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# Modelling the Persuasive Visual Design Model for Web Design: A Confirmatory Factor Analysis with PLS-SEM

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**Abstract.** Visual design plays an important role in grabbing web users' attention in an online environment. Previous research has demonstrated that different types of visual design causes different impact towards the end-users. This paper observes the impact of persuasive visual towards users' first impression, attitudes, and behaviours. It extends existing web visual design by empirically examining the critical roles of the principles of social influence in the form of visual persuasion in motivating users to have a favourable impression of a particular website. Survey data was collected in an experimental study that was conducted online. Structural model assessment is carried out using confirmatory factor analysis (CFA) in conjunction with PLS-SEM analyses. The general analysis of model fit indicates that the two models proposed in this paper surpassed the cut off values for model acceptance with most of the model fit criteria reflects outstanding explanatory power. The result of the analysis indicates that visual persuasion has a big impact in influencing users' attitudes on the web; strong enough to affect their behavioural intention.

## INTRODUCTION

Researchers in the field of information system have long emphasise on the importance of visual aesthetic to satisfy the users. Past research has proved that a website with high aesthetic design satisfies the web users more compared to less appealed website even though usability was well design (Lindgaard & Dudek, 2003), indicating that visual aesthetic is assessed independently from perceived usability (Lindgaard & Dudek, 2002). Thus, it is argued that visual aesthetic plays an important role in influencing users' overall impression of a website. Notably, first impression of a website is made instantly (Dahal, 2011; Sheng, Lockwood, & Dahal, 2013) thus making it more crucial to trigger web users' interest as soon as they set eyes on the website. In such a short time, it is more likely that the web users will only take note at the visual objects that stand out on a website. One of the approaches that can be used to attract web users' attention is by designing the website persuasively (N Ibrahim, Shiratuddin, & Wong, 2016; Urrutia, Brangier, Senderowicz, & Cessat, 2018). With regards to impression formation, it is argued that the users may get attracted to certain aspect of the visual aesthetic while ignoring others (Carrasco, 2011).

Hence, this research examines the use of visual persuasion as the objects of interest to influence favourable impression of the web users. For this purpose, the principles of social influence in Cialdini (2009) are defined as the dimension of social influence in the extended version of first impression formation of persuasive website model by Kim and Fesenmaier (2008). A recent article that compares the impact of a fairly common visual design and a persuasive visual design clearly shows the role of persuasive visual design in influencing the relationship between users' attitudes and their behavioural intention (see N Ibrahim et al. (2016); Nurulhuda Ibrahim, Shiratuddin, & Wong (2016)). This article extends the previous work by assessing the extended persuasive visual design model depicting the relationship between social influence dimension and users behavioural intention.

## RESEARCH BACKGROUND

Early discussion of persuasion in the domain of interface design is evident from the work of (Gurak, 1991) and (Tovey, 1996). The research evaluated the rhetorical effectiveness of metaphor that appeals to users' emotions as well as presenting the idea of influencing computer users with the visual elements in the computer application. The result shows that graphical user interface appeals to the credibility of the application. It is noted that at the time when the research was conducted, computer is still considered as an alienated technology in which users has yet to overcome their fears of computing. Much later, as Internet technology and e-commerce emerge, Winn & Beck (2002) initiated the idea that web design elements also have their own persuasive power. They believed that the design elements on a website can serve as the persuasive triggers that persuade web users to explore and interact, up to the extent that the users may purchase something on the site. The outcome of the research reveals that design elements appeal to users' observation of logic, emotion, and credibility differently based on the way they are being presented on the web. Similarly, researchers in (Chu, Deng, & Chuang, 2014) conducted a pair-wise comparison with 13 experienced online shoppers to rank the importance of 9 persuasive triggers. They conclude that persuasive triggers appealing to website's credibility and logic are more important than appealing to users' emotion.

Likewise, research has proven that sensory information is one of the factors that affect to users emotion while visiting a website (Woojin Lee, Gretzel, & Law, 2010). When visiting a website, the users brain collects information he/she received from the senses e.g. sight, hearing. The information is visualised in the brain to create visual form of the information; a process that is known as mental image processing. Researchers highlight that mental imagery formed from sensory information helps users to form expectations and creating experiences similar to product trial (Woojin Lee et al., 2010).

In psychology, a first impression is the event when one person first encounters another person and forms a mental image of that person. Upon entering a website, it takes around 50-500 milliseconds for average users to process their mental model of first impression (Lindgaard, Fernandes, Dudek, & Brown, 2006; Reinecke et al., 2013). In this short time, it is wise to imply that their impression is mostly influenced by the visual design on which they lay their eyes upon entering the website. This is supported by existing studies that shows how first impression is highly correlated with visual appeals of the website (Lindgaard et al., 2006; Phillips & Chaparro, 2009; Reinecke et al., 2013). The first impression formed during this short time helps the users to decide whether they are going to remain at the website, or continue surfing to other sites (Tuch, Presslaber, Stöcklin, Opwis, & Bargas-Avila, 2012). Regardless of the instant moment taken for the development of first impression, it appears to be powerful and often have a long-term effect on users' perceptions and attitude towards a website (Reinecke et al., 2013; Sheng et al., 2013). In the context of this research, first impression is perceived as the event when a user first encounters a new website, and forms a mental imagery of that website. As such, time duration is not regard as a variable in the research.

Previously, an empirical research was conducted to investigate the key design factors in the formation of impressions towards web interfaces (see Kim (2008); Kim & Fesenmaier (2008). The research investigated the importance of website design in influencing users' impression of the website, and how it affects user' intention to elaborate further on the website. Screenshots of 50 official state tourism websites in the United States are used as the treatments during the experiments, and the research participants were exposed to each screenshots for 7 seconds as the method to examine users' instant reaction of the website's design. Limitation of the research includes inability to perform examinations on the use of particular design components, as well as the experiment was not identical to the actual web environment. It is predicted that these limitations lead to some unfavourable implications to the research findings. As such, the current research aims to improvise Kim (2008) and Kim & Fesenmaier (2008) model by making the following adjustments: 1) Instead of using a slide show of tourism website's homepage, this research's experiments will be carried out using web sample that runs in a web server, thus creating an identical web environment. 2) No time limit was set during the experiment's walkthrough. Research participants freely explored the web site anyhow they like. 3) As time limit was not set, first impression factor is not observed. Contrarily, this research observes users' satisfaction of the website, the model are discussed from the perspective of user experience (UX) of human computer interaction. At this stage, users' satisfaction is estimated to mediate the interactions between users' motivation to process the information on the web and their behavioural intention. 4) In Kim (2008) and Kim & Fesenmaier (2008) research, no specific visual cue is studied. On contrary, this research focused on visual persuasion as the treatment in the persuasive visual design. 5) Visual persuasion is classified according to the Cialdini (2009) social influence's principles of reciprocity, commitment, liking, social proof, authority and scarcity.

This research implies that the added value of social influence principles depicted in the form of persuasive visuals can enhance the persuasiveness of a website. It is predicted that the more persuasive a website is perceived to be, the more likely web users to form a favourable first impression toward the website that consequently affects users' attitudes towards the website. In the extended model, perceived informativeness, usability, credibility, visual aesthetic, engagement, and social influence represent the predictors, whereas satisfaction and behavioural intention represent the observed variables (see Nurulhuda Ibrahim, Shiratuddin, & Wong (2014)). The newly extended model needs to be explored with exploratory analysis before a much solid model can be developed; hence, the inclusion of the social influence dimension in the SEM is made under two conditions: 1) the principles of reciprocity, commitment, authority, liking, social proof, and scarcity are treated as dominant variables in the 1st order model, and 2) in the 2nd order model, the six principles is treated as the constructs for the social influence dimension.

## RESEARCH DESIGN

The objective of the article is to assess the impact of social influence factors by means of visual persuasion in influencing web users' behavioural attention. An online experiment was conducted where participants were randomly assigned to evaluate either the non-persuasive or persuasive website. The survey employed an A/B test method, a common type of live-site study in which the researchers manipulate elements of the page that are presented to the users (Albert & Tullis, 2013). Following the design guidelines for conducting A/B test method, the control and treatment websites were identical and shared the same colour, navigation, and layout themes to ensure that there were only small differences between both web samples. To emphasise the social influence principles in the persuasive website, several design cues are used as the persuasive triggers, as explained in Ibrahim, Wong, & Shiratuddin (2015). Adopting the procedures in (Tang, 2009), participants were required to navigate a website before filling up the online questionnaires. In total, 181 participants recruited via Facebook evaluated the persuasive website. Majority of the participants age between 18-40 years old, hold a degree, employed or a student, spent at least 3 hours online daily, and travel at least one a year.

## DATA ANALYSIS AND RESULT

Data obtained from the survey was not normally distributed, leading to the decision to use Partial Least Squares Structural Equation Modelling (PLS-SEM) to assess the structural model. Due to multicollinearity issue, several factors in the model were either removed or combined as a new factor. It is predicted that the outcome of the model assessment was due to the fact that this research is evaluating the visual design of a website, thus participants' responses relied on the way they look at the visual object on the website. For example, visual cues related to the principles of liking, social proof, and authority were about human figures or something that everyone is paying attention at (e.g. 'like' button). As such, the items split into two categories, i.e. items related to human figure forms a group labelled as human persona, whereas items related to the crowds opinion forms another group referred as the wisdom of crowds. Figure 1 portrays the SEM models after modification. After that, structural model assessment is carried out on the SEM models to discover the model fit as well as the relationship between the predictors and the observed variables.

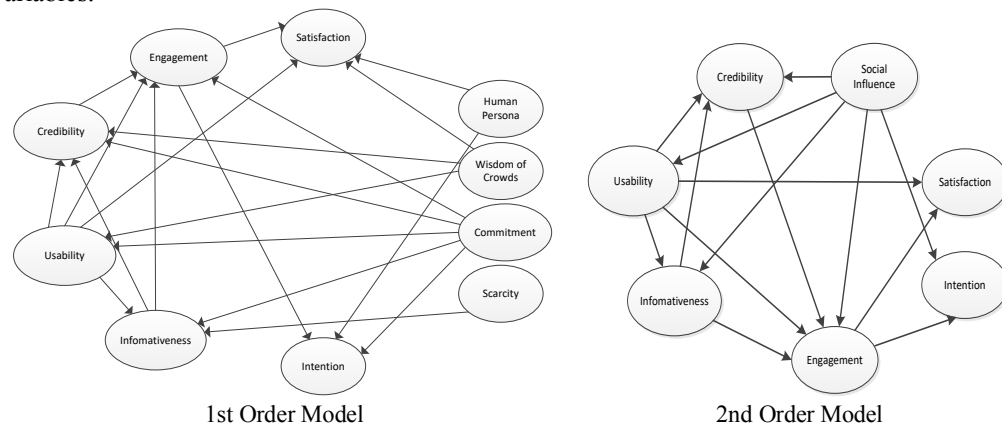


FIGURE 1. 1st order model of persuasive visual design model

Three main criteria in (Kock, 2015) are referred for assessing the model fit: 1) significant P values at 0.05 levels for the Average path coefficient (APC), 2) Average block VIF (AVIF) must be lower than 5, and 3) significant P values at 0.05 level for Average R-squared (ARS); respectively and in the order of importance. Basically, all the model fit criteria mentioned above is well met by the 1st order and the 2nd order models, indicating that both persuasive models have acceptable qualities. The Tenenhaus Goodness of Fit (GoF) thresholds by Wetzels, Odekerken-Schröder, & van Oppen (2009) are used to estimate model's explanatory power. The Gof of equal or greater than 0.25, and 0.36 represent moderate and large explanatory power, respectively. Therefore, the 1st order and the 2nd order model exceed the threshold with GoF of greater than 0.6 each; indicating that both models have outstanding explanatory power. The latent variable coefficient ( $R^2$ ) threshold in Hair, Ringle, & Sarstedt (2011) is referred, i.e.  $R^2$  of 0.75, 0.50, or 0.25 are considered as substantial, moderate, or weak, respectively. The model quality indices indicate substantial variability of the perceived engagement's data in the 1st order and the 2nd order model (i.e.  $R^2$  of 0.813 and 0.821, respectively). The rest of latent variables record moderate  $R^2$  except for perceived credibility that shows weaker coefficient (i.e.  $R^2$  of 0.484 in the 1st order model and 0.477 in the 2nd order model). In particular, the 1st order model better explains perceived credibility, satisfaction, and behavioural intention whereas the 2nd order model better explains perceived informativeness, usability, and visual engagement.

Each arrow in the SEM model represents a hypothesis. The hypothesis is empirically supported if the following three conditions are met: 1) the estimated path coefficient ( $\beta$ ) is in positive value, 2) the p value is significant (less than 0.05), and 3) the effect size (ES) is above 0.02. Otherwise, if one of the conditions is not fulfilled i.e. the  $\beta$  is a negative value, the p value is insignificant, or the ES is below 0.02, the hypothesis will be rejected. Negative  $\beta$  means that any increment of the latent variable causes a decrement in the criterion variable; whereas ES below 0.02 means that the association is too weak to be considered. Referring to the result shown in Table 1, it can be summarised that the outcome of the path analyses are quite consistent between both persuasive models. The only difference spotted is in the association path of perceived informativeness and perceived credibility, that is the association is significant in the 1st order model ( $\beta=0.181$ ;  $p=0.006$ ;  $ES=0.103$ ) and not significant in the 2nd order model ( $\beta=0.100$ ;  $p=0.084$ ;  $ES=0.056$ ).

**TABLE 1.** Path analysis result with WarpPLS 5.0

| Associations                       | 1st order |       |            | 2nd order |       |            |
|------------------------------------|-----------|-------|------------|-----------|-------|------------|
|                                    | $\beta$   | ES    | Supported? | $\beta$   | ES    | Supported? |
| Usability → Informativeness        | 0.461     | 0.326 | ✓          | 0.300     | 0.212 | ✓          |
| Commitment → Informativeness       | 0.137     | 0.090 | ✓          | -         | -     | -          |
| Scarcity → Informativeness         | 0.246     | 0.148 | ✓          | -         | -     | -          |
| Social influence → Informativeness | -         | -     | -          | 0.500     | 0.372 | ✓          |
| Commitment → Usability             | 0.672     | 0.521 | ✓          | -         | -     | -          |
| Crowds → Usability                 | 0.170     | 0.098 | ✓          | -         | -     | -          |
| Social influence → Usability       | -         | -     | -          | 0.805     | 0.649 | ✓          |
| Informativeness → Engagement       | 0.192     | 0.137 | ✓          | 0.127     | 0.091 | ✓          |
| Usability → Engagement             | n.s.      | -     | ✗          | n.s.      | -     | ✗          |
| Credibility → Engagement           | 0.435     | 0.352 | ✓          | 0.412     | 0.333 | ✓          |
| Commitment → Engagement            | 0.315     | 0.251 | ✓          | -         | -     | -          |
| Social influence → Engagement      | -         | -     | -          | 0.394     | 0.331 | ✓          |
| Informativeness → Credibility      | 0.181     | 0.103 | ✓          | n.s.      | -     | ✗          |
| Usability → Credibility            | 0.206     | 0.130 | ✓          | 0.198     | 0.124 | ✓          |
| Commitment → Credibility           | 0.240     | 0.152 | ✓          | -         | -     | -          |
| Crowds → Credibility               | 0.184     | 0.099 | ✓          | -         | -     | -          |
| Social influence → Credibility     | -         | -     | -          | 0.441     | 0.297 | ✓          |
| Usability → Satisfaction           | 0.196     | 0.119 | ✓          | 0.139     | 0.084 | ✓          |
| Engagement → Satisfaction          | 0.633     | 0.465 | ✓          | 0.631     | 0.463 | ✓          |
| Crowds → Satisfaction              | 0.182     | 0.059 | ✓          | -         | -     | -          |
| Human persona → Satisfaction       | 0.178     | 0.062 | ✓          | -         | -     | -          |
| Engagement → Intention             | 0.668     | 0.542 | ✓          | 0.559     | 0.452 | ✓          |
| Commitment → Intention             | n.s.      | -     | ✗          | -         | -     | -          |
| Human persona → Intention          | 0.207     | 0.091 | ✓          | -         | -     | -          |
| Social influence → Intention       | -         | -     | -          | 0.297     | 0.228 | ✓          |

Particularly in the 1st order model, perceived informativeness is positively related to perceived credibility and engagement, but not significantly associated with satisfaction and behavioural intention. Usability has positive



influence on informativeness, credibility, and satisfaction. Perceived credibility is found to only positively affect perceived engagement. Perceived engagement in turn, directly influence satisfaction as well as behavioural intention. As for the social influence dimension, commitment is positively associated with perceived informativeness, usability, engagement, and credibility whereas scarcity only has impacts on perceived informativeness. Reciprocity, liking, social proof, and authority are not tested in this section as the variables were either excluded from the model due to insignificant paths or rebranding as new variables during measurement model assessment of reliability and validity. Due to that, two variables are newly constructed, i.e. human persona and wisdom of crowds. Human persona is found to influence perceived satisfaction and behavioural intention. In the meantime, wisdom of crowds has impact on usability, credibility, and satisfaction.

Similarly, in the 2nd order model, informativeness is positively associated with engagement. Usability is significantly related to informativeness, credibility, and satisfaction in the same way credibility affected engagement. In turn, engagement significantly influences satisfaction and behavioural intention. Interestingly, social influence shows positive impacts on perceived informativeness, usability, engagement, credibility, as well as behavioural intention. The ES for the associations are between 0.228 and 0.649, indicating medium to large effect on the path coefficients. This result shows that social influence factors play a major part in influencing users' motivation during their visit to a website. Interestingly, perceived satisfaction of visual persuasion on the website does not have a direct impact on behavioural intention in both models. Instead, a number of other motivating factors appear to have direct impacts on behavioural intention.

## CONCLUSIONS

This paper is extending the previous work in Ibrahim et. al. (2014, 2016) by assessing the persuasive visual design model for website design. The models' fit in this article shows greater qualities than the non-persuasive model built to estimate the relationship of visual design in general and behavioural intention (see Ibrahim et al., 2016). Thus, it is concluded that persuasive visual design model better explains web users' behavioural intention. Specifically, the use of visual persuasion helps to improve users' perceptions of the website design. This also means that Cialdini's principles of social influence are applicable in the form of visual persuasion.

Social influence positively impact perceived informativeness, usability, engagement, and credibility while indirectly influences users' satisfaction of the website. The result shows that by using visual persuasion in the design, it helps users to easily look for information as the most wanted information are tailored according to their need. The visual persuasion used in the study is also useful in engaging the users with the content of the website. More importantly, with visual persuasion, the website appears more credible to the users. The outcome of research emphasises that persuasive visual design appeals to the web users' perception of first impression, attitudes and behavioural intention.

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