



Designing an E-commerce Site for Users

by [Norbert J. Kubilus](#)

Introduction

Usability considerations should be of prime importance in the design of an electronic commerce (e-commerce) web site. While the number of e-commerce web sites has increased rapidly over the last three years, the satisfaction of e-commerce users has generally decreased. This gap results from too little attention being paid to human factors that affect whether a web site can be used easily, accurately, and without losing user interest. This paper discusses the role of user interface design in developing e-commerce web sites and provides some guidelines for user interfaces.

Attracting the E-commerce User

In 1997, the American Management Association surveyed 3,500 of its members on the business use of the Internet and identified three human interface design issues among the top six obstacles to increased e-commerce: slow response time, lack of user friendliness, and poor web site design [[1](#)]. Two years later, Anders [[2](#)] reports these are still among the critical success factors for an e-commerce site. The primary factor in determining e-commerce user loyalty, according to Anders, is having a web site that is "user friendly and easy to navigate." The other leading success factors are good previous experience, fast response time, and relevant, frequently updated content.

The importance of human interface design in product selection was well established by the mid-1950s when Henry Dreyfuss, a leading industrial designer of his day, made the following observation, "If the point of contact between the product and the people becomes a point of friction, then the industrial designer has failed. If, on the other hand, people are made safer, more comfortable, more eager to purchase, more efficient -- or just plain happier -- the designer has succeeded" [[3](#)].

The prevalence of poor user interfaces is not a new, web specific problem. It has existed since the first interactive computer systems emerged in the 1960s. The application of *human factors* to solve the problem has existed for nearly as long. Three decades ago, Hansen [4] defined four human factors principles for designing the computer-human interface:

- know the user
- minimize memorization
- optimize operations
- engineer for errors.

In 1980, Shneiderman, a psychologist and computer scientist, added the need for usability testing that "confirms that an interface satisfies the user's requirements for simplicity, naturalness, or ease-of-use" [13].

Why have human factors seemingly taken a back seat in the design of e-commerce web sites? The answer lies partly in the rapid growth of web-based applications in the last five years, as well as the rush to e-market. One of the challenges with e-commerce web sites is the need to implement them rapidly, before the next competitor can bring up its web site. According to web guru Jakob Nielsen, "Usability rules the Web. If the customer can't find a product, then he or she will not buy it. The Web is the ultimate customer-empowering environment. He or she who clicks on the mouse gets to decide everything. It is so easy to go elsewhere; all the competitors in the world are but a mouse click away" [8].

Certainly, the success enjoyed by Amazon.com is due in part to being the first to get to market, but it also enjoyed a reputation for above average usability. Nielsen, for example, singled it out as probably the best major e-commerce site in terms of usability as of late 1998 [9]. For every Amazon.com success story, however, there are thousands of start-up e-commerce companies founded and run by engineers and/or graphic designers who do not have a background in human interface design. It is not unusual to find a junior programmer or graphic artist deciding on and implementing a user interface change in the wee hours of the morning, often with an untoward impact on the web site's users.

Maintaining control over the human interface design is fundamentally an organizational problem and a management issue. One way of addressing this problem is to clearly

delineate roles and responsibilities for project team members. For example, the individuals who design the web pages should not be allowed to physically install or change them on the web site. Formal interface reviews and change-control procedures are also effective controls. The latter includes maintaining a development web site on which user interface changes can be prototyped, tested, and perfected before introducing changes to the production web site.

Change control, however, is more than just having a development or staging site that is separate from the production site. It also involves maintaining a design document, or at the very least, a written set of user interface requirements. Any changes to the interface should be documented by the team responsible for designing the user interface and reviewed/approved by one or more people responsible for quality management. Finally, there should be formal processes for deploying new content into production.

Some people rationalize that usability testing is very costly and complex, and therefore cannot be justified. Nielson has dispelled this myth by demonstrating that the best results come from testing no more than five users and running as many small tests as the organization can afford [7]. Repetitive testing is necessary as the human interface design is changed and refined.

The incremental cost and time for testing and other controls can be justified in terms of the *quality cues* that the web site gives to prospective customers. Hoffman and Steenkamp [5] define quality cues as informational stimuli received by a customer prior to purchasing or consuming a product or service. Customers typically use quality cues in choosing between brands. With an e-commerce web site, the first quality cues come from the human interface.

Human Interface Design

Designing the human interface to an e-commerce web site should focus on gaining the user's attention, orienting the user to the business that will be transacted, and retaining the user's attention. The goal is to achieve active participation by the user in the web site. This requires understanding how to extend the human perception of the business transaction in such a way that the computer, and thus the web site itself, becomes virtually transparent. In fact, a widely held belief among experts in computer-human interaction is that the only good computer is an invisible computer.

Rubinstein and Hersh [11] described three components of a user interface design for software user interfaces that are still relevant for discussing or evaluating e-commerce web sites. First, there is the user's *conceptual model* that helps the user anticipate the effect of the input he/she provides to the web site. The second component is the information presented by the web site, which should be consistent with the user's conceptual model. Finally, there is the feedback provided by the web site in response to user input.

Conceptual Model

Cognitive psychologists such as Don Norman [10] tell us that the human mind processes new information based on observations and inferences -- that is, the person forms a conceptual or mental model. For example, almost everyone has a mental model of how a supermarket is organized that is created overtime from various experiences. Walk into an unfamiliar supermarket, and one can make reasonable guesses about where to find the meat department, dairy case, courtesy desk, and check outstations. Specific details found in the supermarket such as aisle signs provide confirming information. In effect, the shopper parses a supermarket and uses the local information together with a conceptual model to navigate the store. So it is with an e-commerce web site.

The design of an e-commerce web site incorporates activities, ideas, terminology, and relationships that the user must handle when using the web site. According to Turkle, "the user knows enough to get involved with it [the web site] at that level" [15]. The user develops an understanding of the web site and its operation in terms of these things.

A conceptual model is the basis for user expectations. When a new user enters an e-commerce web site, he/she quickly starts to build a conceptual model that relates the web site to what he/she already knows. A user will perceive a web site as easy to navigate, and thus user-friendly, if he/she can easily construct a conceptual model of the web site. If a web site requires a complex conceptual model, the user sees the web site as confusing or difficult to use. Mental models map the user's intentions to web site features, thereby bridging what Norman [10] calls the *gulf of execution*. These models also close the *gulf of evaluation* by helping the user to interpret the results of his or her actions, as well as the state of the web site.

The challenge for the web site designer is to come up with a design model *and* a

system image that are consistent with the user's model of the web site. "Ideally, the user's model and the design model are equivalent," according to Norman. "However, the user and designer communicate only through the system itself: it's physical appearance, its operation, the way it responds.... The designer must ensure that everything about the product is consistent with and exemplifies the operation of the proper conceptual model" [10].

Information Presentation

The fundamental question is how can an e-commerce web site present information to a user in a way that promotes a comfortable and effective interaction between the user and the site. The web site developer has a myriad of ways to present information from simple text to multimedia displays. Selection and use of text, graphics, video, and audio depend on how well users will respond to the information.

The look and feel of an e-commerce web site should be based on user requirements. Page layout and navigation should be as intuitive and easy as possible. Sklar [14] recommends "designing for location" to help improve the overall information presentation and guide how the user will traverse a web page. As illustrated in Figure 1, he divides the page into five sectors and ranks them in order of importance. The most important information belongs in the middle of the page, and the next most important across the top of the page. The least important information belongs in sector five in the left-hand margin. This is typically static information such as menu or directory items that the user can choose to navigate the web site.

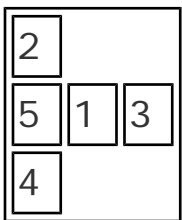


Figure 1: Relative areas of web page importance [14]

Guiding the user's eye may also involve the use of an "attract feature" such as animation, stimulating video, or compelling graphics in sector two. As a function of normal reading habits, the user typically begins scanning or reading a page at the upper left-hand corner. Attract features should not interfere with the speed of the web

site. There seems to be general agreement that a user will leave an e-commerce web site if it takes more than 8-10 seconds for information to download.

Audio and video used to attract users, or generated in response to user input should enhance the buyer's experience and not distract from it. Audio sequences and video display segments should be limited to 20-30 seconds. The user should be able to interrupt video, audio, animation, or other multimedia display. Furthermore, the overuse of images, audio and video can increase the time in which a page downloads, which has a negative impact on usability.

Shneiderman [[12](#)], Sklar [[14](#)], and others agree that a flat hierarchy of information is important for a successful web site design. The hierarchy of information should be apparent at a glance so the user easily understands the information available on a page. He/she should easily recognize any selection points or navigation controls. The user should be able to obtain information at the top and second levels of the hierarchy of information by following the hierarchy for the entire web site, following the hierarchy for a selected product group, bringing up an index, or performing a key word for a search.

Finally, color choices should be pleasing to the eye and should stimulate the user's interest. Kubitius and Cole [[6](#)] provide specific recommendations concerning color selection. Barely discernible color contrasts such as yellow-green on green should be avoided. Negative contrast should be used for flashing patterns--that is, flash a darker foreground on a brighter pattern. Avoid using colors in the yellow/red end of the color spectrum for page backgrounds or flashing patterns. Photoc stimulation response, a potential health risk for millions of people, occurs sooner and is more pronounced with red stimulus than with blue and green stimuli.

Feedback

The interactive cycle between a user and a web site is not complete until the web site responds to a command entered by the user. According to Norman, "feedback--sending back to the user information about what action has actually been done, what result has been accomplished--is a well known concept in the science of control and information theory. Imagine trying to talk to someone when you cannot even hear your own voice, or trying to draw a picture with a pencil that leaves no mark: there would be no feedback" [[10](#)].

Web site feedback often consists of a change in the visual or verbal information presented to the user. Simple examples include highlighting a selection made by the user or filling a field on a form based on a user's selection from a pull down list. Another example is using the sound of a cash register to confirm that a product has been added to an electronic shopping cart. This last feedback feature can be found on Amazon.com, CyberRebates.com, WalMart.com, and other business-to-consumer (B2C) web sites.

Completed orders should be acknowledged quickly. This may be done with an acknowledgment or fulfillment page. The amount of time it takes to generate and download this page, however, is a source of irritation for many e-commerce users. Users are quick to attribute meaning to events. A blank page, or what a user perceives to be "a long time" to receive an acknowledgment, may be interpreted as "there must be something wrong with the order." If generating an acknowledgment may take longer than what may be reasonably expected by the user, then the design should include intermediate feedback to the user indicating the progress being made toward acknowledgment or fulfillment.

Finally, feedback should not distract the user. Actions and reactions made by the web site should be meaningful. Feedback should not draw the user's attention away from the important tasks of gathering information, selecting products, and placing orders.

Conclusion

Successful e-commerce web site development depends on achieving congruence between the user's conceptual model of the web site itself and how the web site delivers information and accepts orders in a non-threatening manner. The guidelines presented in this paper are a basis for developing user-oriented e-commerce web sites.

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Biography

Norbert J. Kubilus, CCP is an Assistant Professor of Computer Science at the College of New Jersey, where he teaches courses in systems development and database management systems. A graduate of Seton Hall University and Rensselaer Polytechnic Institute, he has over 25 years of software engineering experience in industry and education. He has delivered seminars on human interface design to student and professional groups for the last 15 years.