Good Design Ideas Gone Bad: Lessons Learned when System Designs do Not Work as Planned

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GOOD DESIGN IDEAS GONE BAD: LESSONS LEARNED WHEN SYSTEM DESIGNS DO NOT WORK AS PLANNED

Panel Organizer:
Patricia L. McDermott, Micro Analysis & Design, Boulder, CO

Panelists:
Cheryl Bolstad, SA Technologies, Marietta, GA
Greg Jamieson, University of Toronto, Toronto, Canada
Lila Laux, Micro Analysis & Design, Boulder, CO
COL Lawrence Shattuck, United States Military Academy, West Point, NY
Christopher Wickens, University of Illinois at Urbana-Champagne, IL

If at first you don't succeed, try again. Often the first or second design alternatives are modified or discarded based on preliminary evaluation. However, there is much to be learned from design ideas that did not work as planned. Unfortunately, the lessons learned from these inadequate designs are not always shared within the human factors community. This panel provides a forum to share the lessons learned by panelists who are actually creating and evaluating designs in the field. The panelists represent a balance of perspectives from academia, industry, and government. Attendees should come away from the session with concrete examples of inadequate interface designs, how they were improved, and an understanding of why the design did not work for a particular application. A successful panel will create a forum to share lessons learned and perhaps prevent practitioners from repeating work that has already been done.

Many system designers can relate to the following experience. You spend days or even weeks brainstorming the best ways to represent information to the user. You are not so much trying to be innovative as much as you are trying fill the niche of your specific problem. Finally you come up with an idea to be excited about. Not only does it make the meaning in the situation apparent, it helps the user understand the actions they need to take. The bonus is that it has never been done before. At least that's what you think until you start showing the idea to your colleagues. Inevitably, you discover that someone has already successfully implemented a similar design. Maybe you had seen the other design before but it is very likely that you independently converged on the same idea.

This scenario illustrates how easy it is to converge on an idea that has already been tried. If the design concept is recognized, it is likely because

1) it was prototyped and empirically validated;
2) it was implemented and successfully received by users; or
3) it was implemented and found lacking.

The case that is not represented is the one in which preliminary evaluation showed deficiencies in the design and it never reached the implementation stage. However, these cases which can be so instructive are not necessarily shared within the human factors community. The purpose of this panel is to share case studies in which designs did not work as planned as well as the lessons learned from those experiences. Attendees should come away from the session with concrete examples of inadequate interface designs, how they were improved, and an understanding of why the design did not work for a particular application.

Several forums exist to pass along lessons learned from inadequate designs that have made it to the public. Norman's *The Psychology of Everyday Things* (1988) is full of examples of inadequate designs that do not follow solid design principles. The website, www.baddesigns.com (Darnell, 2002), illustrates design flaws and how they could be effectively redesigned. In the area of web pages which are so quickly and easily implemented, there are a host of books and articles describing things that did not work (DiNucci, 2001;

Flanders, 2004; Johnson, 2003; Nielsen, 2000) and how they could be revamped. We can certainly learn from these examples, but what about inadequate interface designs that failed preliminary evaluation and were augmented or modified prior to implementation?

Any good design process advocates an iterative cycle of design, test, and redesign. It is often in these preliminary evaluations that design inadequacies are discovered. Preliminary evaluations can take the form of empirical studies testing performance with different displays, heuristic evaluations, or user walk-throughs of the tool. The purpose of these evaluation approaches is to find design flaws before they are fully implemented and a product is released. There are many reasons that a design may be inadequate. Darnell (2002) found twenty types of bad designs for displays and controls alone including such things such as controls that work in unexpected ways and displays that are too similar to each other. Designs may be inadequate because the designer did not fully understand the user, the task, or the environment. For example, if the designer does not understand that the operator needs to compare two population values, the designer may place the values on very different areas of the display. Another reason for inadequate designs is that the designer did not foresee the consequences of a design feature. COL Shattuck will discuss such an example involving a message filtering feature that allowed messages to be missed resulting in an incomplete picture of the battlefield.

However, it is not the discarded designs that tend to fill journals and conference proceedings. Even within an organization, practitioners may not share the inadequate designs alternatives because they are embarrassed (Berkun, 2000). In the best of situations, lessons learned may be shared within an organization, but as Dr. Laux will discuss, this is not always or often the case as organizations grow and personnel turn over. This is unfortunate because there is a lot to be learned from discarded designs. As a field, it is important that these human factors lessons are shared. I have purposely not referred to inadequate designs as "failures" because that implies that nothing was learned and the effort was wasted. Not true! It is often from these "failures" that we learn the most. *The Psychology of Everyday Things* (Norman, 1988) and *Set Phasers on Stun* (Casey, 1998), two books that describe how designs could be improved, are now classic textbooks for introductory studies in human factors.

This panel is a forum to share lessons learned from inadequate designs. The panelists will draw on their knowledge and experiences in confronting design challenges. They were carefully selected to represent human factors practitioners who are actually doing and testing system and interface design. The panelists represent a balance of perspectives from academia, industry, and government. Each is directly engaged in developing new and innovative design concepts across the spectrum of domains including air traffic control, aviation, telecommunications, nuclear power plants, and military command and control.

Panelists and attendees will discuss stories about designs that did not work as expected and the implications for future design efforts. Inadequate designs typically result from multiple interrelated factors including environmental, situational, physical, cognitive, and social factors. Panelists will describe the factors that contributed to the design's downfall and how to avoid pitfalls in the future. The panel format will be interactive to encourage as much audience participation as possible. Each panelist will take ten minutes to present examples and lessons learned from their experience. Panelists will also be asked to suggest approaches to capturing interim faulty design for compilation and access by other designers in more locations.

Audience members will be invited to ask questions, make comments, and share their own design lessons learned. Attendees should come away from the session with concrete examples of what design aspects did not work and an understanding of why they didn't work as planned. Design is not easy. It can be a long iterative process of trial and error. This panel is a success if it can prevent human factors practitioners from repeating work that has already been done.

PANELISTS

Dr. Cheryl Bolstad, SA Technologies

When designing systems for individuals, the goal is to develop a product that the user can interact with

effectively and efficiently. Bad design work can lead to products that are not used or are ineffective. The design work I have done primarily focuses on designing systems around Situation Awareness (SA). I use a 3-step approach called SA Oriented Design (SAOD). The first step of SAOD is determining the information needs of the user through goal directed task analysis, the second step involves creating the design based on these information needs and the last step is the validation or evaluation of the system. I will present some designs, my own as well as others, which did not follow the SA oriented design approach and ended up not being a very good product/system. In addition to presenting the design, I will provide thoughts on how best to improve the product or system.

Dr. Greg Jamieson, University of Toronto

For the past eight years, I have attempted to develop graphical representations for process control systems using the Ecological Interface Design framework. While several of my designs have been validated empirically, many more have fallen down at every possible stage of analysis, design and evaluation. One of the most important lessons that I have learned is that 'Shock and Awe' is a very poor technique for eliciting user feedback on design concepts. Ecological interfaces tend to be very different from the representations with which operators are accustomed. The novelty of the representational form can easily overwhelm an operator and effectively silence them as critics. As designers, we must go beyond simply 'including' users in the iterative design process and enable them to exercise their domain expertise in critiquing new representational forms. I will discuss some of our ongoing efforts to learn from my mistakes in leveraging the expertise of process plant operators in the design of new ecological interfaces.

Dr. Lila Laux, Micro Analysis & Design

In eight years as a human factors engineer for a major telecommunications company, I worked on several teams to develop applications to assist employees in performing their work faster, with fewer errors, and with significantly less training. Yet in those eight years we only successfully deployed one completed application, and it was largely technical with little direct impact on users. A number of proposed solutions were rejected by the user groups because they were difficult to learn and use. Corporate memory was short, and the stories behind these failures were seldom, if ever, memorialized in corporate memory. Similar failed efforts were often experienced in a new iteration of the effort. I will discuss the factors that caused user groups to reject software that was ostensibly developed to assist them and why these human factors failures were not recognized and utilized in subsequent corporate decision-making. I will use two case studies to demonstrate what "went wrong" and why this information was lost to development organizations.

COL Lawrence Shattuck, United States Military Academy

It apparently made sense to the designers and programmers, but it didn't work! A recent Army tactical simulation evaluated a new command and control software system. In order to reduce the potential for data overload, users were given the ability to filter what they perceived to be superfluous data. One filtering strategy permitted users to toggle alerts on or off (e.g., notify me when I am within 5 km of an enemy vehicle or position). During one 90 minute scenario, if all alerts would have been turned on, a user would have received 9600 alerts, an average of two per second. In another scenario, there were 54 alert messages generated on a single enemy vehicle. Since the four scenario participants tailored their filtering capabilities differently, no one received all 54 alerts, nor did any players receive the same set of alerts. Therefore, they spent an inordinate amount of time determining the status of the enemy vehicle. Filtering data may reduce overload at the expense of SA. In team settings, filtering schemes must be coordinated to ensure all relevant data are perceived and processed into the team's SA.

Dr. Christopher Wickens, University of Illinois

There are a variety of reasons why good design ideas have not worked, when put into practice. One of these is inadequate concern, in design, to the cognitive effort required to operate features of the system. A second is insufficient attention given to ultimate users of the system, in bringing those users on board as contributors to the design team. A third is understanding the organizational context into which new systems will be introduced, including the role of managers (rather than users) of the systems. I will describe some examples of these problems with regard to systems designed to assist air traffic controllers in traffic management and conflict resolution.

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