

HUMAN FACTORS USABILITY STUDY ON PROTOTYPE PORTAL

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This paper describes the results of a human factors usability study conducted in 2004 on a prototype information portal. The portal was intended as an applications and content management system for Federal Aviation Administration employees and managers at the William J. Hughes Technical Center. The main focus of this study was to evaluate the organization and layout of the portal content. Six users representing a cross section of the target user population participated in the study. First, participants were asked to indicate their top ten most frequently used items from a list of the portal contents. Second, participants were given items of information and asked to find the item. They were asked to talk aloud while finding the item in the portal. The researchers recorded the path taken by the participants to find the information, the number of clicks it took to find the information and comments made by the participants while performing the task. The results of this study identified high priority items and items that were difficult to find in the tested organization. Recommendations were made to improve the usability of the portal based on the results and participant comments.

INTRODUCTION

This report gives an overview of a human factors usability study conducted on a prototype information portal targeted for Federal Aviation Administration William J. Hughes Technical Center (WJHTC) employees and managers. The information portal was developed to consolidate and standardize many information systems used by employees into a web-based portal. Some examples of systems to be included were the existing employee intranet, several human resources systems, the employee directory, various accounting and tracking systems, and e-mail.

The NAS Human Factors Group helped design the organization of information in the portal using a variety of user-centered design techniques such as guidelines and card sorting (Ahlstrom & Allendoerfer, 2004 a & b). Once a prototype of the portal was created, we conducted a usability assessment to evaluate the organization and other elements of the portal user interface. In this report, we give a high level overview of the methods and the results of this assessment. The full study along with detailed results will be published in a technical note.

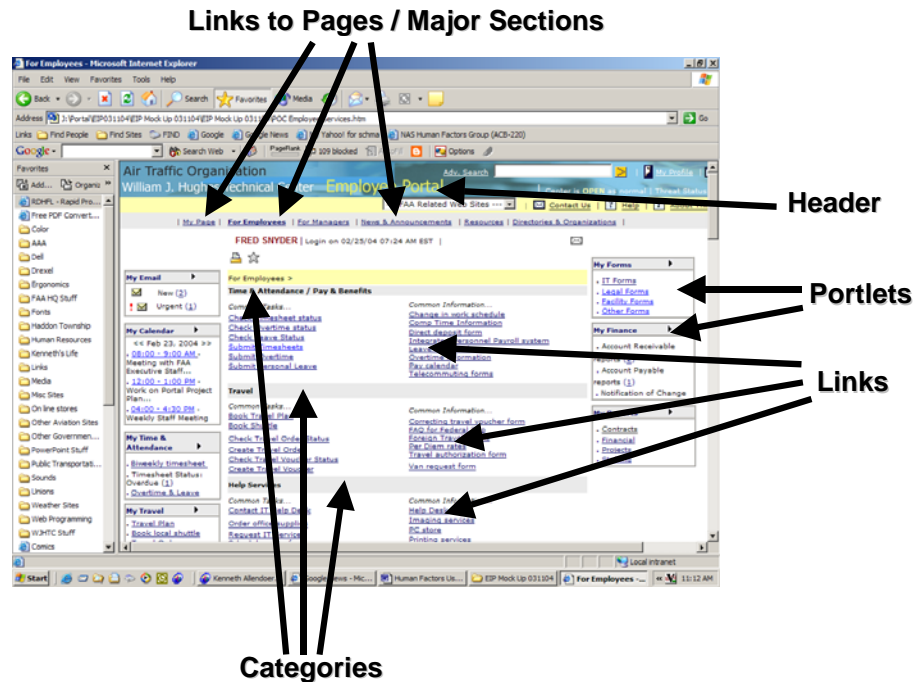


Figure 1. A screenshot of the portal showing user interface elements.

Materials

The prototype portal consisted of static HTML pages providing the appearance of a live portal as shown in Figure 1. Participants could interact with the prototype using standard web browser software.

The prototype portal was displayed on a desktop computer. Participants interacted with the system using a mouse (a keyboard was also available but no participants chose to use it). Data collection materials included a video cassette recorder attached to a monitor and a scan converter that recorded the images on the screen as the participants completed tasks. The videos served as backups for the primary data.

- *Information Priority Sheet* The information priority sheet contained an alphabetical list of 95 information items and systems that could be included in the portal. This was used to determine which items participants use most frequently.
- *Task Checklist* The task checklist contained 25 tasks that Technical Center employees complete as part of their jobs. These were selected because they were common, high priority, or had been identified as difficult to classify in earlier development activities. The tasks were randomized so that each participant had a different task order.
- *Researcher Checklist* The researcher checklist described the assessment procedure to ensure consistency across participant sessions.

Participants

Six employees (two female, four male) of the WJHTC served as assessment participants. This small sample of users represented a cross section of jobs at the WJHTC.

Procedure

One participant served in each session. Sessions were conducted over several days based on the availability of the participants. Sessions ran from 30 minutes to slightly more than one hour, depending on how quickly the participant found the items and how many comments he or she had. At the beginning of each session, a researcher read a statement of confidentiality to the participants to ensure that they understood that their participation was voluntary and the data were confidential. The researcher then explained the purpose of the study.

The assessment consisted of two parts. First, participants were asked to indicate their top ten most frequently used pieces of information or systems (top ten list) on the Information Priority Sheet. The purpose of this task was to ensure that frequently accessed information was given higher prominence in the portal.

Second, participants were asked to talk aloud while finding items in the portal. Participants were given a few

minutes to familiarize themselves with the portal. When the participants said that they were ready, a researcher began reading the tasks aloud. Participants were then instructed to find each item in whatever manner seemed natural to them. The researcher recorded the path that the participant took in finding the information by page, and recorded categories and comments as the participants completed the tasks. If the participants paused, the researcher prompted the participant for information by asking questions like "What are you looking for?" or "Where are you looking now?" Participants were instructed that if they could not find an item, or if at some point they would give up using the portal and pursue some other method of finding the information (e.g., make a phone call, ask a secretary), they should inform the researchers. Once the participant had found the information or given up, the researcher asked the participant to return to the home page and begin the next task.

RESULTS

High priority items

In a well-designed system, items that users rank as a high priority or frequently used should be given prominent, easy-to-access positions, especially when multiple users rank the same items highly. From the list of ninety-five potential items for the portal, thirteen items were on the top ten lists of two or more participants. Another nineteen items made the top ten list of only one participant. Due to the small number of participants in the sample, even items that were chosen by only one participant should be made easy to find and access in the portal.

Success and level of difficulty in task completion

We used two different metrics to quantify the usability of the prototype portal: success and level of difficulty. We defined success as task completion, regardless of the number of steps taken. Success rates ranged from 50% (half of the participants were unable to complete the task) to 100% (all of the participants were able to complete the task). Nine out of the twenty-five items (36%) had at least one participant who was unable to complete the task. Three of these nine items were on the top ten list of frequently used items for more than one user. Failure to achieve success in a fielded portal would have major consequences for organizational efficiency, as it would indicate that either a user is unable to complete a task necessary for their job, or it would require the involvement of additional time and resources such as a help desk or additional personnel to help the user find the needed information. The cost to an organization in failures to complete a task are multiplied for items that are accessed frequently, such as those identified by the user top ten lists.

Another measure we collected was the level of difficulty for task completion. We defined the level of difficulty by the number of steps taken to complete the task,

with more steps indicating more difficulty and fewer steps indicating less difficulty. Ideally, a portal designer would want to minimize the number of steps taken by the user to accomplish a task. The prototype portal was designed with a broad, shallow hierarchy so that any item could be found in one to two steps if the user knows where the item is. Ten out of the twenty-five items (40%) were found in one to two tries. This means that 60% of the items were difficult to find.

We did not put a limit to the number of tries a users could take before giving up and saying they could not find an item, however, the most tries that any user made before giving up was five. Most users gave up if they did not find an item after four tries.

Participants were not prohibited from using the search function, however, none of the participants used it. All of the participants relied on the navigation links rather than the search. This indicates that, for this set of users, the search would not be the primary means of navigating through the portal.

Critical path data

For any item, there is a navigation path that leads from the front page to the desired item in the shortest possible distance. The data shows that this gold path is not always the path taken by the users. We analyzed the actual paths taken by the participants. The critical path analysis gave us information on both usability issues and other valid but less common information-seeking approaches.

In some of the cases, the paths taken by the participants were different than the intended path because of different user approaches to finding information. For example, when looking for a specific form, some participants first looked in the topic area, and then looked for the form. Other users first looked for a "forms" link, and then looked for the topic area. Portals should be flexible enough to accommodate the different common user approaches.

In other cases, the paths taken by the participant were different than the intended path because of usability factors. Some of the factors that caused the users to take a different path than intended by the designers include:

- *Navigation link labels that did not match user mental models* Links in the portal were named differently than users expected.
- *Participants did not see items located in the header* Portal designers put some frequently used items in the header of the portal to make them more accessible to the users. Almost none of the users saw these items in the header. We believe that there were two reasons that the users did not see the items. First, the text was not sufficiently distinct from the background to make it stand out and second, the items were located at the top right hand side of the portal.
- *Participant navigation schemas that don't match the portal navigation schema* Participants

sometimes tried to locate information based on the organization responsible for the information rather than the category of information. This is analogous to using the white pages of a phone book to look up a service by name rather than the yellow pages to look up an item by category.

- *Too much information on a page* Participants said that there was too much information on a page. This makes it hard for users to scan the information without missing items.
- *Unclear breakdown of links* The prototype portal organized links into the columns "common tasks" and "common information". This breakdown proved to be confusing and bothersome to the participants.

User comments

Finally, we consolidated the comments made by the participants and the notes taken by the researchers during the data collection sessions. In many cases, multiple participants made similar comments. We cross-referenced the comments with the critical path data to develop a complete list of usability issues. We prioritized each issue based upon its criticality to the task, the priorities provided by the participants, and our analysis of the impact of the issue to the overall usability of the portal. We developed a recommended solution for each issue based on human factors design standards, best practices, our experience developing user interfaces, and suggestions made by the study participants. The complete set of results will be published in a technical note in 2005.

DISCUSSION

The development of a usable system is a complex, iterative process. The results of the usability study identified several critical items that users had difficulty finding with the prototype arrangement. If this system had been implemented as originally created, several of the users would not have been able to complete tasks that are critical to their job. By conducting the usability testing on a prototype, the changes could be made quickly and easily before the creation of the final system.

The research reported here deals with a specific prototype portal meant for a specific group of users. We believe, however, the methods and findings described in this paper have implications for the design of employee portals.

- *Multiple navigation strategies* It became evident as we evaluated the usability of the prototype portal was that there were individual differences in the strategies that participants used to complete the tasks. A portal that will be used by a wide range of individuals will need to be flexible enough to accommodate at least the most common interaction paths.

- *Appropriate labels for links* The participants indicated that several of the links were unclear or confusing. Links in the portal should use terminology that is familiar to the users.
- *Place important items on the left* We observed that our participants often overlooked or missed items that were on the right hand side of a page. This suggests that more critical items should be located on the left of the page when possible.
- *Meaningful breakdown of information* In the world of portal design, distinctions are made between content or information management and applications or enterprise management. The portal designers tried to impose these distinctions on the users by breaking links into “common tasks” (applications or enterprise management) and “common information” (information or content management). For example, the system to book travel was located in common tasks, and the information on per diem rates was in common information. This distinction was not meaningful to participants and caused confusion. Participants expected all of the items necessary to complete a task to be located together, whether the item was a piece of information or an application. To provide task-focused design, functions and information that are frequently used together should be located together.

- *Minimize scrolling* Users had to scroll down to see all of the information on a page. Some users missed items on a page because the item was located at the bottom of the page and they did not scroll down to see it. One potential solution to this problem is to show only the most frequently accessed items on the page with a “more” button or link to allow the user to expand the category and display all of the items.

While the screens tested in this study are expected to evolve based on the results of the usability evaluation, the prototype was representative of an initial portal design. The findings from this usability study should help guide any future design of the portal.

REFERENCES

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