MIS Quarterly

The Effects of Web Personalization on User Attitude and Behavior: An Integration of the Elaboration Likelihood Model and Consumer Search Theory

Shuk Ying Ho

Research School of Accounting and Business Information Systems, College of Business and Economics, The Australian National University, Canberra, ACT 0200, AUSTRALIA {susanna.ho@anu.edu.au}

David Bodoff

Faculty of Management, University of Haifa,
Haifa, 31905, ISRAEL {dbodoff@univ.haifa.ac.il}

Appendix A

Task Scenarios for the Lab Study

Scenario 1

Next week, you will have your first job interview. The job is being offered by a small firm. The firm provides no training, no medical benefits, and no travel allowance to its employees. The starting salary is A\$30,000 per annum, below the average starting salary of a fresh graduate, i.e., A\$50,000. Indeed, you do not care much about this job.

Your friends told you that the job interviewers might ask you a few questions relevant to your textbook knowledge of your major. You believe that reading a book about your major might improve your performance in the interview. You are now deciding which book on the subject of your major to purchase.

Scenario 2

Next month, you will have your final examinations. After calculating your average scores for each course, you are sure that you can get high distinctions in almost all courses. You have finished reviewing all lecture materials, all tutorial materials, and all textbooks. However, there are still four weeks before the examination. Since you have extra time available, you plan to buy a book about your major to do some extra preparation.

You are now deciding which book about your major to buy. The book should cover most of the important topics for courses about your major. Because of your limited budget, you can only purchase one book.

Scenario 3

You get a new job, that of a teaching assistant (a tutor) at the University of Canberra. In the winter break, you need to deliver tutorials on an introductory course about your major. There will be 10 students in each tutorial. You will be responsible for one tutorial group only. You understand that the lecturer may use your performance as a reference to decide whether you can continue your tutor position, but students do not evaluate tutorials. If you teach well, you may be able to get another contract for the summer break. That means, you can have an income of A$3,000 in December 2011.

To prepare tutorial materials, you plan to purchase a book that covers most of the important topics about your major. Remember that it is an introductory course. The University of Canberra will reimburse you for the book.

Scenario 4

Sara is a friend of your friend. You have known her for two weeks. Sara has just enrolled in the Bachelor of Commerce degree at the Australian National University. She is a lazy learner. Her family is rich, and thus, she does not care about her academic results. These days, Sara is considering her major in the College of Business and Economics. Somehow, she guesses that she may like your major and asks you what you think. Since you know that Sara does not care about her studies, you might not want to spend much time on her. Hence, you decide to buy a book related to your major and give it to her, saying that she can have a look at it and decide for herself. You are now deciding which book about your major to purchase for her.

Scenario 5

Next week, you will have your first job interview. You are very interested in this job, considering that it is for a large Australian firm. The firm provides its new employees with good training. The benefits of medical support and travel allowance are also good. The starting salary is high, A$80,000 per annum. It is well above the average starting salary of a fresh graduate, i.e., A$50,000.

Your friends told you that the job interviewers will thoroughly test you on your textbook knowledge of your major. You believe that in the coming week, it is critical for you to read a book about your major to improve your interview performance. You are now deciding which book to purchase about your major.

Scenario 6

Next month, you will have your final examinations. Since you have been sick for six weeks, you missed most of the lectures for all courses. Although you listened to the audio recording on Wattle, it did not help much. To make things worse, you did not perform well in some assessments. You had very poor marks in the assignments and failed the mid-term examinations of two courses. You plan to purchase a book about your major.

You are now deciding which book to buy. The book should cover most of the important topics for the courses in your major. The book content should be concise and precise. Due to your limited budget, you can only purchase one book.

Scenario 7

You have just gotten a new job, an associate lecturer position at the University of Canberra. In the winter break, you are going to deliver lectures on an introductory course about your major. There will be 100 students in each lecture, and there will be three streams. Altogether, you will have 300 students. You are very excited about this new job. You understand that your teaching performance is crucial. If you teach well, you will be able to obtain a long-term contract. This means that, in every summer or winter break, you can have an income of A$20,000. Your performance will be evaluated by students.

To prepare lecture materials, you plan to purchase a book that covers most of the important topics about your major. Remember that it is an introductory course. The University of Canberra will reimburse you for the book.

Scenario 8

Sara is your best friend. You have known her for 15 years. She has just enrolled in the Bachelor of Commerce degree at the Australian National University. Sara is a very keen, enthusiastic, and hard-working learner. These days, she is considering her major in the College of Business and Economics. It seems that Sara is very interested in your major. Sara would like to seek your advice. After talking to her several times, you believe that a book about your major can be very useful to her. You are now deciding which book to purchase for Sara.

Appendix B

Measures █████████████████████████

All items were measured with nine-point scales. Most were anchored with strongly disagree (1) – strongly agree (9) unless noted with an asterisk (*) and described below.

For each variable, we provide a description of "Data from which session to be used in data analysis." As mentioned in the sections on the measures for Study 1 and for Study 2, given four logon sessions, there are two ways to test our model, using data from sessions 1 to 3, and data from sessions 2 to 4. In this appendix, we assume that the model is being tested on sessions 2–4. In this case, the bulk of variables are measured at—or up to—session 3, as appropriate, with depth of processing to predict attitude persistence measured during session 2, and subsequent breadth of sampling measured during session 4.

Quality of Personalization (Tam and Ho 2006)

Definition: A person's perception of the extent of matching of personalized items to his/her needs.
Nature of measures: Perceptual, to be captured in questionnaires.
Measures:

Study 1:   The lab study
Quality1:   The book recommendations shown at the bottom of the window are personalized to my needs.
Quality2:   The book recommendations displayed at the bottom of the window match my needs.
Quality3:   The book recommendations are personalized to me.

Study 2:   The field study
Quality1:   The song recommendations shown at the bottom of the window are personalized to my preferences.
Quality2:   The song recommendations displayed at the bottom of the window match my preferences.
Quality3:   The song recommendations are personalized to me.

When this variable was measured: In all pre-task (except session 1) and all post-task questionnaires, we used present tense for the questions in the pre-task questionnaire, and past tense for the questions in the post-task questionnaire.
Data from which session to be used in data analysis: Data from the pre-task questionnaire in session 3.

Variation of Personalized Items

Definition: The variance in a person's perception of the quality of individual personalized recommendations.
Nature of measures: Perceptual, to be captured in the course of navigation.
Measures: Participants scored sampled personalized items with a nine-point Likert scale (1 = strongly dislike, 9 = strongly like). We calculated variance of these scores for each participant to form this construct.
When this variable was measured: In all sessions.
Data from which session to be used in data analysis: Data from sessions 1 to 3.

Attitude Persistence (Petty and Krosnick 1995)

Definition: The extent to which a previously formed attitude endures over time.

Nature of measures: Perceptual, to be calculated from data collected in questionnaires.

Measures: The inverse of the absolute value of the difference between attitude valence reported in the post-task questionnaire in the previous session and attitude valence reported in the pre-task questionnaire in the current session.

When this variable was measured: Derived from attitude valence, so this variable is defined and available for all sessions after the first.

Data from which session to be used in data analysis: As of beginning of session 3.

Attitude Confidence (Berger and Mitchell 1989)

Definition: How certain a person is in his/her attitude.

Nature of measures: Perceptual, to be captured in questionnaires.

Measures: *

Conf1:   How confident are you in the estimation of the goodness of personalized items? (1 = very unconfident; 9 = very confident)

Conf2:   How precise is your estimation of the goodness of personalized items? (1 = very imprecise; 9 = very precise)

When this variable was measured: We captured this variable in all pre-task (except session 1) and post-task questionnaires.

Data from which session to be used in data analysis: Data from the post-task questionnaire in session 3.

Depth of Processing (Petty and Cacioppo 1986)

Definition: The extent to which the person carefully thinks about each recommendation provided by the personalization agent.

Nature of measures: Behavioral, to be captured in the course of website navigation.

Measures: Depth of processing was operationalized as the average number of textual comments that a user wrote to describe their thoughts related to a sampled personalized recommendation. We averaged the total number of textual comments on personalized recommendations by the number of sampled personalized recommendations.

When this variable was measured: As a moderator of link between quality of personalization and perceived usefulness, measured at session 3; as an antecedent of attitude persistence, measured at session 2.

Remarks: We captured this variable in the lab study, but not in the field study.

Subsequent Breadth of Sampling (Tam and Ho 2005)

Definition: The number of personalized recommendations that a user samples in a particular session.

Nature of measures: Behavioral, to be captured in the course of website navigation.

Measures: Subsequent breadth of sampling was operationalized as the number of sampled personalized recommendations in the logon session after we captured attitude confidence.

When this variable was measured: In all sessions.

Data from which session to be used in data analysis: Session 4.

Cumulative Breadth of Sampling

Definition: The total number of personalized recommendations that a user had sampled up to and including a particular session.

Nature of measures: Behavioral, to be captured in the course of website navigation.

Measures: Cumulative breadth of sampling was operationalized as the total number of sampled personalized recommendations in *all* logon sessions before we captured attitude confidence.

When this variable was measured: We captured breadth of sampling from the personalization agent in all logon sessions. Thus, theoretically, we were able to calculate *cumulative* breadth of personalized sampling for any round of visits.

Data from which session to be used in data analysis: Total of breadth of sampling from the personalization agent from sessions 1 to 3.

Actual Selection from the Agent (Tam and Ho 2005, 2006)

Definition: Whether a person chooses a personalized recommendation as his/her final selection.
Nature of measures: Behavioral, to be captured in the course of website navigation
Measures: It was a binary number. "1" refers to a choice of a personalized item as a participant's item selection, and "0" refers to otherwise.
When this variable was measured: In all sessions.
Data from which session to be used in data analysis: Session 3.

Perceived Usefulness (Van der Heijden 2004)

Definition: The degree to which a person believes that using the personalization agent would enhance his/her performance in product selection.
Nature of measures: Perceptual, to be captured in questionnaires.
Measures:

Study 1:   The lab study
By using the personalization agent,
PU1:   I could decide more quickly which book I wanted to select than in the past.
PU2:   I could better decide which book I wanted to select than in the past.
PU3:   I was better informed about relevant books.
PU4:   I could decide more quickly whether I wanted to explore a particular book or not.
PU5:   I could better decide whether I wanted to select a particular book or not.

Study 2:   The field study
By using the personalization agent,
PU1:   I could decide more quickly which song I wanted to select than in the past.
PU2:   I could better decide which song I wanted to select than in the past.
PU3:   I was better informed about new songs.
PU4:   I could decide more quickly whether I wanted to explore a particular song or not.
PU5:   I could better decide whether I wanted to select a particular song or not.

When this variable was measured: In all post-task questionnaires.
Data from which session to be used in data analysis: Data from the post-task questionnaire in session 3.

Attitude Valence (Bhattacherjee and Premkumar 2004)

Definition: The direction and extremity of an attitude.
Nature of measures: Perceptual, to be captured in questionnaires.
Measures: *

Study 1:   The lab study
Valence1.   Using the personalization agent in my book selection is a (bad … good) idea.
Valence2.   Using the personalization agent in my book selection will be (unpleasant … pleasant).
Valence3.   Overall, I (dislike … like) the idea of using the personalization agent in my book selection.

Study 2:   The field study
Valence1.   Using the personalization agent in my song selection is a (bad … good) idea.
Valence2.   Using the personalization agent in my song selection will be (unpleasant … pleasant).
Valence3.   Overall, I (dislike … like) the idea of using the personalization agent in my song selection.

When this variable was measured: We captured this variable in all pre-task (except session 1) and post-task questionnaires.
Data from which session to be used in data analysis: Data from the post-task questionnaire in session 3.

Need for Cognition (Cacioppo and Petty 1982)—a control variable

Definition: A personality variable reflecting the extent to which people engage in and enjoy effortful cognitive activities.
Nature of measures: A self-reported personality trait, to be captured in a pre-task questionnaire.
Measures:
NFC1.   I would prefer complex to simple problems.
NFC2.   I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
NFC3.   I find little satisfaction in deliberating hard and for long hours. (reversely-coded)
NFC4.   I prefer to think about small, daily projects to long-term ones. (reversely-coded)
NFC5.   I think primarily because I have to. (reversely-coded)
NFC6.   I tend to set goals that can be accomplished only by expending considerable mental effort.
When this variable was measured: Session 1.

Motivation (Deci et al. 2001)—a control variable

Definition: How eager a person is to form a correct judgment.
Nature of measures: Perceptual, to be captured in post-task questionnaires.
Measures:
Mot1:   The book-selection task was important.
Mot2:   I attached great importance to the book-selection task.
When this variable was measured: We captured this variable in all post-task questionnaires.
Data from which session to be used in data analysis: Data from session 3.
Remarks: We captured this variable in the lab study, but not in the field study.

Ability (Tam and Ho 2005)—a control variable

Definition: How capable a person is to form a correct judgment.
Nature of measures: Perceptual, to be captured in post-task questionnaires.
Measures:
Ability1: I was capable of selecting a book to fulfill the book-selection task.
Ability2: I was knowledgeable about the book topic specified in the book-selection task.
When this variable was measured: We captured this variable in all post-task questionnaires.
Data from which session to be used in data analysis: Data from session 3.
Remarks: We captured this variable in the lab study, but not in the field study.

References

Berger, I. E., and Mitchell, A. A. 1989. "The Effect of Advertising on Attitude Accessibility, Attitude Confidence, and the Attitude-Behavior Relationship," *Journal of Consumer Research* (16:3), pp. 269-279.

Bhattacherjee, A., and Premkumar, G. 2004. "Understanding Changes in Beliefs and Attitudes Towrd Information Technology Usage: A Theoretical Model and Longitudinal Test," *MIS Quarterly* (28:2), pp. 229-252.

Cacioppo, J. T., and Petty, R. E. 1982. "The Need for Cognition," *Journal of Personality and Social Psychology* (42:1), pp. 116-131.

Deci, E. L., Ryan, R. M., Gagné, M., Leone, D. R., Usunov, J., and Kornazheva, B. P. 2001. "Need Satisfaction, Motivation, and Well-Being in the Work Organizations of a Former Eastern Block Country: A Cross-Cultural Study of Self-Determination," *Personality and Social Psychology Bulletin* (27:8), pp. 930-942.

Petty, R. E., and Cacioppo, J. T. 1986. "The Elaboration Likelihood Model of Persuasion," *Advances in Experimental Social Psychology* (19), pp. 124-205.

Petty, R. E., and Krosnick, J. A. 1995. *Attitude Strength: Antecedents and Consequences*, Mahwah, NJ: Erlbaum.

Tam, K. Y., and Ho, S. Y. 2005. "Web Personalization as a Persuasion Strategy: An Elaboration Likelihood Model Perspective," *Information Systems Research* (16:3), pp. 271-293.

Tam, K. Y., and Ho, S. Y. 2006. "Understanding the Impact of Web Personalization on User Information Processing and Decision Outcomes," *MIS Quarterly* (30:4), pp. 865-890.

Van der Heijden, H. 2004. "User Acceptance of Hedonic Information Systems," *MIS Quarterly* (28:4), pp. 695-704.

Appendix C

Construct Validation for the Lab Study

Table C1. Factor Analysis (The Lab Study) (Note: loadings below 0.30 excluded)								
	NFC	**PU**	**Valence**	**Persist**	**Quality**	**Mot**	**Ability**	**Conf**
Mot1						0.960		
Mot2						0.966		
Ability1							0.857	
Ability2							0.882	
NFC1	0.852							
NFC2	0.794							
NFC3	0.842							
NFC4	0.846							
NFC5	0.840							
NFC6	0.812							
Quality1		0.459			0.774			
Quality2		0.445			0.786			
Quality3					0.876			
PU1		0.831						
PU2		0.852						
PU3		0.826	0.337					
PU4		0.797			0.395			
PU5		0.874						
Valence1		0.336	0.891					
Valence2		0.341	0.905					
Valence3		0.390	0.871					
Persist1				0.863				
Persist2				0.909				
Persist3				0.898				
Conf1				0.414				0.742
Conf2								0.903

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
Note: Mot = Motivation; Ability = Ability; Quality = Quality of Personalization; PU = Perceived Usefulness; Valence = Attitude Valence; Conf = Attitude Confidence; Persist = Attitude Persistence, NFC = Need for Cognition.

Table C2. Reliability, Correlations and AVE (The Lab Study)									
	Reliability	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. Motivation	0.926	**0.982**							
2. Ability	0.731	0.288	**0.883**						
3. Need for Cognition	0.917	-0.051	-0.137	**0.839**					
4. Quality of Personalization	0.911	-0.067	0.076	-0.100	**0.921**				
5. Perceived Usefulness	0.943	0.075	0.116	-0.163	0.658	**0.904**			
6. Attitude Valence	0.957	0.065	0.089	-0.153	0.398	0.607	**0.977**		
7. Attitude Confidence	0.779	0.204	0.099	-0.117	0.122	0.223	0.265	**0.904**	
8. Attitude Persistence	0.893	0.156	0.059	-0.044	0.065	0.114	0.153	0.505	**0.907**

Note: Diagonal entries (bold) are the square root of the average variance extracted (AVE).

Appendix D

The Path Analysis of Study 1—The Lab Study—Using Sessions 1–3 Data ▰▰▰▰

Figure D1 depicts the path analysis model for the lab study using sessions 1-3 data. We followed the report of modification indices to include two additional paths: NFC ↔ motivation and attitude valence → subsequent breadth of sampling. The model showed a CFI of 0.948 and a TLI of 0.948, a WRMR of 1.01, and a RMSEA of 0.080. The CFI (close to the cutoff of 0.95), TLI (close to the cutoff of 0.95), and RMSEA (< cutoff of 0.08) were satisfactory, but WRMR was larger than the cutoff of 0.9. This model demonstrated a reasonably good fit. The R-squares of the dependent variables were satisfactory—0.201 for depth of processing; 0.523 for perceived usefulness; 0.862 for subsequent breadth of sampling; 0.603 for attitude confidence; 0.338 for attitude persistence; 0.421 for attitude valence; and 0.812 for item selection.
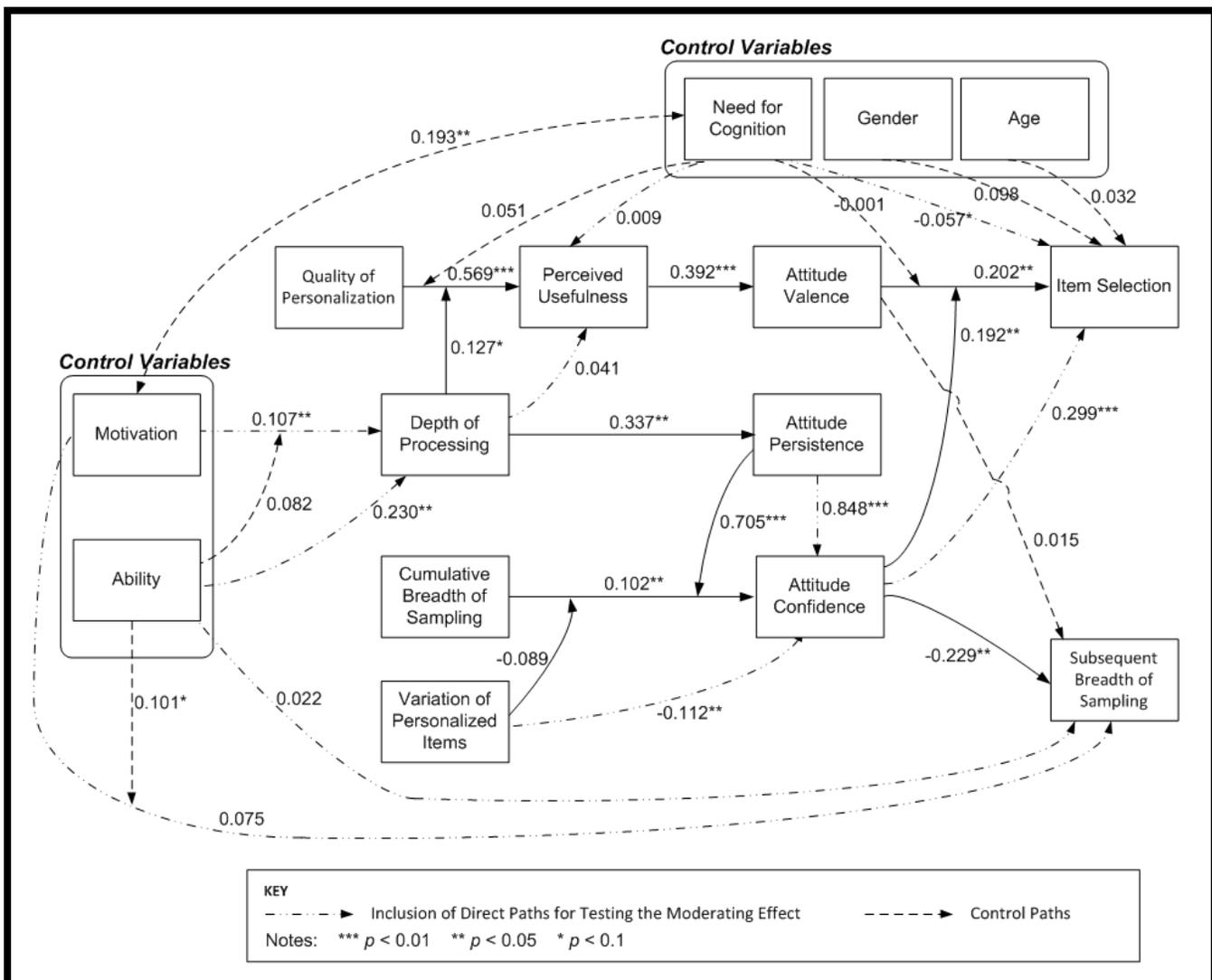

Figure D1. Path Analysis of the Lab Study (Sessions 1–3)

Appendix E

Construct Validation for the Field Study

Table E1. Factor Analysis (The Field Study) (Note: loadings below 0.30 excluded)						
	PU	**NFC**	**Valence**	**Persist**	**Quality**	**Conf**
NFC1		0.743				
NFC2		0.622				
NFC3		0.748				
NFC4		0.659				
NFC5		0.657				
NFC6		0.675				
Quality1					0.764	
Quality2					0.742	
Quality3					0.754	
PU1	0.799					
PU2	0.820					
PU3	0.754					
PU4	0.773					
PU5	0.692					
Valence1			0.710			
Valence2			0.831			
Valence3			0.824			
Persist1				0.877		
Persist2				0.930		
Persist3				0.935		
Conf1						0.936
Conf2						0.930

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
Note: Quality = Quality of Personalization; PU = Perceived Usefulness; Val = Attitude Valence; Conf = Attitude Confidence; NFC = Need for Cognition.

Table E2. Reliabilities, Correlations and AVE (The Field Study)							
	Reliability	**1**	**2**	**3**	**4**	**5**	**6**
1. Need for Cognition	0.780	**0.706**					
2. Quality of Personalization	0.877	0.177	**0.794**				
3. Perceived Usefulness	0.859	0.166	0.393	**0.798**			
4. Attitude Valence	0.742	0.097	0.278	0.079	**0.799**		
5. Attitude Confidence	0.799	0.146	0.017	0.051	0.069	**0.942**	
6. Attitude Persistence	0.863	-0.059	0.051	-0.007	-0.127	0.002	**0.946**

Note: Diagonal entries (bold) are the square root of the average variance extracted (AVE).

Appendix F

The Path Analysis of Study 2—The Field Study—Using Sessions 1–3 Data ▰▰▰

Figure F1 depicts the path analysis model for the field study using sessions 1–3 data. The model showed a CFI of 0.953 and a TLI of 0.950, a WRMR of 0.72, and a RMSEA of 0.040. The CFI (> cutoff of 0.95), TLI (> cutoff of 0.95), WRMR (< cutoff of 0.9), and RMSEA (< cutoff of 0.08), were satisfactory, and this demonstrated a good model fit. The R-squares of the dependent variables were satisfactory—0.203 for perceived usefulness; 0.319 for subsequent breadth of sampling; 0.435 for attitude confidence; 0.101 for attitude valence; and 0.129 for item selection.
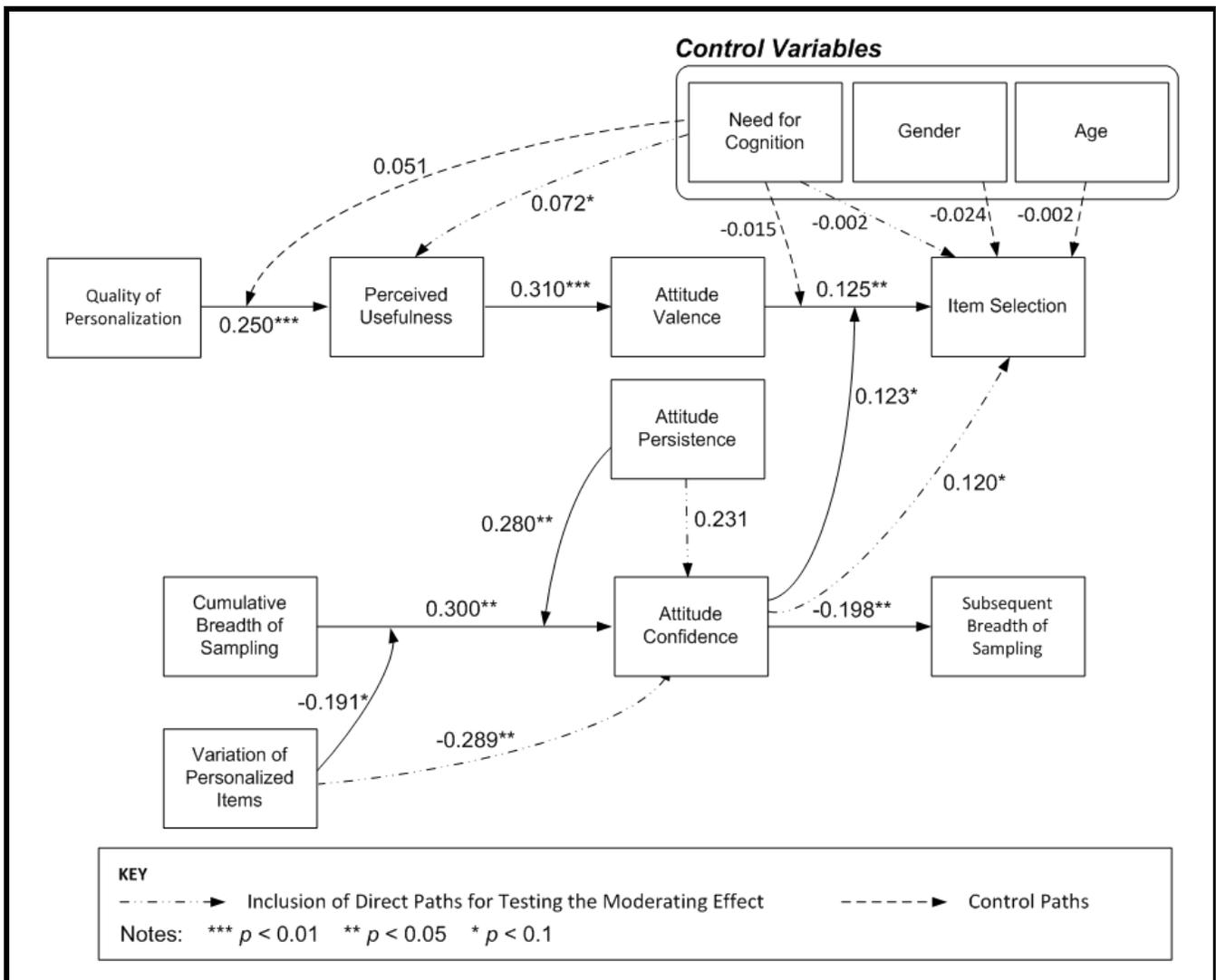

Figure F1. Path Analysis of the Field Study (Sessions 1–3)