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The Nature and Dimensionality of Cognitive Absorption: A Literature Review Protocol

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ABSTRACT

Cognitive absorption (CA) has been widely used in research since its inception in 2000. However, conflicting findings regarding its relationships with other constructs, and nuanced interpretations of flow theory present challenges for the research involving CA. We present our ongoing literature review, which aims to examine the multidimensional structure of CA and its relationships with other constructs in its nomological network by conducting a meta-analysis. Our preliminary results indicate that researchers' modifications of the measurement model of CA follow a pattern, suggesting possible theory-building activities. Empirical data also indicates two dimensions with relatively weaker correlations, providing nuanced insights into the CA construct. In this literature review protocol, we discuss our methodology, preliminary findings, and implications for research and future steps.

Keywords

Cognitive absorption, meta-analysis, multidimensional constructs, IS use.

INTRODUCTION

Conceiving and operationalizing new concepts is vital to pushing the boundaries of research. The literature stream stemming from the Technology Acceptance Model (TAM) (Davis 1989) exemplifies how new constructs and measurement items expand the power of an initial research idea. Examples include self-efficacy, task-technology fit, mindfulness, habit, addiction, and cognitive absorption (CA) among others. In this study, we focus on the last of these examples, CA, which is defined as "a state of deep involvement with software that is exhibited through five dimensions: (1) temporal dissociation, (2) focused immersion, (3) heightened enjoyment, (4) control, and (5) curiosity" (Agarwal and Karahanna 2000, p. 673). With the emergence of innovative content delivery modes, e.g., virtual and augmented reality, alongside the escalating interaction capabilities of technological devices, the relevance of the CA construct in IS research can be expected to increase further.

IS research has studied the CA construct for the past two decades, generating insightful findings. Findings mostly show that CA leads to an increased sense of perceived usefulness (PU) and perceived ease of use (PEOU), as well as leading to an increased intention to use the tested technology. However, some findings suggest that CA does not significantly impact PU, mainly when the IS is used in a hedonic context (Wakefield and Whitten 2006). On the other hand, some studies are inconclusive about whether CA affects PEOU and PU (Thomas 2006). These diverging findings regarding CA suggest that other factors might influence the strength and the directionality of CA's impact on users' perceptions of technology.

Given the presence of mixed and sometimes conflicting findings, we aim to critically evaluate the literature using the CA construct to identify the potential moderating effects over the conceptual relationships involving CA. Moreover, we also aim to understand CA's multilevel structure by using empirical data. Through this research effort, we aim to identify a set of moderators and research design factors that may be considered in studies using the CA construct. More specifically, we investigate the following research questions:

1. What does the accumulated empirical evidence indicate about the contextual factors impacting CA's multidimensional structure?
2. What does the accumulated empirical evidence indicate about the moderators of the relationships between CA and other constructs in its nomological network?

METHODS

This literature review uses a systematic study identification methodology to synthesize quantitative research evidence involving the use of CA, as defined by Agarwal and Karahanna (2000). This research roundtable proceeding serves both as a research-in-progress report and a literature review protocol.

Eligibility Criteria

This review only includes quantitative studies that report primary data and use CA in their measurement model.

Included and Excluded Studies

For our pilot study, we conducted a forward search on Web of Science, resulting in 2,046 records. After removing non-English papers and duplicates, 1,555 abstracts were screened, and 148 primary studies were excluded. Full-text screening resulted in the elimination of 1,316 records, leaving 91 studies for analysis. Finally, a backward citation search on these 91 studies returned 26 additional articles. Two reviewers evaluated a random set of 100 abstracts and resolved 16 disagreements by discussing and clarifying the exclusion criteria. The first reviewer then evaluated the remaining studies based on the agreed criteria.

Data Extraction

Extracted data points include the correlation coefficients among CA dimensions, correlation coefficients between CA and other measured variables, reliability measures for each dimension and variable measured, type of IS (hedonic, utilitarian, or both), and the nature of use (voluntary or mandatory). Data extraction coding for the type of IS and the nature of use was evaluated by a second reviewer for a subset of 10 studies with no disagreements.

Seventy-one of the 117 selected papers could not be included in the analysis of CA dimensions due to missing correlation data of first-order constructs. From the remaining 46 papers, we collected 259 effect sizes from a total sample of 94,786 participants for this analysis.

Analysis

As an initial step, we focused on the correlations across the CA dimensions to identify differences based on other study variables. We designed the analysis based on the random effects (RE) model, assuming that the source of variability across studies originates from contextual differences in the studies. In cases where a high heterogeneity can be expected, a RE model is suggested (Card 2012, p. 341).

Still, when the number of included primary studies is small, and heterogeneity is high, the estimator may be biased (Hartung and Knapp 2001). It can be reasonable to expect a considerable between-study heterogeneity from the set of included sources in this review since they focus on different IS use contexts, use different participant sets, and test their models on different technologies.

Measurement errors are considered using an artifact adjustment procedure that adjusts the reported correlation values using the reported reliability scores (Baugh 2002). Following adjustments, a Fisher-z transformation is applied to the effect sizes. At the end of the analyses, the grand averages are converted back to normal correlations through inverse z transformations. Considering our expectations regarding high heterogeneity, Knapp-Hartung adjustments are used in confidence interval calculations.

The analysis procedure was applied to 46 primary studies as a proof-of-concept, using the R package *metafor*. As a next step, we will apply the two-stage meta-analytic

structural equation modeling (TSSEM) (Lowry et al. 2023) to investigate CA's relationships with other constructs in its nomological network.

PRELIMINARY RESULTS

The systematic literature search plotted a snapshot of the research stream mentioning CA in any way. Thirty percent (30%) of excluded studies cited Agarwal and Karahanna (2000) in their introduction section only, whereas 27% cited it only in their hypothesis development to support their arguments. Furthermore, 20% of the screened studies cited Agarwal and Karahanna (2000) in their methods section as the source of the measurement items of TAM variables, namely perceived usefulness and perceived ease of use. Many studies cite Agarwal and Karahanna (2000) in discussing future research opportunities and another body of research that proposes or uses a different operationalization for CA (7% and 6%, respectively).

Studies Using Only Several Dimensions of CA

We found that researchers do not always follow the exact construct definition and dimensionality suggested by Agarwal and Karahanna (2000). Some pick several dimensions of CA and use them to measure CA. More interestingly, even though they select the same subset of CA dimensions in their measurement model, in some cases, their justifications differ, and even conflict.

The justifications regarding the removal of a dimension of CA from the measurement model can be grouped into two categories. Eleven studies in the first group assume that the dimensions of CA correlate as expected; thus, they consider each dimension equivalent, whereas the second group of studies (n=20) implies that the dimensions of CA are not the same. Among the studies in the second group, there are various explanations for the authors' reasoning for modifying the measurement model. These include a dimension not being relevant to the study's context (e.g., Lee et al. 2016), empirical results of previous studies (e.g., Hou et al. 2019), or theoretical explanations on the nature of causality among the dimensions (e.g., Suh et al. 2017).

Correlations Among the CA Dimensions

Based on our preliminary proof-of-concept analysis of the correlations among the CA dimensions, the control dimension correlates weaker, compared to others. Except for correlations involving control and temporal dissociation dimensions, most of the confidence intervals for corrected correlations included values greater than .7, an acceptable internal consistency reliability level. Similarly, all inter-item correlations are higher than .3, a suggested threshold for removing items from a construct's measurement model (Boateng et al. 2018). As a follow-up, we will conduct a subset analysis based on the study context and the IS type, e.g., hedonic or utilitarian.

DISCUSSION AND FUTURE OUTLOOK

The current state of this study has some shortcomings to be addressed. Therefore, before discussing the potential implications of the results, this section starts with the limitations of the current version. Firstly, in the current pilot study, we relied on Web of Science's citation tracking feature only. To account for possible selection bias, we will identify a set of keywords from the currently identified papers, and run keyword searches on more databases.

Another limitation is publication bias, the idea that published studies tend to be biased toward significant results and greater effect sizes (Adams et al. 2017). We aim to address this issue by including grey literature and reaching out to known researchers for unpublished data.

Implications for IS Publications

Although 117 papers were eligible according to our exclusion and inclusion criteria, only 46 reported necessary correlation figures of the first-order constructs. Turner et al. (2010) also report having similar difficulties in their meta-analysis on the relationship between TAM and actual use, where they had to exclude several studies due to missing correlation matrices (Turner et al. 2010, p. 468).

The common omission of key statistical data, such as correlation figures, in IS research limits the field's ability to perform thorough meta-analyses. We suggest the adoption of stricter reporting standards to ensure comprehensive data availability.

CONCLUSION

Cognitive absorption (CA) is a construct with great potential in the days of increasingly more interactive and immersive IT artifacts. In this work-in-progress literature review, we demonstrated our meta-analysis to identify the moderating effects on the dimensional structure of CA.

The population correlation estimates for the dimensions of CA show that two dimensions, control and temporal dissociation, may be less correlated to the other three. However, the preliminary results are not conclusive due to potential publication bias. We aim to pursue this research further and contribute to the theoretical developments related to rich measurements concerning the use of IS.

REFERENCES

Adams, R. J., Smart, P., and Huff, A. S. 2017. "Shades of Grey: Guidelines for Working with the Grey Literature in Systematic Reviews for Management and Organizational Studies: Shades of Grey," *International Journal of Management Reviews* (19:4), pp. 432–454.

Agarwal, R., and Karahanna, E. 2000. "Time Flies When You're Having Fun: Cognitive Absorption and Beliefs about Information Technology Usage," *MIS Quarterly: Management Information Systems* (24:4), pp. 665–694.

Baugh, F. 2002. "Correcting Effect Sizes for Score Reliability: A Reminder That Measurement and Substantive Issues Are Linked Inextricably," *Educational and Psychological Measurement* (62:2), Sage Publications Sage CA: Thousand Oaks, CA, pp. 254–263.

Boateng, G. O., Neilands, T. B., Frongillo, E. A., Melgar-Quiñonez, H. R., and Young, S. L. 2018. "Best Practices for Developing and Validating Scales for Health, Social, and Behavioral Research: A Primer," *Frontiers in Public Health* (6), p. 149.

Card, N. A. 2012. *Applied meta-analysis for social science research*, Methodology in the social sciences, New York: Guilford Press.

Davis, F. D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly* (13:3), Management Information Systems Research Center, University of Minnesota, pp. 319–340.

Hartung, J., and Knapp, G. 2001. "A Refined Method for the Meta-Analysis of Controlled Clinical Trials with Binary Outcome," *Statistics in Medicine* (20:24), pp. 3875–3889.

Hou, A. C. Y., Shiao, W.-L., and Shang, R.-A. 2019. "The Involvement Paradox: The Role of Cognitive Absorption in Mobile Instant Messaging User Satisfaction," *Industrial Management & Data Systems* (119:4), pp. 881–901.

Lee, Y.-H., Dunbar, N., Kornelson, K., Wilson, S. N., Ralston, R., Savic, M., Stewart, S., Lennox, E., Thompson, W., and Elizondo, J. 2016. "Digital Game Based Learning for Undergraduate Calculus Education: Immersion, Calculation, and Conceptual Understanding," *International Journal of Gaming and Computer-Mediated Simulations* (8:1), pp. 13–27.

Lowry, P. B., Moody, G. D., Parameswaran, S., and Brown, N. 2023. "Examining the Differential Effectiveness of Fear Appeals in Information Security Management Using Two-Stage Meta-Analysis," *Journal of Management Information Systems (JMIS)*(10-Apr-2023).

Suh, A., Cheung, C. M. K., Ahuja, M., and Wagner, C. 2017. "Gamification in the Workplace: The Central Role of the Aesthetic Experience," *Journal of Management Information Systems* (34:1), pp. 268–305.

Thomas, P. 2006. "Cognitive Absorption: Its Antecedents and Effect on User Intentions to Use Technology," *AMCIS 2006 Proceedings*, p. 147.

Turner, M., Kitchenham, B., Brereton, P., Charters, S., and Budgen, D. 2010. "Does the Technology Acceptance Model Predict Actual Use? A Systematic Literature Review," *Information and Software Technology* (52:5), pp. 463–479.

Wakefield, R. L., and Whitten, D. 2006. "Mobile Computing: A User Study on Hedonic/Utilitarian Mobile Device Usage," *European Journal of Information Systems* (15:3), pp. 292–300.

