THE IMPACT OF LEARNING STYLE ON WEB SHOPPER ELECTRONIC CATALOG FEATURE PREFERENCE

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ABSTRACT

The purpose of this study is to investigate the relationship between web shoppers' VARK (Visual, Auditory, Read/Write, and Kinesthetic) learning styles and their preference for electronic catalogs including text-oriented catalogs, 3-D and 2-D catalogs, visual catalogs, animated catalogs, custom animated catalogs, and virtual trials. We propose that web shoppers' VARK learning styles can provide a basis for the personalization of electronic catalogs. Participants' VARK learning styles were measured by using the VARK questionnaire. An e-catalog survey instrument was used to measure participants' preferences for electronic catalogs. The findings suggest that the VARK learning styles provide a basis for customization of electronic catalogs that include text-oriented catalogs, visual catalogs, animated catalogs, and custom animated catalogs. By personalizing electronic catalogs, catalog designers can overcome the problems of information mismatch, improve web shoppers' online shopping experience, and facilitate their purchasing decisions.

Keywords: electronic catalog, learning style, VARK, virtual trial

1. Introduction

Electronic commerce (e-commerce) is emerging as the market with the most potential both in developed nations and in developing countries. With the rapid development of the World Wide Web and an increasing percentage of the worldwide population gaining internet access, e-commerce will play an ever-increasing economic role [Chiang & Nunez 2007]. The upside potential of e-commerce is tremendous. However, as electronic commerce sites are proliferating [Zviran et al. 2006] and accessing commerce related information online is becoming an everyday activity for many people [Spink & Jansen 2008], one of the major challenges facing online retailers is their ability to attract and keep customers at their websites [Yen & Kong 2002]. Successful methods of attracting customers and providing them with an adequate amount of information remain elusive. Online retailers are discovering ways to personalize the online shopping experience in a bid to enhance user satisfaction and loyalty to their sites.

Online retailers use electronic catalogs to provide information on their products and services. These catalogs allow users to shop in virtual malls (that is, help users to browse various products and services, compare prices of the same product, and make an order electronically using the web) with the convenience of staying at home or in the

office. However, most web-based electronic catalogs are relatively static and loaded with a large amount of information [Yen & Kong 2002]. Such catalogs cause "information overload" and limit their usefulness to online shoppers. "Information overload" often has an adverse effect on decision making [Buchanan & Kock 2000]. Due to information overload, online shoppers may feel lost and frustrated [Yen & Kong 2002], may not understand how a particular product can meet their needs, or simply may not find what they are looking for [Milosavljevic & Oberlander 1998].

Online businesses (e-businesses) can overcome information overload by providing a customized electronic catalog for each visitor [Yen and Kong 2002]. The customization of electronic catalogs involves the personalization of information content, information organization, and information display to meet web shoppers customized needs. "Personalization" plays a very significant role in facilitating consumer learning, and this learning relates to the consumer decision to purchase or not to purchase a product or service. Fung [2008] posits that customization is an essential element for a viable e-commerce website. Several studies have proposed ways to customize electronic catalogs. Chiang and Nunez [2007] suggest that online storefronts can be adapted to meet the requirements of different customer segments by analyzing the traverse logs and topology of catalogs. They propose two optimization models to extract the browsing behavior of customers and identify the best catalog for them at each experience level. Ardissono et al. [2002] posit that the presentation of online catalog information such as price, aesthetic information (e.g., size and color), and technical information (e.g., functionalities and requirements) can be customized according to the user's interests. Web retailers also consider consumers' information processing style, shopping patterns, and storefront preferences for developing attractive, user-friendly, and successful online storefronts. Yet others suggest the use of an interactive visual interface [Lee et al. 2004], and the construction and use of user profiles [Yen & Kong 2002], etc. to personalize the presentation of information for electronic catalogs. However, there is little or no research in the e-commerce literature that discusses the use of web shopper's learning styles in generating personalized electronic catalogs. The purpose of this study is to fill this void by examining whether learning styles influence individual preference for information presented via online catalogs that include text-oriented catalogs, 3-D and 2-D catalogs, visual catalogs, animated catalogs, custom animated catalogs, audio enabled catalogs, and virtual trials.

The rest of the paper is organized as follows. Section two discusses the theoretical background and the research hypotheses. Section three provides the methodology of this study. The findings are presented in the fourth section. Finally, the conclusions, limitations, and future research are discussed in the fifth section.

2. Theoretical Background and Research Hypotheses

Understanding product descriptions is a part of pre-purchase search activity in shopping – both online via a catalog or at a physical store [Lightner & Eastman 2002]. Pre-purchase search activities involve information seeking and processing that facilitate decision making. Shim et al. [2001] indicate that searching the Internet for product information leads to an intention to purchase the product online. Describing products adequately in the website through electronic catalogs may reinforce the intention to search the web for product information and thus the corresponding intention to purchase online [Lightner & Eastman 2002]. Therefore, the daunting task facing web retailers is not simply to present web shoppers with every piece of product information but also to provide them with the information that is appropriate for their specific needs.

Web retailers use electronic product catalogs (e-catalogs) for providing valuable product information to potential web shoppers. The ability of websites to generate customized catalogs may fulfill web shoppers' information needs better, which, in turn, may lead to favorable buying behavior. By creating compelling online experiences with electronic catalogs, Internet retailers can potentially increase the value of product information presented, engage consumers in an active shopping experience, increase the number of unique and repeat visitors, and can ultimately establish an online competitive advantage [Li et al. 2003].

The greatest problem associated with generating customized electronic catalogs is to determine the basis for customization. Web retailers cannot always know *a priori* what information presentation format is best suited for any individual web shopper. Without knowing what catalog presentation format is relevant to an individual web shopper, the number of possible presentation formats can be very large, resulting in information overload. However, web retailers can provide shoppers with customized electronic catalogs to overcome information overload. Yen and Kong [2002] posit that customized catalogs for web shoppers can be generated based on their preferences. Prior consumer studies indicate that web shoppers' learning styles can be used as a basis for determining their preferences [Lightner & Eastman 2002; Alba et al. 1997]. Therefore, web shopper's learning styles can serve as a basis for information customization in electronic catalogs.

2.1. Learning Styles

The literature in cognitive psychology indicates that people exhibit significant individual differences in cognitive processing styles which they adopt in problem-solving and other similar decision-making activities [Robertson 1985]. Findings from both qualitative and quantitative researchers indicate several consistent major dimensions of individual differences [Dunn et al. 1981]. Of these dimensions, learning style is a major contributor to individual differences [Charlesworth 2008].

Learning style refers to an individual's habitual or typical way of perceiving, remembering, thinking, problem solving, and information processing [Fleming 2001; Alport 1976]. According to Dunn [1984], learning style is "the way a person absorbs and retains information and/or skills". Kirby [1979] explains learning style as a preference, which develops and changes over time. This supports the concept that a person's learning style is affected by the individual's traits such as personality, cognitive style, temperament, sensory processes and age [Kolb 1974; Fleming 2001). Each learner has an individual learning style, which is thought to be an enduring, patterned, and preferred mode of learning [Sproles & Sproles 1990]. However, as Griggs [1991] points out, it is important to recognize that learning styles are not related to intelligence, mental ability or actual learning performance and that no learning style can be said to be better than another. The best learning style for any individual is specific to that individual's cognitive abilities and the learning situation he/she is in [Logan & Thomas 2001].

Various studies have extensively investigated learning styles [e.g., Hawk & Shah 2007; Kolb & Kolb 2005; Duff 2004; Coffield et al. 2004; Kolb 1984; Dunn 1990; Dunn et al. 1995]. These studies have reviewed several learning style models and validated their instruments in various settings. Hawk and Shah [2007] provide a comprehensive review of six learning style models, compare and contrast these models, and outline the contexts of their usefulness. The models include: (1) the Kolb Experiential Learning Theory, (2) the Gregorc Learning Style Model, (3) the Felder and Silverman Learning Style Model, (4) the VARK Model, (5) the Dunn and Dunn Model, and (6) the Entwistle and Tait Revised Approaches to Studying Inventory (RASI) Model. Table 1, adapted from Hawk and Shah [2007, p. 11, Table 4], provides a brief description of these models.

Table 1. Summary of Learning Style Models

Kolb Experiential Learning Model: This model is characterized by generalized differences in learning orientation based on the degree to which people emphasize the four modes of the learning process [Kolb 1984, p. 76]. This model uses the Kolb Learning Style Inventory (LSI). LSI is a commercially available questionnaire (www.learning fromexperience.com), and has twelve items.
Gregorc Learning Style Model: Learning styles are defined as distinctive and observable behaviors that provide clues about the mediation abilities of individuals and how their minds relate to the world and, therefore, how they learn [Gregorc 1979, p. 19]. The Gregorc Style Delineator (GSD) instrument is used to measure four learning styles, namely, concrete-sequential (CS), abstract-sequential (AS), abstract-random (AR), and concrete-random (CR). This instrument is commercially available at www.gregorc.com.
Felder and Silverman Learning Style Model: Learning styles are defined as the characteristic strengths and preferences in the ways that individuals take in and process information [Felder & Silverman 1988, p. 674]. A 44-item questionnaire, the Index of Learning Styles (ILS) instrument is used to measure the learning styles of this model. This instrument is available at www.ncsu.edu/effective_teaching at no cost.
VARK Model: This model defines learning styles as an individual's characteristics and preferred ways of gathering, organizing, and thinking about information. VARK is in the category of instructional preference because it deals with perceptual modes. It is focused on the different ways that we take in and give out information [Fleming 2001, p. 1]. The VARK questionnaire is used to measure the VARK learning style preference. The instrument has thirteen items and is available at http://iliad.cats.ohiou.edu/vark/questionnaire.htm at no cost.
Dunn and Dunn Model: Learning styles are defined in this model as the way in which individuals begin to concentrate on, process, internalize, and retain new and difficult information [Dunn & Dunn 1990, p. 353]. This model is measured by the Productivity Environmental Preference Survey (PEPS). A 100-item questionnaire, PEPS is commercially available at www.humanresources.com.
RASI Model: This model defines learning styles as the composite of characteristic, cognitive, affective, and psychological factors that serves as an indicator of how an individual interacts with and responds to the learning environment [Duff 2004, p. 56]. RASI stands for Revised Approaches to Studying Inventory. It has two forms – a short form with 30 items, and a long form with 44 questions. The short form is available at no cost at http://www.scotcit.ac.uk:8082/resources/pv rasi.doc. However, the scoring is not available at this site.

Table 2 highlights some key features of these instruments. This study considers the VARK Learning Styles as the basis for the customization of electronic catalogs. There are three reasons for this. First, there is no cost to

administer the VARK instrument. The questionnaire is available online and the website generates and reports the results to the researcher. Second, the time to administer this web-based instrument is reasonably short [Hawk & Shah 2007]. Finally, the VARK model deals with perceptual modes. The VARK questionnaire provides metrics in each of four perceptual modes: visual, auditory, read/write, and kinesthetic. In fact, only the VARK model contains the read/write and kinesthetic dimensions of learning style [Hawk & Shah 2007]. The only perceptual modes that the VARK does not incorporate are taste and smell, which play no role in the online shopping environment.

Table 2. Key Features of LSI, GSD, ILS, VARK, PEPS, and RASI

	LSI	GSD	ILS	VARK	PEPS	RASI
Supporting model type	Experiential	Phenomenological	Combination of the experiential, the phenomenological, and the sensory	Sensory/perception	Combination of the experiential, the phenomenological, and the sensory	Cognitive, affective, and psychological
Validity	Solid support	Low support	No support	Some support	Solid support	Solid support
Reliability	Solid support	Moderate support	No support	Some support	Solid support	Solid support
Cost	Commercially available online	Commercially available online	Available online at no cost	Available online at no cost	Commercially available online	Available online at no cost

Source: Hawk & Shah [2007]

The acronym VARK stands for Visual (V), Auditory (A), Read/Write (R), and Kinesthetic (K). Learners with these learning styles differ in the way they gather, organize, and process information [Fleming 2001; Hawk & Shah 2007]. Visual learners prefer the depiction of information in maps, diagrams, charts, pictures, etc. Auditory learners learn best from discussion, lectures, tutorials, tapes, web chat, talking things through, etc. Read/Write learners like essays, handouts, textbooks, readings, web pages, taking notes, etc. Kinesthetic learners prefer activities such as field trips, trial and error, doing things to understand them, laboratories, hands-on approaches, etc.

2.2. Electronic Catalogs

Electronic catalogs (e-catalogs) are online displays and descriptions of products and services. There are two aspects of electronic catalogs – (1) the aspect of the content management system, and (2) the aspect of an interactive interface [Lee et al. 2004]. As a content management system, electronic catalogs provide sellers with the ability to assemble, aggregate, and normalize product or service information and to quickly, inexpensively, and easily disseminate that information. Companies such as CardoNet, Interwoven, OnDisplay, and Vignette have developed a number of commercial products that serve as content management systems and that are used by many e-commerce sites [Lee et al. 2004]]. On the other hand, as an interactive interface, they provide potential buyers with a product presentation that contains standard functionalities including retrieval, classification, and ordering services [Lee et al. 2004; Ceri et al. 1999]. Electronic catalogs provide a more powerful source of information on products and services than do the printed product catalogs [Koch and Turk 1997]. They have developed quite extensively as Internet based retailers have progressed tremendously throughout the 1990s. The use of electronic catalogs builds on traditional catalog retailing, and the concept of "the electronic storefront" brings greater focus to online retail activities [Hoffman et al. 1996; Stewart 1993].

Table 3. Description of Electronic Catalogs

Text-Oriented Catalog: The majority of the contents of the electronic catalog are in the form of textual description. The rest of the contents is in the form of pictures, audio, video, etc.

3-D and 2-D Catalog: 3-D electronic catalogs portray three dimensional views of the products; 2-D catalogs portray two dimensional views of the products.

Visual Catalog: The majority of the contents of the electronic catalog are in the visual form (image/video). The rest of the contents is in the form of audio, text, etc.

Audio-Enabled Catalog: Audio descriptions of the attributes of the products are included in the catalog.

Animated Catalog: Animations are included in the catalogs for facilitating the viewing of the products from different angles.

Custom Animated Catalog: This feature allows the web shoppers to adjust the animation according to their needs. Custom animation ensures individually tailored catalogs. It allows the shoppers to adjust the shape, size, and color of the cataloged products.

Virtual Trial: Virtual trial enables web shoppers to have an online trial of the product(s) they will be buying. Virtual trial experiences will be quite similar to the physical trial experiences shoppers have in the retail stores. Creation of online avatars can make this feature feasible for the customer.

Electronic catalogs present product or service information in six ways: (1) text, (2) 2-D image, (3) photorealistic virtual reality object and panoramic view, (4) 3-D virtual object, (5) video clip, and (6) combinations of these ways [Yen & Ng 2007, 2000]. Palmer [1997] suggests that they provide information on products or services typically including textual and visual descriptions, animations, or in some cases, audio clips and video clips. Therefore, electronic catalogs can be presented in many different formats (e.g., text-oriented catalogs, 2-D catalogs, etc.). In this study, we present electronic catalogs in seven categories: text-oriented catalogs, 3-D and 2-D catalogs, visual catalogs, audio-enabled catalogs, animated catalogs, custom animated catalogs, and virtual trials. Table 3 provides a brief description of these catalogs.

2.3 Research Hypotheses

Web shoppers' purchase decisions are usually made based on the information provided by electronic catalogs. Since electronic catalogs play a central role in consumer learning in web-based shopping, the presentation formats of these electronic catalogs play a significant role in inhibiting or facilitating web shoppers' decision-making [Li et al. 2003]. In order to better maintain customers' attention and encourage purchases, electronic catalogs have to be highly interactive, dynamic, and tailored to the customer's interests and information needs [Yen & Ng 2007, 2003; Adrissono et al. 2002; Yen & Kong 2002]. For this reason, electronic catalog designers require techniques to retrieve information from various sources and summarize and tailor the presentation of the information to meet web shoppers' learning needs. Customized electronic catalogs can provide a degree of interactivity, meet a web shopper's learning needs, and influence their purchasing decisions. Web shoppers' learning styles can be used as a basis for this personalization of electronic catalogs. As posited, we consider the VARK (visual, auditory, read/write, and kinesthetic) learning styles to provide the basis of customization. That is, we suggest that there is an association between web shoppers' VARK learning styles and their preference for electronic catalogs. Consistent with the theoretical foundation, we propose the following research hypotheses:

- H1: There is a relationship between web shoppers' VARK learning style and their preference for 3-D versus 2-D electronic catalogs.
- H2: There is a relationship between web shoppers' VARK learning style and their preference for text-oriented electronic catalogs.
- H3: There is a relationship between web shoppers' VARK learning style and their preference for visually-oriented electronic catalogs.
- H4: There is a relationship between web shoppers' VARK learning style and their preference for audio-enabled electronic catalogs.
- H5: There is a relationship between web shoppers' VARK learning style and their preference for animated electronic catalogs.
- H6: There is a relationship between web shoppers' VARK learning style and their preference for custom-animated electronic catalogs.
- H7: There is a relationship between web shoppers' VARK learning style and their preference for virtual trials.

3. Research Methodology

We employed a survey method to collect data for the study. Two instruments were used for data collection. First, the VARK questionnaire was used to assess participants' learning styles. Second, an e-catalog survey questionnaire was used to obtain participants' preference for electronic catalogs.

The VARK questionnaire was first developed in 1987 by Neil Fleming at Lincoln University, New Zealand. In its development at Lincoln University, New Zealand, participants indicated that it matched their perceptions of their preferences, and, more importantly, matched the learning strategies associated with their preferences. The language used in the inventory has been subjected to a number of critiques by communication experts and some words were changed to prevent inappropriate influence on the choices [Fleming 2001, p. 50]. The questionnaire is short, consists of only 13 questions, and allows multiple responses for each question. Although providing one response to each question provides a somewhat stronger indication of a learning style, the proponents of the VARK tool posit that forcing a single response defeats the purpose of the instrument, which purports to reinforce that one can learn in a variety of ways [Byrne 2002]. This means that each respondent completing the questionnaire gets a profile made up of four scores rather than a single categorization. The VARK instrument uses self-report through the respondents' recalling of their past or present behaviors. Its content validity is strong when it is used to work with recalled situations [Zhang 2002; Fleming 2001].

The second questionnaire was an e-catalog survey questionnaire. It was used to solicit responses for web shoppers' preference for text-oriented catalogs, visual catalogs, 3-D and 2-D catalogs, animated catalogs, custom animated catalogs, audio enabled catalogs, and virtual trials. Some demographic information was also collected using this instrument. The e-catalog instrument consists of 16 items and was reviewed by experts in the field of

electronic commerce. The reviewers included university professors who have been teaching various courses on e-commerce and information technology for more than a decade. A pilot test was also administered among 7 doctoral students majoring in information technology. The items were refined based on the feedback of the experts and the pilot test. The e-catalog instrument is given in Appendix A.

Data were collected from students enrolled in a sophomore level information systems course (BCIS 3610: Basic Information Systems) in a major southwestern university in the United States, the University of North Texas. Though convenience sampling was used, these students were chosen to participate in the survey for the following reasons. First, the course, BCIS 3610, requires that the students have completed the prerequisite course, titled Introduction to Computers in Business (BCIS 2610). BCIS 2610 introduces the concept of e-commerce to students and uses e-commerce sites such as amazon.com, half.com, ebay.com, etc. to substantiate students' understanding of e-commerce. Therefore, students taking BCIS 3610 are familiar with e-commerce and electronic catalogs. Second, BCIS 3610 is required for all College of Business students as well as many other majors outside the College of Business. Thus, the sample represents a cross-section of a wide-range of majors. Finally, the e-catalog survey begins with the question "Have you ever shopped online?" More than 77% of the participants who fully completed the survey responded yes to this question. This suggests that participants were familiar with the concepts of e-catalog and e-commerce. Therefore, the sample was appropriate for this study.

The survey was administered in one session of approximately 25 minutes duration. For the VARK questionnaire, data were collected using an interactive online program available at http://iliad.cats.ohiou.edu/vark/questionnaire.htm. For the e-commerce questionnaire, participants' responses were collected through paper and pencil means. Survey participants were instructed to take the survey as candidly as possible and were assured that there would be no right or wrong answers. Two criteria were used to determine the eligibility of a survey for inclusion in the data collection. First, only fully completed surveys were considered. Incomplete surveys were not considered to avoid the non response bias. Second, the completed surveys that had a "Yes" response to the question "Have you ever shopped online?" in the e-catalog survey were included in the sample data. Of the 186 participants, one hundred forty four (144) fulfilled the above criteria, representing a 77.42% response inclusion rate. Demographic information was also collected (see Appendix B). No significant differences were found between male and female participants.

4. Analyses and Results

In order to test the proposed hypotheses, two methods of analysis were employed: multiple regression and canonical correlation. The VARK learning styles scores provide the four independent measures – visual, auditory, read/write, and kinesthetic. There are seven dependent variables, which represent web shoppers' preferences for the seven types of electronic catalogs. The e-catalog survey provides the measures for these variables. Table 4 lists the dependent variables and the items measuring these variables. Responses to these items were measured using a 7 point Likert scale anchored between (1) strongly disagree to (7) strongly agree.

Table 4. Dependent Variables and Their Measurement

Variable	Measurement Item
Text-Oriented Catalog	I want the majority of the contents of my online catalog in the form of textual description.
Visual Catalog	I want the majority of the contents of my online catalog in visual form (e.g., image and video).
3-D and 2-D Catalog	I want my online catalog to include 3-D and 2-D views of the products.
Animated Catalog	I want my online catalog to include animated views of the products.
Audio-Enabled Catalog	I want my online catalog to include audio description of the products.
Custom Animated Catalog	I want my online catalog to include animation that can be adjusted for shape, size, color, etc.
Virtual Trial	I like to have online trial of the product(s) that I will be buying.

4.1 Multiple Regression

Regression Analysis is a statistical tool used to evaluate the relationship between a dependent variable and one or more independent variables [Hossain & Prybutok 2008]. This study has seven dependent variables and four independent variables. Each of the seven types of electronic catalogs was used as dependent variable, and the VARK learning styles measures were used as independent variables. We conducted seven multiple regression analyses – one for each dependent variable. The results of these regression analyses are summarized in Table 5.

Table 5. Summary of the Results of Regression Analyses

Model	Dependent Variable	F-value	Significant coefficient			
			Visual	Auditory	Read /Write	Kinesthetic
1	Text-Oriented Catalog	1.294	-	-	-	0.085*
2	Visual Catalog	5.494**	0.127*	0.153*	-	-
3	3-D and 2-D Catalog	1.235	.043*	-	-	-
4	Animated Catalog	7.332**	-	0.275*	0.079*	-
5	Audio-Enabled Catalog	1.556	-	-	-	-
6	Custom Animated Catalog	7.092**	0.244*	-	-	0.188*
7	Virtual Trial	4.133**	-	- 0.130*	- 0.159*	-

** All F values are significant at the 0.05 level of significance.

* All coefficients are significant at the 0.05 level of significance.

Model 1: Though the model is significant at the 0.05 level of significance, only one coefficient (kinesthetic) is significant ($p < 0.001$). The positive coefficient value indicates that the more kinesthetic a web shopper is, the more his/her preference is for text-oriented catalogs.

Model 2: The overall model (F-value 5.494; $p < 0.001$) and two coefficient values – visual ($p < 0.001$) and auditory ($p < 0.001$) – are statistically significant. The positive relationship between visual scores and preference for visually-oriented catalogs confirms previous research that found that visually oriented people learn better from visual displays than they do from textual descriptions.

Model 3: The model is not significant at the 0.05 level of significance (F-value 1.235; $p < 0.299$). However, the coefficient for visual learning style is marginally significant ($p < 0.071$).

Model 4: The model is highly significant with an F-value of 7.332 ($p < 0.001$). Two positive coefficients – auditory ($p < 0.001$) and read/write ($p < 0.001$) – were found significant. This implies that learners with high auditory or read/write scores have a greater preference for animated electronic catalogs.

Model 5: Neither the overall model (F-value 1.556; $p < 0.187$) nor the coefficients for independent variables are significant at the 0.05 level of significance. This implies that web shoppers' learning styles do not influence their preference for audio-enabled electronic catalogs.

Model 6: This model is significant at the 0.05 level of significance (F-value 7.092; $p < 0.001$). The coefficients for visual ($p < 0.01$) and kinesthetic ($p < 0.002$) learning styles are also significant. This model suggests that visual learners learn best from charts, graphs, flow charts, symbolic arrows, circles, hierarchies and other devices whereby kinesthetic learners are more inclined to learn through experience and practice (simulated or real).

Model 7: The model (F-Value 4.133; $p < 0.003$) and the coefficients for auditory ($p < 0.041$) and read/write ($p < 0.002$) are significant. The coefficients are negative, implying that auditory and read/write web shoppers dislike virtual trials.

4.2 Canonical Correlation

Canonical correlation analysis provides another multivariate perspective on the relationships between web shoppers' individual learning styles and their preference for different features of electronic catalogs. Table 6 summarizes the results of this analysis and shows the canonical coefficients for the four statistically significant roots. The meanings of each root can be described by examining the items with the highest canonical coefficients in each of the two variables set. All of the roots are interpretable, and some of them build strong cases for the specific relationships between web shoppers learning styles and their preferences for different features of e-catalogs.

Of the four roots, the first one is most important and clearly interpretable. Examination of the first root reveals that web shoppers' preference for animated and custom animated catalogs appear to be associated with visual and auditory learning styles. This relationship is theoretically plausible and completely consistent with that of the regression analysis. The second root shows that kinesthetic and auditory learning styles influence web shoppers' preference for visually-oriented and custom animated catalogs.

Compared to the first and the second roots, the third root is less transparent, but explainable. The third root appears to reinforce the relationships between kinesthetic, and read/write learning styles and web shoppers preference for visually-oriented and text-oriented e-catalogs. Finally, the fourth root links the read/write and kinesthetic learning styles with web shoppers' preference for custom animated, and 3-D and 2-D catalogs. This finding is partially consistent with the regression outcome, showing that insignificant relationships exist between read/write and kinesthetic learning styles and preference for 3-D and 2-D catalogs. Another interesting relationship uncovered by this root is the link between kinesthetic and read/write learning styles and virtual trials.

Table 6. Summary of the Results of Canonical Correlation Analysis

	Canonical Coefficients			
Variables	**1**	**2**	**3**	**4**
E-Catalog Features				
3-D and 2-D Catalog	0.026	0.344	0.019	-0.503
Text-Oriented Catalog	0.02	-0.02	0.451	0.39
Visually-Oriented Catalog	0.237	-0.484	0.599	0.183
Audio-Enabled Catalog	0.285	-0.052	-0.188	0.266
Animated Catalog	-0.586	0.28	0.131	0.385
Custom Animated Catalog	0.5134	0.483	-0.057	0.558
Virtual Trial	0.332	-0.321	-0.425	0.498
Web Shoppers Learning Styles				
Visual	0.51	0.365	-0.499	-0.296
Auditory	-0.794	0.463	-0.2816	0.273
Read/write	-0.395	0.202	0.63	-0.637
Kinesthetic	0.334	0.523	0.615	0.485
Roots	0.442	0.239	0.161	0.024
Canonical R	0.665	0.489	0.401	0.157
Chi-square	477.32	373.84	262	132
DF	32	21	12	5
Probability	0.000	0.000	0.008	0.010

5. Discussion

It is evident from the findings that web shoppers differ in their preference for different features of electronic catalogs based on their learning styles. As hypothesized, web shoppers' VARK learning styles were found to have significant positive association with text-oriented catalogs, visual catalogs, animated catalogs, and custom animated catalogs. The kinesthetic learning style provides the basis for generation of text-oriented catalogs. Visual catalogs are better suited for visual learners. The visual and/or kinesthetic learning styles are significant determinants of custom animated catalogs. Animated catalogs are preferred by auditory and read/write learning styles.

Contrary to the proposed hypotheses, this study found that audio-enabled catalogs, and 3-D and 2-D catalogs cannot be personalized based on web shoppers' VARK learning styles. Another significant finding is that web shoppers' auditory and read/write learning styles were negatively correlated with virtual trials. This suggests that these web shoppers dislike virtual trials.

Catalog designers can use web shoppers' learning styles as a basis for generating customized, interactive catalogs to overcome the problems of information mismatch, enhance web shoppers' online shopping experience, and facilitate their purchasing decisions. By utilizing natural language generation (NLG) technology, web developers can build server-side systems that can provide users with personalized electronic catalogs that are capable of matching their preferences.

Adaptive web stores can also be developed by using the modeling and personalization techniques adopted in SETA. SETA is a shell that supports the development of adaptive web stores which customize the interactions with web shoppers and adapt the description of the electronic catalog to their preferences [Ardissono & Goy 1999]. Catalog designers can use tools such as the SETA Personalization Agent to dynamically generate the HTML code for the hypertextual pages that are customized based on some personalization strategies such as web shoppers' VARK learning styles. Dynamic hypertext systems can automatically construct entire hypertext networks and the nodes (or documents) of those networks at run-time, and adapt these to individual user's preference and needs. The content of the documents may be constructed either from an existing database or from a knowledge base consisting of facts. Thus, each user can be presented with a highly personalized catalog that can make reference to, or comparisons with, other catalog items.

6. Limitations and Future Direction

There are a number of limitations of this study. The first limitation involves the sample. Though students are web shoppers, the results from a student sample limit the generalizability of the findings. Future studies may test the relationships between web shoppers' VARK learning styles and their preferences for electronic catalogs by

collecting data from a different group of subjects. The second limitation of the study is in instrument design. The e-catalog survey questionnaire has not been validated by other research efforts. More consistent and useful results may have been obtained if a validated and reliable instrument had been available for the e-catalog survey questionnaire. Finally, in this study we haven't studied the possible relationship between web shoppers' preferences for different features of electronic catalogs and their brain orientation/hemisphericity. A number of prior studies indicate that brain hemisphericity has a significant influence on verbal or visual orientation of human beings. Identification of a significant relationship between verbal and visual orientation will give catalog designers another option to use web shoppers' brain hemisphericity as a basis for designing electronic catalogs.

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APPENDIX A: E-Catalog Survey Instrument

The objective of this survey is to assess web shoppers' preference for electronic catalog. Please take about 10 minutes to fill out this survey. There is no identifying information on this survey. While this information is important to us, you are under no obligation to complete the survey. Also, if you are under the age of 18, please do not fill out this survey.

Part I:

1. Have you ever shopped online?
   O Yes
   O No
2. Please specify your concerns about online shopping. Circle as many as you deem fit.
   a. It is difficult for me to get appropriate information from the electronic catalogs.
   b. Online shopping lacks the touch-and-see feel of the products.
   c. There happens to be too many choices for the same product to choose from.
   d. Online shopping lacks the real environment feeling of shopping.
   e. I am doubtful about the quality of the products presented via electronic catalogs.

Please read the questions/statements and choose the option that best expresses your view using the following scale: 1 = Strongly Disagree; 2 = Disagree; 3 = Somewhat Disagree; 4 = Neither Agree Nor Disagree; 5 = Somewhat Agree; 6 = Agree; and 7 = Strongly Agree.

3. I want the majority of the contents of my online catalog in the form of textual description.
4. I want the majority of the contents of my online catalog in visual form (e.g., image and video).
5. I want my online catalog to include 3-D and 2-D views of the products.
6. I want my online catalog to include animated views of the products.
7. I want my online catalog to include audio description of the products.
8. I want my online catalog to include animation that can be adjusted for shape, size, color, etc.
9. I like to have online trial of the product(s) that I will be buying.

Part II: Demographic Information

Please note, survey responses are completely anonymous.

10. What is your gender?
    O Male
    O Female
11. How old are you? _____.
12. Please indicate your ethnicity.
    O Asian
    O Black
    O Hispanic
    O White
    O Other
13. What is your major?
    O Accounting
    O BCIS/IT
    O Finance/Real Estate Management
    O Marketing/Logistics
    O Management
    O Other
14. How many years of experience do you have with personal computer? _____.
15. How many years of experience do you have with Web/Internet? _____.
16. How many years of work experience do you have? _____.

APPENDIX B: Demographic Information

All participants				
	Mean	**Std. Dev**	**Median**	**Range**
Sex (M=1, F=2)	1.38	0.50	1.00	1-2
Age (Years)	23.73	4.96	22.00	18-43
PC Experience (Years)	7.76	2.23	5.00	5-14
Web Experience (Years)	4.25	1.26	3.00	1-7
Work Experience (Years)	3.12	2.12	2.00	1-8

All Participants	
Ethnicity	
Asian (0)	16.7%
Black (1)	11.7%
Hispanic (2)	6.2%
White (3)	59.3%
Other (4)	6.2%
Major	
Accounting (0)	11.7%
BCIS/IT (1)	30.9%
FINA/REAL (2)	12.3%
LOGI/MKTG (3)	17.9%
MGMT/POM (4)	13.0%
Other (5)	14.2%