



Design-to-lure in the e-shopping environment: A landscape preference approach



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ABSTRACT

With the increasing popularity of online shopping, e-shoppers have been provided with a new medium for making purchases and this has attracted increasing attention from researchers and practitioners. Researchers are challenged to understand what constitutes a theoretical model for website design research. In exploratory work, we employ Kaplan and Kaplan's landscape preference model involving coherence, legibility and complexity, and investigate their relationship to trust and satisfaction and their impact on e-shoppers' willingness to buy. Data from a survey of 300 shoppers were used to validate the model. A multi-group analysis with gender was further used to cross-validate it. The results show that trust and satisfaction are great influences of willingness to buy. Coherence and complexity have great influences on trust and satisfaction, but legibility only has adequate influences on these two variables. The structural weights are invariant across different gender subgroups. Implications for researchers and practitioners are also discussed.

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1. Introduction

The realization of the remarkable benefits brought by the Internet depends on the willingness of e-customers to use websites to transact business. Evidence reveals that web surfers are satisfied with fast load website. When business takes place online, the Internet environment where the e-vendor is faceless does not allow e-shoppers to inspect products or interact with the customer receptionist. Thus, without an appealing storefront or store image, e-shoppers find it difficult to evaluate whether e-vendors will deliver on their commitments [19]. Consequently, e-shoppers become reluctant to engage in transacting with e-vendors [1,32].

The concept of website design is explored in this research because website design has the potential of making e-shoppers decide whether or not they will use the site in the future. When e-shoppers first engage with an unfamiliar website and the website itself is not logical to shoppers, the way that website design makes e-shoppers willing to use a website and make a purchase with e-vendors is critical [10]. For this reason, website design plays an important role in inducing e-shoppers to transact with e-vendors and is thus critical to the success of an e-vendor in attracting

e-shoppers [13]. Essentially, e-shoppers rely on a website's appearance, symbols, colors or whatever information it has, to arouse the willingness to purchase [21].

Lack of good design on a website makes e-shoppers hesitate before transacting with e-vendors [22]. Compounding this issue, there are studies examining e-stores as an environment or landscape affecting shopping behavior [11]. A "pleasant" environment influences shopping behavior variables, such as unplanned spending, duration of store visit and social interaction. Thus, e-shoppers react negatively when put in an unpleasant web environment. Consequently, they will not bring any benefits such as sales to e-vendors [37]. Furthermore, when the website is viewed as a physical landscape [12], people wish to make sense of and get involved with their landscapes. When e-stores do not make sense to e-shoppers, they will not generate higher e-customer response in the form of higher sales volume.

Website designers have analyzed the web in terms of design aesthetics to ensure that the web gives e-shoppers an enjoyable experience [28]. Researchers have stressed design aesthetics, such as a mixture of colors, shapes, language, music or animation, as an important tool in producing effective website design. In another vein, some researchers are investigating the concept of usability and how usability impacts on e-customer behavioral intentions such as the reinforcement of e-loyalty [30]. Moreover, perceived risks as well as uncertainty when interacting with e-vendors [19] are also related to website design. These research topics originate

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from the difference between e-vendors and brick-and-mortar vendors. Surprisingly enough, the use of a theoretical model in website design to study e-customer behavior is very scarce, making it an interesting research problem to address.

A particular approach to the web – landscape preference – was chosen for the following reasons. Landscape preference is an evaluation on how people perceive the surrounding environment and what preferred landscape is for people in mind [12]. Landscape preference views that environments could provide information in many different ways, such as icons, signs, words or non-words. Designing web content is very similar to designing a physical landscape [27]. The Kaplan and Kaplan's framework of landscape preference [12] provides some guidelines for designing an effective web landscape. From the literature point of view, very few studies focus on the impact of landscape preference in website design on e-shopper behavioral intention and they rarely use such a theoretical model to empirically investigate how such a website design model affects e-shoppers' cognitive perceptions. Then, from an understanding of marketing strategies, the problem of how to convert web surfers into actual buyers is important. The success of e-vendors depends on this conversion. Finally, for web developers, web design features should not be just limited to technology-driven or service quality-enhancing features, but should be extended to a cognitive approach that may also ultimately and effectively lead to continued visits and repeat business. A website with a landscape preference is really a lens into a better understanding of what constitutes a high quality, yet interactive, website design. In addition, from cognitive psychology, environmental psychologists such as Kaplan and Kaplan [12] suggest that the concept of landscape preference can increase our understanding of how the interactive experience can be gained in such a setup [12]. What entails an interactive experience is often a pleasant feeling [37] and subsequently purchase behavior [22]. Thus, an investigation from the perspective of cognitive psychology is clearly one way of examining the development of effective web design. We propose a research model, developed from existing research, explore and validate the path factors in landscape preferences that affect the cognitive perceptions of e-shoppers and their impact on e-shoppers' willingness to buy.

The remainder of this paper is organized as follows. In keeping with existing research, we felt that the cognitive aspect of website development is important and may have implications on e-shopper behavioral intentions. Thus, we summarize the relevant literature and develop our hypotheses in Section 2. Then, Section 3 explains the research methodology and introduces the experiment, followed by Section 4 which provides the results of the model. Section 5 gives a discussion of the results and of the implications as well as potential limitations of the study. Finally, Section 6 concludes this paper.

2. Literature

Relevant works on utilizing the principles of landscape preference to construct theories about websites are scarce in the literature. So as to complement the literature, the present study identified those components that a website should incorporate especially when it is designed along these principles. Based on prior works, three components were identified: coherence, legibility, and complexity. Although these variables were identified and their effectiveness was supported by relevant literature [27], the efficacies of these design components in making the site effective and in generating higher customer response in the form of a behavioral intention to purchase were still not clearly understood.

2.1. E-shopping behavior intentions

The research on e-commerce is extensive and online behavioral intentions such as purchasing have remained one of the fastest growing areas of Internet research [9,15]. This is the case because the Internet environment is enabled by information technology and numerous studies of technology acceptance have measured behavioral intentions rather than behaviors [15]. More importantly, Venkatesh and Davis [33] confirmed a strong correlation between behavioral intentions and actual behaviors. In addition, Mcknight et al. [23] defined e-shopping behavior intentions as anyone who is willing to transact with the vendor through the web. To purchase, a customer needs to share personal information, such as name, telephone numbers, address, and credit card numbers. In this situation, the customer must have shopping behavior intention and then provide personal information to the website.

For most shopping sites, the major objective is to persuade e-shoppers to make a purchase [32]. That e-shoppers purchase may be a result of high trust and high satisfaction. Moreover, antecedent factors within the trust and satisfaction domains are also effective at luring e-shoppers and converting visitors into buyers. Addressing technology-based factors such as social presence [9], cognition-based factors such as information quality [15], and institutional-based factors such as reputation [5], researchers found these variables to have a significant effect on developing consumer trust [23]. This rationale taps into the traditional online shopping sequence (e.g. [15]).

The development of trust and satisfaction has been shown to be sensitively associated with various website design factors by prior studies. Moreover, as confirmed by Cyr [5], trust and satisfaction are recognized as imperative antecedents to online purchasing in different cultures (i.e. Indian and Hong Kong) and closely related to website success or effectiveness. Hence, we wish to test their relationships to a willingness to shop, but in another culture (i.e. Taiwan). Collectively, our understanding of other website design factors and their research focus has been enriched as shown in Appendix A.

2.1.1. Trust in e-shopping

Trust is the basic connection in human society, the essential factor between interpersonal cooperation, and is also the primary mechanism in many economical activities. Evidence suggests that consumers often hesitate to transact with e-retailing because of uncertainty about vendor behavior [2] or the perceived risk of having personal information stolen by hackers [19]. Trust plays a central role in helping consumers overcome perceptions of risk and insecurity. Trust makes consumers comfortably share personal information, make purchases, and act on web vendor advice—behaviors essential to widespread adoption of e-commerce. As for antecedent factors of trust, Walczuch and Lundgren [34] indicated that psychological antecedents such as reputation and word-of-mouth can be used to build consumer trust in e-retailing. Thus the following hypothesis was tested:

H1. Higher perceived trust will result in higher willingness to shop on websites.

2.1.2. User satisfaction in e-shopping

In another vein, Zviran et al. [38] tested the effect of user satisfaction on the acceptance of e-shopping in the technology sector. It was found that satisfaction significantly influences e-shopper online buying behavior. Li and Yeh [18] found satisfaction to be the main variable influencing customer buying decisions in mobile commerce. This point of view was also posited by [35]. Other antecedent factors of satisfaction in relevant fields from the utility aspect such as convenience and usability and perception

aspect such as site design and security were identified. Thus the following hypothesis was tested:

H2. Higher perceived satisfaction will result in higher willingness to shop on websites.

2.2. Cognitive landscape as website design

Based on the concept of physical landscape, the concept of landscape preference examines physical environments in an attempt to create patterns for environmental design that include end user environmental cues, making it easier for people to process information easily and effectively [12]. Applying cognitive psychology, Kaplan and Kaplan [12] found that through information stimuli such as signs, icons, or text embedded in the physical landscape, people form a cognitive map, a mental representation of the real environment at a particular moment in time. Cognitive maps are also known as mental maps, cognitive models, or mental models [36]. This concept has been widely used in web site usability and navigation systems [36–38]. Cognitive map can be recognized as a basic comprehension of the structure of the web site. A cognitive map enables people to make sense of the landscape or environment. This map influences “how the landscape feels to that person, what is noticed, and what is ignored” [12]. Moreover, Kaplan and Kaplan [12] suggested that the cognitive map must be extended to include peoples’ motivation to use and process information. Recent researchers have suggested that the cognitive map undergoes a quick but sequential formation during the process of extension [16]. Lack of a map extension may cause people to have trouble understanding information.

The structure of a cognitive landscape can be analyzed in a 2×2 (making sense vs. involvement) \times (two-dimensional vs. three-dimensional) perceptual structure. Based on Kaplan [12], in a two-dimensional environment, a cognitive landscape represents an immediate assessment of such an environment. Someone making sense of the environment is able to comprehend the surroundings and to understand the current setup, often in a larger situation as well. That person becomes involved with the environment and has his/her interests maintained if the environment is supported with rich elements. Therefore, in a supportive environment with rich elements, the process of making sense takes stimuli to make it easier to characterize and summarize (coherence) and makes the subject sustain his/her interest (complexity). However, such a 2-dimensional setting is not sufficient to activate someone’s cognitive map.

The making of an immediate assessment is tracked by [12]. The cognitive landscape moves from 2-dimensional (coherence and complexity) to 3-dimensional (legibility and mystery). To penetrate deeper in the cognitive landscape, the environment must help the subject stay oriented (legibility) and provide perceived curiosity and fancy (mystery).

Finally, Rosen and Purinton [27] served as a catalyst to our study. They incorporated the concept of a cognitive landscape into website design. Based on the argument that humans are cognitive creatures and the Internet is an information-laden environment, they suggested that guidance in designing a physical landscape is also applicable to the online environment. Rosen and Purinton [27] used a modified Preference Framework, based on a cognitive landscape [12], to provide guidance on designing cognitive landscapes. According to the Preference Framework, a cognitive website must accommodate three components: coherence, complexity and legibility. The focus of this research is to investigate how these cognitive variables will be used to facilitate e-shopper information processing and to demonstrate how e-shoppers can use information to satisfy their need to make sense of and explore

an uncertain cyber world. Ultimately, a positive overall website impression will in turn influence e-shoppers’ willingness to purchase.

2.2.1. Coherence

Coherence refers to the ability of a website to provide consistent and meaningful information organized in an orderly and structured way [12]. While these features allow e-shoppers to easily feel and to correctly understand the design of the website, they also facilitate the shopping process. To do this, e-vendors commonly use similar design aesthetics such as layout, color, font as well as frames across web pages to enable e-customers to have a consistent experience across web pages when surfing. Using a website as a storefront, e-vendors often use an encryption mechanism or guarantees of satisfaction or a refund policy to enhance e-customers’ trust in conducting transaction activity. Since it is true that e-customers are often already interested in receiving company or product information, it is not uncommon to find that an e-vendor uses its reputation (i.e. awards in relevant fields) to assure e-customer confidence. From an e-vendor’s point of view, its store image should resonate on the site and its messages should also be clearly communicated to e-customers. This result in higher trust and more satisfaction [38] for e-shoppers when they are on a website, which further makes e-shoppers more willing to provide their personal information such as date of birth and credit card information to e-vendors to complete the transaction [23]. We therefore propose the following hypotheses:

H3a. Higher perceived coherence of websites will result in higher trust in e-vendors.

H3b. Higher perceived coherence of websites will result in higher satisfaction with e-vendors.

2.2.2. Legibility

Legibility is defined as the ease of navigation around a website [17]. Legibility can be seen as low disorientation of navigation in a website. To measure the legibility, one can examine apparent efficiencies in user navigation. Tools such as value-added search engine, landmarks, appropriate hyperlinks or frames are seen as essential to help a website become navigational. Effective use of these tools in a website that is designed on one page or screen result in low error rates and less disorientation, which allow e-shoppers to efficiently find what they want [17]. Retrieving desired information easily and quickly can be a reason for e-shoppers to stay longer on a website. They will also stay longer on websites that have light cognitive load and create enjoyment and satisfaction [16]. Hence, it seems that e-shoppers will be more willing to place trust on a website that can be easily and quickly navigated to find the desired information with minimum effort. E-shoppers will also have higher satisfaction when their needs are satisfied with less disorientation and more enjoyment [38]. Therefore, we hypothesize that:

H4a. Higher perceived legibility of websites will result in higher trust in e-vendors.

H4b. Higher perceived legibility of websites will result in higher satisfaction with e-vendors.

2.2.3. Visual complexity

Visual complexity is defined as the ability of a website to provide diverse website components capable of creating vivid interaction and arousing e-shoppers’ interest [27]. E-shoppers are generally impatient. Geissler [10] suggested five to thirty seconds as a rule of thumb for website designers to grab an e-shopper’s

attention. Once they feel bored, e-shoppers simply leave the site. Because of this, there are various website design components that help e-shoppers develop a sense of presence in the Internet environment. For example, some information or images about the product and bestseller are provided to increase sociability. In some popular young adult clothes websites, such as Abercrombie & Fitch (A&F) or ASOS, they introduce their products by vivid product photos. In social presence perspective, using image communication has better effect than using text-only communication [7]. Moreover, video clipping enabled by Youtube having a real sales person introduce the product can be found to deepen engagement. By combining these, e-shoppers have a more pleasant experience and have a positive attitude toward e-vendors. Thus, it can be reasoned that e-shoppers will have more trust in a website that allows them to gather more useful product information or relevant images. Similarly, e-shoppers will have more satisfaction for the same reasons. Hence, we hypothesize that:

H5a. Higher perceived visual complexity of websites will result in more trust in e-vendors.

H5b. Higher perceived visual complexity of websites will result in higher satisfaction with e-vendors.

3. Research methodology

3.1. Instrument development and subjects

To develop the instruments, we conducted a literature review to ensure that the questions posed are representative. However, since cognitive landscape applied to IS research is still scarce, we employed some constructs from generally accepted concepts of landscape preference and made some modifications to reflect the research context. As a result, constructs of coherence, legibility, visual complexity, trust, satisfaction and willingness to buy were used and 18 items were generated. They are listed in [Appendix A](#) along with corresponding literature sources.

Both a pre-test and a pilot test were conducted to ensure the clarity of content and appropriateness of aspects. The pre-test involved three respondents who were experts in the field of e-commerce. Respondents were asked to comment on the length of the instrument, wording, and item order. Then, a pilot test involving 50 subjects selected from one of the two previously selected universities in northern Taiwan was conducted to ensure the clarity of content. All items that were included were measured on a five-point Likert scale, ranging from “strongly disagree” (1) to “strongly agree” (5).

According to a Taiwan national survey [26], 70.2% of Internet users are concentrated in northern Taiwan and 90.2% of Internet users are college students. Since [5] advocated the use of students for e-commerce research, in order to exploit our research resources, we chose two universities in northern Taiwan as our research samples. These two universities are located in two different cities, which have 75.9% and 75.5% Internet adoption rates, ranked 1st and 2nd among cities in Taiwan. After obtaining permission from class instructors, information such as the background and purpose of the research as well as a questionnaire hyperlink were emailed to 450 students enrolling at undergraduate level and graduate level on IS classes between October 2009 and November 2009. To increase response rate, subjects were incentivized with extra credit for their course. For those who volunteered and reported having at least one online shopping experience are based on five popular categories (i.e. clothing/accessories, books/magazines, booking of travel tickets and hotel, family items, and 3C products), we collected their demographic and questionnaire data online and data were saved on the web

server. A total of 300 (response rate of 66.7%) subjects successfully completed the survey. Compared with previous studies, this size of sample was suitable for further statistical analysis [5].

3.2. Experimental manipulations

The experiment consists of two steps. The first is presenting a purchasing scenario of an online travelling package to participants and next is asking them to make a purchasing of an online travelling package by browsing the selected e-travelling websites for at least 5 min before completing the questionnaire. The experiment has two questions for participants: (1) what was not included in today's promoted items on the frontpage? (2) What was the current targeted country for travelling?

All tasks were completed online to increase the realism of online shopping. [Appendix C](#) shows the scenario. The goal of the scenario was to stimulate participants' memory of navigating around these websites. We selected three online travel sites (<http://www.eztravel.com.tw/>, <http://www.settour.com.tw/>, and <http://www.liontravel.com/>) as targets for participants to navigate. These sites were well-known by the selected student subjects and were top-ranked in the field of travel. By selecting well-recognized websites, participants experienced less stress. Also, since participants are well familiar with these websites, the training time can be reduced.

The questionnaire comprised two parts. The first part was intended to measure potential e-shopper perception of each construct in the model. The second part recorded e-shopper demographic data. Demographics of the subjects are shown in [Table 1](#).

3.3. Instrument validity and reliability

Items selected for constructs were primarily adapted from prior studies to ensure the validity of content [4]. In our study, web site satisfaction is considered as a measure of the utility of an e-commerce web site and defined as the attitude toward the web site [24]. In Kaplan and Kaplan's model, coherence is to measure the ability of a website to provide consistent and orderly contents, structures, and multimedia components. E-shoppers can easily grasp the organization of a website by providing a common look and feel to each page, and this positively affects their attitude toward the website [16]. On the other hand, legibility is to measure the ease of navigating a site. So e-shoppers will be pleased when they can be navigated the website easily and quickly to find the information they want [16]. Complexity implies the website design contains a variety of images that satisfy the desire to explore the environment [27]. Using product images that fit the site content ties the complexity of the site to its content enhancing comprehensibility and encouraging rather than discouraging exploration. So e-shoppers wanted more visual effects and graphics as this would improve the online shopping environment [27]. Trust is based on the expectation that a trustee will act in the interests of the trustor without a guarantee and that it is involved with minimizing the risk of harm [37]. Finally, willingness to buy is based on trust and satisfaction. This includes willingness to pay to access information on the web site and has possibility to buy in this website [23].

In this research, constructs of coherence, legibility, complexity, trust, satisfaction and willingness to buy came from existing literature, which demonstrated strong content validity. [Appendix B](#) shows the 18 survey items used in the questionnaire.

Construct reliability was examined using Cronbach α -values. [25] recommends that α -values should be greater than 0.7 for items to be used together as a construct. As shown in [Table 3](#), α -values ranged from 0.906 (willingness to buy) to 0.816

Table 1
Demographics of subjects.

Measure	Items	All	Male	Female
Age	Below 20	2	1	1
	20–25	154	55	99
	26–30	128	70	58
	Over 30	16	5	11
Total		300	131	169
No. years shopping online	Years < 1	2	1	1
	1 ≤ Years < 3	197	75	122
	3 ≤ Years < 5	90	50	40
	Years ≥ 5	11	5	6
Total		300	131	169
No. purchases last year	1 ≤ Times < 3	2	1	1
	3 ≤ Times < 5	152	58	94
	Times ≥ 5	146	72	74
	Total		300	131

(complexity). Therefore, all constructs passed the test of construct reliability.

Construct validity examines the extent to which a construct measures the variable of interest and ensures that there are relatively high correlations between measures of the same construct (convergent validity) and low correlations between measures of constructs that are expected to differ (discriminant validity) [29]. An exploratory factor analysis with a varimax rotation was performed on 6 latent variables that correspond to 8 hypotheses [25]. Factor extraction was based on the existence of eigenvalues higher than 1. As a rule of thumb, a measurement item is highly loaded if its loading coefficient is above 0.6 and is not highly loaded if the coefficient is below 0.4 [14]. Table 2 shows that all loadings were well above 0.6 (convergent validity). There are some other ways to examine convergent validity. [14] proposed assessing three criteria: (1) all factor loadings should be significant at $P < 0.05$ and exceed 0.7, (2) the composite reliability of each construct should exceed 0.7, and (3) the average variance extracted (AVE) by each construct should exceed the variance due to the measurement error for that construct [14]. Table 3 shows all factor loadings that surpass 0.7 and are significant at $P = 0.001$. Composite reliabilities ranged between 0.86 to 0.92 and AVE values were well above 0.5. As shown in Table 3, all constructs demonstrated convergent validity on all three measures proposed by [14].

Table 2
Exploratory factor analysis.

Items	Coherence	Legibility	Complexity	Trust	Satisfaction	Willingness to buy
C-1	0.862	-0.037	-0.056	0.148	0.131	-0.005
C-2	0.842	0.074	0.044	0.119	0.190	0.151
C-3	0.815	0.82	0.120	0.098	-0.043	0.146
L-1	0.055	0.851	0.052	-0.013	0.041	0.099
L-2	-0.017	0.855	0.092	0.112	0.160	-0.026
L-3	0.069	0.822	0.064	0.139	0.092	0.110
CX-1	0.065	0.123	0.799	0.159	0.109	0.151
CX-2	0.045	0.051	0.835	0.219	0.083	0.120
CX-3	-0.006	0.049	0.818	0.024	0.181	0.171
T-1	0.124	0.086	0.174	0.835	0.060	0.217
T-2	0.201	0.097	0.128	0.861	0.094	0.173
T-3	0.100	0.096	0.138	0.794	0.305	0.170
S-1	0.085	0.196	0.160	0.050	0.844	0.128
S-2	0.101	0.088	0.121	0.194	0.810	0.350
S-3	0.161	0.075	0.175	0.256	0.776	0.318
WTB-1	0.135	0.016	0.155	0.272	0.221	0.800
WTB-2	0.073	0.105	0.212	0.157	0.235	0.847
WTB-3	0.139	0.115	0.171	0.180	0.254	0.842
Mean	3.54	3.66	3.44	3.55	3.48	3.46
SD	0.71	0.69	0.73	0.83	0.89	0.81

Table 3
Construct validity.

Construct	Items	Loadings	Cronbach's alpha	Composite reliabilities	Average variance extracted
Coherence	C-1	0.74	0.826	0.87	0.70
	C-2	0.81			
	C-3	0.79			
Legibility	L-1	0.74	0.818	0.87	0.70
	L-2	0.83			
	L-3	0.77			
Complexity	CX-1	0.79	0.816	0.86	0.67
	CX-2	0.79			
	CX-3	0.73			
Trust	T-1	0.82	0.877	0.87	0.71
	T-2	0.89			
	T-3	0.81			
Satisfaction	S-1	0.74	0.884	0.90	0.76
	S-2	0.91			
	S-3	0.89			
Willingness to buy	WTB-1	0.90	0.906	0.92	0.80
	WTB-2	0.86			
	WTB-3	0.85			

Table 4
Discriminant validity.

Discriminant validity	1	2	3	4	5	6
(1)Coherence	0.70	0.12 [*]	0.14 [*]	0.34 ^{**}	0.29 ^{**}	0.29 ^{**}
(2)Legibility	0.12 [*]	0.70	0.21 ^{**}	0.24 ^{**}	0.29 ^{**}	0.22 ^{**}
(3)Complexity	0.14 [*]	0.21 ^{**}	0.67	0.38 ^{**}	0.39 ^{**}	0.43 ^{**}
(4)Trust	0.34 ^{**}	0.24 ^{**}	0.38 ^{**}	0.71	0.44 ^{**}	0.50 ^{**}
(5)Satisfaction	0.29 ^{**}	0.29 ^{**}	0.39 ^{**}	0.44 ^{**}	0.76	0.59 ^{**}
(6)Willingness to buy	0.29 ^{**}	0.22 ^{**}	0.43 ^{**}	0.50 ^{**}	0.59 ^{**}	0.80

^{*}Denotes significance at the .05 level.

^{**}Denotes significance at the .01 level.

^{***}Denotes significance at the .001 level.

Discriminant validity was based on the principle that constructs differed from each other. By satisfying the criteria of [14] for discriminant validity, the squared correlations between items in any two constructs should be lower than the average variance shared by items within a construct. As shown in Table 4, the results showed that the squared correlations of each construct were less than the average variance extracted (AVE) by the indicators measuring that construct.

4. Results

To test the proposed hypotheses, the Structural Equation Modeling (SEM) approach was adopted, supported by AMOS 5.0 with a maximum likelihood estimation. SEM can simultaneously test structural and measurement models and provides a more complete analysis of the inter-relationships in a model [14]. SEM has received popularity in several fields including marketing, psychology, social science and information systems.

Results of SEM include two components: the measurement model and the structural model. The measurement model, giving relationships between latent variables and observed variables, aims to provide reliability and validity based on these variables. The structural model, on the other hand, studies the path strengths and direction of relationships among latent variables [14].

A confirmatory factor analysis was conducted to validate the measurement model. It was measured by examining if the measurement model has acceptable goodness-of-fit measures. Seven common model-fit measures were used to assess the model's overall goodness of fit: the ratio of χ^2 to degrees-of-freedom (d.f.), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), norm fit index (NFI),

root mean square error of approximation (RMSEA) and root mean square residual (RMR). These indices were employed to test the goodness-of-fit not only of the measurement model but also of the structural model. Overall, seven goodness-of-fit measures, as shown in Table 5, suggested that both models adequately fit the data, following the suggested cut-off value guideline (Fig. 1).

Fig. 2 shows the results of the structural model. The results in Table 6 show that all path coefficients of hypothesized causal links were significant. More precisely, coherence, legibility and complexity significantly influenced e-shopper trust and satisfaction and explained the variance of 35.7% in trust and 33.5% in satisfaction. Moreover, e-shopper trust and satisfaction were found to significantly influence e-shopper willingness to buy from an e-vendor. Approximately 51% of the variance in the willingness to buy online was accounted for by the variables of trust and

Table 5
Fit indices for the measurement.

	Recommended criteria	Measurement model	Structural model
$\chi^2/d.f.$	<3.0	1.52	1.68
GFI	>0.9	0.93	0.93
AGFI	>0.8	0.91	0.90
CFI	>0.9	0.98	0.97
NFI	>0.9	0.94	0.93
RMSEA	<0.08	0.042	0.048
RMR	<0.05	0.034	0.046

satisfaction in the model ($R^2 = 0.509$). Thus, hypotheses H1 through H8 were supported. All the R^2 of the endogenous constructs in the model exceed the 10% benchmark recommended by [14].

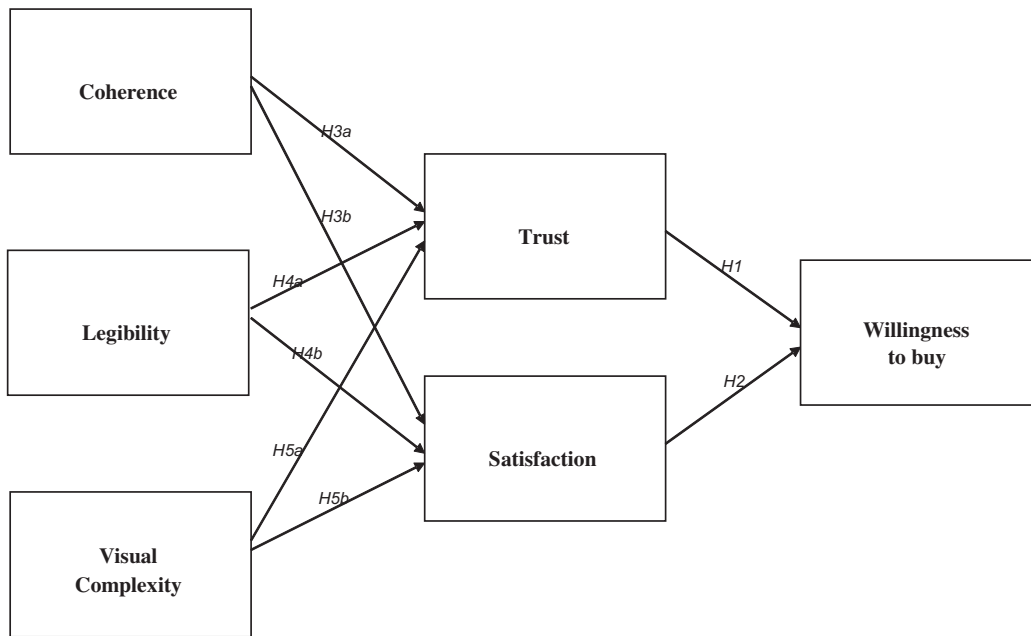


Fig. 1. Proposed research model.

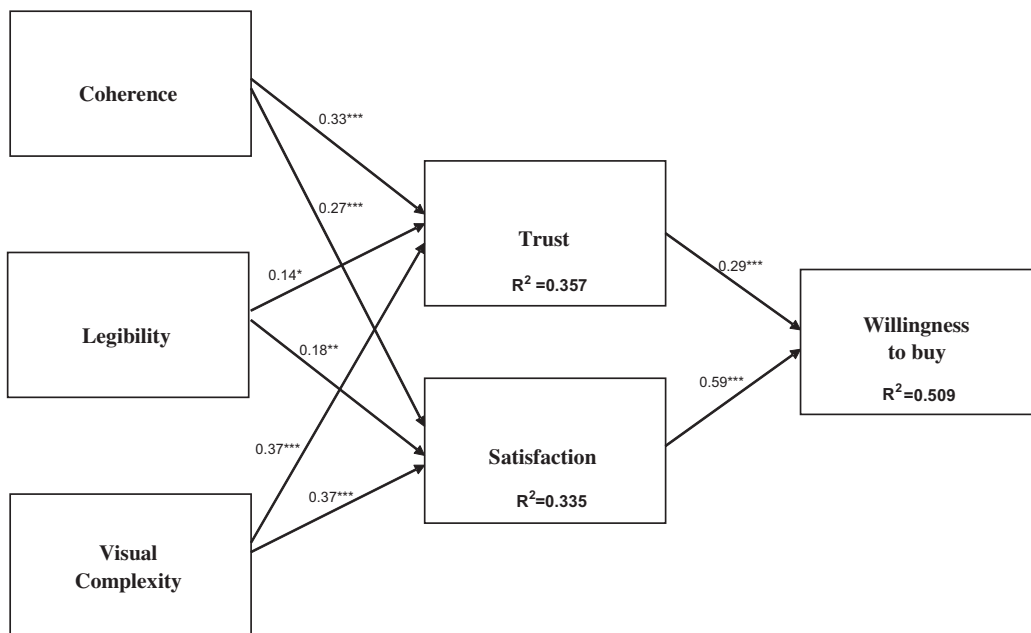


Fig. 2. Standardized structural model analysis.

Table 6
Results of hypothesis testing.

Hypothesis	Causal path	Path coefficient	t-Values	Supported
H1	T → WTB	0.28	5.34	Yes
H2	S → WTB	0.50	10.18	Yes
H3	C → T	0.41	5.30	Yes
H4	C → S	0.36	4.53	Yes
H5	L → T	0.20	2.33	Yes
H6	L → S	0.26	2.95	Yes
H7	CX → T	0.48	5.53	Yes
H8	CX → S	0.51	5.73	Yes

Notes: T, trust; S, satisfaction; C, coherence; L, legibility; CX, complexity; WTB, willingness to buy.

[†]Denotes significance at the .05 level.

[‡]Denotes significance at the .01 level.

^{***}Denotes significance at the .001 level.

5. Discussion

This study deals with cognitive psychology factors in e-commerce and further enriches its content by developing the relationships with e-shoppers' trust and satisfaction. These two constructs, trust and satisfaction, are often referred to as precursors for a website's success [5,9]. On the other hand, coherence indicates that e-shoppers feel easily and correctly understand the design of the website. This can facilitate the e-shopping process and e-shoppers would have good shopping experience. In this website, e-shoppers are willing to provide their personal information to complete the transaction. The previous situation must be based on highly trust and satisfaction for e-vendors. This result has also been confirmed by previous studies [23,38]. Legibility indicates the ease of navigation around a website. For a clear structure and layout of a website, e-shoppers can easily and quickly retrieve information their desired and higher possibility to stay longer on a website. In other words, this comfortable e-shopping environment can reduce cognitive load and create satisfaction for e-customers. So e-shoppers will place trust in an easily navigational website and buy the products they desire.

By providing clear and vivid product photos, a website can attract e-customers and has chances to let them stay longer for further shopping. Visual complexity plays an important role to demonstrate the specific characteristics of the products. If e-vendors offer more visual designs on their products, e-shoppers can understand the products easily and place higher trust for this e-vendors. Thus this can be true that vivid product photos can satisfy e-shoppers' desires for product information, which text-only description for product cannot make [36].

The proposed model had robust psychometric properties and was capable of explaining much of the variance in e-shoppers' willingness to buy. According to the path model of Fig. 2, we found that e-shopper willingness to buy can be triggered by trust and satisfaction, both of which were significantly influenced by the three proposed cognitive constructs: coherence, legibility and visual complexity. Altogether, these factors explained approximately 51% of the variance in e-shopper willingness to buy. Consistent with Lee and Kozar [16], what were identified as theoretical usability factors in website design exerted power to influence an e-shopper's willingness to buy. Their findings indicate that a blend of legibility, coherence, and components and content designed by visual complexity can successfully communicate with online consumers and invoke positive appraisals.

The results of the study also reveal that visual complexity is equally important to an e-shopper's cognitive perceptions (i.e. trust and satisfaction). This is not surprising because visual complexity was defined in an operational sense here as the capability of a website to create vivid interactions and to arouse

e-shoppers' interest in staying. Thus, seeing something visually appealing (visual complexity) that also provides expected curiosity allows the e-shopper to draw inferences of trustworthiness and satisfaction about the e-vendor. Te'eni [31] and Lee and Kozar [16] indicated the importance of this hedonic feature of a commercial website as this can entail a cognitive appraisal which directly leads to e-shopper buying behavior. Moreover, the results of our study indicate that coherence is the strongest factor. Both legibility and visual complexity have significant impact on trust and satisfaction, suggesting that e-vendors should provide relevant content and product photos that satisfy consumers' desires for website or product information.

A multi-group analysis was conducted in order to examine whether the proposed model and instruments were invariant across different subgroups (e.g. gender) [8]. On the one hand, the analysis extends the generalizability of measurement items; on the other hand, it directly compares the structural weights by using equivalent measurements where observed scores from different groups are on the same scale. This analysis gains support from Deng et al. [8] who suggested that a multi-group analysis may be a more appropriate test of differences in structural weights than an analysis of covariance when the samples in each group exceed the minimum of 100. Appendix D provides the detailed procedures of this analysis. Nevertheless, some interesting differences were found from the multi-group analysis. For gender, all hypothesized relationships were significant except legibility–trust ($\Lambda = .06, P > 0.05$) and legibility–satisfaction ($\Lambda = 0.13, P > 0.05$) for the male group. However, none of the hypothesized relationships were insignificant for the female group. Satisfaction ($\Lambda = 0.58, P < 0.05$) showed a significantly stronger influence on e-shopper willingness to buy than trust in males ($\Lambda = 0.30, P < 0.05$). This is also true for females ($\Lambda = 0.53, P < 0.05$ and $\Lambda = 0.27, P < 0.05$ for satisfaction and trust, respectively). Since satisfaction is primarily an affective evaluative response [20], the significant results in our samples suggest that females may be more task-oriented and more emotional than males. Finally, complexity was the strongest factor influencing satisfaction for males, while coherence was the strongest for females.

From a theoretical perspective, this study proposed and validated a new model for e-commerce, especially in e-shopper buying intention. Although the literature has provided a comprehensive understanding of why people buy online and the rationales behind this buying intention, as a way to innovate and contribute to the literature, our model incorporates concepts from cognitive psychology and validates its relationship with e-shopper buying intention. The significant results suggest that a scrutiny of the relationship between the proposed constructs may provide another effective way of explaining e-shopper buying behavior. Another academic implication is that the multi-group analysis extends the generalizability of results across different gender groups. The findings imply that the model is robust and that the results can be applied to both males and females. Females may care about the website functions and components that can facilitate the e-shopping process. This may be true in Taiwan because females prefer a grounded and secure environment to complete the transaction. For instance, one famous cosmetics product website in Taiwan emphasizes product information, especially in ingredients. This is very useful for females to consider whether or not to buy the product. On the other hand, males care about the visual effect of a website that includes vivid photos or video clips (visual complexity). This may be true because males prefer highly interactive environment, such as the online game website.

From a practical perspective, the results of this study can have direct implications for website developers. Repeat purchases are deemed essential to differentiate a successful from a failed

endeavor for an e-vendor. Website developers should consider features that facilitate orientation, increase curiosity and maintain information and layout consistency, as they can evoke e-shoppers' willingness to buy. Website developers are also encouraged to explore other means of increasing enjoyment and fun that can be experienced on an e-vendor site.

6. Conclusion

Despite these valuable implications, like all other studies, this study had some limitations. At first, the results derived from the three websites built in Taiwan cannot be overlooked. Other demographic influences are still in need of further investigation. Prior studies suggest that cultural differences, subjects' ages and attitudes also exert influence in explaining e-shopper buying intentions. Second, by selecting well-recognized online travel agencies that are equipped with similar designs, our study did not take any account of website variation. As a result, further insights across different websites in different service domains must be carefully interpreted and compared. Future work may employ other types of commercial websites. Different perceptions delivered by different website layout and design may result in different results. Third, because our samples are university students, the generalization of our research to elder people may have limitation. Finally, because of the chosen methodology, the data is cross-sectional. Future work should determine the extent to which the findings presented in this paper can be applied to other times.

In "IT doesn't matter," Carr [3] argued the role of IT and suggested that advances in IT exceed user requirements. Compounding this issue, Cyr et al. [6] employed the concept of aesthetics in IT, which redefined the experience of using IT as experience enhancing instead of functionality improving. The core of aesthetics is to make the use of IT a visually appealing experience. Our study suggests that website design must not only help e-shoppers complete their shopping process, but also create an interactive, yet vivid, experience to hold onto existing customers and, at the same time, to attract new ones. From an e-shopper's point of view, such an experience may determine his/her willingness to pay a return visit and therefore to make a new purchase. Thus, the success of e-vendors in the market begins with effective website design.

Appendix A. Previous website design dimensions identified by researchers

Dimensions of website design	Researchers	Research focus	Website design factors
Functionality factor	[5] [16]	Usability	Convenience, Site navigation, Information architecture, Site speed, Site design, Searchability/accessibility, Transaction efficiency
	[10] [11]	Interactivity	Online support, Customization, Customer service/after sales
Psychological factor	[5]	Loyalty	Site design, Trust,
	[6]		Privacy policies, Reputation Social presence, Familiarity, Word-of-mouth, Control, Usefulness, Ease-of-use
Content factors	[6]	Aesthetics	Design, Presentation quality,
	[15]		Style/atmosphere, Design elements
	[23] [15]	Marketing mix	Communication, Product display,
	[20]		Product involvement, Promotion, Price

Appendix B. Instrument items

Coherence [16]

- C-1. All components of website are well related to each other.
- C-2. Components of website work well together.
- C-3. Each component of website seems to hang together.

Legibility [16]

- L-1. It is clear where I can go in the website.
- L-2. It is easy to get around the whole website.
- L-3. It does not take much time to figure out a way of moving around the website.

Complexity [27]

- CX-1. The website contains many visual images.
- CX-2. The graphics and pictures in the website fit with the content.
- CX-3. The website uses different types of visual images.

Trust [37]

- T-1. This website gives me a feeling of trust.
- T-2. This website gives me a trustworthy impression.
- T-3. I have trust in this website.

Satisfaction [37]

- S-1. I am satisfied with this website.
- S-2. This website offers what I expect from a good website.
- S-3. This website gives me a feeling of satisfaction.

Willingness to buy [23]

- WTB-1. The likelihood of purchasing online is:
- WTB-2. The probability that I would consider buying online is:
- WTB-3. My willingness to buy the product online is:

Appendix C. Online travel package purchase scenario

To refresh your memory with past online purchases, we ask you to navigate the following e-travel sites (<http://www.eztravel.com.tw/>, <http://www.settour.com.tw/>, and <http://www.liontravel.com/>) for at least 5 min. Before you are asked to make a purchase, make yourself familiar with the contents, search engine and layout of the websites. Then, assume that you wish to travel to either Vancouver, Canada or Las Vegas, U.S. in the near future, but you are not sure about the possible travel costs. To facilitate decision making, you wish to make a price comparison. Follow the guidelines written below and use the features provided by each website to search for the information you need for this trip, but do not actually make a purchase.

1. Take no more than 5 min to select the travel information about Vancouver and Las Vegas. You may compare travel plans, flight information and special offers.
 2. Once you have made your choice, click to gather information such as travel description and customer reviews.
 3. Click Help to review available customer support service.
 4. Complete checkout process by entering all information required except credit card information.
 5. Return to homepage.
1. Review the "Visa Information" and "Travel Insurance".
 2. Use the remaining time to evaluate the features (e.g. content, layout, color, hyperlinks, etc.) of each website and see if they are concise and readable.

Appendix D. Multi-group analysis

Multi-group analysis has recently been favored by researchers as a way of validating the generalizability of constructs including

end-user perceptions of website usability [16], and technology adoption model [8]. The significant results may indicate the invariance of factor loadings or structural invariance. Prior to evaluating the structural invariance, we at first conducted a comprehensive assessment of item-factor loadings and model-data fit for each subgroup. The significant results may suggest that data for each group fit the model and can be processed for further statistical analysis. Then, we conducted a structural weights invariance test. The criterion for examining the invariance test is based on the statistical magnitude associated with the change in chi-squares/degrees of freedom ($X^2/d.f.$). In addition, we relied on several fit indices (CFI, TLI, and RMSEA) which surpass acceptable thresholds to reflect adequate model-fit.

As shown in Table C1 and Table C2, the item-factor loadings between males and females were still high, ranging from 0.70 to 0.94. Fit indices for both male and female groups demonstrate an adequate model-fit. Based on these findings, we proceeded to a multi-group analysis.

Table C1.

Construct	Items	Gender	
		Male (n = 131)	Female (n = 169)
Coherence	C-1	0.72	0.75
	C-2	0.83	0.81
	C-3	0.79	0.80
Legibility	L-1	0.81	0.70
	L-2	0.82	0.83
	L-3	0.71	0.82
Complexity	CX-1	0.74	0.77
	CX-2	0.82	0.81
	CX-3	0.70	0.78
Trust	T-1	0.84	0.80
	T-2	0.90	0.87
	T-3	0.80	0.84
Satisfaction	S-1	0.71	0.77
	S-2	0.94	0.87
	S-3	0.89	0.91
Willingness to buy	WTB-1	0.84	0.83
	WTB-2	0.88	0.88
	WTB-3	0.90	0.91

Table C2.

Fit index	Gender	
	Male	Female
$X^2/d.f.$	1.29	1.47
CFI	0.97	0.96
NFI	0.89	0.91
RMSEA	0.05	0.06

Two models were used in the multi-group analysis, as shown in Table C3. Model 1 is the equal patterns model which serves as the baseline model. With a chi-square/degree of freedom ratio of 1.36 and relative fit indices (CFI = 0.97, TLI = 0.96, RMSEA = 0.036), this baseline model demonstrates an adequate model-fit. Model 2 is a factor loadings invariant model, which was modeled by forcing each item-factor loading to be equal across different groups. Model 2 also demonstrates adequate model fit (chi-square/d.f.=1.36, CFI = 0.97, TLI = 0.96, RMSEA = 0.035). The non-significant change in the chi-squares (6.91 with 5d.f., $p < 0.2274$) indicates that the model was invariant across subgroups.

Table C3.

No.	Model	χ^2	d.f.	p Value	CFI	TLI	RMSEA
Model 1	Equal patterns	371.243	273	0	0.97	0.96	0.036
Model 2	Factor loadings invariant	378.153	278	0	0.97	0.96	0.035

The standardized structural weights were shown in Table C4 for both male and female groups. These weights were estimated with item-factor loadings held equal across groups. Thus, they were the best estimates of the true structural weights [16].

Table C4.

D.V.	I.V.	Gender	
		Males	Females
Trust	Coherence	0.28	0.37
	Legibility	0.06	0.23
Satisfaction	Complexity	0.46	0.30
	Coherence	0.21	0.34
	Legibility	0.13	0.24
Willingness to buy	Complexity	0.53	0.29
	Trust	0.30	0.27
	Satisfaction	0.58	0.53

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