

Websites that Satisfy Users: A Theoretical Framework for Web User Interface Design and Evaluation

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Abstract

With the fast development and increasing use of the World Wide Web as both an information seeking and an electronic commerce tool, web usability studies grow in importance. While web designers have largely focused on functional aspects of websites, there has been little systematic attention to (1) the motivational issues of web user interface design or (2) a theoretically driven approach to web user satisfaction studies. The objective of this paper is to provide a conceptual framework and foundation for systematically investigating features in the web environment that contribute to user satisfaction with a web interface. This research uses Herzberg's [1] motivation-hygiene theory to guide the identification of these features. Among the implications and contributions of this research are the identification of web design features that may maximize the likelihood of user satisfaction and return visits to the web site.

1. Introduction

With the fast development and increasing use of the World Wide Web as both an information seeking and an electronic commerce tool, web usability studies grow in importance. Numerous web design checklists have been developed that focus on features such as loading time, color and font use, organization of information content, navigability, active links, etc.--features that may influence users' satisfaction with the website. Yet it is unclear whether there is an inclusive collection of

features, whether some of these features are more important than others, and whether addressing these features is sufficient to make users satisfied with the websites, to keep their interest in the websites, and eventually to motivate them to revisit the websites. While few current checklists are theoretically driven or have a theoretical foundation [2, 3], this research study plans to systematically investigate features in the web environment that influence user satisfaction with a website.

The study uses Herzberg's [1] motivation-hygiene theory as guidance to identify and distinguish features that may be considered hygiene features from those that could be considered motivators in web environments. Based on examinations of events in the work life of engineers and accountants, Herzberg found that hygiene factors tend to satisfy their basic physiological, safety, and social needs [4]. Such factors are extrinsic to the job itself and include company policies, supervision, working conditions, salary and so on. If not adequately provided, they contribute to extreme dissatisfaction with work life. Motivator factors, on the other hand, correspond to Maslow's esteem and self-actualization needs that are stimulated by the drive for growth and achievement. They are intrinsic to the job itself, related to its content, result in achievement, recognition, increased responsibility and continued growth, and lead to extreme satisfaction. We propose that the underlying goals for creating a motivating website are similar to those for creating a motivating workplace: to provide the conditions and environment that maximize employee (user) satisfaction and allow them to focus on and achieve high task performance.

In this paper, we present a theoretical framework on user satisfaction with web user interface. In this

framework, as depicted by Figure 1, there are three components contributing to user satisfaction or dissatisfaction with a web interface. They are features in the web environment, user's information seeking tasks, and information seeker characteristics. We propose that the user's satisfaction or dissatisfaction with a web interface is the result of the interplay between the three components.

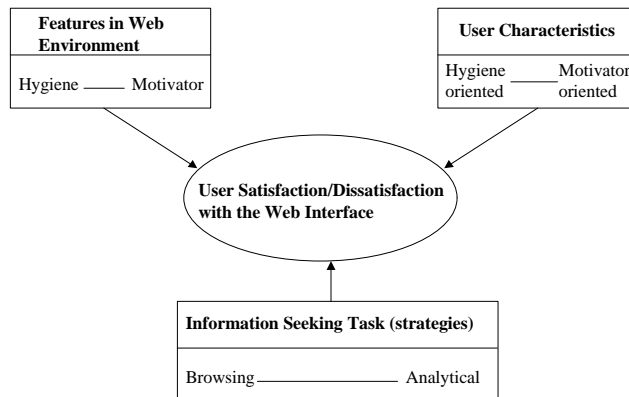


Figure 1. Components contributing to web user satisfaction

First, by applying Herzberg's [1] motivation-hygiene theory, we hypothesize that there are two types of features in the web environment that play different roles on user satisfaction or dissatisfaction with a web interface. We propose that some features can be considered "hygiene features" that are necessary, but not sufficient to ensure user satisfaction with a web user interface. We contend that "motivational features" contribute to the user satisfaction with and continued use of a website. We also expect that some hygiene and motivational features are more important than others. It is worth noting that some features may fall into both categories, just as some of the factors in Herzberg's study can be considered both hygiene and motivator factors, depending on the individuals and situations. We therefore propose that the distinction between hygiene and motivational features is a continuum rather than a dichotomy, represented in Figure 1 with a line connecting both ends, where features can fall anywhere in between the two ends.

Secondly, according to Marchionini [5], users' information seeking tasks or searching behaviors make use of two classes of strategies, browsing and analytical strategies. This research will focus on browsing within a website, defined by Marchionini as an informal and natural information seeking approach that depends heavily on the information environment and the user's recognition of relevant information. Analytical strategies, in contrast, depend on careful planning, recall of query terms, iterative query reformulation, and examination of results. We

decided on the browsing task strategy in this study because our research interest centers on web interface issues rather than search engine algorithms issues. Browsing tasks are more dependent on web interface designs and thus are more relevant to many website designers. On contract, analytical tasks are more dependent on the functions of search engines, although interface design is also an issue.

Thirdly, we assert that individual psychological characteristics, such as locus of control and levels of empowerment/self-efficacy, will modify the impact of the web interface features on user satisfaction because individuals with an internal locus of control and high levels of empowerment/self-efficacy are likely to be intrinsically motivated [6]. Their level of satisfaction with web interfaces will depend less on the web environment and more on the challenges of the information tasks themselves.

2. Review of the Literature

The relationship between information systems and human behavior has been studied for several decades and the application of motivational theories to a constantly evolving technological context has many precedents [7, 3, 8, 9]. Motivation in working place is defined as "the willingness to exert high levels of efforts toward organizational goals, conditioned by the effort's ability to satisfy some individual need" [10]. Most commonly, motivation theories are divided into content and process theories. Content or needs theories, represented by Maslow [4], Alderfer [11], McClelland [12] and Herzberg [1] suggest that people are motivated by internal needs and that managers have to learn to identify those directly to structure work to fit the prevailing needs of employees. Process theories aim to provide an understanding of the cognitive processes people use to motivate themselves. Examples, such as equity theory [13], expectancy theory [14], cognitive evaluation theory [15], and reinforcement theory [16], emphasize employees' perceptions and thoughts about work. They suggest that managers check to determine whether inequities on the job or lack of positive work related outcomes may hinder employee productivity.

In recent studies intended to predict information system success before actual implementation, expectancy theory [14] served as a theoretical foundation. De Sanctis [17], for example, studied whether motivation to use an information system was a function of the expectation that use of information system techniques will lead to good performance, that good performance will lead to desired outcomes, and that the desirability or valence of the outcome was strong. She found that a user's positive attitudes toward information systems increase the actual use of the system. According to Burton, Chen, Grover and Stewart [18], a user of a newly implemented system

will continuously evaluate the outcomes of system use and subjectively assess the likelihood that his or her action will lead to desired outcomes. However, Markus and Keil [7] assert that if the desired outcomes conflict with the factors that motivate the users, a system's features will not solve the problem, thus highlighting the role of individual factors that influence high or low motivation. According to Gill [19], user satisfaction with a system can be enhanced through intrinsic motivational factors similar to those identified by Herzberg [1]. Among them are the increased sense of user control, more task variety, less task routine, and providing capabilities to move task performance to higher levels.

As outlined in Robbins [10, p.516] there are at least seven different task characteristic theories. The best known is the Job Characteristics Model (JCM) developed by Hackman & Oldham [20]. It defines task characteristics and describes their relationship to employee motivation, performance and satisfaction. The JCM describes all jobs in terms of five core job dimensions: skill variety, task identity, task significance, autonomy, and feedback. The Requisite Task Attributes Theory by Turner & Lawrence [21] predicts that employees prefer jobs that are complex and challenging, and defines job complexity in terms of six task characteristics: variety, autonomy, responsibility, knowledge and skills, required social interaction, and optional social interaction. Based on the criteria outlined above, it becomes clear that Herzberg's motivation-hygiene theory can also be considered a task characteristic theory that predicts the types of tasks that will likely lead to high motivation, performance, and satisfaction.

Markus and Keil [7] describe the huge monetary loss to U.S. businesses as the results of the nonuse or underuse of technically successful information systems. While they cite poor interface design as one potential cause, the challenge is to identify and develop certain design features that help to attract users to a website, maintain their interest in the website, cause them to return to the website at a later time, and promote user satisfaction. The web as well as a proliferating number of print publications provide numerous lists of evaluation criteria for "great" or "terrible" websites [22, 23, 24, 25, 26, 27, 28, 29, 30, 31]. Most of them are based on the individual author's opinions and preferences or on criteria developed for other media. While the lists are becoming more inclusive, few provide a ranking of the most important features or discuss their effects, and few are empirically tested. Most designers interested in creating websites are therefore left with the impression that more "bells and whistles" are better.

The objective of this research paper is to provide a conceptual framework and foundation for systematically investigating features in web environment that contribute to user satisfaction with a website. By applying Herzberg's

two-factor theory [1, 32], the researchers classified features in the web environment on theoretical grounds into hygiene or motivating categories. This classification is then compared to and refined by features in several existing web checklists. The next step of the research is to empirically evaluate this classification and the effects of these features by providing a ranking of features.

3. A Theoretical Framework for User Satisfaction with Website User Interface

Our theoretical framework for Web user satisfaction begins with an adaptation of Herzberg's Two-Factor Theory to the web environment. Herzberg [1, 32] claimed that job satisfaction and dissatisfaction are two dimensions of a worker's motivation rather than two ends of the same dimension. Job *dissatisfaction* occurs when a group of "hygiene" factors are absent. Hygiene factors describe extrinsic factors that impact a person's relationship to the context or environment in which s/he does her or his job. Specifically, hygiene factors are working conditions, salary, company policy and administration, interpersonal relations, and supervision. The presence of these hygiene factors removes job dissatisfaction; they do not, however, in themselves cause people to become highly satisfied and motivated in their work. Job *satisfaction* is determined by a group of intrinsic factors named "motivators." Motivators describe a person's relation to what s/he does: the job content, achievement of a task, recognition for task achievement, the nature of the task, responsibility for a task, and professional advancement or growth in task capability.

Herzberg [1, 32] proposed a dual continuum for hygiene and motivating factors based on his interpretation of the findings that factors leading to job dissatisfaction are separate and distinct from those leading to job satisfaction. Both kinds of factors, however, can be considered either a hygiene or motivating factor, depending on the individual differences. In a web environment, typical user tasks involve accessing and retrieving information. The web interface provides the context or the environment within which a user conducts these tasks. Numerous lists have been compiled that seem to indicate that some features of website design are essential, but not sufficient, for a user's satisfaction with the website. These (e.g. fast loading time, active links) can be considered the hygiene features, according to Herzberg. The importance of these features is obvious; a website that takes a long time to load or has inactive links most likely will result in user dissatisfaction. Thus web designers want to make sure that most, if not all, hygiene features are addressed to prevent dissatisfaction from occurring. This, however, may not be enough to guarantee user satisfaction. Herzberg's motivation-hygiene theory

states that "not dissatisfied" does not equal "satisfied" and "not satisfied" is not the same as "dissatisfied." Just having quick loading time or active link does not guarantee user satisfaction with the website.

Users' satisfaction with a website is one of the many goals web designers want to achieve. Satisfied users may spend longer at a website, may revisit the website later, and may recommend the website to others, issues particularly relevant with the increase of electronic commerce. Therefore, it is useful to determine what makes a user satisfied with a website as well as what are potential dissatisfiers. In addition, it will be helpful to differentiate both hygiene and motivating features according to their relative importance. Based on Herzberg, we hypothesize that there are specific features associated with web user interface design that can be categorized as hygiene or motivation features. The contribution of this study is the theoretical grounding and the future empirical testing of its hypotheses. We apply and extend Herzberg's theory by comparing job characteristics in a working environment and task characteristics in the web environment. Our ultimate goal is to study user satisfaction and dissatisfaction with websites when conducting information-seeking tasks.

3.1 Web Environment and Tasks

Shneiderman [33] cites a number of cognitive aspects (e.g. short and long-term memory, problem solving, decision making, and searching) related to the user and the task that can have a significant impact on system design. We focus our research on tasks requiring searching and information-seeking. Marchionini [5] described information-seeking tasks in an electronic environment as those manifestations of an information-seeker's problem that motivate information-seeking actions. The strategy or approach a person uses to seek information may be analytic (planned, goal-driven, deterministic, and formal) or browsing (opportunistic, data driven, heuristic, informal and continuous). Analytical strategies are useful when using search engines on the web. Users tend to begin with a clearer search goal and high motivation to resolve their information problems. The web user interface support to this type of task is heavily dependent on the functionality of search engine algorithms, although website design also plays an important role. For example, some analytical search strategies in a web environment are using an index or Boolean operators to locate specific documents or types of documents. In a strictly analytical search task, hygiene features become critical while motivators may be of little or no importance. Motivator features increase in importance as the user incorporates browsing strategies.

Browsing strategies require a web user interface that supports "easy and flexible control, high-quality display,

and rapid response time" [5, p. 157]. While browsing, the user is constantly redefining his/her information problem; therefore, the web environment plays a significant role in the browsing process. Specifically, a user has the following reasons to browse a website: to gain an overview, to monitor a process, to shift/share cognitive load, to clarify an ambiguous information problem, to develop a formal strategy, to discover/learn, and respond to environmental invitations [5, p. 103]. These actions require specific web design features that address users' needs. In a web environment, for example, orientation (a browsing action) requires consistently organized screen designs and window placement. While hygiene features remain important, motivators assume a critical role in attracting the user to a site and maintaining user interest in that site.

3.2 Individual Differences Affecting Motivation

To control for individual differences in identifying hygiene and motivation features, this research uses validated questionnaire items that are developed to identify people with internal and external locus of control. Herzberg [1] identified two types of employees in the work place, hygiene seekers and motivation seekers, leading one to the conclusion that hygiene seekers are motivated by hygiene factors. Applying other motivational theories one may propose that hygiene seekers have an external locus of control and are extrinsically motivated while motivation seekers have an internal locus of control and are intrinsically motivated [1, 34]. Similarly, web users with high levels of empowerment defined as self-efficacy are likely to be more satisfied by interesting and challenging tasks than those with low levels of self-efficacy. Distinguishing these types of users is important in explaining users' reactions to certain website designs. For example, for some hygiene seekers, a specific web design feature can have such importance that without it, they will be dissatisfied. For some motivation seekers, however, a lack of this feature may not significantly affect their satisfaction with the website. We suggest therefore that the threshold of *not being dissatisfied* for hygiene and motivation seekers is different.

3.3 Hygiene and Motivation Factors in the Web Environment

As noted earlier, we believe that the underlying goals for creating a motivating website are similar to those for creating a motivating workplace: to provide the conditions and environment that maximize user (employee) satisfaction and allow them to focus on and achieve high task performance. Thus Herzberg's two-factor theory can

be applied to the web environment. The procedure of applying this theory is a top-down process. We first examined the examples of events in the working place that generalize the categories of factors in Herzberg's theory. We then derived similar categories in the web environment. To be more specific, we provided detailed categories in the web environment to correspond to Herzberg's original categories so specific features could

be identified. After we identified all the features we could think of, we examined several existing web checklists or web usability study results [22, 23, 24, 25, 26, 27, 28, 29, 30, 31] and compared the items in those studies with our features. Table 1 lists each of Herzberg's original categories and factors, the derived or applied categories in the web environment, and the features.

Table 1. Application of Herzberg's Two-Factor Theory to the Web Environment

Herzberg's Hygiene Factors	Specific Examples of Herzberg's Hygiene Factors *	Theorized Application to the Web Environment	Theorized Examples of Possible Hygiene Features in Web Environment
Working condition	Light, temperature, furniture, office size, "tools or equipment" to get tasks done, first impression or general appearance	First impression or general appearance	1. Brightness of the screens/pages 2. Utilization of the screen size (viewable size of the screen) 3. Screen background color and pattern 4. Sharpness of displays (including images) 5. Eye catching image(s) or title on the homepage that makes you want to continue exploring the site
		Basic functions/features that help to get tasks done	6. Live/broken links 7. Consistent use of link colors within the web site 8. Existence of unloadable items that are not central to the task (e.g. non-found images are used as bullets or decoration) 9. Need to scroll to view the homepage 10. Need to scroll to view the detailed/content pages 11. Robustness of the web interface (user mistake-tolerant, few bugs) 12. Stability of the site: should be consistently available for access 13. Support for different platforms and/or browsers 14. Search function/engine to work with large amount of info on the web site
Salary	Wages	N/A	
Company policy and administration	Procedures or rules of doing things; pace of feedback from administration; privacy and proper use of employee's private information; in general the bureaucratic aspects of the working environment	Requirements for doing tasks	15. Length of the procedure to complete a task (e.g. steps/pages/actions to go through in order to get certain info) 16. Time on learning to use and becoming skillful at using the site
		Feedback or response	17. Length of a page's loading or responding time 18. Indication of system action time expectation (e.g. long loading time warning)
		Access restriction	19. Access restrictions (e.g. one needs to pay a fee, to sign on, to enter a password, or to provide some private info before one can access task-related info)
		Privacy and data confidentiality	20. Collection of user's data without user's knowledge (including using cookies, write to user's local machine) 21. Informing users that their information will be collected 22. Declaration of specific use of the information that users need to provide (e.g. declare for statistics only, not to provide to the vendors, not for marketing purpose, etc.)
Interpersonal relations	Co-workers attitudes, perceptions and trust	Credibility of owners/designers and the website: trust and trustworthy	23. Identification of site owners/designers 24. Credibility of the website owner/designer 25. Credibility of the website (e.g. the site won awards) 26. Number of times the website has been visited (e.g. shown by a counter)
Interpersonal relations	Co-workers attitudes, perceptions and trust	Web owners/designers' attitudes and perceptions	27. Information about improper or controversial materials 28. Indications of gender or racial/ethnic biases and stereotypes

Herzberg's Hygiene Factors	Specific Examples of Herzberg's Hygiene Factors *	Theorized Application to the Web Environment	Theorized Examples of Possible Hygiene Features in Web Environment
Supervision	Authority; guidance & support; availability of the supervisor; technical support	Authority and availability of owners/designers	29. Authority of the web designer/owner 30. Indication of the purpose or objective of the web site or potential audience 31. Availability of designer/owner for further information (e.g. email)
		Navigation	32. Working navigation aids (buttons or links) where necessary 33. Be able to know where to get started with the site's primary features 34. Be able to determine current position within the site 35. Simple and clear directions for using the website

Herzberg's Motivation Factors	Specific Examples of Herzberg's Motivation Factors *	Theorized Application to the Web Environment	Theorized Examples of Possible Motivational Features in Web Environment
Work Itself	Work-related tasks are challenging, stimulating, interesting, meaningful, useful, creative, fun	The information seeking tasks	36. Interestingness of the browsing task 37. Challenge of the browsing task 38. Usefulness of the browsing task to job/work, school, etc. 39. Meaningfulness of the browsing task 40. Fun to explore
		Quality of the information content: what a website covers ** (relevant, timely and current, complete and accurate, objective and novelty, understandable, consistent)	41. Task-relevant information 42. Relevant links (to the task, context, or information content) 43. Amount of irrelevant information (such as online ads, meaningless images) 44. Up-to-date information 45. Indication of addition of new information in the future 46. Complete/comprehensive/inclusive/adequate coverage of information 47. Precise/accurate and referenced information 48. Objective, unbiased information 49. Indication of limitations of information (e.g. source, coverage, date last modified) 50. Novelty and interesting information 51. Understandable information 52. Appropriate detail level 53. Coherent content that supports the web site's intended purpose/objective
		Presentation/organization of information: how a website covers information ** (information architecture, aesthetic and affective, learning consideration)	54. Logical organization of information within the website (e.g. by topic, by date, from broad to narrow) 55. Familiar terminology 56. Consistent use of terms and graphics 57. Overview, table of contents, summaries/headings 58. Scannability of a page (incl. chunks, screen uncluttered, highlights, etc.) so that users can easily scan the page to get info without reading line by line 59. Visually pleasing screen layout 60. Visually pleasing color use 61. Multimedia that adds information value 62. Variety of media (audio, video), formats (visual oriented or analytical oriented), types (use of examples, questions, plain descriptions) for different learning or thinking styles 63. Use of humor
Achievement	Successful task completion.	Task completion	64. Achieved results for the task 65. Quality of the task results 66. Time spent on the task 67. Problems solved (e.g. users may encounter unexpected problems while conducting the task and eventually solve the problems)

Herzberg's Motivation Factors	Specific Examples of Herzberg's Motivation Factors *	Theorized Application to the Web Environment	Theorized Examples of Possible Motivational Features in Web Environment
Responsibility	Certain control or power over the environment; make job related decisions with a minimum supervision	User control	68. User control of amount of information accessed 69. User control of procedures/steps of accessing information 70. User control of difficult levels (or details/depth) of information to be accessed (e.g. headings and details in a page allows a user to decide to either read heading or go for more details) 71. User control of pacing (how fast to go through the website) 72. Opportunities for interactivity
Advancement & Growth	Professional advancement; Growth potential in task capability, knowledge or skills	Knowledge or skills gained	73. New skills, knowledge gained by doing the tasks on the website
Recognition	Recognition by peers or supervisors for performance; real skills and capacities are put to use on jobs	Recognition by owners/designers on knowledge and skill levels	74. Assumed/recognized audience's knowledge and skill levels

* Some of the examples of Herzberg's categories (2nd column) are from the Motivation Questionnaire [35] that is based on Maslow's theory and the corresponding relations between Maslow's theory and Herzberg's.

** Quality and presentation of information cannot be found directly from Herzberg's work. We put these two categories here as part of the application of "Work Itself." We argue that in the web environment, one's task is to explore the information provided by the web environment. That is, the core part of doing a task (in our case, browsing) is to deal with the information on the web site. From this perspective, information on the web site becomes part of the task. Thus it is logical to treat "Quality of information content" and "Presentation of information" two categories as "Work Itself."

4. Planned Empirical Validation of the Framework

Using the theoretical framework developed above, the next step in our research is to empirically validate the identified hygiene features that contribute to a user's dissatisfaction and motivation features that contribute to a user's satisfaction with a website.

The major research hypotheses are:

1. Subjects are either satisfied or dissatisfied with the website:
 - a. If dissatisfied, due to absence of hygiene features
 - b. If satisfied, due to presence of both motivation and hygiene features.
2. Some hygiene and motivation features for websites are of greater importance than others.

5. Implications of the Research

Among the implications of this research are that in an increasingly competitive web environment, motivational

websites may prove to be a competitive advantage. Identification of web design features that are more important than others in creating a sense of user satisfaction or dissatisfaction adds value to the proliferation of exhaustive lists of design features now in print. If our framework proves to be a useful framework for increasing the motivational character of websites and decreasing dissatisfaction because of missing hygiene features, future web designers can choose those design elements that maximize the likelihood of user satisfaction and return visits. Lastly, if individual psychological differences, like an internal versus an external locus of control, influence user identification of the most important hygiene or motivational features, web designers can more successfully gear design elements to the audience they intend to reach.

This study, like Herzberg's methodology, disregards situational factors and may measure satisfaction rather than motivation. Lastly, this research unlike Herzberg's, tries to account for attributional tendencies of participants, by using personality variables like internal versus external locus of control, intrinsic versus extrinsic motivation, behavioral monitoring and others as control variables.

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