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Design of Health Information Management System Interfaces Using Human-Centered Design Principles

Austin Dains[a], Cesar Gracia[b], Adol Esquivel[a], Kim Dunn[a]

[a]*The University of Texas Houston Heath Science Center School of Health Information Sciences*
[b]*Escuela de Medicina, Instituto Technológico y de Estudios Superiores de Monterrey, NL, México*

Abstract and objective

This project used the Human-Centered Distributed Information Design Methodology (HCDID) to develop a series of interfaces for a Health Information Management System. HCDID employs several levels of analysis including an analysis of the user, a functional and task analysis, a representational analysis, then prototype development, a heuristic evaluation, and finally prototype iteration. Based on the user, functional, task and representational analyses, an initial prototype was developed and then evaluated using a heuristics worksheet. Using the information from the heuristic evaluation, an improved prototype was created that addressed the problems of the original prototype. HCDID was an effective methodology for analysis of interfaces of a Health Information Management System. During the design phase, the focus was on the users' needs rather than the system's developers so that the final product would meet the users' requirements.

Keywords:

User interface engineering, health information management, heuristics, work domain analysis

Introduction

This project used the Human-Centered Distributed Information Design Methodology (HCDID) to develop a series of interfaces for a Health Information Management System. HCDID is based on User Interface Engineering (UIE), a process of designing interfaces for human interactions between a human (user) and a machine focusing on the way the user inputs and retrieves information, and how effectively users navigate the system.

Health information management was a challenge during the relief efforts of last year's U.S. Gulf Coast hurricanes Katrina and Rita. Multiple systems, both electronic and paper, were implemented in an effort to collect, distribute and share information about the victims. The integration of these systems failed due to the lack of standards and inconsistencies in data.

In response to the information challenges during the gulf coast disasters, The UT-School of Health Information Sciences developed a web-based system to assist during major disaster's relief efforts, the Health Information Management System -Disaster Relief Efforts. (HIMS-DRE) This HIMS-DRE allows the creation and use of web-based forms by an interviewer, who utilizes them to enter data into the system.

Methods

HCDID employs several levels of analysis including an analysis of the user, a functional and task analysis, a representational analysis, then prototype development, a heuristic evaluation, and finally prototype iteration. [1]

User analysis

User analysis is a method that allowed us to identify and classify the most important attributes of potential users that will directly affect how the user interacts with the system. The information about the users of the system was acquired by performing interviews, site visits, surveys, and a review of the literature. The user's own definition of their role was also an important factor to consider when designing the system.

Functional analysis

We used functional analysis to describe the main user's goals, and task analysis to identify the information, processes, and expected outcomes needed to achieve those goals. We used Work Domain Analysis (WDA) to identify the functional properties of the system.

Representational analysis

We constructed Abstraction Decomposition Maps (ADM) to graphically represent the WDA. The representational analysis consists of a graphical analysis of the interaction between a system and its user, taking into account the previously completed user analysis and the functional and task analysis. Representational analysis also utilizes several design principles including layout, type face, color, language, and structure.

Heuristic evalution

Heuristic Evaluation is a type of usability inspection method in which evaluators examine an interface for usability issues. In our case, three independent users evaluated the user interface using heuristics to identify usability problems, grade the severity of the problems, and propose solutions. There were 14 heuristics in the evalua-

tion including the following: consistency and standards, visibility of system state, match between system and world, minimalist, good error messages, prevent errors, clear closure, and help and documentation.

Results

User analysis

Based on techniques such as job description and interviews with the system's designers we designed a basic profile for the interviewer user. The focus was on several aspects of the interviewer that are flexible and several that have more rigid requirements. The more flexible characteristics of the interviewer user include the user's location, profession, lifestyle, and gender, because these characteristics would have less influence on the user's interaction with the system. Other aspects were less flexible and had more requirements. For example, the education level of the user, a minimum of high school, would have to include basic reading and writing skills. The user's technical expertise would have to consist of at least basic computer use (e.g. word processor and internet browser use) because the interface would have similar features to these programs. The minimum age of the user would be 18 years old age, because some agencies involved in the aftermath of hurricane Katrina, preferred to have volunteers that were older. The upper age limit is not definite because it would depend on the physical and mental abilities needed to complete the tasks required. Being physically and mentally competent means the ability to talk freely without impediment, have no trouble seeing or reading, have motor control of the hands, have the ability to hear without aid, have medications that do not require refrigeration, to work outdoors, and have cognitive awareness. These are all basic factors needed to be able to conduct an interview and interact with the system's interface. It is possible that the user could be of limited mobility, and still be able to perform the tasks, as long as the location allowed the user access. The user would have to possess certain skills, for example, the ability to perform an interview, to work in stressful situations, and be proficient in the victims' language. These skills are important because the user must be able to work in crisis situations. The user would also be required to have affiliation with an organization granted access to the system. These conditions should be considered when looking for qualified users.

Functional/task analysis

We identified several high-level interviewer functions and interaction with the system. Based on the WDA that was conducted, security, storage, display and retrieval, transmission, and usability were priorities because these values were important and they encapsulated all of the tasks that the interviewer-user would perform. These values also influence all of the user's interactions with the system. The purpose-related functions that related to security included logon, logoff, and editing already entered data. These functions would allow structured access and interaction with the system as well as provide a safe environment for both the user and the information that is being stored, displayed, retrieved, and transmitted. The values of storage, display and retrieval share relations with many of the same purpose related functions including browse clients, edit already entered data, create clients, browse forms, and use forms for interview. These functions are the ones that will have the greater impact on how the user interacts with the system. In addition, the display and retrieval values also include the navigation function and shares the communication function with the transmission value. These last two functions are important to the user because they are the functions that provide routing through the system and support for the user when it is needed.

Heuristic analysis and prototype development

Based on the user, functional, task and representational analyses, we developed an initial prototype and then evaluated it using a heuristics worksheet. In just one prototype screen, there were 75 heuristics violations. 14 were minor (0-2 on the rating chart) and 61 were rated as major violations (3-4). We catalogued all of the heuristics evaluations along with information about the description of the problem, the heuristic that was being evaluated, the severity of the problem, and the recommended solution. Using the information gathered, we created an improved prototype that addressed the problems of the original prototype.

Conclusion

We used HCDID based on UIE to develop interfaces of the HIMS-DRE. WDA greatly assisted us in the interface design process. It helped us identify the purpose, priorities, values, functions, and draw connections that facilitated the graphical representation of our interface. Heuristics evaluation was an effective and time-efficient method of evaluating user interface prototypes. During the design phase, we focused on the users' needs rather than the system's developers so that the final product would meet the users' requirements.

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