

## Modeling Computer Users' Interest in the World Wide Web across the Adult Life Span: The Role of Age, Education, Ability, and Discontentment

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The current study examined the factors related to the interest in Web related activities across the adult life span. Using the mediation model put forth by Ellis and Allaire (in press), the extent to which age, education, Web ability, and Web discontentment are related to computer users' interest in the World Wide Web was examined.

It was hypothesized that Web ability and discontentment would fully mediate the effects of age and education on Web interest. Six hundred surveys, sampled from the Project 2000 data (Novak & Hoffman, 1997), were used to examine this model. Using structural equation modeling techniques, the mediation model was largely supported. The Web discontentment was found to fully mediate the effect of Web ability, age and education on Web interest.

Running head: MODELING WEB INTEREST

Key words: Web ability, Web discontentment, Web interest

### INTRODUCTION

The adoption of computer technology in general and the World Wide Web (Web) in particular have recently expanded. Once the domain of younger adults, the Web now hosts something of interest to computer users at all stages of the life span. Although a general increase in the use of computer and the Web has been documented, there is scarce and sometimes conflicting evidence on what caused computer users to show interest in adopting computer technology and the Web as a part of their daily life. Previous literatures have mentioned age, education, computer anxiety, and computer skill to be some of the important factors contributing to the interest of using computers and the Web (Ellis & Allaire, in press; Everhart, 1997; Hemby, 1997; Jay & Willis, 1992; Raub, 1982; Ray & Minch, 1990; Selwyn, 1997).

Ellis and Allaire (in press) developed a mediation model, which described the effect of age and education on computer ability, computer anxiety, and computer interest. Their research focused exclusively on prospective older users.

In their study, Ellis and Allaire (in press) found that Computer Anxiety fully mediated the effects of education and Computer Knowledge on Computer Interest. However, not all of the age-related variance in Computer Interest was explained by Computer Anxiety or Computer Knowledge. Significant age differences in computer interest, a positive cross-sectional age gradient for computer anxiety and that higher computer knowledge was related to less computer anxiety.

The present research extends the applicability of the mediation model in three ways: First, the model was fit to data from current computer users across the adult life span. Second, instead of investigating the general use of computers, the focus of the present study is on the use of the Web in

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particular. Finally, the interest (or alternatively, propensity to use) construct was broadened to include ideas such as importance and relevance.

The current study examined the extent to which age, education, and Web ability and discontentment are related to Web interest. It was hypothesized that individual differences in Web interest would be explained by a complex inter-relationship among these factors.

#### Objectives and Summary of Hypotheses

The objective of this study was to examine whether the mediation model of older adults' computer interest would hold across the adult life span, focusing on a specific computer application, the Web. To accomplish this objective specific questions were addressed: (1) What is the correlational relationship between age, education, Web ability, Web discontentment, and Web interest? (2) Does a theoretically derived model explain individual differences in Web interest?, and (3) To what extent does each underlying factor explain individual differences in Web interest, both uniquely, and in combination with other factors?

## METHODS

### Participants

The Project 2000 questionnaire consisted of 77 items, administered as a Web-based form that was posted April 10 to May 10, 1997 in conjunction with the 7<sup>th</sup> WWW User Survey fielded by the Graphic, Visualization, and Usability Center (GVU) at the Georgia Institute of Technology (Kehoe & Pitkow, 1997). Participants were solicited by announcements placed on Internet-related newsgroups, banner ads placed on pages on high exposure sites (e.g. Yahoo, Netscape, etc.), announcements made to the WWW-survey list maintained by GVU, and announcements in the media.

Six hundred randomly selected subjects from 3776 complete cases (defined as the individuals with 100% non-missing data) with oversampling of the older adults (all of subjects aged 70 years and above were included) were analyzed. The respondents ranged in age from 18 to 80 years, with an average age of 44.33 years (S.D. = 15.68 years). The sample was predominantly male (66%). Education levels ranged from high school to doctoral degree. The education data was converted into years of education, averaging 15.39 years (S.D. = 2.29 years).

### Procedures and Measures

Web Discontentment. Out of the 77 items in Project 2000 survey, items that matched the criteria of Ellis and Allaire's (in press) computer anxiety definition were selected to be factor analyzed. The instrument was 9-point discrete scale. The subjects were asked rate their feelings when using the Web such as "sad" vs. "happy", with "sad" rated as 9 and "happy" rated as 1. The complete set of questions is listed in Table 1. Together these six items had a strong internal consistency ( $\alpha = .85$ ), indicating that they were a homogeneous set of questions.

Web Interest. The level of Web interest of the respondents was measured with nine 9-point discrete scales on their general feelings about the Web. These items ranged from statements such as "means nothing to me" rated as 1 to "means a lot to me" rated as 9. Together these nine items had a strong internal consistency ( $\alpha = .92$ ). The complete set of questions is listed in Table 1.

Web ability. Web ability was self-assessed by seven 9-point Likert scale items. The items consisted of statements such as "I am very skilled at using the Web." The respondents were asked to endorse these

items along a scale from “Strongly Disagree” (rated as 1) to “Strongly Agree” (rated as 9). The internal consistency for these items was high ( $\alpha = .89$ ). The complete set of questions is listed in Table 1.

Demographics. This portion of the questionnaire consisted of sociodemographic items. The variables of particular interest included in the analyses were age and level of formal education.

## RESULTS

The purpose of this study was to investigate the relationships between age, education, Web ability, Web discontentment, and interest in computers. Analysis focused on: (1) Examining the correlational relationships between these constructs, and their relationship with demographic variables, (2) evaluating the fit of a theoretical model where the effects of age and education on Web interest are mediated by Web ability and discontentment, and (3) determining the unique and shared variance components in the prediction of Web interest.

### Correlational Relationships

Table 2 contains the correlations between age, education, Web ability, Web discontentment, and Web interest. Each of the Web-related variables was created by summing the items on each scale. The values above the diagonal represent correlations between the summed scores for Web ability, Web discontentment, and Web interest as well as age and education. The values below the diagonal represent correlations between the constructs obtained in the latent space using confirmatory factor analysis (Joreskog & Sorbom, 1993). The three Web-related constructs represent 60.8% of the total variance accounted for by the variables.

Corresponding with the finding of Ellis and Allaire (in press), the correlations among those variables were significant at  $p < .05$ . The sole difference was the insignificant correlation between education and Web interest in the present study.

Examining the pattern of correlations, Age was negatively related to Web ability and Web interest and positively related to Web discontentment. Education was positively related to Web ability, negatively related to Web discontentment, and insignificantly related to Web interest. With respect to the interrelationships of the computer related variables, higher levels of Web discontentment were related to lower levels of Web ability and Web interest. Finally, Web ability and Web interest were positively related to one another.

As was expected by the experimenter, the six questions that measure how the subjects feel when they use the Web load on Web discontentment factor. The factor loadings ranged from 0.59 to 0.78 with  $p < 0.001$ . The nine items that measured the general feelings about the Web load on Web Interest factor with factor loading ranging from 0.61 to 0.86 ( $p < 0.001$ ). The measures of the subject's self-rated ability clearly load on Web ability with factor loading ranging from 0.63 to 0.85 ( $p < 0.001$ )

### Latent Relationships

In order to determine the extent to which Web ability and discontentment mediated the effects of age and education on Web interest, structural equation modeling was employed (Joreskog & Sorbom, 1993). Structural equation modeling allows one to create latent constructs comprised of several observed variables intended to assess a particular construct. The advantage here is that the relationship between these latent constructs are disattenuated for measurement error. This technique also allows the predictive relationship between all latent constructs to be examined simultaneously. All structural models were estimated using the LISREL VIII program (Jöreskog & Sörbom, 1993). Models with Chi-square

estimates less than two times the degrees of freedom (Akaike, 1987; Carmines & McIver, 1981), residual error less than .05 and overall fit indices above .90 were considered adequate fitting models.

Analysis began with the specification of a measurement model where the constructs are correlated to one another. The specified measurement model included some correlated measurement errors of variables that represent the same constructs. This measurement model had an adequate fit:  $\chi^2(233, N = 600) = 465.05$ , residual error  $< 0.05$ , all fit indices  $> .90$ .

Mediation. Next a series of structural equation models was performed in order to determine the pattern of relationship between the computer-related latent constructs (as well as age and education), that would most parsimoniously reproduce the pattern of covariation in the measurement model.

The first structural model was the Ellis and Allaire model (see Figure 1). The fit of this model (MOD 1) was adequate:  $\chi^2(235, N = 600) = 466.06$  (see Table 3 for fit indices), and it was not significantly different from the initial measurement model:  $\chi^2 \text{ diff}(2) N = 600 = 1.01$ . However, several path coefficients were insignificant. Therefore, several nested model tests were conducted.

In the second model (MOD 2), the direct path from Age to the Web Discontentment was eliminated. MOD 2 showed one insignificant path coefficient left. Next in MOD 3, a direct path from age to Web Interest was eliminated, leaving no insignificant path coefficients. Therefore, this final model is considered to reproduce the original factor covariation matrix in the most parsimonious manner. As can be seen in Figure 2, this final model accounted for 33% of the variance in Web interest, and found that age predicted Web Ability; education predicted the Web Discontentment and Web Ability; Web Ability predicted Web Discontentment; and Web Discontentment predicted Web Interest.

## DISCUSSION

The current study attempted to examine the correlates of Web interest. Based on Ellis and Allaire (In Press), the relationships between four constructs (i. e., age, education, Web ability, and Web discontentment) and Web interest were examined.

The pattern of correlational relationships between age, education, and the Web-related variables was congruent with our expectations. Specifically, negative age-related differences were evident for our measures of Web ability and Web interest, while Web discontentment was positively related to age. Higher educational attainment was related to higher levels of the Web ability and lower level of Web Discontentment. The interrelations among the Web-related variables revealed that higher Web ability was related to less Web discontentment and more Web interest, while lower levels of Web discontentment was related to higher Web interest.

These results are especially interesting in several ways. For example, the fact that higher levels of the Web ability was related to lower Web Discontentment is similar to the common finding that experience with computers leads to more positive attitudes towards computers (Czaja & Sharit, 1998; Dyck & Smither, 1994; Ray & Minch, 1990).

The factor loading pattern also showed an interesting result. The variables load on relevant factors with medium to high loadings, indicating the those variables well represent the intended underlying constructs.

Turning to the second empirical question of the study, although the model largely replicated Ellis and Allaire (in press), the best-fitting model here was the fully mediated model. Specifically, Web Discontentment fully mediated the effects of age, education and the Web ability on Web interest.

Note that due to the cross-sectional nature of this study, statements regarding causality among the hypothesized factors can not be made. Instead, the identified pattern of predictive relationships should be considered as a first step in determining the relationship between Web Interest and various possible underlying constructs, as well as the interrelationships that exist among underlying constructs.

The limitations of using a convenience sample should be acknowledged. This data was analyzed with the data from Project 2000 that contain more long-term, sophisticated computer users than the general population (Hoffman & Novak, 1996)

Future research should concentrate in at least two areas. Particular focus on specific Web applications and how they fit in to the overall context of adults' lives should be examined. Researchers have commented that relevance plays a role in acceptance of computer technology (Czaja, et al., 1993). Further analysis should focus on the relative importance and usefulness of computers in various aspects of daily life, ranging from leisure (e.g. hobbies, games) to more instrumental tasks of daily living (e.g., managing medications). Additionally, more research should focus on the outcomes associated with Web usage. As Web-based technology is further integrated into commerce and human services, the benefits could be great.

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Table 1  
 List of questions and the correlation between observed and latent variables

Interest	Ability	Discontentment	Questions
0.75***	-	-	49. means nothing to me vs. means a lot to me
0.82***	-	-	50. unexciting vs. exciting
0.70***	-	-	51. unappealing vs. appealing
0.72***	-	-	52. irrelevant vs. relevant
0.86***	-	-	53. dull vs. neat
0.68***	-	-	54. unimportant vs. important
0.86***	-	-	55. boring vs. interesting
0.61***	-	-	57. does not matter to me vs. matters to me
0.79***	-	-	58. not fun vs. fun
-	0.86***	-	3. I am very skilled at using the Web.
-	0.63***	-	24. I know how to find what I want with a search engine.
-	0.63***	-	34. Downloading software is easy for me to do on the Web.
-	0.82***	-	38. I consider myself knowledgeable about good search techniques on the Web.
-	0.79***	-	40. I know more about using the Web than most users.
-	0.69***	-	44. I find the Web easy to use.
-	0.64***	-	67. When I encounter a problem using the Web, I get stuck because I don't know what to do next vs. the Web isn't as challenging to me as it used to be.
-	-	0.60***	60. The Web challenges my capabilities to their limits vs. I don't use the Web much and don't care to.
-	-	0.76***	62. Irritable vs. cheerful
-	-	0.78***	63. Sad vs. happy
-	-	0.74***	66. Apathetic vs. "in flow"
-	-	0.59***	69. Lonely vs. sociable
-	-	0.72***	72. Hostile vs. friendly

Note: Question 49-58 asked the subjects how they feel about the Web in general.

Question 59-74 asked the subjects how they feel when they use the Web.

\*\*\* =  $p < 0.001$

Table 2

Correlations among Interest, Ability, Discontentment, Age and Education (N = 600)

	INTEREST	ABILITY	DISCONTENTMENT	AGE	EDU
INTEREST	1.00	0.13	-0.52	-0.11	-0.07
ABILITY	0.13	1.00	-0.19	-0.38	0.12
DISCONTENTMENT	-0.58	-0.21	1.00	0.09	0.13
AGE	-0.13	-0.42	0.13	1.00	0.18
EDU	-0.07	0.15	0.14	0.18	1.00

Note: The values above the diagonal represent correlations between the summed scores.  
The values below the diagonal represent correlations between the constructs.



Table 3: still old one  
 Nested Comparison of Model Fit for Prediction Models (N = 600)

Model Step	$\chi^2$	df	p	GFI	RMSEA	RMR	CFI	NNFI	NFI	RFI	IFI	Comparison to Measurement Model			Comparison to Previous Model		
												$\chi^2$	df	p	$\chi^2$	df	p
Measurement Model	465.05	237	.00	.94	.041	.043	.97	.94	.96	.93	.97						
MOD 1: Ellis and Allaire Model	466.06	235	.00	.94	.041	.042	.97	.94	.96	.93	.97	1.01	2	.34			
MOD 2: Drop path from Age to Web Discontentment	466.07	236	.00	.94	.041	.042	.97	.94	.96	.93	.97	1.02	3	.78	0.01	1	.98
MOD 3: Drop path from Age to Web Interest	468.42	237	.00	.94	.041	.042	.97	.94	.96	.93	.97	3.37	4	.43	2.35	1	.18

Figure Captions

Figure 1. Ellis and Allaire model.

Figure 2. The final best fitting structural model, with standardized regression weights (MOD 3 from Table 3).



