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Facets of Visual Aesthetics of Mobile Website

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ABSTRACT

With the advent of the era of mobile commerce, user browse mobile website on mobile devices is in the majority. The current literature focused on the web aesthetics. However, there is no related visual aesthetics scale for mobile website. Our purpose in this study was to verify the essential characteristics of aesthetics by conceptualizing, constructing, refining, and testing a multiple-item scale, VisMWA, designed to measure aesthetics in the mobile environment. The results showed that five factors and 26 key indicators of VisMWA. The VisMWA scale developed by present study will be able to provide enterprise the standard when they are designing mobile website; and makes it become high-aesthetics mobile website to increase the visitors.

Keywords: Mobile commerce, Mobile Visual Aesthetic, Scale development.

INTRODUCTION

Advancements in mobile device technology and the prevalence of mobile devices such as smart phones and tablet computers have profoundly influenced consumers' modes of mobile technology usage, consumption patterns, and everyday life. The International Data Corporation estimated that by 2016, 44% of the world's population (approximately 3.2 billion people) would be connected to the Internet, of which 2 billion people would be connected through mobile devices. Countries such as China, India, and Indonesia would serve as the main sources for Internet population growth. The International Data Corporation predicted that in the next 5 years, the number of people who use mobile devices to connect to the Internet would grow by 25% annually, entailing that mobile devices would gradually replace personal computers as the main device for connecting to the Internet [1]. Mobile commerce is gradually developing into a future mainstream.

The aesthetics of human-computer interaction has been receiving increasing attention in recent years [21]. For example, the iMac was considered an aesthetic revolution in personal computing. Therefore, concerning the visual aesthetics of websites, they should be evaluated prudently, and various methods have been used for this purpose. Single-item measures were conventionally the most widely used method for such evaluations until Lavie and Tractinsky proposed multiple-item measures, in which the visual aesthetics of a website are categorized into two dimensions, namely classical and expressive aesthetics [16]. These categories have been widely accepted and used by subsequent scholars. To date, Moshagen and Thielsch obtained the most fruitful results in visual website aesthetics research, bridging the gaps in the studies of Lavie and Tractinsky and other subsequent scholars by further categorizing visual website aesthetics into simplicity, diversity, colorfulness, and craftsmanship [21]. The Visual Aesthetics of Website Inventory (VisAWI) was developed on the basis of these four dimensions. This inventory compensates for the insufficiencies of previous studies, which have conducted measurements by using the single-item method to investigate classical and expressive aesthetics. Therefore, the present study adopted the VisAWI as a basis for exploring the visual aesthetics of mobile websites.

The present study developed a Visual Aesthetics of Mobile Website Inventory (VISMWA) on the basis of the VisAWI. Despite the discussed trend of mobile devices and mobile websites, few studies have focused on the visual aesthetics of mobile websites, and even fewer studies have explored the aesthetic constructs of such websites. Thus, a research gap exists between website aesthetics and mobile aesthetics, which entails that several key questions require further investigation, such as what factors constitute the aesthetics of mobile websites and what criteria can be used to determine the aesthetic value of a mobile website. The present study therefore addressed this research gap by developing the VISMWA, which can be used to determine whether significant differences exist between websites of high and low aesthetic values.

LITERATURE REVIEW

Website Aesthetics

From a historical perspective, the emergence of aesthetic value changed people's idea of beauty. In ancient times, people valued the existence and perceptions of beauty [8] because of the pleasant mood that beauty generates. However, during the Renaissance, the rules of beauty approximated a set of laws; beautiful designs were considered to accurately reflect the beauty of nature [15].

Generally, beauty can be assessed from subjective and objective perspectives. During the Renaissance, beauty was considered objective; consequently, the beauty of artworks in this period was measured according to proportion and symmetry [9][22]. By contrast, the subjective aesthetic perspective claims that aesthetics serves as a bridge between beauty and affection; different judgements of beauty derive from differences in individual backgrounds [22][24].

In modern times, aesthetics plays an essential role in users' affectional attitude toward web pages. To satisfy users, the aesthetic characteristics of a website must be attractive to users, particularly the home page. As the visitor's first impression of a website, the home page has a strong effect on whether a visitor will continue browsing a website or whether they will revisit. However, a user's first impression of a home page tends to be very subjective. To ensure that users clearly express and delineate their

aesthetic ideas, a few scholars have adopted quantitative methods to measure aesthetics [14][23][27].

Lavie and Tractinsky proposed using classical aesthetics and expressive aesthetics to evaluate the aesthetics of websites [16]. Classical aesthetics refers to aesthetic ideas that can be traced back to ancient times, namely orderliness in webpage design, such as symmetry, clean, and organization. Expressive aesthetics assesses the creativity and expressivity of website design including its originality, sophistication, and whether it has a fascinating design. Subsequent scholars have investigated the aesthetics of human-computer interaction on the basis of these two dimensions.

Lavie and Tractinsky's classical aesthetics and expressive aesthetics dimensions have been widely adopted by other scholars in the field of visual aesthetics. Subsequent scholars have conducted a considerable amount of research on the aesthetic features of website [6] [7] [19] [26]; however, relatively few arguments have been developed regarding psychology-related attributes, practicality, and effects of the features, and none of the aforementioned studies have extended the framework proposed by Lavie and Tractinsky. Therefore, Moshagen and Thielsch developed the VisAWI, dividing visual aesthetics into dimensions of simplicity, diversity, colorfulness, and craftsmanship [21]. Simplicity refers to how simple the layout of a webpage is and whether it enables users to experience homogeneity, orderliness, clarity, and balance. Diversity refers to the visual richness of a website, including the levels of dynamics, variety, creativity, and novelty. Colorfulness means the level to which users perceive the color combinations of a webpage as attractive and elegant. Finally, craftsmanship indicates the level to which users perceive the thoughtfulness that has been put into the design of a website, which is achieved by the website designers using modern technology-based craftsmanship.

Mobile Aesthetics

Since the launch of the iPhone in 2007, smartphones have become a key mobile device for communication, information transmission, and entertainment. This rapid transformation has affected the design and usability mobile device user interfaces. Smartphones are now viewed as the mainstream device of future mobile devices [5].

Simplicity is a key dimension of webpage aesthetics. Choi and Lee asserted that simplicity can be used to measure the aesthetic value of mobile websites and further discussed the influences of webpage aesthetics on user satisfaction. Simplicity comprises visual aesthetics, information design, and task complexity. In an investigation of 205 mobile device users, Choi and Lee identified a positive relationship between the design simplicity of interfaces and user satisfaction.

In recent years, usability has received increasing recognition as a key construct of successful mobile websites and applications. Baharuddin, Singh, and Razali investigated the usability of mobile applications and inferred 10 crucial dimensions of usability, which have served as a basis for subsequent studies [3]. The 10 dimensions are effectiveness, efficiency, satisfaction, usefulness, aesthetic value, learning ability, simplicity, intuitiveness, understandability, and attractiveness. Because few usability-related studies pertaining to mobile websites have been conducted, the present study adopted the aforementioned dimensions to explore their relevance in this context.

METHODS

The present study aimed to develop a VISMWA, with which the abstract concepts of aesthetics can be accurately expressed using the measurements of each item. A questionnaire survey was employed as the data collection method. The survey measure development framework proposed by Hinkin was used as the development method in the present study [13]. The inventory development steps are detailed in the following paragraphs.

Step 1 is item generation, namely to develop items to identify appropriate constructs. Deductive and inductive approaches can be applied to generate items. Using deduction to generate preliminary items requires an appropriate theoretical basis and sufficient information. A thorough literature review and arrangement must be conducted to define the theoretical constructs. By contrast, induction is applied when the constructs cannot be clearly defined, or when no sufficient theoretical basis exists to generate items; this involves a preliminary survey to collect opinions. Step 2 is questionnaire administration. At this stage, representative respondents are interviewed to assess the validity of the questionnaire content, after which the constructs suggested by the respondents are added to the final questionnaire. Step 3 is initial item reduction. Upon completion of data collection, a factor analysis is performed to reduce the number items. The elimination criteria are items that obtain factor loadings of less than 0.4 on all factors, or those with factor loadings of more than 0.4 on two factors. Each construct must contain at least three homogeneous items. Cronbach's α values are used to evaluate the internal consistency of the constructs; a result of higher than 0.7 indicates high reliability. Step 4 is confirmatory factor analysis (CFA). Although the aforementioned scale can be used to determine whether it exhibits favorable internal consistency and content validity, it are not quantitative. Therefore, CFA is used to determine whether the factor structure satisfies the expectation. In Step 5, convergent/discriminant validity are tested to ensure that the developed scale has satisfactory content validity and internal consistency (reliability). Construct validity is further used to determine whether a new scale is adequate to serve as a reference for future studies. Convergent validity and discriminant validity are two key indicators; high convergent validity confirms that items in the same construct are related, whereas high discriminant validity confirms that items in different constructs are unrelated. In recent years, structural equation modeling has been widely used to test for convergent validity and discriminant validity.

Item Generation

On the basis of the VisAWI proposed by Moshagen and Thielsch, the present study developed the VISMWA to measure users' opinions of the aesthetics of mobile websites. The proposed scale comprised four dimensions (simplicity, diversity, colorfulness, and craftsmanship) with a total of 13 items.

Because of the slight differences between the aesthetic characteristics of mobile websites and regular websites, the present study adapted the VisAWI by extending it to suit the characteristics of mobile websites. This was achieved through both deductive and inductive approaches were adopted to develop the new scale items. For the deductive approach, relevant papers on website aesthetics and mobile aesthetics published within the past 10 years were collected; subsequently, the key terms of these papers were arranged according to the constructs of the VisAWI. For the inductive approach, a focus group interview was held to determine which items of mobile website aesthetics were overlooked in the deduction step and to identify items that are unique to mobile website aesthetics and have not been used in previous studies on website aesthetics

Developing The Preliminary Constructs

The proliferation of mobile devices offers Internet users various methods to browse mobile websites. Regarding browsing behavior, users typically value the readability of the textual content on mobile websites, specifically the convenience to read and browse. Therefore, usability was added to the VISMWA.

The supportability of mobile devices has received increasing attention [17]. This concept refers to designs such as guiding instructions on webpages and buttons and hyperlinks that function as intended. Therefore, supportability was added to the VISMWA.

Interactions between general users and companies on mobile websites differ slightly from those on general websites such as the applicability of location-based services (LBSs) on mobile websites. Therefore, the relevance of technology has been increasingly addressed [2]. Mobile websites enable companies to provide LBSs, customized information, and even message-sharing functions for mobile device users (e.g., through Facebook, LINE, and Twitter). Accordingly, technology was added to the VISMWA. The research model in Figure 1 lists the factors we used to measure our VISMWA construct.

Questionnaire Administration

The proposed questionnaire was administered on the Internet. Prior to completing the questionnaire, the respondents were asked whether they had previously used a mobile website; only those who answered yes proceeded to the questionnaire. The literature review shows that mobile websites are currently an emerging trend that has not achieved a state of maturity. Therefore, the respondents of this study were early mobile website users. In total, 785 respondents filled out the questionnaire: 381 respondents evaluated a website with high aesthetic value and 404 respondents evaluated a website with low aesthetic value. Respondents who exhibited a lack of understanding of aesthetics were excluded from further analysis. Finally, 342 (89.7%) questionnaires pertaining to high-aesthetic value websites and 62 (15.3%) questionnaires pertaining to low-aesthetic value websites were considered valid. In the questionnaire survey, the questionnaires for the websites of high and low aesthetic values were distributed separately, which might explain the exceptionally high rate (84.7%) of invalid questionnaires in the low aesthetic value website group (low group). Thus, the respondents demonstrated a tendency of giving high scores when completing the questionnaire. A 5-point Likert scale was employed to rate the questionnaires. All of the subsequent analyses focused on the high-aesthetic value website group (high group). Questionnaires on the low-aesthetic value website were collected to identify any notable differences between the responses of the high and low groups. Several independent constructs and items were included in the questionnaires to enable estimation of criterion-related validity.

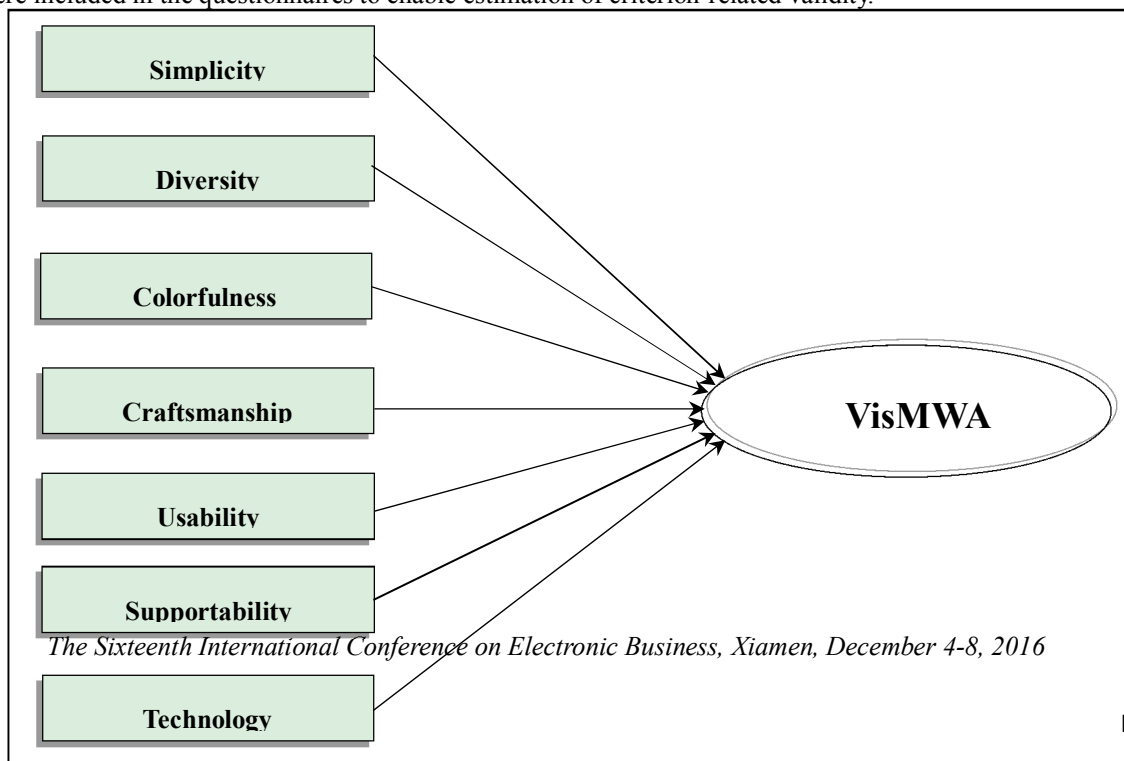


Figure 1: Research Model

Dimension	Operational definition
Simplicity	The extent to which users perceive the layout of a mobile website as simple and harmonious.
Diversity	The extent to which users perceive the visual richness of a mobile website.
Colorfulness	The extent to which users perceive the attractiveness and elegance of the color combinations of a mobile website.
Craftsmanship	The extent to which users perceive the thoughtfulness of a mobile website design, which is achieved by the website designers using modern technology-based craftsmanship.
Usability	The extent to which users perceive the ease of use of a mobile website.
Supportability	The extent to which users perceive the smoothness in browsing a mobile website.
Technology	The extent to which a mobile website is constructed using appropriate technologies.

DATA ANALYSIS

The reliability and validity of the proposed scale were established through a descriptive statistical analysis, item analysis, exploratory factor analysis (EFA), and CFA. To verify the scale structure, SPSS version 21, and AMOS version 21 were used for a path coefficient analysis and model fit examination. A z-test was conducted to eliminate outliers, which were identified as responses with z-scores higher than 3 or lower than -3. Descriptive statistics were used to summarize the demographic characteristics and information of the respondents. The results of the item analysis served as the basis for determining the reliability of the scale; missing values were checked to ensure data completeness. The corrected item-total correlation was then calculated, which refers to the product-moment correlation coefficient between the total of all items (containing a specific item) and the total of all remaining items (eliminating a specific item). An EFA was conducted following the item analysis. The factor structure of the constructs was built, in which observed variables with factor loadings lower than 0.4 were eliminated. Finally, the extracted factor structure was adopted for the CFA in order to assess the convergent validity and discriminant validity of the instrument. Because of the low number of valid questionnaires in the low group, 500 bootstrapped samples were used during the CFA.

Item Analysis

The comprehensiveness of the items in the proposed scale (33 items in total) was reexamined using the answers provided by the respondents who had browsed mobile websites. A z-test was employed to identify and eliminate extreme values (those with an absolute z-score of >3), resulting in 39 questionnaires being eliminated from the high group. Scale items were then eliminated according to the Cronbach's α values and corrected item-total correlations. The corrected item-total correlation evaluates the correlation between a construct and its constituent items. Simplifying factors in a construct prevents the generation of multiple meaningless factors in a subsequent factor analysis. After correction, items with an item-total correlation coefficient of 0.2-0.8 were considered appropriate. Items with a Cronbach's α value of less than 0.7 were also eliminated. At this stage, all items met the item-total correlation coefficient and Cronbach's α criteria; thus, no items were eliminated.

Exploratory Factor Analysis

EFA was employed to assess the 33 scale items to validate the factor structure of the VISMWA. A total of 342 questionnaires were analyzed. A Kaiser-Meyer-Olkin measure of >0.7 and significance in Bartlett's test of sphericity indicated that the collected data did not form an identity matrix and were therefore appropriate for the EFA.

At this stage, EFA was used to analyze the 33 scale items. Principal component analysis with varimax orthogonal rotation was employed as the extraction technique to verify the scale dimensions; factors with eigenvalues of ≥ 1 were retained.

A total of five factors comprising 26 scale items were extracted. These five factors explained 58.4% of the total variance in the items. Because the number of valid questionnaires in the low group ($n = 62$) did not meet the minimum sample size for a CFA (200), 500 bootstrapped samples were used during the CFA. Table 1 compiles the factor loadings of the 26 scale items based

on the data of the high group; the results show that all five factors were retained. Figure 2 presents the final model and definitions of the scale constructs.

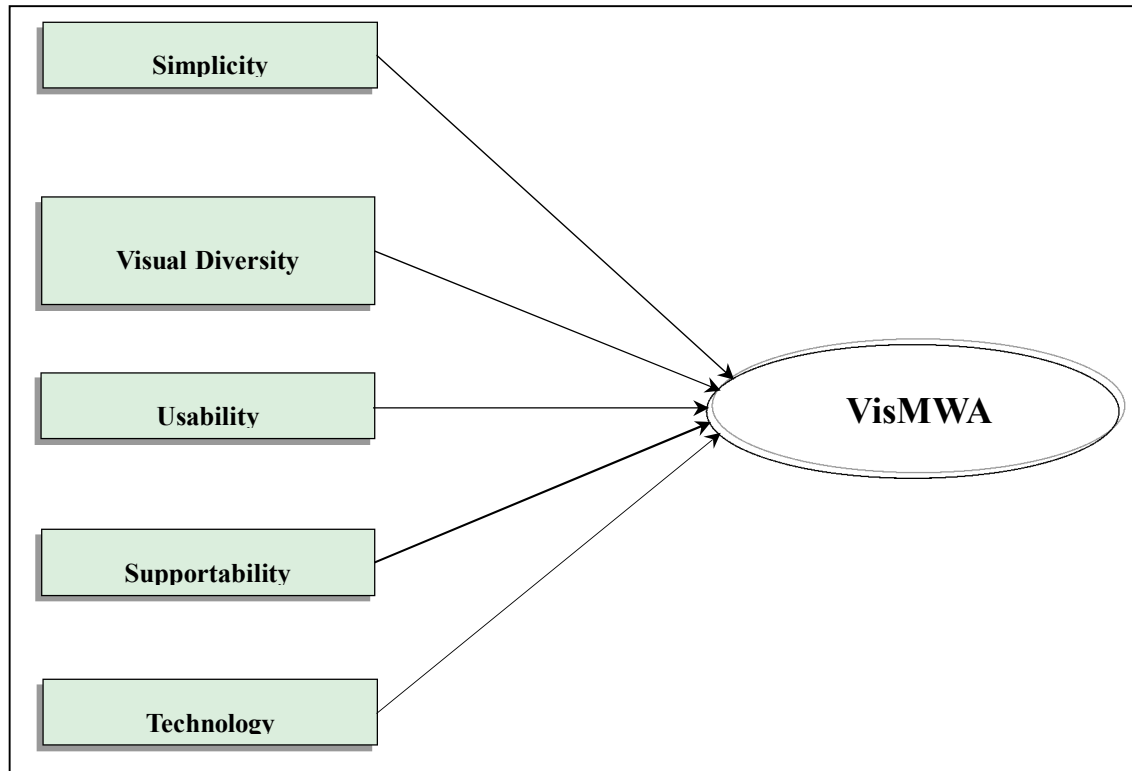


Figure 2: Finalized model of VisMWA

Dimension	Operational definition
Simplicity	The extent to which users perceive the layout of a mobile website interface to be simple and harmonious.
Visual Diversity	The extent to which users perceive the visual richness of a mobile website (e.g., the graphical interface elements and colors).
Usability	The extent to which users perceive the ease of use of a mobile website interface.
Supportability	The extent to which users perceive the smoothness in browsing a mobile website.
Technology	The extent to which a mobile website is constructed using appropriate technologies.

Table 1: Factor Loadings of the 26 items on VISMWA

Factor	Item	Simplicity	Diversity	Usability	Supportability	Technology
Simplicity	The configuration of the webpages of the mobile website is easy to understand.	.690	.209	.253	.119	.131
	The structural layout of the mobile website is complete.	.676	.236	.186	.243	.033
	The configuration of the elements on the mobile website exhibits vertical and horizontal symmetry.	.638	.167	.129	.184	.038
	The pages of the mobile website are organized in an orderly manner.	.739	.083	.253	.191	.034
	The shapes and sizes of the elements on the mobile website are highly similar.	.509	.014	.198	.318	.113
	The structural layout of the mobile website is harmonious.	.666	.189	.218	-.015	.074
Visual Diversity	The overall structural layout of the mobile website is lively.	.206	.659	.069	.104	.132
	The overall design of the mobile website exhibits diversity.	.146	.671	.154	.133	.303

	The mobile website has a unique webpage design.	.150	.649	-.089	-.077	.358
	The webpage of the mobile website exhibits a multilayered design.	.278	.682	.149	.029	.180
	The mobile website has a colorful design.	-.001	.771	.127	.334	-.094
	The color combinations of the mobile website are high-contrast.	.086	.609	.071	.028	.099
	The mobile website has an innovative webpage design.	.207	.732	.101	-.128	.202
Usability	The mobile website employs a self-adaptive webpage design techniques.	.104	.148	.655	.107	.239
	The design of the mobile website makes it easy to use.	.303	.122	.753	.133	.151
	The design of the mobile website makes it easy to browse.	.380	.129	.763	.093	.092
	The mobile website can be viewed on different operating systems.	.058	-.001	.636	.375	.170
	The design of the mobile website makes the webpages easy to read.	.358	.186	.668	.162	.204
Supportability	The mobile website provides users with guidance and instructions.	.315	.122	.352	.409	.326
	All buttons on the mobile website function normally.	.227	.089	.131	.807	.172
	All hyperlinks on the mobile website function as intended.	.165	.031	.223	.803	.145
	The mobile website provides vertically stacked menus.	.168	.099	.092	.576	.371
Technology	The mobile website is animated.	.277	.325	.219	.147	.494
	Message-sharing functions are embedded in the mobile website.	.001	.146	.168	.248	.691
	Customized information is provided on the mobile website.	.069	.187	.212	.171	.681
	Offering location-based services on mobile websites is essential.	.032	.213	.152	.036	.633
Eigenvalue		11.6	2.92	2.1	1.4	1.3
Variance explained		35.2%	44%	50.3%	54.5%	58.4%

Confirmatory Factor Analysis

A CFA was conducted to examine whether the factors extracted using EFA were suitable constructs for the VISMWA. The measurement model constructed with AMOS was used to calculate the path coefficients and model fit. The procedure for eliminating the items with path coefficients of <0.5 was repeated until a favorable model fit was achieved.

Model fit indices were key indices used to assess the relationships between scale items and the overall model. Table 3 details the model fit indices that had been recommended by previous scholars and were adopted in the CFA of the proposed scale model. The indices in the table show that the proposed model obtained a close fit to the data (i.e., the RMSEA, GFI, AGFI, and CFI were 0.063, 0.869, 0.841, and 0.903, respectively).

Table 2: CFA and reliability results

Factor Items	Factor loadings	Average variance extracted	Composite reliability	
Simplicity	The configuration of the webpage of the mobile website is easy to understand.	.786	0.555	0.8814
	The structural layout of the mobile website is complete.	.794		
	The configuration of the elements on the mobile website exhibits vertical and horizontal symmetry.	.729		
	The webpages of the mobile website are organized in an orderly manner.	.807		
	The shapes and sizes of the elements on the mobile website are highly similar.	.635		
	The structural layout of the mobile website is harmonious.	.704		
Visual Diversity	The overall structural layout of the mobile website is lively.	.745	0.5479	0.894
	The overall design of the mobile website exhibits diversity.	.789		
	The mobile website has a unique webpage design.	.744		
	The webpage of the mobile website exhibits a multilayered design.	.769		
	The mobile website has a colorful design.	.698		
	The color combinations of the mobile website are high-contrast.	.626		
	The mobile website has an innovative webpage design.	.796		
Usability	The mobile website employs a self-adaptive webpage design techniques.	.737	0.6424	0.8993
	The design of the mobile website makes it easy to use.	.861		
	The design of the mobile website makes it easy to browse.	.850		
	The mobile website can be viewed on different operating systems.	.716		
	The design of the mobile website makes the webpages easy to read.	.832		
Supportability	The mobile website provides users with guidance and instructions.	.688	0.6389	0.8746
	All buttons on the mobile website function normally.	.893		
	All hyperlinks on the mobile website function as intended.	.886		
	The mobile website provides vertically stacked menus.	.707		
Technology	The mobile website is animated.	.718	0.5654	0.8385
	Message-sharing functions are embedded in the mobile website.	.794		
	Customized information is provided on the mobile website.	.782		
	Offering location-based services on mobile websites is essential.	.710		

Table 3: Model fit indices of the proposed model

Model fit index	Criterion guidelines	CFA result
Chi-square		682
Degrees of freedom		289
Absolute fit measures		
GFI	$> .80$ [20]	0.869
RMSEA	$< .10$ [25]	0.063
Normed chi-square / df	< 3 [12]	2.36
Incremental fit measures		
CFI	$> .90$ [11]	0.903
Parsimony fit measure		
AGFI	$> .80$ [20]	0.841

Note. RMSEA = root mean square error of approximation, GFI = goodness of fit index, AFGI = adjusted goodness of fit index, CFI = comparative fit index.

Figures 3 and 4 present the VISMWA analysis results. Figure 3 shows the first-order CFA model, in which the items with all factor loadings higher than 0 or those without factor loadings approximating or exceeding 1 in the path coefficients were examined. Figure 4 illustrates the second-order CFA model, in which the relationships between the VISMWA items and the five factors were determined. This figure shows that the path coefficients of the five factors and items were all higher than 0.5, suggesting strong relationships between the factors and items.

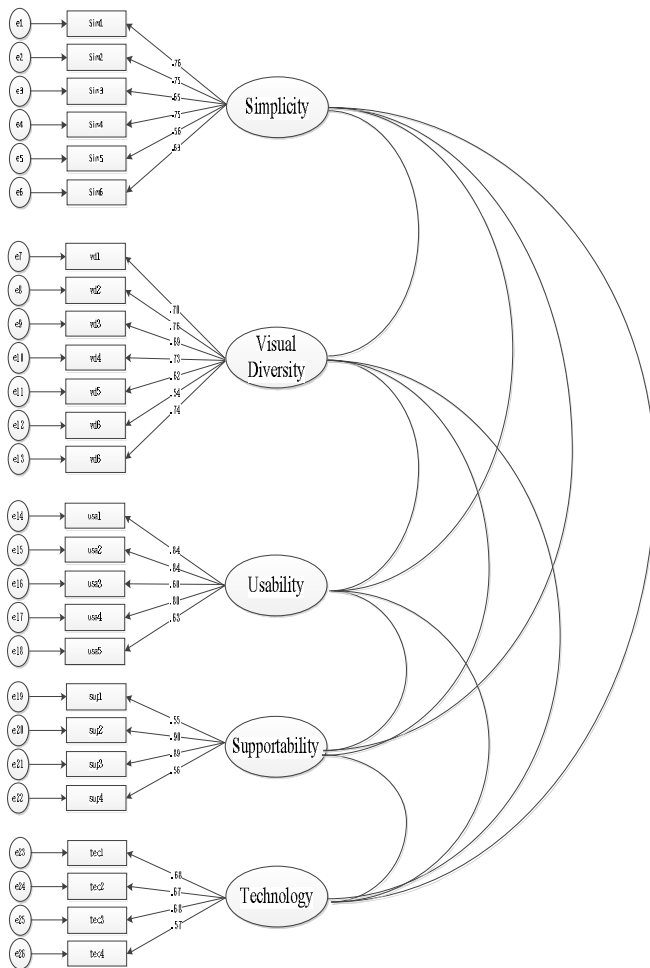


Figure 3: First-order CFA model

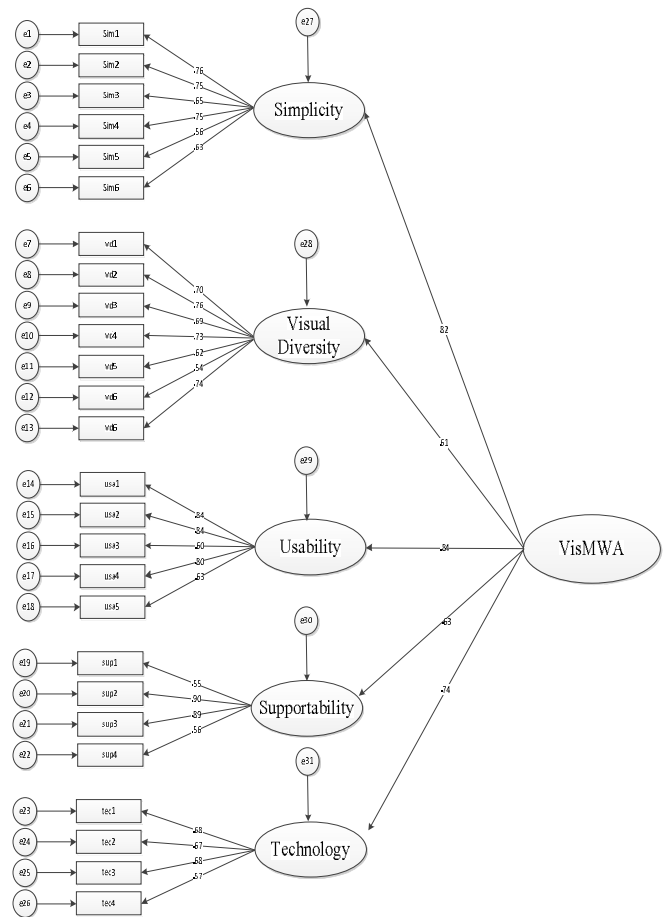


Figure 4: Second-order CFA model

Estimating Reliability and Validity

Reliability is as a key indicator of whether a scale produces consistent and stable results. Cronbach’s α was adopted as an indicator of scale reliability; a Cronbach’s α value of larger than 0.7 entails strong covariance and satisfactory internal consistency of the scale, thus confirming the scale to be favorable. In addition, validity refers to the extent to which a scale accurately measures what it is designed to measure. The following section and Table detail the validity, convergent validity, discriminant validity, and criterion-related validity of the VISMWA.

Validity Analysis

Cronbach’s α is used to measure a scale’s reliability and the internal consistency of all items of the same factor. Table 4 shows the Cronbach’s α values of all factors in the proposed scale. A Cronbach’s α value of larger than 0.7 indicates favorable internal consistency and reliability. Table 4 shows that all the factors of this scale attained a Cronbach’s α value of >0.7 , indicating favorable reliability.

Table 4: Validity analysis results

Dimension	Cronbach’s α value
Simplicity	0.84
Visual Diversity	0.86
Usability	0.86
Supportability	0.8
Technology	0.74

Convergent Validity and Discriminant Validity

The final VISMWA contained five factors and 26 items. Normalized factor loadings were employed to calculate the composite reliability (CR) and average variance extracted (AVE) of the constructs. Table 2 shows that all CR and AVE values are higher than 0.7 and 0.5, respectively, suggesting that this scale attained favorable convergent validity

The AVE of a dimension indicates the explanatory power of all items in the construct relative to this dimension; the higher the AVE is, the greater the convergent validity becomes. Fornell and Larcker indicated that the convergent validity of a scale can be verified using the normalized factor loadings and AVE of all comprising factors [10]. If all factors in a construct have factor loadings and AVE values higher than 0.5, then this construct is considered to exhibit satisfactory convergent validity. Table 2 shows that the proposed scale attained favorable convergent validity.

The square root of AVE and correlation coefficients are commonly applied indices for measuring the discriminant validity of a scale. A factor with a square root of AVE higher than the correlation coefficients between that factor and the other factors is considered to exhibit adequate discriminant validity. Table 5 tabulates the square root of AVE and correlation coefficients of all factors in the proposed scale, showing that all factors met these criteria. Thus, this scale attained favorable discriminant validity.

Table 5: Square root of AVE and correlation coefficients

	Simplicity	Diversity	Usability	Supportability	Technology
Simplicity	.74				
Visual Diversity	.44**	.74			
Usability	.61**	.37**	.80		
Supportability	.52**	.34**	.57**	.80	
Technology	.40**	.50**	.50**	.51**	.75

Note. Bold type indicates the square root of variance extracted

Criterion-Related Validity

Criterion-related validity refers to the correlation of this scale with other existing criteria. This type of validity indicates whether the proposed scale can be applied to previous studies. The greater the correlation of this scale and other existing criteria is, the more satisfactory the criterion-related validity of this scale becomes.

Several previous studies have indicated that the aesthetics of general websites affect shopping enjoyment, shopping process value, and trust in m-commerce websites (m-trust); empirical results have indicated that all three of these factors are significant [4] [18]. In the present study, general websites were replaced with the VISMWA for a regression analysis of these three factors to determine whether these factors correlated significantly with the VISMWA.

Shopping enjoyment, shopping process value, and m-trust were measured on a 5-point Likert scale with scores ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's α values of these three factors were 0.88, 0.89, and 0.77, respectively. Table 6 presents the regression results; the coefficient from regression analyses is referred to as the β coefficient. Factors with a higher β coefficient had a greater influence on VISMWA. Table 6 shows that the β coefficients of shopping enjoyment, shopping process value, and m-trust were 0.69, 0.67, and 0.69, respectively, all of which achieved significance; thus, the VISMWA exhibited favorable criterion-related validity.

Table 6: Subsequence influence of the VISMWA

Factor	Criterion variables		
	Shopping enjoyment	Shopping process value	m-trust
VISMWA	.69**	.67**	.69**
R ²	.48	.45	.49

Note: * $p < .05$, ** $p < .01$

Independent Samples t Test

This study conducted an independent samples t test to verify the validity of the VISMWA, specifically investigating whether significant differences existed in the assessment results between the high and low groups. The level of significance was set at 0.05. The respondents of both groups were assigned randomly; no relationship existed between the respondents of these two groups. Table 7 shows that the scores differed significantly between the high and low groups ($t = 16.93$, $p < 0.05$).

Table 7: Results of the t test

Independent variables	Mean (standard deviation)	<i>t</i> value	<i>p</i> value
Group		16.93**	0.003
High Group	94.36 (12.24)		
Low Group	72.39 (8.79)		

Note: * $p < .05$, ** $p < .01$

Conclusion

We adopted EFA and CFA to examine the VISMWA model. The first model comprised seven factors and 33 items, which were obtained through deductive and inductive approaches. In the official questionnaire survey, the VISMWA was reduced to five factors according to the EFA results. Eight items that did not satisfy the criteria were eliminated from the final scale. We also conducted a CFA to validate whether the five-factor model exhibited satisfactory model fit. To enhance the scale validity, we performed a *t* test to verify whether significant differences existed in the questionnaire results between the high and low groups.

We did not propose new theories or revise existing theories in the present study, nor did we investigate the relationships between the model variables. However, through a strict procedure, we developed a scale that can serve as a basis for future studies in developing new theories. Our study contributes to research on the visual aesthetics of mobile websites. Related studies have been ongoing over the last decade; the proliferation of mobile devices in recent years has contributed to the emergence of numerous business activities on mobile websites. The development of the VISMWA is thus fundamental to researching the effectiveness of such websites. The EFA results indicate that colorfulness and craftsmanship on the visual aesthetics inventory should be combined with diversity and be renamed “visual diversity” on the basis of the similarity of their item attributes. Consequently, as shown in Figure 4, the final factors of this scale and the factor definitions, diversity in the context of mobile websites covers the diversity, colorfulness, and craftsmanship of an interface. The uniqueness of mobile commerce has motivated an increasing number of users to migrate from e-commerce platforms to mobile commerce platforms; hence, a comprehensive definition of the visual aesthetics of mobile websites is essential. This paper serves as a milestone in the exploration of the visual aesthetic design of mobile websites.

We developed the scale model through a strict procedure and applied a comprehensive verification process. Data of the verification indices indicate that the proposed VISMWA is a satisfactory model of a sufficiently large scale. Finally, we verified the scale validity by examining the correlation between the VISMWA and another scale on the aesthetics of mobile websites. The results show that this scale correlated significantly with shopping enjoyment, shopping process value, and m-trust, thus confirming the scale reliability. We categorized mobile websites into the high and low groups according to their aesthetic value to increase the generalizability of the results. In addition, we examined the relationship between the website aesthetic values and subsequent user behavioral intentions. Finally, we confirmed that significant differences existed between the high and low Groups.

The research limits of the present study are as follows: Regarding the samples, because we adopted a convenience sampling method, the sampling method might not be strict enough. Respondents were mostly students aged 20–25 years. Concerning the questionnaire survey, 85% of the questionnaires collected in the low group were invalid. We inferred that the respondents tended to give high scores when filling the questionnaire; however, this tendency generated a considerable number of invalid questionnaires. We suggest that future studies adopt laboratory experiments, in which the respondents can view both mobile websites with high and low aesthetic value to reduce the number of invalid questionnaires. We initially proposed seven factors, which were subsequently integrated into five factors. Nevertheless, along with technological advancements, new functions of mobile devices continue to be developed. We recommend that future scholars propose relevant factors in a timely manner to measure the visual aesthetics of mobile websites.

In summary, we developed the VISMWA to determine the expected aesthetic value of mobile websites. The results indicate positive relationships between the aesthetic value of mobile websites and shopping enjoyment, shopping process value, and m-trust. Companies using mobile websites can also apply the research results to induce purchasing intentions in the consumers, thereby improving their potential revenue through mobile websites.

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