simply never collected. Even when mechanisms are in place for reporting critical incidents during actual use, users will choose which problems to report, often neglecting those they deem unimportant (Costabile, 2001). Neglecting low-severity problems can in some cases be a benefit to data quality, but only to the extent that users are able to recognize which problems recur and to tune their feedback activities effectively. Users conversely will often neglect reporting high-severity problems, naturally in favor of focusing their attention on correcting such problems and getting their work done.

Neglecting feedback altogether may in some cases be the lesser of two feedback evils, the other