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# Coherence, Richness and Cognitive Absorption in Website Design

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## ABSTRACT

Kaplan's theory on environmental preferences can offer a holistic perspective on cognitive absorption in e-commerce website design. Drawing on Kaplan's theory, this paper proposes that coherence and richness of a website can enhance cognitive absorption of users. The findings from our study not only support the hypotheses, but also suggest that coherence and richness can reach an optimal proportion in website design, after which they are inversely correlated.

## Keywords

Coherence, complexity, cognitive absorption, website design.

## INTRODUCTION

Poor website design is associated with monetary loss (Kalonatchi, 2015). Cyr, Head, Larios, and Pan (2009) provide suggestions for the use of images that are capable of stimulating affective reactions in website users. In addition, research on visual effects of websites suggests that treating a website as a cognitive map or landscape facilitates user browsing behavior (Tan & Wei, 2006) and revisits of the website (Rosen & Purinton, 2004). Hence, website design should incorporate elements that go beyond a utilitarian perspective by creating user interfaces that are motivating and engaging. Such websites would encourage exploration and experimentation that lure users into a state of deep involvement termed cognitive absorption (Agarwal & Karahanna, 2000).

Previous research that has examined richness and order of elements in website design has drawn on Kaplan's theory on environmental preferences (Kaplan, Kaplan, & Ryan, 1998; Lee & Kozar, 2009; Brunner-Sperdin, Scholl-Grissemann, & Stokburger-Sauer, 2014). We reviewed relevant prior literature related to Kaplan's work in visual representation as well as the literature on cognitive absorption and technology acceptance model (TAM) to develop the hypotheses for this research. The results of the study are presented along with their implications.

## LITERATURE REVIEW

Studies on website design identified orientation as instrumental in understanding user navigation (Danielson,

2003). Danielson (2003) suggests that the mental model of a website is influenced by several factors including website richness, i.e. the variety of media cues that entices exploration, and the global coherence of the website. Danielson (2003) also indicates that more locally focused navigation design can increase the perceived global coherence of a website. In order to cope with potential user disorientation, it is suggested that the information presented on a website should be split into clearly separate regions to facilitate user navigation (Jarvenpaa & Todd, 1997). In addition, the organization of a website was found to influence website effectiveness and users' attitudes. Research suggests that well-designed websites can reduce disorientation (Webster & Ahuja, 2006).

## Kaplan's Position on Environmental Preferences

Kaplan and her colleagues (1998) have extensively studied the relationship between people and the surrounding environment. Central to their research framework is the notion of information. Information about living, food, family, opportunities, etc. is considered "inescapable, essential and pervasive" (Kaplan, Kaplan, & Ryan, 1998). Kaplan's research emphasizes that people are surrounded by information that generate their mental maps. This information can come from friends, relatives, etc., or can simply exist in people's mind from previous experiences. The environment provides information in various forms such as textual, sounds, pictures, and icons. Such information is intrinsically related to elements composing the environment. Kaplan argues that the way elements of an environment are related to one another is essential for people's ability to understand and explore the environment. Kaplan proposes a framework known as the preference matrix (Table 1) that explain people's preferences based on the content and organization.

Based on Kaplan's work, coherence depicts an orderly setting organized in clear areas, of which one can easily understand, whereas richness refers to the variety of elements in a setting that encourages exploration of the setting. Legibility defines the property of a setting having memorable distinct components, where one can find one's way back easily. Finally, mystery defines the property of a setting that suggests more are to be discovered or seen. In the context of our research on two-dimensional websites, coherence and richness are most relevant.

	UNDERSTANDING	EXPLORATION
2 D	Coherence	Exploration
3 D	Legibility	Mystery

(Adopted from Kaplan et al. 1998)

**Table 1. Preference Matrix**

### Cognitive Absorption

Cognitive absorption is defined as a “state of deep involvement” (Agarwal & Karahanna, 2000, p. 665). The state of cognitive absorption has been used in the IS literature with the purpose of describing broad experiences related to IT usage. The underlying dimensions of cognitive absorption are: (1) temporal dissociation – lose the passage of time while engaged in an interaction; (2) focused immersion – total engagement while other attention demands are ignored; (3) heightened enjoyment – experiencing joy in the interaction; (4) control - be in charge of the interactions, and (5) curiosity - arouse an individual’s strong desire to learn something.

### Technology Acceptance Model

TAM is among the most acknowledged models for predicting intentions to use a system. TAM (Davis, 1989) and related models have been demonstrated to clarify and explain IT use in a variety of contexts. The core structure of TAM suggests that perceived ease of use influences perceived usefulness, and both perceived ease of use and perceived usefulness determine user intention to use a particular system. TAM has been studied in a profusion of environments including online shopping.

In this research, we explore if Kaplan’s findings related to two-dimensional visual representations of natural environments can act as antecedents for cognitive absorption in the context of website design, and whether cognitive absorption that arises from website design influences two core constructs of TAM, perceived usefulness and perceived ease of use, that are part of the nomological network for cognitive absorption.

### KAPLAN’S THEORY AND COGNITIVE ABSORPTION

Kaplan and her colleagues (1998) assert that essential to the management of information conveyed by two-dimensional visual representations are understanding and exploration. Previous research has termed coherence as the orderly organization in the clear areas of a website (Rosen & Purinton, 2004; Lee & Kozar, 2009) that entices the creation of cognitive maps to help users easily make sense of an environment and navigate through it. As a part of the sense-making mechanism, coherence has been shown to influence emotional states (Brunner-Sperdin, Scholl-Grissmann, & Stokburger-Sauer, 2014). The easiness of making sense of an environment can be associated with a high level of engagement or cognitive absorption. Moreover, coherence influences cognitive

appraisals (Lee & Kozar, 2009). Therefore, we hypothesize that:

H1: Website coherence is positively associated with cognitive absorption.

Webster and Ho (1997) have demonstrated that the incorporation of a variety of elements in a visual representation such as two-dimensional websites can result in a state of engagement. A similar suggestion is made by Kaplan who noted that the richness of the elements in a setting encourages exploration. Such exploration would trigger emotional states such as pleasure and arousal (Brunner-Sperdin, Scholl-Grissmann, & Stokburger-Sauer, 2014). Hence, exploring rich content of two-dimensional websites can induce cognitive absorption. Therefore, we hypothesize that:

H2: Website richness is positively associated with cognitive absorption.

### COGNITIVE ABSORPTION, PERCEIVED EASE OF USE, AND PERCEIVED USEFULNESS

Research on cognitive absorption suggests that both website technical characteristics (Visinescu, Sidorova, Jones, & Prybutok, 2015) and website non-technical characteristics (Agarwal & Karahanna, 2000) affect the state of cognitive absorption. Such non-technical characteristics included in the nomological network for cognitive absorption are perceptual constructs, behavioral constructs, and individual user characteristics. For a more comprehensive list of constructs associated with the nomological network for cognitive absorption, please refer to Agarwal & Karahanna (2000).

TAM shows that perceived ease of use influences perceived usefulness; they also both influence attitude toward using a system (Davis, 1989). As the core of TAM has been successfully tested in online environments, we focus only on the antecedents of perceived ease of use and perceived usefulness in this research. Our purpose is not to test the entire TAM model, which has been tested in multiple contexts. Previous research suggests that cognitive absorption is an antecedent of TAM (Chandra, Theng, Lwin, & Shou-Boon, 2009). Therefore, cognitive absorption has a positive effect on perceived ease of use and usefulness.

H3: Cognitive absorption is positively associated with perceived ease of use.

H4: Cognitive absorption is positively associated with perceived usefulness.

Research using the cost-benefit paradigm suggests that perceived website usefulness is associated with the benefit gained while visiting a website, and website ease of use is associated with a reduction in the cognitive effort while visiting a website (Visinescu, Sidorova, Jones, & Prybutok, 2015). In addition, the relationship between perceived ease of use and perceived usefulness has been

successfully tested in the context of IT usage (Agarwal & Karahanna, 2000). Therefore, we propose that:

H5: Perceived ease of use is positively associated with perceived usefulness.

## METHODOLOGY

In order to empirically test the hypotheses implied by our research model, we carried out a survey study using students at a large state university as the subjects. We selected several e-commerce websites for use in this research. The websites were selected by the authors of this research with Kaplan's definitions of coherence/order and richness in mind. We selected a number of e-commerce websites that have different levels of coherence and richness. Students were informed that there is no wrong or right answer to the survey and the students were offered credit points for their participation in this study. We randomly assigned the students to the selected websites and received 268 usable responses. Each participant was asked to browse the website and select two products that he/she would buy, after which he/she would be directed to a survey questionnaire. In the survey questionnaire, we measured all the research variables using multiple item scales by adapting them from Davis (1989), Agarwal and Karahanna (2000), and Rosen and Purinton (2004).

## RESULTS

We used a variance based structural equation modeling, partial least squares (PLS), approach to test the hypotheses and establish the nomological validity of our constructs. The assessment of the measurement model includes reliability checks, as well as the convergent and discriminant validity for the constructs. The Cronbach's alpha coefficients and the composite reliability for the measured constructs exceed the minimal threshold of 0.7. The square roots of the average variance extracted (AVE) for each construct is larger than the inter-construct correlations. All the AVEs are more than the minimal threshold of 0.5. The item cross-loadings support the convergent and discriminant validity. The results are presented in Figure 1.

All the p-values for our hypotheses are smaller than 0.01, thus lending support for our research model. The more coherent a website is, the higher the cognitive absorption that is experienced by users. Hence, when one navigates a website organized in clear areas of which one can easily make sense, one is more enticed to be absorbed during website browsing. Similarly, a rich website enhances the user's temptation to further explore the website. Looking at the values of path coefficients for coherence and richness on cognitive absorption, it seems that there is a "golden proportion" of coherence and richness embedded in the e-commerce websites. We found that richness and coherence can both increase until they reach a certain point where after this point, richness and coherence

become inversely correlated, suggesting that an optimal point is reached in balancing richness and coherence.

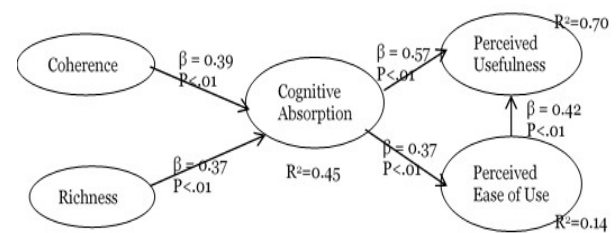


Figure 1. Research Model and Results of Hypothesis Testing

## CONCLUSION

Our research combines Kaplan's theory on environmental preferences of visual representations with the theory on cognitive absorption. While we acknowledge potential weaknesses and limitations of our study, we operationalized two new constructs, coherence and richness, based on previous research. We further explored the sensitivity of their measurements to changes in website design and found that they are effective in distinguishing between different types of design. Both constructs, coherence and richness of websites, explain cognitive absorption of users. However, our results show that there is trade-off between the coherence and richness of a website, and practitioners should bear this trade-off in mind while designing websites. Hence, Kaplan's theory is applicable to website design and can be used to explain cognitive absorption of user experience in the e-commerce context.

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