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E-training: Can young and older users be accommodated with the same interface?

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ABSTRACT

This work explores the feasibility of proposing universal design guidelines for E-training modules considering aging differences as an important factor. A controlled experiment was designed and conducted to evaluate the effects of module design characteristics on information recall, satisfaction, disorientation, and task workload, and the implications for E-Training. Sixteen Web modules with two different lesson content types were developed for this study, considering different independent variables such as camera focus, environment simulator, video size, and instructor's gender. The experimental results suggest that an interface that ensures high levels of satisfaction and information recall as well as low levels of disorientation and task workload could be accomplished only partially if young and aging participants were to be target simultaneously with the same type of training module. Based on the results of this study the specific preferences in design suggest an interface that provides narrative type information, where a large video is displayed with a realistic background, and text is larger than18 point font avoiding colored text, is preferred over other combination of design variables.

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1. Introduction

Enrollment in distance education courses has nearly doubled since 1995, with more than half of two and four-year degree-granting institutions in the United States offering distance education courses in the 2000–2001 academic years (Oliver, 2003). Organizations are turning to E-Training (Sims, Burke, Metcalf, & Salas, 2008), as a resource to innovate and adapt to the changes in the knowledge-based environment, train their human resources, and ensure organizational viability and competitiveness.

Workforce demographics suggest that about 40% of the working force will be 45 years of age by 2015 (US Census Bureau, 2003). As our workforce ages, their training needs represent a challenge today's Web instruction application designs. One of the approaches that can provide a feasible solution to the perhaps inappropriate designs for the aging is universal usability. This concept proposed by Norman (2004), means "barrier free" and suggests that one design would include and accommodate older and less experienced users and simultaneously younger and more experienced users. Some state that universal design is utopian, proposing designs that target only specific populations (Hawthorn, 2000). A common practice when designing for older adults is building a restricted interface or computer environment to eliminate misunderstanding and the execution of undesired actions. In practice the goal should be to use natural constraints (Burell & Sodan, 2006) and knowledge from multimedia learning principles (Mayer, 2001).

It is imperative to understand the influencing factors of aging as a moderator variable (Sun & Cheng, 2007) in relation to the design of goal oriented learning interfaces, consider aging population needs as part of their design criteria, and identify if Universal design guidelines for E-Training are viable.

An aging individual is defined by the Age Discrimination and Employment Act (ADEA, 1967) as any individual over 40 years old. In the aging related literature, several learning theories can be found. They can be divided in two groups: (1) biological declining functions (Burke & MacKay, 1997; Cronholm & Schalling, 1988; Rabbitt & Lowe, 2000); and (2) accumulation of knowledge (Kowalski-Trakofle, Steier, & Schwerha, 2005; Westerholm & Kilborn, 1997). The "biological" group affirms that the decline in biological functions affects the ability to learn and to perform many work related tasks. The "accumulation of knowledge" group suggests that the accumulation of knowledge and

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experience leads to an increase in skills with age. Others (Bruyer & Scailquin, 1994; Colley & Beech, 1989) believe that perhaps there is not enough information to determine a definite answer. Moreover, as aging occurs, there is a reduction in both physical and cognitive functions, which impact the ability of older adults to acquire new skills (Seidel et al., 2009). Most of these changes, especially visual changes (Johnson & Choy, 1987) are generally considered to be noticeable at a chronological age of 55 years.

It is evident that communication, technology, globalization and accessibility changes have produced a different and almost strange environment for the aging, compared to the world they experienced as they grew up. An alternative to reach a wide age range segment of young and aging adults in design allowing users to accommodate interface aesthetic aspects and hardware is called customization. Although convenient customizable interfaces with multimedia instructional material is a very costly design approach (Sun & Cheng, 2007).

It is relevant to ask what is the best alternative to design E-Training modules for young and aging individuals. How should E-Training modules be designed to improve satisfaction, information recall, low levels of disorientation and mental overload? Up to date these are questions remain unanswered by controlled and systematic experimental methods that integrate multiple design variables in one experiment.

The main purpose of this research is to answer the questions proposed before through a controlled experimental study with the aim of developing design guidelines that will provide effective and quality educational training modules considering users between 25 and 65 years of age. The results of this study will help develop modules that will provide high user satisfaction and information recall, while maintaining low levels of disorientation and task workload. These experimental instructional modules refer specialized E-Training modules that can be applied to a wide range of technical areas and individual ages in universities, continuing education programs, and in the service and manufacturing sectors.

To accomplish the proposed objective the following questions should be answered:

1. How do Web module video characteristics (Lesson Content Type, Camera Focus, Background Simulator, Video Size and Instructor's Gender) affect user response (Information Recall, Satisfaction, Disorientation and Task Workload) for a training interface?
2. Is it possible to have universal design guidelines for E-Training modules that target young and aging populations simultaneously?

2. Methods

A controlled experiment was designed and conducted to evaluate the effects of module design characteristics on information recall, satisfaction, disorientation, and task workload, and the implications for E-Training. Sixteen Web modules were developed for this study, considering different independent variables such as camera focus, environment simulator, video size, instructor's gender and lesson content type.

Table 1
Summary of design criteria by categories.

Design criteria summary				
	Attributes	Elements observed	Applied to interface	Literature review (references)
Appearance	Headings	Text, size, colors, position	Letters 22+, Black font, left alignment.	Hartley, 1994; Weale, 1961
	Body Text	Size, type, length	Letters 22+, Arial and Georgia font, less than 60 characters per line.	Bernard, Liao, & Mills, 2001; Boyarski, Neuwirth, Forlizzi, & Regli, 1998; Kline & Schieber, 1985; Pomales-Garcia & Liu, 2006b; Pomales-García & Liu, 2006c; Sorg, 1985
	Background, Contrast	Color and color vs. text color	Letters Black (HEX code #000000) and Midnight blue (HEX code#191 970) and white for banners. Background Light gray (HEX code#D3D3D3) and smoke white (HEX code #F5F5F5).	Bauer & Cavonius, 1980; Charness & Bosman, 1990; Gould & Schaefer, 2005; Hill & Scharff, 1999; Kline & Schieber, 1985; Tobias, 1987; Weale, 1961; Wolfmaier, 1999
	Hyperlinks	Labeling, positioning, size, length	Center oriented, 22+, use of metaphors, single word description.	Bernard et al., 2001; Bernard, Fernandez, & Hull, 2002; Bernard & Hamblin, 2003; Burell & Sodan, 2006; Knoved & Shneiderman, 1986; Nygren & Allard, 1996; Maldonado & Resnick, 2002; Truong, 2004
	Banners	Placement	Bottom of the screen with, flash effect	Austin, 2009; Benway & Lang, 1998; Chang-Hoan, 2003; Doyle, Minor, & Weyrich, 1997
Structure	Hierarchy	Application depth	Wide rather than deep	Kim & Yoo, 2000; Larson & Czerwinski; Mead, Spaulding, Sit, & Meyer, 1997; Norman, 2004
	Field of view	Balance, stability, sequence, equilibrium	Center oriented screens, margins larger than 3 inches	Benway & Lang, 1998; Burell & Sodan, 2006; Chang-Hoan, 2003; Hawthorn, 2000; Ngo & Byrne, 2001; Plude & Hoyer, 1981; Pointer Institute Report, 2000
Physical interaction	Decision making, Attention Capacity	Concurrent activities, competing displays, reaction times, attention span	Content was precise, and interface information sources complemented verbal instructions. Feedback effects recaptured attention in every chapter.	Chang-Hoan, 2003; Hawthorn, 2000; Snel & Cremer, 1994; Vercruyssen, 1994
	Memory decrease	Short term memory and long term memory	Use of previous and error prevention messages to avoid relaying on memory rather than recall.	Kowalski-Trakofle et al., 2005
	Fine motor precision	Scrolling, clicking	Interfaces required no scrolling, only clicking by aiming at big targets	Casali, 1992; Hawthorn, 1998
	Feedback	Sounds, lights, messages, alarms, images	Lights, and images, and window loading effects.	Hawthorn, 2000