

Considering User Satisfaction in Designing Web-Based Portals

Web portals can best serve higher education institutions if portal designers first understand and satisfy user needs

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A recent Gartner Inc. survey declared portals the second-most hyped information technology trend, right after e-business.¹ Along with this hype come various interpretations of what actually constitutes a portal. Traditionally regarded as World Wide Web gateways,² portals have become more than convenient launch pads for Internet searches. Today's portals are increasingly sophisticated applications designed to give users simple, quick, secure access to relevant organizational and personal data. Combine these qualities with the provision for users to select and arrange their portal content in ways that make sense to them, and you begin to understand the basis for some of the hype.

Many universities have recently jumped on the portal bandwagon, developing enterprise-wide portals and sharing their experiences in journals such as this one. Enterprise portals offer important benefits to higher education institutions. In particular, they let universities coordinate user access to multiple services and information sources, and let users personalize how they view and work with that information.

Enterprise portals also present several

development challenges, however. On the technological side, a single application must bring together and make available vast amounts of organizational data. The administration must redefine business practices to let individual departments and business units update and maintain their information within the new environment. And, if the final product is to be a success, users must ultimately adopt the portal. As with other technologies, user acceptance hinges on the intended audience perceiving portals as both useful and easy to use.³

Surprisingly little research focuses on user satisfaction, however. Experts routinely tout personalization as portals' primary attraction,⁴ yet offer developers little guidance on how best to provide such features to users. To create portal systems that meet both organizational and user requirements, universities must first identify enterprise portal characteristics that contribute to users' satisfaction and potentially to their ultimate adoption of the system.

Toward this end, we share findings from a usability study of an Indiana University enterprise portal application. The results suggest that, although Web-based portals are a relatively new phe-

nomenon, many existing interaction design principles still apply.

Enterprise Portals in Higher Education

Portals have become popular among higher education institutions for various reasons. Many institutions believe portals will give them a competitive advantage in recruiting students. To attract the best students, universities want to give the public impression that they're at the forefront of information technology and offer the most convenient services.

Universities also believe portals will help make their employees "more efficient and productive by centralizing access to needed data services—for example, competitive information, manufacturing and accounting data, 401k information, and other human relations data."⁵ An enterprise portal offers more than just an access point for organizational data, however. Portals also remove the need for multiple logins to various applications, let users perform individualized or self-service processes that previously only dedicated staff could handle, and let organizations target users for individualized services and information.⁶

Figure 1

OneStart Portal Default Screen*



* From October 2001

Personalization features probably account for most of a portal's ability to attract and retain users. Excite.com executives report that users of such portals as MyExcite and MyYahoo are five times more likely to return to those sites than if they couldn't personalize them to meet their individual needs.⁷

Universities will likely step up portal development as they seek new ways to attract students to their campuses and away from their competition. Early pioneers included the University of California at Los Angeles, the University of Delaware, and the University of Buffalo.⁸ More recent success stories include the University of Minnesota,⁹ Villanova University,¹⁰ and Louisiana State University.¹¹ More will surely emerge as other universities launch development efforts.

Indiana University's OneStart Portal

Indiana University launched its OneStart portal project in May 1998 with the publication of the university's Information Technology Strategic Plan.¹² Among the goals this document identified were the development of a single "front door" to all administrative applications and improved service from the institution's administrative offices and service providers. The document's authors envi-

sioned a Web-based, enterprise portal application as a way to meet these goals.

Developers created the OneStart portal (see Figure 1) to give users single sign-on access to all applications and services, continuous availability (24 hours a day, 7 days a week), remote access to the institution's applications, role-based activity presentation, automated workflow capability, and a personalized desktop.¹³ The university wanted to make these features available to its entire constituency, including cur-

rent students, staff, faculty, prospective students, alumni, and service vendors.

The Information Technology Strategic Plan recommended a user-centered design approach. This included gathering input and feedback from numerous steering committees and focus groups early in the project. The plan also recommended an iterative approach, with multiple rounds of usability testing throughout the development cycle.

In spite of the project's emphasis on user-centered design, certain decisions have had some negative effects on usability and accessibility. The OneStart portal's implementation of I-frame technology is one example. Similar in some respects to regular HTML frames, I-frames let users arrange, view, manipulate, and refresh multiple content channels on the screen independently (see Figure 2). Their powerful functionality, however, requires that users adjust the way they think about navigation on the Web.

Similarly, pop-up windows are used extensively in OneStart, allowing users to easily expand and work with small channels of content. The portal's personalization window is one example (see Figure 3). The window lets users select the channels they wish to appear on each page and determine their arrangement on the screen. Pop-up windows may pose challenges for unsighted

Figure 2

OneStart Three-Column View*



* From October 2001

Figure 3

OneStart Personalization Window*



* From October 2001

users, however, and require careful attention to ensure accessibility for the portal's entire audience.

Measuring User Satisfaction

While many factors contribute to a new technology's successful adoption and use, system usability has recently garnered increasing attention. A critical attribute of what we commonly refer to as usability is users' satisfaction with the systems they use. The International Standards Organization (ISO) defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use."¹⁴ Definitions of usability do vary, but virtually all of them include users' satisfaction.

Popular definitions of satisfaction tend to focus on whether users like a system and find it pleasant to use. Shackel's notion of *attitude* suggests that a usable system should result in "acceptable levels of human cost in terms of tiredness, discomfort, frustration, and personal effort."¹⁵ Bevan described satisfaction as a combination of comfort and acceptability of use:

Comfort refers to overall physiological or emotional response to use of the system (whether the user feels good, warm, and pleased, or

tense and uncomfortable). Acceptability of use may measure overall attitude towards the system, or the user's perception of specific aspects such as whether the user feels that the system supports the way they carry out their tasks, do they feel in command of the system, is the system helpful and easy to learn.¹⁶

User satisfaction studies have used such varied indicators as the ratio of positive to negative comments during the test, job absenteeism rate, and health problem reports.¹⁷ Some studies equate satisfaction with users' self-reported measures of actual use.¹⁸ Most usability studies, however, measure user satisfaction with some form of attitude questionnaire. We took this latter approach to study users' satisfaction with the OneStart portal.

Users' Rationales for Satisfaction with a Portal

In Fall 2001, Zazelenchuk conducted a usability evaluation study of the OneStart portal as part of his dissertation research. Forty-five undergraduate School of Education students participated, completing a series of tasks that required locating information and personalizing the portal system. Specifically, students had to locate certain channels of information, such as their

course schedule or the campus newspaper, add them to their portal pages, and change the arrangement of certain channels on their pages to match a given sample. All participants were enrolled in a first-year educational computing course and received a long-distance telephone card and a CD-ROM of educational software in return for their participation.

At the end of each session, users rated their satisfaction with the OneStart portal using IBM's Post-Study System Usability Questionnaire (PSSUQ).¹⁹ The results revealed high user satisfaction with the portal system ($M = 5.115$, $SD = 1.103$, with anchors of 1 = strongly disagree and 7 = strongly agree). Users' satisfaction measures correlated with time spent completing tasks ($r = -.452$, $p < .01$) and success rate in completing tasks ($r = .593$, $p < .01$). Users' time spent per task also correlated with their success rate ($r = -.394$, $p < .01$).

We also asked users to explain their reasons or rationales for rating the system as they did. A content analysis of the transcripts revealed seven common rationales that suggest important design considerations for Web-based enterprise portals.

Perceived Utility

Study participants most frequently mentioned the perceived utility or usefulness that the OneStart portal offered them over systems they typically used. Present in more than 85 percent of transcripts, this finding lends further empirical support to previous literature suggesting that utility and the extent to which a system meets users' expectations contribute greatly to users' satisfaction and, ultimately, to usability.²⁰

Users described the portal's utility in numerous ways, mentioning the ability to personalize page layout and organization, the option to choose content they deemed important, and the opportunity to have it "all in one place" for easy access and viewing. Together, these attributes effectively represented the "relative advantages" that the OneStart portal offers, a critical factor in determining whether users will adopt an innovation.²¹ When asked whether they

expected to use the OneStart portal in the future, most subjects indicated that they did intend to use it. Unfortunately, their actual adoption rates remain unknown because the study ended before we could properly investigate this question.

For Web-based portal application designers and developers, this rationale emphasizes the need to fully understand the gap between what users currently have and what they desire in order to accomplish their goals. In the case of OneStart, users identified personalization and convenience as two highly desirable features.

Clear and Helpful Instructions

Users indicated through both negative and positive comments that clear instructions and effective help screens contributed to their overall satisfaction with the system. Users who found the system to be self-explanatory or who engaged the help screens and found answers to their questions seemed more satisfied with the system. Users who said they found the instructions and help screens to be incomplete or inaccurate tended to rate the system more severely.

Other researchers have also noted users' expectations for clear instructions and effective help. Nielsen advocated the importance of constructive help in his usability heuristics list:

Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.²²

Van der Meij and Carroll's principles for minimalist instruction recommend providing immediate opportunities for action, encouraging exploration, and designing instructions to reflect the user's task structure.²³ OneStart provided an introductory tutorial for new users that encouraged exploration. Usability study results, however, suggested that instructions did not always reflect users' task structures, and oppor-

tunities for taking early action with the portal were limited.

Our transcript analysis showed that users frequently embarked on a task without referring to the available instructions. Upon encountering difficulty, however, they quickly returned to the instructions to compare their approach with the suggested one. This observation and the rationale in general suggest that users' satisfaction with a Web-based portal depends on the presence of and easy access to clear instructions and help features—even if users initially ignore them.

Efficiency of Use

On the surface, the relationship between the time spent completing tasks and users' satisfaction may seem obvious: a well-designed, responsive system provides a more efficient experience and greater satisfaction. Indeed, earlier satisfaction research with client-based systems confirmed that system response time contributes significantly to user satisfaction.²⁴ More recent studies, however, question the correlation between users' efficiency and satisfaction because users have demonstrated preferences for systems with which they performed less efficiently.²⁵ This raises the question of how well efficiency relates to user satisfaction for recent technologies such as Web-based portal applications.

The OneStart study findings support a strong relationship between users' efficiency and satisfaction. Users who perceived the system as responsive to their actions (for example, loading new screens or displaying available options) generally reported greater satisfaction than users who felt the system responded slowly. Similarly, those users able to complete their tasks in fewer attempts reported greater satisfaction than those who had to make multiple attempts.

These qualitative findings were supported by a correlational analysis that revealed a significant negative correlation between users' satisfaction and the length of time spent performing tasks ($r = -.452, p < .01$). Portal application developers therefore should design

systems with an eye to improving user efficiency.

Everything in its Place

Web-based portal designers wrestle with presenting large quantities of information in a manner that is both organized and aesthetically appealing. The never-ending effort to develop content-rich systems and increasingly complex applications often leads software engineers to justify their busy designs on the basis of increased functionality and added value. The relationship between information quantity and its presentation quality need not be so linear, however. Designers may consciously choose to simplify. As Tufte²⁶ reminded us, "Clutter and confusion are failures of design, not attributes of information."

Web-based interfaces often repeat elements that ultimately add to the perception of clutter without adding any real value. Tufte calls this the $1 + 1 = 3$ phenomenon, which manifests when two or more elements interact on a screen to create a multiplying effect that increases viewer perception of visual noise and clutter. For example, in a table, two colored rows separated by a row of white space assumes the appearance of three colored bars on the screen (hence the name $1 + 1 = 3$).

Portal study participants frequently rationalized their satisfaction ratings (both high and low) with references to the portal interface's organization and layout. Users commented positively on the ability to locate information in consistent screen locations, having similar units of information chunked or compartmentalized, and the ability to logically and efficiently scan information. Conversely, users commented negatively on the portal's organization whenever new windows unexpectedly popped open, they had to scroll extensively, or they felt the combination of screen elements produced a cluttered effect. Portal designers therefore should implement, wherever possible, visual design principles for effective proximity, contrast, repetition, and alignment to optimize their interfaces' organizational appearance.²⁷ Similarly, they must guard

against visual design pitfalls such as the $1 + 1 = 3$ phenomenon to avoid confronting users with unwanted and displeasing visual noise.

The Paradox of Information Quantity

As mentioned earlier, information portals must make available large amounts of information without overwhelming the user. The difficulty in addressing this challenge manifested in subjects' love-hate relationships with the amount of information the portal provided. On the one hand, users perceived the portal as valuable because it was information-rich. On the other hand, several subjects criticized the portal for "trying to do too much" and making their experience more difficult as a result.

Once again, Neilsen's heuristics²⁸ stress the value of aesthetic and minimalist design for computer systems. Dialogues should not contain irrelevant or rarely needed information. Every extra information unit in a dialogue competes with the relevant information units and diminishes their relative visibility.

Many online newspapers achieve such a minimalist, visual design by presenting headlines followed by "more about..." or "read more..." hyperlinks. This approach lets users obtain additional information if needed, without forcing them to filter out all of the extra details on every screen. By combining such techniques with effective personalization features, portals will give users comprehensive, relevant information that they can easily scan or further investigate as desired.

Feedback Is Important

Software design guidelines commonly recommend providing users with timely, informative, and corrective feedback.²⁹ Not surprisingly, study participants frequently commented on this aspect of the OneStart portal as they explained their satisfaction ratings. Users' comments reflected either the perceived presence or absence of adequate feedback depending on their individual experiences. Highly satisfied users tended to perceive the feedback as being effective and ade-

quate, whereas those who reported lower overall satisfaction with the portal criticized the system for its lack of meaningful feedback.

During the study, it became clear that the OneStart portal provided inadequate feedback when users tried to create their own custom channels. Users created custom channels by entering a specific URL and requesting that the new channel be made available for presentation. This let users tailor their portal to include Web-related resources beyond the initial services and applications the OneStart portal offered. A usability problem appeared, however, when users couldn't locate their newly established custom channel due to insufficient feedback. The system informed users that their new channel had been created, but didn't help them locate it and place it as desired. Subsequent portal releases have resolved this problem thanks to the evaluation study results.

For Web-based portal designers, this rationale reinforces the importance of existing guidelines that call for providing users with informative feedback. This appears particularly important to allow novice users to become familiar with new systems and reach a state of competency.

Confusing Terminology

When discussing what parts of the system dissatisfied them, users also mentioned confusing terminology. For example, OneStart used such portal jargon as pages, channels, and themes. Although Web users understand the concept of a "page," portals such as OneStart may confuse users by introducing individual portal pages along with actual Web pages all within the same framework.

Researchers in the usability field are well acquainted with the principles of using natural language and avoiding technical jargon. As one of his 10 usability heuristics, Nielsen recommended that interfaces demonstrate a match between the system and the real world:

The system should speak the users' language, with words, phrases, and concepts familiar to the user rather than system-oriented terms. Fol-

low real-world conventions, making information appear in a natural and logical order.³⁰

The OneStart study results support this heuristic, reminding portal designers to refrain whenever possible from introducing new terminology where existing terms may already suffice. For example, if the portal uses the familiar Web page concept, introducing the term *channel* to refer to such pages will certainly create confusion as users try to incorporate what they already know.

Conclusions

Portals appeal to college and university administrators, technologists, faculty, staff, and students alike because they consolidate information and services and give university members quick, easy, secure access to personal data. Portals can also become overly complex systems that people find difficult to learn and use, which may jeopardize the technology's ultimate adoption. To reap the full benefits of the Web-based portal applications they develop, colleges and universities must comprehend and meet users' satisfaction requirements for such systems. The study results and user satisfaction rationales discussed here offer guidance toward this goal. *☞*

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