Modelling Visual Aesthetics of m-atmospherics : An Environmental Psychology Perspective

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Introduction

Mobile commerce is getting very popular in today's world and increasingly m-commerce is becoming easier and affordable to a larger section of people. As the numbers of users are increasing day by day, the m-commerce industry is progressing at a rate of 17% and is expected to grow at a rate of 30-35% by 2019 (Chou, Chuang & Shao, 2016). This has resulted in an abundance of mobile apps and increasingly marketers are using them for multiple related applications, like for customer relationship management; precision targeting and relationship management (Pentina*et al*., 2016).Mobile applications, popularly known as apps, can be defined as software that is downloadable to a mobile device, which often displays a brand identity and has higher levels of user engagements (Bellman*et al*., 2011; Zhao & Balagué, 2015). Apparently the number of apps available in the global market is beyond 1,000,000 (Hou & Ho, 2013), and as more and more apps are flooding the market one of the major challenges for the marketers is in making the customers to use and re-use their apps. So identifying those key factors that influence the app adoption behavior of users is a key aspect, which marketers should focus on.

In academic literature also, there are numerous studies which attempted to understand the various marketing aspects related to apps, like simplicity of interface and satisfaction (Choi& Lee, 2012);type of mobile platform and user experience (Taylor & Levin, 2014); consumption behavior on mobile news apps (Xu *et al*., 2014); source's influence on app users' attitude (Shen, 2015), and factors influencing affective involvement with apps (Kang, Mun& Johnson, 2015). Yet, barring a few studies (e.g; Li, Dong &Chen, 2012; Zhou, 2011), those which attempt to identify those crucial factors influencing the adoption of mobile apps, remain largely unexplored in the marketing literature(Taylor & Levin, 2014). One such crucial factor, which influences the adoption of mobile apps, is the visual aesthetics of interfaces (e.g; Cyr, Head & Ivanov, 2006; Hoehle & Venkatesh, 2015; Li & Yeh, 2010) and studies have shown that visual aesthetics can influence the revisit and loyalty intentions for apps (Cyr, Head & Ivanov, 2006), increase customer engagement (Kim, Lin & Sung, 2013) and user experience (Hou & Ho, 2013). Interestingly, understanding the aesthetics aspects of mobile apps is very similar to that of aesthetics in service delivery environments – atmospherics (Kotler, 1973) and hence, in line with Guido and others (2017), this study also chooses to call it as mobile atmospherics (m-atmospherics).

When it comes to visual aesthetics, consumers quite often evaluate the aesthetic features holistically and subjectively than as separate entities like color, layout etc. (Tveit, Ode & Fry, 2006).Hence capturing the holistic evaluation of aesthetics is quite crucial. Environmental psychology deals with study of environment on human behavior and has various models, which help in evaluating visual aesthetic factors holistically (Stamps, 2004). This study proposes a holistic model by making use of Kaplan's (1987) information processing model from environmental psychology, Technology Adoption Model (TAM) (Davis, Bagozzi &Warshaw, 1989) thereby linking the visual aesthetics of mobile apps to re-visit intentions or m-loyalty.

Background and Literature review

Aesthetics, often referred as "the philosophy of beauty" in art literature (Rosen & Purinton, 2004), started gaining attention in marketing literature in early 1980s (Holbrook, 1980; Levy & Czepiel, 1974). Since then aesthetics has been applied in various studies related to marketing like product designs (e.g; Bloch, 1995), packaging designs (e.g; Raghubir & Greenleaf, 2006); servicescapes (e.g;Bellizzi & Hite, 1992), logo designs (e.g; Pittard, Ewing & Jevons, 2007) and website designs (e.g;Rosen & Purinton, 2004). Vacker (1993) has demonstrated that theories and studies related to visual aesthetics can be largely classified into two - objective and subjective. Studies in marketing have overwhelmingly adopted an objective approach of aesthetics (e.g; Bloch, 2011; Townsend & Shu, 2010; Wardono, Hibino & Koyama, 2012). However, when it comes to appreciation of visual aesthetics in atmospherics, websites, or m-atmospherics, the experience is based on the overall evaluations and the interactive experience with it (Kumar, Purani & Sahadev, 2013; Manganari, Siomkos & Vrechopoulos, 2007; Rosen & Purinton, 2004) and this can be best captured using subjective approach (Verhoeven, van Rompay & Pruyn, 2009). Studies have attempted usingsubjective variables like perceived complexity on consumers' perceptions and behavioral intentions (Sohn, Seegebarth & Moritz, 2017), over all design aesthetics on m-loyalty (Li& Yeh, 2010) yet all these stimuli variables are not comprehensive enough in capturing the subjective aesthetic attributes. So we propose to use Kaplan's (1987) information processing model from environmental psychology which has a comprehensive set of aesthetic variables and which has strong empirical validation in landscape, built environments and website studies. However, Kaplan's (1987) model lacks elaborate response taxonomy, and so we integrated it with TAM model (Davis *et al*., 1989), which provides a parsimonious set of mediating variables from users' perspective, resulting in revisit (loyalty) intentions. Thus the integration of these two makes the proposed model robust in explaining the perceived visual aesthetics and user responses.

Hypotheses Development:

Kaplan (1987) model, a well-suited one to study aesthetic attributes (Eckman & Wagner, 1994), talks about four sets of subjective aesthetic variables, namely coherence, legibility, complexity and mystery. Coherence refers to how the various elements hang together, the unity, patterning or visual harmony (Herzog & Leverich, 2003; Tveit *et al*., 2006). Legibility is the inferential aspect of comprehension or the ability to understand and find way in an environment (Singh, Dalal& Spears, 2005). Complexity deals with the visual richness of the environment, or the information rate (Herzog & Leverich, 2003), while mystery refers to those aspects of the environment which encourage one to explore with a promise of gaining more information (Herzog& Bryce, 2007). The model is developed in the context of landscapes where humans make sense of the environment through the visual cues present. Out of these four, coherence and legibility are classified as understanding variables, whereas complexity and mystery are classified as exploration variables. Rosen and Purinton (2004) applied Kaplan's variables in website contexts and found out that mystery is not a relevant variable for websites, and hence it is excluded from this study.

Technology Acceptance Model (TAM) by Davis (1989) is one of the parsimonious models related to new technology adoption and has been well researched, adapted and applied in multiple contexts (e.g; Chen*et al*.,2015; Pantano & Priporas,2016; Venkatesh & Davis, 2000). TAM theorizes the mediating effects of ease of use and usefulness resulting in adoption. Later extension of TAM to World Wide Web introduced a new variable of playfulness (Moon& Kim, 2001), which is better expressed as the perceived enjoyment in m-shopping experience (Cyr *et al*., 2006). Hence for this study too we consider ease of use, usefulness and enjoyment as the mediating variables, leading to m-loyalty. Perceived ease of use refers to the extent to which using a particular system would be effort free, where as usefulness is the extent to which some one believes that using a particular application enhances any specific task related performance (Davis, 1989). Perceived enjoyment refers to the extent to which the activity of the using the system is perceived to be enjoyable in its own right (Van der Heijden, 2004).

Influence of complexity:

Extending Rosen and Purinton (2004) definition to apps, complexity can be defined as the visual richness of the graphical user interfaces (GUI) of m-atmospherics. According to information processing theory, increasing complexity leads to uncertainty and human beings increase their involvement levels to cope up with this uncertainty (Nasar, 1987). Complexity increases the perceived information load in the environment, resulting in higher levels of affective responses (Foxall& Yani-de-Soriano, 2005), leading to perceived enjoyments. Also, increase in affective responses positively impacts the ease of use and usefulness (Cyr *et al*.,2006). Again, as involvement increases, the ease with which one uses the app and its perceived usefulness also increase. Unlike in the case of websites, m-atmospheric interactions demand higher degree of cognitive and physical effort (Ghose, Goldfarb & Han, 2012). Also, higher complexity, to some extent can help in overcoming this by increasing the involvement levels of users. Hence it is hypothesised that;

> ***H1****: The perceived level of complexity of m-atmospherics will positively influence the a) perceived ease of use b) perceived usefulness and c) perceived enjoyment.*

Influence of Coherence:

Coherence refers to those features of the environment which help in understanding the setting and hence for m-atmospherics, it refers to the various design aspects of the GUI like the harmony of colour schemes used, redundancy of the elements and structures etc (Rosen & Purinton, 2004). As an understanding variable, coherence aids in immediate understanding of GUI and thus increases the perceived visual quality (Finlay *et al.*, 2006). Studies in landscapes have shown that the more organized and harmonious the setting is, higher will be the affective responses (Nasar, 1987). Positive affective responses result in increased level of perceived usefulness, perceived ease of use and perceived enjoyment (Cyr *et al*., 2006). Also, coherence decreases entropy (Stamps, 2006), which aids the ease of use, which inturn results in perceived usefulness and enjoyment (Cyr *et al*., 2006). Hence it is hypothesised that;

> ***H2****: The perceived level of coherence of m-atmospherics will positively influence the a) perceived ease of use b) perceived usefulness and c) perceived enjoyment.*

Influence of Legibility:

Legibility refers to the level of distinctiveness that enables the users to understand the environment and where by facilitating way finding or navigation (Lynch, 1960). Hence any features or "landmarks" which enables way finding adds to the legibility (Herzog & Leverich, 2003). For m-atmospherics, it can be in terms of meaningful graphics, presence of icons and other features which facilitate exploration. Information theory suggests that legibility aids way finding through the creation of "cognitive maps", where by reducing the confusion and related emotional discomfort (Wener& Kaminoff, 1983). So m-atmospherics which are high on perceived legibility adds to the affective responses of users, leading to enhanced ease of use, usefulness and enjoyment. Hence it is hypothesised that;

> ***H3****: The perceived level of legibility of m-atmospherics will positively influence the a) perceived ease of use b) perceived usefulness and c) perceived enjoyment.*

Interconnection between TAM Variables:

TAM (Davis, 1989) has established the cause effect relationship between perceived ease of use and usefulness, which was reestablished in modified TAM model - TAM2 (Venkatesh & Davis, 2000). Further, these links are also found to be significant in multiple contexts like for internet adoption studies (Moon & Kim, 2001), in m-commerce contexts (Cyr *et al.*, 2006), in consumer technology acceptance model (c-TAM) with hedonic factors (Bruner& Kumar, 2005). Hence, this study also hypothesises that perceived ease of use and perceived usefulness will have a positive relationship in the context of m-atmospherics;

> ***H4:*** *Perceived Ease of Use will positively influence Perceived Usefulness of m-atmospherics*

Like in the case of any other technology products, when ease of use increases, the fun and enjoyability in usage of m-atmospherics will also increase, as ease of use results in mastery of app where by making the usage less cumbersome (Bruner& Kumar, 2005). Also, apps that are easy to use make it less intimidating for the users, resulting in enjoyment (Moon & Kim, 2001). Hence we hypothesise that;

> ***H5:*** *Perceived Ease of Use will positively influence Perceived Enjoyment of m-atmospherics.*

M-loyalty can be defined as the re-use and recommendation intentions of the app users. Higher levels of m-loyalty results in better user engagements with the m-atmospherics. Studies in mobile commerce have shown that perceived usefulness and perceived enjoyment positively influence loyalty (Cyr *et al*., 2006). Also, a similar relationship has been established between usefulness and loyalty in e-services context (Cyr *et al*., 2007). Also, a construct very similar to ease of use -efficiency has been established to have a relationship with e-loyalty in web site contexts (Cyr, Head & Ivanov, 2009). Hence in the context of m-atmospherics also the perceived levels of usefulness, ease of use and enjoyment can result in positive intentions. In line with these studies, we also hypothesize in m-atmospherics;

> ***H6:*** *Perceived Usefulness will positively influence m-loyalty of m-atmospherics.*

> ***H7:*** *Perceived Ease of Use will positively influence m-loyalty of m-atmospherics.*

> ***H8:*** *Perceived Enjoyment will positively influence m-loyalty of m-atmospherics.*

Along with main hypotheses, three separate mediation hypotheses were also introduced;

> ***H9:****Perceived Ease of Use, Perceived Usefulness, and Perceived Enjoyment will mediate the effect perceived level of Complexity on m-Loyalty.*

> ***H10:****Perceived Ease of Use, Perceived Usefulness, and Perceived Enjoyment will mediate the effect perceived level of Coherence on m-Loyalty.*

> ***H11:****Perceived Ease of Use, Perceived Usefulness, and Perceived Enjoyment will mediate the effect perceived level of Legibility on m-Loyalty.*

Research methodology:

The study employed a field experiment with one-shot treatment (Malhotra, 2007) using 4 travel related mobile apps(*Trip.com, TripAdvisor, Cleartrip and Tripoto*) as stimuli. Since the goal of the study was to simulate the users experience in m-atmospherics, in line with Yeh and Li (2014), this study also employed real apps. These apps were installed in 4 android mobile phones of the series HM 2LTE-IN. The display specifications of the devices are kept the same(Size: 4.7 inches, Resolution: 720 x 1280 pixels, Type: IPS LCD capacitive touchscreen, 16M colors).The respondents were mostly working executives and few post graduate students from 3 Indian cities. The respondents were contacted in their office / institute premises and were asked to use two randomly chosen apps for 5 minutes for a given task. They were instructed to perform a task as to select a destination which they would like to visit, identify hotels which they would prefer to stay, read the reviews about tourist destination and the hotels, check the flight rates, and browse through the pictures and maps in the app. On completion of the above-mentioned task, the participants were asked to fill a physical questionnaire.

Out of a total of 280 participants contacted for the study, 258 usable responses were obtained. Respondents were in the age range of 18-62 years with an average age of 27 years. 56 % of the subjects who participated in the study were women and 38% have completed their graduation. The scales on complexity, coherence, legibility were adapted from Rosen and Purinton (2004); perceived usefulness, perceived ease of use, perceived enjoyment and m-loyalty were adapted from TAM (Cyr, Head &Ivanov, 2006) using a 5 point Likert scale.

Data Analysis:

The study made use of partial least square (PLS) Structural Equation Modelling - to test the hypothesised relationships using WarpPLS 5.0 software (Hair, Ringle, & Sarstedt, 2011). The minimum sample size required to perform PLS-SEM should be larger of: (a) 10 times the largest number of formative indicators used to measure 1 construct or (b) 10 times the largest number of structural paths directed at a particular latent construct in the structural model (Hair *et al*., 2011). So 258 responses satisfied the minimum size requirements. Like CB-SEM, in the case of PLS-SEM also the model assessment is done based on structural model and measurement model results.

The study made use of full collinearity VIFs, as recommended by Kock and Lynn (2012) for checking common method variance. This method is more conservative and arguably superior to, the traditionally used exploratory factor analysis test (Kock, 2013). An accepted rule is that a full collinearity VIF of < 5 suggests no common method bias (Hair *et al*., 2011). The full collinearity VIFs (reported below) suggests that there are no serious issues related to common method bias. Since complexity, coherence and legibility was conceived as formative in landscape studies (Diamantopoulos & Winklhofer, 2001), this study has also considered them as such. The assessment of measurement model in PLS-SEM are done differently for formative and reflective variables (Hair *et al*., 2011). Formative variables – complexity, coherence and legibility are assessed for full collinearity indices and significant loadings, and are found to have acceptable indices (Complexity (VIF=2.448), Coherence (VIF=2.925) Legibility (VIF=1.551)). The reflective constructs viz., perceived usefulness, ease of use, enjoyment and m-loyalty are checkedfor its individual item reliability, composite reliability (CR) and discriminant validity (Hair *et al*., 2011) and have found to have acceptable values (Usefulness (CR=0.850, α=0.735, AVE= 0.654, VIF= 1.787), ease of use (CR=0.803, α=0.509, AVE=0.671, VIF=1.611), enjoyment (CR= 0.852, α=0.653, AVE= 0.742, VIF=2.009) and m-Loyalty (CR=0.887, α=0.744, AVE=0.796, VIF=2.469)). Discriminant validity, assessed by comparing the average variance extracted (AVE) values associated with each construct to the correlations among constructs and the variables are proven to have discriminant validity as each variable's square root of AVE is larger than correlation between the variable with any other of the model's constructs (Fornell & Larcker, 1981).

To assess the measurement model, a bootstrapping procedure with 999 resamples is used to generate the path co-efficients and *p*-values for the structural paths (Hair*et al*., 2011). The path analysis model is shown in Figure 1. In PLS-SEM, the structural model is assessed on Tenenhaus GoF (GoF) , average path coefficient (APC), Average R-squared (ARS), Average adjusted R-squared (AARS) and Average full collinearity VIF (AFVIF) (Kock, 2013). The Tenenhaus GoF (GoF) is estimated to be 0.573, which is large as per Wetzels, Odekerken-Schroder, and Van Oppen's (2009) threshold (Tenenhaus *et al*., 2005). The average path coefficient (APC) = 0.282; $p<0.001$, average R-square (ARS) =0.542; $p<0.001$, Average adjusted R-squared (AARS)=0.535; $p<0.001$(all are significant at 0.001 level), and the average variance inflation factor (AVIF) =2.114; should be lower than 5 (Hair *et al*., 2011). The R^2 values of the four dependent variables, Ease of Use, Usefulness, Enjoyment and m-Loyalty are 0.579, 0.447,0.492 and 0.650 respectively. According to Falk and Miller (1992), an acceptable level of R^2 is that it should be greater than 0.1.

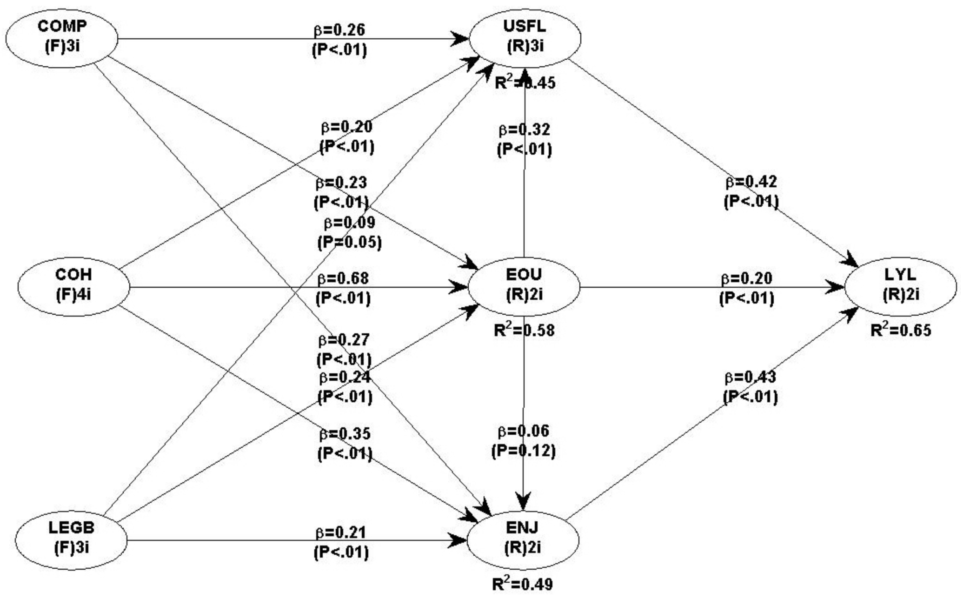

Figure -01: Path Analysis Model

The path co-efficients, which represents the direct hypotheses H1 through H11 and their p – values are provided in Table -01. As evident from the path coefficients and p-values, all hypotheses, except H5 are supported.

Table- 01: Path Coefficients are p-values

Sl.	*Path*	*β*	*p*-value	*Remarks*

No.				
1	Complexity → Perceived Usefulness Complexity → Perceived Ease of Use Complexity → Perceived Enjoyment	0.259 0.235 0.270	<0.001* <0.001* <0.001*	***H1 is supported***
2	Coherence → Perceived Usefulness Coherence → Perceived Ease of Use Coherence → Perceived Enjoyment	0.195 0.677 0.212	<0.001* <0.001* <0.001*	***H2is supported***
3	Legibility → Perceived Usefulness Legibility → Perceived Ease of Use Legibility → Perceived Enjoyment	0.086 0.243 0.212	0.050* <0.001* <0.001*	***H3 is supported***
4	Perceived Ease of Use → Perceived Usefulness	0.315	<0.001*	***H4 is supported***
5	Perceived Ease of Use → Perceived Enjoyment	0.063	0.118	*H5 not supported*
6	Perceived Usefulness → m-loyalty	0.442	<0.001*	***H6 is supported***
7	Perceived Ease of Use → m-loyalty	0.195	<0.001*	***H7 is supported***
8	Perceived Enjoyment→m-loyalty	0.426	<0.001*	***H8 is supported***

*** = p<0.05 ** = p<0.00**

For testing the mediation effects Warp PLS 5.0 provides the measures of indirect effects, which is the estimation of the mediation effects in the model and can be treated as equivalent to the conventional methods of linear mediation estimations by Preacher and Hayes (2004). For a mediating effect to be considered significant, the *p*-value must be significant at a specified level (< 0.05). The results suggest that they are significant, where by supporting hypotheses H9, H10 and H11.

Discussion and Conclusion

The study considers the users' adoption and loyalty to m-atmospherics by considering the comprehensive set of visual aesthetic variables from Kaplan's (1987) model in environmental psychology. These antecedent variables are largely integrated with the technology adoption model to generate a holistic model for assessing the visual aesthetic qualities. The study establishes that the perceived levels of complexity, coherence and legibility drives perceptions of usefulness, ease of use and enjoyment of m-atmospherics. While m-atmospherics is gaining ground in literature, there is tremendous scope to explore the factors which influence its adoption and visual aesthetics is one such crucial factor. The importance of these aesthetic variables, namelycomplexity, coherence and legibility comes to the fore in this context. The extant studies on aesthetics related to m-atmospherics have not attempted a subjective, holistic approach in capturing visual aesthetic qualities.This study addresses this gap by usingtwo broad categories of understanding and exploration variables. The insights of this study can possibly help managers and designers in assessing, designing or redesigning the GUIs of their apps so as it increase the user involvement and behavioural loyalty. The study therefore underlines the importance of adjustingcomplexity, coherence and legibility in m-atmospherics in order to achieve greater levels of loyalty. It is seen that the relationship between ease of use and enjoyment are not supported in the study, possibly because as ease of use increases, boredom sets in, which results in lack of enjoyment. In short, our study further extends the existing aesthetic studies related to mobile apps by providing a subjective, parsimonious set of stimuli variables.

The study throws up important issues for further research. For instance, it could be interesting to probe further the impact of other independent aesthetic variables like novelty, visual scale, familiarity, typicality etc. and how they impact overall loyalty and adaptability for m-atmospherics. The study can also be conducted by considering the moderating effects of usage types like for shopping, banking, information seeking, hospitality etc. A true experimental study by manipulating the independent variables can also provide richer insights.

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