Usability Heuristics for Large Screen Information Exhibits

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Abstract: This paper reports on current development of usability heuristics for large screen information exhibits. By basing the creation of such heuristics on real systems, and identifying real problems with those systems, our set is grounded and tailored to the specific application class. This process was done through scenario based design techniques involving claims identification and analysis, identifying specific problem areas with existing large screen information exhibits, and using those problem areas to formulate high level statements to serve as guides in an analytical usability evaluation.

Keywords: heuristic evaluation, large screen displays, scenario based design, claims, usability, notification systems

1 Introduction

Ensuring usability is an ongoing challenge for software developers. Myriad testing techniques exist, creating a trade-off between cost and effectiveness. Some methods are easier to administer, others perhaps are less costly. Finding and using the right method for a specific application is part of the usability process, but determining the most effective methods for a given application class is not clear.

Usability testing techniques are broken down into *analytical* and *empirical* types. Analytical methods involve inspection of the system by users, typically experts in the application field, who write down problems they identify in a walkthrough process. Empirical methods leverage people who could be real users of the application in controlled tests of specific aspects of the system, often to determine efficiency in performing tasks with the system. Using either type has advantages and disadvantages, but practitioners typically have limited budgets for usability testing, hence they want the most cost effective methods, which are typically the analytical ones.

There are problems with using analytical methods (like heuristics). These problems come from applying a small set of guidelines to a wide range of systems, illustrating how generic guidelines are not readily applicable to all systems. Realizing the potential in analytical evaluation techniques, we have developed a set of heuristics tailored for evaluating large screen information exhibits. *Large screen information exhibits* (LSIE) are information presentation applications built to run on large screen displays. These displays can range from projections on walls to large electronic LED displays (like at sporting arenas), but are perhaps most easily recognized on situated large screens like the SMART board™ or Liveboard™. These applications are part of a larger class of systems known as *notification systems* (McCrickard & Chewar, 2003). Typically used to support secondary tasks, these notification systems are characterized through some common user goals revolving around dual- and multi-task situations.

LSIEs focus on very specific user goals. First, users want to gain a better understanding of the information presented on the display. This *high-level comprehension* involves making sense of the information and storing it in long term memory. A second goal associated with these types of applications deals with minimizing the distraction caused by the display, while simultaneously allowing the user to decide when he/she wants to look at the information. This *self-defined interruption*, along with being shown on large screen displays, is what clearly separates these applications from other typical information interfaces. A third goal, although somewhat more flexible than the other two, is to be able to react to the information. This *appropriate reaction* depends on usage context and personal goals, as some users may need to be able to make important decisions based on the information shown on the display, in a quick and efficient manner, and others may not need to do anything. It is important to note that these applications are used in dual- or multi-tasking situations. Users are busy with other tasks, such as editing documents, or searching through databases, and rely on these displays to facilitate awareness and understanding of the secondary information.

Creating effective, useful applications for large screen displays is an important goal for developers. Effective evaluation methods, which can be readily implemented, are needed to ensure user goals are met. Heuristics are a logical choice for this system class, but no heuristics specific to this class are available. This work seeks to create a set of heuristics, specifically targeting LSIEs, with the eventual goal of being able to allow efficient, accurate testing of formative designs.

2 Related Work

Tremendous effort has been devoted to the study of usability evaluation, specifically in comparing analytic to empirical methods. Nielsen's heuristics are probably the most notable set of analytical techniques, developed to facilitate formative usability testing (Nielsen & Mack, 1994). They have come under fire for claims that they are comparable to user testing, yet require fewer test subjects. Comparisons of user testing to heuristic evaluation are numerous (Jeffries et al, 1991; Karat et al, 1992; Tan et al, 2002). These works have shown that heuristics find many more "minor" usability problems than "major" problems, when compared to user testing, but these studies do not indicate large statistical significance between the two types of test. But, in terms of cost, heuristics are recommended over user testing.

Beyond comparing analytical to empirical methods, others have worked to develop targeted heuristics for specific application types. Baker et al report on adapting heuristic evaluation to groupware systems (Baker et al, 2002). They show that applying heuristic evaluation methods to groupware systems is effective and efficient for formative usability evaluation. Mankoff et al compare an adapted set of heuristics to Nielsen's original set (Mankoff et al, 2003). They studied ambient displays with both sets of heuristics and determined that their adapted set is better suited to ambient displays.

These efforts illustrate the interest and need for effective heuristics. Furthermore, it illustrates the desire to create evaluation methods that are effective for specific types of interfaces. However, these works do not specify exactly how one can create heuristics for an application class. The following section reports on how we approached this problem.

3 Creating Heuristics

Scenario based design (SBD) (Rosson & Carroll, 2002) was used to develop a set of heuristics for LSIEs. This method relies on scenarios and claims to illustrate and highlight typical usage for a target system. Relying on techniques from SBD, a thorough review and inspection of five example LSIEs was conducted to facilitate creation of heuristics tailored to these displays.

SBD focuses on the user tasks and goals for a system; hence we felt it would lead us to accurate and useful heuristics, if employed in an analysis of existing systems. We identified five LSIEs; created usage scenarios for each; identified claims related to activity, information, and interaction design aspects; then synthesized those claims into heuristics. The following sections provide some details on this process.

3.1 Systems

We chose five LSIEs to inspect and perform claims analysis. We felt by using existing LSIEs, and identifying common problems with them, we would be better able to develop heuristics for this system class. The five systems we chose to inspect are:

GAWK (Somervell et al, 2003) This system provides teachers and students an overview and history of current project work by group and time, on a public display in the classroom.

Photo News Board (Somervell et al, 2003) This system provides photos of news stories in four categories, shown on a large display in a break room or lab.

Notification Collage (Greenberg et al, 2001) This system provides users with communication information and various data from others in the shared space on a large screen.

What's Happening? (Zhao & Stasko, 2002) This system shows relevant information (news, traffic, weather) to members of a local group on a large, wall display.

BlueBoard (Russell et al, 2002) This system allows members in a local setting to view information pages about what is occurring in their location (research projects, meetings, events).

These five systems are all information exhibits, due to their associated user goals – users are busy with other work, and rely on these systems to stay aware of specific information needs. Each provides a different type of information, and the information is presented in different ways. These differences are the keys to understanding what constitutes a "good" design. Thus, we performed a claims analysis on these systems, and used the results to identify potential heuristics, which could guide future usability evaluations of these types of systems.

3.2 Claims

Claims are simple statements about an interface component which reflect good and bad results of using the component in the interface. An example claim might be:

Using blinking to highlight new items can:

+ support rapid recognition of new information
- but may increase distraction from other work

Claims like these were made for each of the five systems, touching on interface components related to the activity, information, and interaction design aspects associated with SBD. Activity design involves what users can and cannot accomplish with the system. Information design deals with how information is shown and how the interface looks. Interaction design focuses on how a user would interact with a system (clicking, typing, etc).

3.3 Analysis

The claims made for the five systems were categorized into activity, information, and interaction categories. These claims were then analyzed for impact on user goals. Not surprisingly, very few claims from the interaction category had a significant impact on the user goals. Recall that the main user goals involved with LSIEs include comprehending the information, and being able to define when the user wants to look at the display. Interaction with the display would not be part of these goals, since the user would no longer be worried about self-defined interruption or high-level comprehension (by the time they need to interact with they display, these goals have been met and new goals are formed). Activity and information design held the most claims, and these categories certainly impact the user goals as they directly dictate what and how information is shown to the users.

Determining whether or not a specific claim impacted the user goals for a system was done by the authors through a series of discussions and debate on how a claim impacted the goals, if at all. Generally it was simple to determine whether or not a claim impacted a goal, based on the wording and content; and on the rare occasions when there was ambiguity, lengthy discussions and debates allowed the authors to classify the impact. For example, if we use the above example claim, we can see that it might impact the user's ability to react (appropriate reaction) to the information, as well as cause unwanted distraction (self-defined interruption).

It turns out that some claims do not impact the goals associated with LSIEs. These claims were sent through the analysis twice to ensure their non-classification was correct. This analysis was useful in determining what design elements in each of the systems had positive and negative impacts on the associated user goals. But, it was then necessary to synthesize and group the resulting claims to identify potential heuristics.

The synthesis of multiple claims into higher level heuristics was done through an inspection process, weighing the impact and wording of the claims to formulate a higher level goal that encompassed the idea put forth in the claims. Related claims were grouped according to how they impacted user goals (positive or negative impact on self-defined interruption, high-level comprehension, and appropriate reaction). These groupings were then inspected to determine the over all concepts related to the claims. This synthesis process resulted in several heuristics for LSIEs. Individual claim wordings helped clarify the higher level heuristics. The following section lists the heuristics we identified in this process, along with some clarifying remarks about how they could be used and what they mean.

4 Potential Heuristics

In the spirit of Nielsen & Mack, we have provided a list of heuristics that can be used to guide evaluation of LSIEs. Explanatory text follows each heuristic, to clarify and illustrate how the heuristic could impact evaluation. Each of these heuristics is general enough to be applied to many different systems, yet they all address the unique user goals of LSIEs. The heuristics are:

Appropriate color schemes can be used for supporting information understanding. Try using cool colors such as blue or green for background or borders. Use warm colors like red and yellow for highlighting or emphasis.

Layout should reflect the information according to its intended use. Time based information should use a sequential layout; topical information should use categorical, hierarchical, or grid layouts. Screen space should be delegated according to information importance.

Judicious use of animation is necessary for effective design. Multiple, separate animations should be avoided. Indicate current and target locations if items are to be automatically moved around the display. Introduce new items with slower, smooth transitions. Highlighting related information is an effective technique for showing relationships among data.

Use text banners only when necessary. Reading text on a large screen takes time and effort. Try to keep it at the top or bottom of the screen if necessary. Use sans serif fonts to facilitate reading, and make sure the font sizes are big enough.

Show the presence of information, but not the details. Use icons to represent larger information structures, or to provide an overview of the information space, but not the detailed information; viewing information details is better suited to desktop interfaces. The magnitude or density of the information dictates representation mechanism (text vs icons for example).

Using cyclic displays can be useful, but care must be taken in implementation. Indicate "where" the display is in the cycle (i.e. 1 of 5 items, or progress bar). Timings (both for single item presence and total cycle time) on cycles should be appropriate and allow users to understand content without being distracted.

Avoid the use of audio. Audio is distracting, and on a large public display, could be detrimental to others in the setting. Furthermore, lack of audio can reinforce the idea of relying on the visual system for information exchange.

Eliminate or hide configurability controls. Large public displays should be configured one time by an administrator. Allowing multiple users to change settings can increase confusion and distraction caused by the display. Changing the interface too often prevents users from learning the interface.

These heuristics are to be used in analytical evaluations to identify usability problems for other LSIEs. By having these heuristics as guides, inspectors can focus on the most likely areas in an interface for identifying real usability problems, i.e. those that hinder a user in accomplishing his/her goals.

5 Conclusions

We have described the process of creating usability heuristics for LSIEs. By using scenario based design, which focuses on user goals and tasks, we have inspected five different systems from the information exhibit class, and identified several high level heuristics. By grounding these heuristics in real systems that have been developed and used, we have established a set that is based on real system problems. Other researchers do not adequately describe how their heuristics were developed (Baker et al, 2002, Mankoff et al, 2003), which allows critics to undermine and berate their use; whereas this report on the creation process provides the background and foundation for this heuristic set.

We envision these heuristics as guiding and grounding analytical evaluation of LSIEs. However, we do not expect practitioners to simply pick these up and use them without knowing whether or not they work, especially when they have alternatives (albeit not the most desirable) that have been extensively studied (Nielsen's for example). Therefore, the next step in this creation process is to perform empirical tests on our heuristics. We will compare them to the more established heuristics (like Nielsen's), measuring the number of problems uncovered by each method, thereby determining whether or not our heuristics will be useful in formative usability evaluation for the LSIE class.

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