An Analysis on Human Personality and Hotel Web Design: a Kohonen Network Approach

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Abstract

Having an eye catching and attractive website could help hotels to compete in the vigorous online market. This study attempts to examine the relationship between human personality and the web design preferences. Kohonen Networks were adopted to cluster people with similar personality characteristics and identify their differences on web design preferences. Empirical results indicated people with similar personality traits have similar design preferences. For example, to attract those who got high scores in agreeableness, conscientiousness and openness but low score in neuroticism, a web page should start with a language selection page with introductory movie, one large image on the web page showing hotel interior design with hotel guest in the photo, and with background music.

Keywords: Kohonen Networks, Big-Five Personality, web design, clustering, user behavior

1 Introduction

In 2001, 28 million websites were available; whereas in 2010, it has an eight-fold increase to 226 million websites (Netcraft, 2010). Apparently, the number of websites is growing in millions sites every month. Prior research found that users took less than one second to judge a website's acceptability (Lindgaard, Fernandes, Dudek, & Brown, 2006). If a website does not satisfy the users, they will search for alternatives immediately. To attract users to stay, web masters need to improve the first impression of the website. However, different people have different aesthetic view points, so web designer should consider individual differences caused by personality traits and cater for different users' needs (Chung & Ahn, 2007; Cunningham, Thach, & Thompson, 2007). Currently, many of the existing hotel website evaluation studies calculate the mean score of each attributes and use the total score to represent the performance of the website (Bai, Law, & Wen, 2008). However, these scores only reflect the overall performance but personal preferences were not considered. The objective of this study is three-fold, to: i) cluster people with similar personality

characteristics, ii) examine the web design preferences by different personality traits, and iii) analyze the relationship between each design preference and the Big-Five personality.

2 Literature Review

2.1 Five-Factor Personality and Human-Computer Interaction

Many personality psychologists hypothesize that traits are reasonably stable over time, relatively consistent over situations, and make people different from each other (Allport, 1961; Larsen & Buss, 2008). The Five-Factor model, also known as the Big Five model, categorized a large number of traits into five groups of *Neuroticism*, *Extraversion*, *Openness*, *Agreeableness*, and *Conscientiousness* (Goldberg, 1990; McCrae & Costa, 1987). Personality is "an important and easily-measured individual difference among users" (Nass & Lee, 2000, p.330) and it can influence individual cognition, motivations and behaviors (Ryckman, 2008). Several prior studies have indicated that individuals interact with computers according to their personality (Isbister & Nass, 2000). As human factor is an important factor in Human-Computer Interaction (HCI) design, individual differences must be considered when designing system interface. People with extraversion and neuroticism show different patterns when they access the Internet (Hamburger & Ben-Artzi, 2000), and it demonstrated the Internet can no longer be perceived as a general and undifferentiated medium (Amiel & Sargent, 2004). Incorporating individual personality difference into future interactive system design is thus required (Amichai-Hamburger, 2002) because different personality types have different artistic preferences on artistic items (Rentfrow & Gosling, 2003) and color preferences (Kobayashi, 1998).

2.2 Hotel Website Design and Aesthetic Preferences

Many hotel website usability evaluation methods concentrated on ease of use, and efficiency considerations (Au Yeung & Law, 2006) but aesthetics of the website were rarely examined. The design of a website can influence the way a user interacts with the page (Michailidou, Harper, & Bechhofer, 2008). Prior studies indicated that the aesthetic aspect of website context serves as an important role especially in HCI (Schenkman & Jonsson, 2000). In addition, usable products are not equivalent to pleasurable products (Jordan, 1998). As such, if a website is not attractive, customers will leave immediately before they can experience how well the usability is. By manipulating a website's visual components such as colors, text style and size, images and animations, users' perceptions on the website could be altered (Zettl, 2008). A positive first impression of a website could prolong the web usage time (Kim & Fesenmaier, 2008). Furthermore, creditability and acceptability of a website are probably made within a second and this first impression will directly affect whether a user will stay or not (Robins & Holmes, 2008). Obviously, aesthetic is a key factor in the first impression but some researchers also highlighted individual evaluators may differ in terms of their tastes on aesthetic (Tractinsky, Cokhavi, Kirschenbaum, & Sharfi, 2006). Visual aesthetics, as a strong determinant of interactive enjoyment

(Jordan, 1998), could affect the perceptions of ease of use, and the overall impression and website preferences (Schenkman & Jonsson, 2000).

3 Methodology

3.1 Personality Segmentation Study

Segmentation refers to the process of forming groups of people that are homogeneous in terms of demand elasticity and accessible via marketing strategies (Brey *et al.*, 2007; Kim *et al.*, 2003). The advantages of segmentation analysis include the identification of appropriate segments for target marketing, competitive advantages through product differentiation, and the ability to target customers more effectively. The need for in-depth knowledge of segments thus remains an essential element in understanding the behavior and expectations of groups of consumers (Bowen, 1998; Cooper *et al.*, 2006; Lieuz *et al.*, 1994). From a methodological point of view, clustering algorithms learn to group data patterns by inspecting the similarities between different input records, and the clustering result is that the degree of similarity among users within the same group is maximized; whereas that between/among different groups is minimized. Clustering serves several purposes in this study. First, it allows us to inspect the entire group of online users and immediately find those who appear to be significantly different from others. Second, clustering allows natural grouping structures to emerge, which gives us an alternative view of the entire group of online users. Observing and modeling the behavior and expectations of each natural group, as distinguished by the characteristics of the data, may be a more insightful approach than observing the behavior and expectations of pre-defined groups. Once a natural grouping structure has emerged, the result could be used as a prediction tool for future data. Rather than examining individual personality trait, this study clustered users with similar personality traits in Big Five as a whole and examine their preferences on web design attributes.

3.2 Kohonen Networks

A Kohonen Network algorithm originated from neuro-physiological experiments (Kohonen, 1995; Mazanec, 1994), and it can be considered as a feed-forward neural network with two layers of nodes. The first layer contains all the data samples as the input nodes that are fully connected with the output nodes on the second Kohonen layer. Each node on the Kohonen layer has a weight vector ω, and the component of this vector represents the strength of the synapse connection to the "input" node. Moreover, the location of each Kohonen node also depends on its weight vectors. The more similar the weight vectors of the input nodes are, the closer they will be mapped on the Kohonen layer. When a new input node is added into the network, it is compared with the weight vectors of the output nodes on the Kohonen layer. Once the most similar weight vector is found, the weights of the winning node and its neighbors are strengthened to reflect this similarity. For its visualization capability, Kohonen Networks can be utilized to do market segmentation. Comparing with traditional clustering-based methods such as K-means, Kohonen networks can automatically determine the best number of segments, while preserving a 2D or 3D

visualization map which is easy for understanding. Successful applications can be found in Rong, Li and Law (2009).

4 Experiment and Analysis

4.1 Data Collection

A database which contains 98 Hong Kong hotel website links and 15 web design attributes were used in the online questionnaire. For each design attributes, websites were divided into two groups with contrasting design. In June 2010, a total of 80 hospitality and tourism undergraduate students were invited to participate in this study.

Table 1. Attributes in Personality Data Set

Attribute	Description
Personality Attribute	
Agreeableness Tendency to be compassionate and cooperative	**High Scorer** - Soft-hearted, good-natured, trusting, helpful, forgiving, gullible, straightforward **Low Scorer** - Cynical, suspicious, irritable, rude, uncooperative, vengeful, ruthless, manipulative
Conscientiousness Tendency to show self-discipline and aim for achievement	**High Scorer** - Organized, reliable, hardworking, ambitious, persevering, self-disciplined, punctual, scrupulous, neat **Low Scorer** - Aimless, unreliable, lazy, careless, negligent, lax
Extraversion Tendency to seek stimulation	**High Scorer** - Active, sociable, talkative, optimistic, person-oriented, **Low Scorer** - Reserved, sober, unexuberant, task-oriented, retiring, quiet
Neuroticism Tendency to experience unpleasant emotions easily	**High Scorer** - Worrying, nervous, emotional, insecure, inadequate, hypochondriaca **Low Scorer** - Calm, relaxed, unemotional, hardy, secure, self-satisfied
Openness Tendency to curiosity, unusual ideas and adventure	**High Scorer** - Curious, broad interests, creative, original, imaginative **Low Scorer** - Conventional, down-to-earth, narrow interests, inartistic, unanalytical
Web Design Related Attribute	
q1: Language Selection	Prefer hotel home page has a language selection page?
q2: Introductory Movie	Prefer hotel home page contains an introductory movie?
q3: Background and Font Color	Prefer dark background and light text color or vice versa?
q4: Pop-up Window	Prefer to have a pop-up window on the web pages?
q5: Menu Bar Location	Prefer to have a menu bar on the top or left of the web pages?
q6: Image Size/Number	Prefer one single large image or several small images on home page?
q7: Slide Show	Prefer to have a slide show of the hotel photos?
q8: Scrolling Text	Prefer to use scrolling text to show promotional information?
q11: Staff in Photo	Prefer to have the hotel staff inside the photos?
q12: Guest in Photo	Prefer to have the hotel guests inside the photos?
q13: Staff or Guest in Photo	Prefer to have hotel staff or the guests in the photos?
q9: Background Music	Prefer to have background music when you are browsing?
q10: Video	Prefer to have a video shown on the web page?
q14: Hotel Building / Interior Design	Prefer to see the hotel building or the interior design images?
q15: Additional Text Description	Prefer to have additional hotel information or selection menu only?

A self-administered online questionnaire which contains 15 questions on website design preferences and ten Big-Five personality scales which was adopted from Rammstedt and John (2007) were distributed. Each of the 15 design questions

randomly display two Hong Kong hotel websites with contrasting design (namely "*A*" was displayed on left hand side and "*B*" was on right hand side). Students were asked to indicate their preference of designs and styles between these two hotel website from "strongly like A" to "slight like A", "no preference", "slightly like B" to "strongly like B". Table 1 listed the details of each question. The personality characteristics were also questioned for each student. Five major personality categories are considered in this work: agreeableness, conscientiousness, extraversion, neuroticism, and openness. As considering the nature of the human personality, three labels (*weak*, *neutral*, *strong*) were used to measure the expression degrees of each personality category. Each student was given five labels for these five personality categories respectively. For example, a set of personality labels like "agreeableness = *neutral*, conscientiousness = *strong*, extraversion = *neutral*, neuroticism = *weak*, openness = *strong*" is given to a person who is hard-working with an opened mind but maybe not very sensitive to the other external effects. In this way, the personality of the students is not simply classified into one single category, but to make it possible to shown the mixture of several personality characteristics on the same person. That is, the result could represent the personality in a more natural way. Totally, 76 students had completed the online questionnaire, representing 95% response rate, and formed the experiment sample data set for this study.

4.2 Results and Discussion

Profile Segmentation Based on Personality Categories. Based on the similarity of the five personality characteristics, all data samples were mapped into a 2-dimensional *xy*-space ($x = [0,3]$ and $y = [0,3]$). The 76 data samples were grouped into 9 segments (Seg_A to Seg_I), as shown in Figure 2. Each segment corresponds to a group of people with similar personality characteristics.

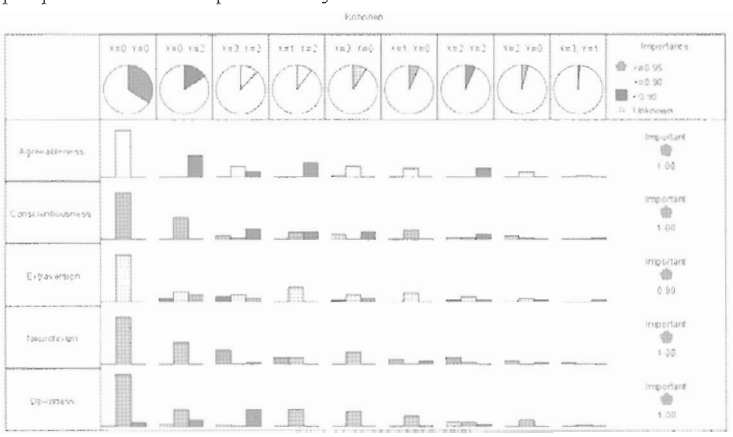

Fig. 1. Segmentation Results Based on Personality Categories

Seg_A contains more than 34% of the people in the data set, in which the majority have no noticeable personality. In this group, the people do not show any particular deviation to any one of the five personality categories. Thus is similar to the people in Seg_F, who are neutral on most of the categories, but none of them is neutral in Neuroticism. In contrast, people in Seg_C have significant personality characteristics.

According to Fig. 1, there are high scores in both Conscientiousness and Openness, but low scores in Neuroticism. People who are considered as agreeable, conscientious but not neurotic are grouped into Seg_D and Seg_G. The difference between these two segments is that people in Seg_D are more neutral in both Extraversion and Openness than those in Seg_G. Seg_B also has people who received high score in agreeableness; however, these people have *stronger* characteristics on both Extraversion and Openness personalities. Besides, people with strong Conscientious characteristics were segmented into Seg_E. Those who received low scores in both Neuroticism and Conscientiousness were grouped into Seg_H. Only one person was separated out from all others, who has a very strong personality on Conscientiousness and Extraversion but very weak on Neuroticism. This person is too special for fitting into any other segments. Therefore, Seg_I was filtered out to hold this special case. The profiles of all nine segments are briefly summarized in Table 2.

Table 2. Segmentation Results Based on Personality Categories

Segmentation	Profile Characteristics	Percentage
Seg_A $(x=0,y=0)$	People with no noticeable personality characteristics	34.21%
Seg_B $(x=0,y=2)$	People who received high scores in agreeableness, extraversion, and openness	15.79%
Seg_C $(x=3,y=2)$	People who received high scores in agreeableness, conscientiousness, openness, but low scores in neuroticism	11.84%
Seg_D $(x=1,y=2)$	People who received high scores in agreeableness and conscientiousness but low scores in neuroticism	10.53%
Seg_E $(x=3,y=0)$	People who received low score in agreeableness but got either high or low scores in conscientiousness	9.21%
Seg_F $(x=1,y=0)$	People who are received either high scores or low scores in neuroticism	6.58%
Seg_G $(x=2,y=2)$	People who received high scores in agreeableness, conscientiousness but low scores in neuroticism and openness	6.58%
Seg_H $(x=2,y=0)$	People who received low scores in conscientiousness	3.95%
Seg_I $(x=3,y=1)$	People who received high scores in conscientiousness, extraversion but low scores in neuroticism	1.32%

Results on Website Design Preference. One of the objectives in this study is to analyze the relationship between each design preference and the Big-Five personality. To achieve the expected the results, web design related attributes were applied as the associated attributes on the segments that are generated by Kohonen model. The scores given to these associated attributes would show people's preference to certain web design issues. By studying the similarities as well as the differences among all nine segments with various personality characteristics, some guides for better hotel website designs could be developed.

Language Selection (Question 1) -- Most people in this study prefer to have a language selection page on the home page. As shown in Fig. 2, all those in Seg_D and Seg_H prefer a language selection page. Furthermore, 51 of 76 people prefer to have a selection language first before they enter the main page.

Introductory Movie (Question 2) -- Introductory movie is the most favorable option to be requested on the hotel website, which has the highest percentage (77.63%) among all attributes. It is especially preferred by the groups of people who scored low in neuroticism (Seg_D, Seg_G and Seg_H) (Fig. 3).

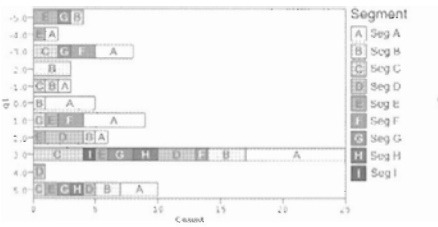

Fig. 2. Language Selection – Q1

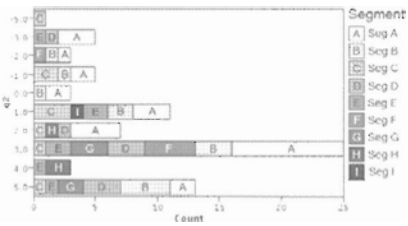

Fig. 3. Introduction Movie - Q2

Background and Font Color (Question 3) -- People with high scores in agreeableness and conscientiousness, and low in neuroticism (Seg_C and Seg_G) prefer this combination more than those with other personality characteristics (Fig. 4). Nearly 70% people feel comfortable with a combination of dark background with a light color text to display information on the hotel websites.

Pop-up Window (Question 4) -- Different to the previously mentioned three issues, pop-up window is one of the only two components that people do not like to appear on hotel websites. It is particularly disliked and avoided by those who scored low in neuroticism (Seg_C, Seg_F and Seg_G) (Fig. 5).

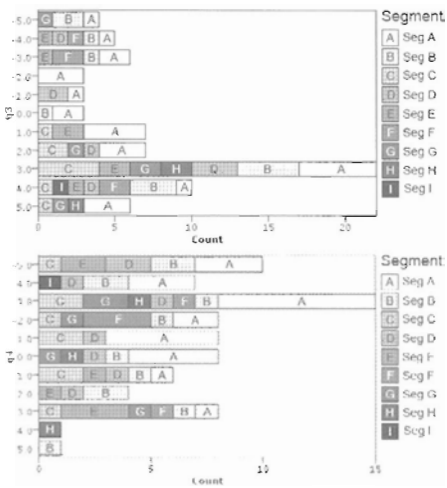

Fig. 4. Background and Font Color – Q3

Fig. 5. Pop-up Window – Q4

Menu Bar Location (Question 5) – As indicated in both Table 3 and Fig. 6, people do not care much about where the web designers put the menu bar. 26 people prefer to

have a menu bar on the top of the web pages, while 25 like to have it on the left side, and the remaining 25 people show no preference on the location.

Image Size/Number (Question 6) -- Those from Seg_D, Seg_F and Seg_G with low score in neuroticism enjoy a nice and clear web page with single large image (Fig. 7).

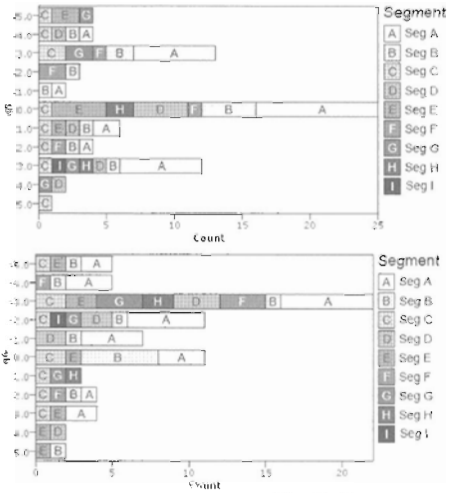

Fig. 6. Menu Bar Location – Q5

Fig. 7. Number of Images and Size – Q6

Slide Show (Question 7) -- Slide show is the second most favorable attribute on hotel website design, which achieves 76.32% support from the people. According to Fig. 8, those with relatively high scores on agreeableness, conscientiousness and low score in neuroticism (Seg_C to Seg_G) especially prefer to watch slide shows on hotel websites.

Scrolling Text (Question 8) -- Scrolling text is the second component that is not popular in all groups (Fig. 9).

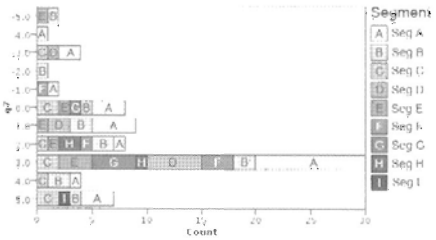

Fig. 8. Slide Show – Q7

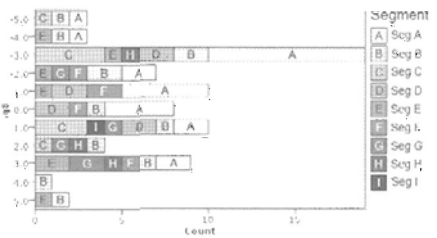

Fig. 9. Scrolling Text – Q8

Background Music (Question 9) -- Similar to the scrolling text, about half of the people enjoy the background music when they are browsing the hotel websites. However, Fig. 10 shows that people with low score in neuroticism (Seg_D and Seg_H) have higher preference than other groups.

Hotel Video (Question 10) -- Unlike the introduction movie, video of the hotel home page does not attract the majority except for Seg_G (Fig 11).

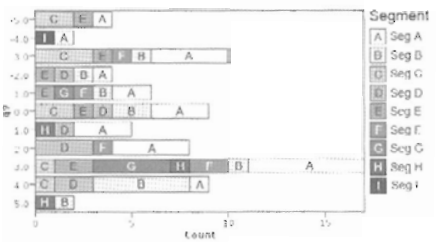

Fig. 10. Background Music – Q9

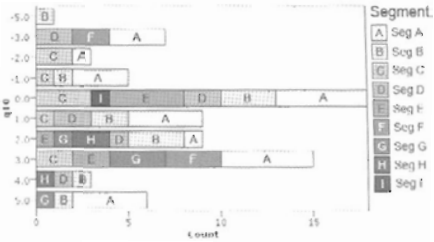

Fig. 11. Hotel Video – Q10

People in the Photos (Question 11-13) -- The answers to these three questions indicated that people like to see other people inside the photos on hotel websites. When having a close look at the preference from the people in different personality segments, Seg_F likes to see human beings inside the photos no matter it is a guest or a staff. Seg_D, Seg_E, and Seg_G prefer to have hotel guests on the photos. However, Seg_H prefer photos without hotel staff or guests (Fig.12).

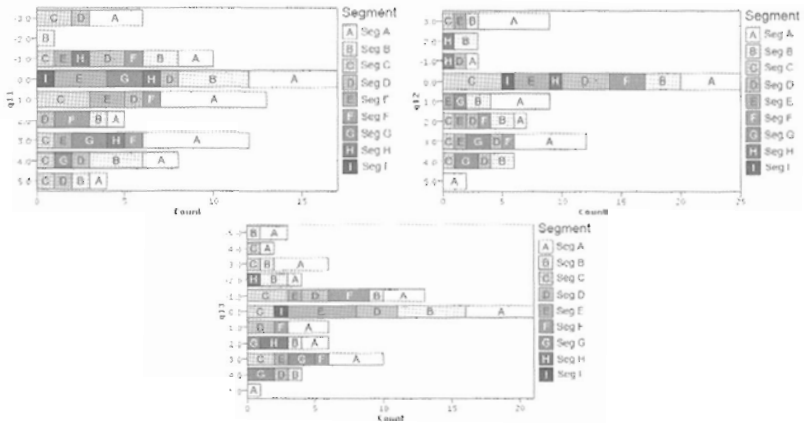

Fig. 12. Hotel Staff and Guests in Photos – Q11 to Q13 (from top left clockwise)

Table 3. Web Design Attributes Preferences

Web Design Attributes	Value/Label		Count	Percentage
q1: Language Selection	[-5, -1]	Disagree	20	26.32%
	0	Neutral	5	6.58%
	[1, 5]	Agree	51	**67.10%**
q2: Introductory Movie	[-5, -1]	Disagree	14	18.42%
	0	Neutral	3	3.95%
	[1, 5]	Agree	59	**77.63%**
q3: Background and Font Color	[-5, -1]	Light background + dark text	21	27.63%
	0	Neutral	3	3.95%
	[1, 5]	Dark background + light text	52	**68.42%**
q4: Pop-up Window	[-5, -1]	Disagree	48	**63.16%**
	0	Neutral	8	10.52%
	[1, 5]	Agree	20	26.32%

q5: Menu Bar Location	[-5, -1]	On the top	26	34.22%
	0	Neutral	25	32.89%
	[1, 5]	On the left	25	32.89%
q6: Image Size/Number	[-5, -1]	One large image	50	**65.79%**
	0	Neutral	11	14.47%
	[1, 5]	Several small images	15	19.74%
q7: Slide Show	[-5, -1]	Disagree	10	13.16%
	0	Neutral	8	10.52%
	[1, 5]	Agree	58	**76.32%**
q8: Scrolling Text	[-5, -1]	Disagree	42	**55.26%**
	0	Neutral	8	10.52%
	[1, 5]	Agree	26	34.22%
q9: Background Music	[-5, -1]	Disagree	26	34.22%
	0	Neutral	9	11.84%
	[1, 5]	Agree	41	**53.94%**
q10: Video Show	[-5, -1]	Disagree	16	21.05%
	0	Neutral	18	23.69%
	[1, 5]	Agree	42	**55.26%**
q11: Staff in Photo	[-5, -1]	With no one	17	22.37%
	0	Neutral	17	22.37%
	[1, 5]	With staff	42	**55.26%**
q12: Guest in Photo	[-5, -1]	With no one	15	19.74%
	0	Neutral	25	32.89%
	[1, 5]	With guests	36	**47.37%**
q13: Staff or Guest in Photo	[-5, -1]	Staff	28	36.84%
	0	Neutral	21	27.63%
	[1, 5]	Guest	27	35.53%
q14: Image with Hotel Building / Interior Design	[-5, -1]	Hotel building	10	13.16%
	0	Neutral	12	15.79%
	[1, 5]	Hotel's interior design	54	**71.05%**
q15: Additional Text Description	[-5, -1]	Selection menu only	18	23.69%
	0	Neutral	11	14.47%
	[1, 5]	Rich hotel information	47	**61.84%**

**numbers in bold indicated the highest percentage in that question*

Hotel Building/Interior Design Image (Question 14) -- Compared to showing hotel buildings, more people prefer to see room interior design. Interior design images are especially attractive to those with high scores in agreeableness and conscientiousness and low in neuroticism which are mainly from Seg_C and Seg_G (Fig.13).

Additional Text Description (Question 15) – Over 61% respondents prefer to have more text describing the hotel services and products; whereas the remaining 23.69% prefer have a selection menu only on a hotel main page (Fig. 14).

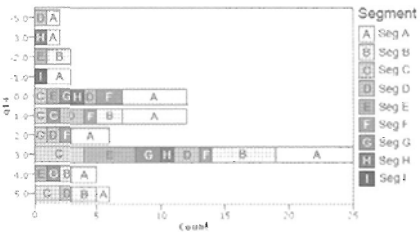

Fig. 13. Hotel Building Image – Q14

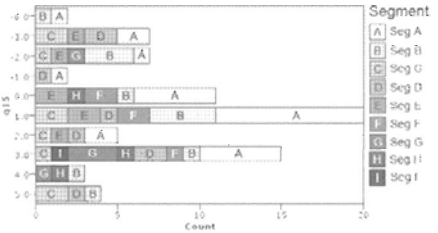

Fig. 14. Additional Text Description – Q15

5 Conclusions and Limitations

This study attempts to identify the website design preferences for people with different personality traits. Findings in this study show people with similar personality characteristics have certain similarities in design preferences. For people who belong to Seg_C (high scores in agreeableness, conscientiousness, and openness, and low in neuroticism), they prefer dark background with light color text, and the photos showing in slide show which contain a hotel's interior design. For those who belong to Seg_D (high scores in agreeableness, conscientiousness and openness but low score in neuroticism), they prefer to have a language selection page with introductory movie, one large image on the web page showing hotel interior design with hotel guests on the photo, and with background music. People who grouped in Seg_F (either high score or low score in extraversion), dislike pop-up windows but prefer rich information display on the home page. For people grouped in Seg_G (high scores in agreeableness and conscientiousness, but low scores in neuroticism and openness), they prefer introductory movies, having hotel videos and images display in a slide show which contains the photos showing hotel's interior design without hotel guests. Finally for Seg_H (People who got low score in conscientiousness), they prefer to have language selection page with an introductory movie, dark background with light color text, having a slide show showing hotel photos without individuals, and contains background music. The study of the individual differences could help develop website customization. Base on individual preferences, web designers could prepare various design templates to cater individual interests. Furthermore, individual personality could be predicted via their browsing history. In the future, website customization could be automated by the website itself.

This exploratory study has some limitations which render its inability to generalize the findings. First, the sample size is relatively small and all the subjects were undergraduate students in hospitality and tourism from one university. Therefore, result on personality test could skew towards certain personality traits. Second, all the websites displayed in the questionnaire were randomly selected from a database which contain all Hong Kong Hotels Association members' websites. The overall design of the individual website might also affect the user's preferences on a specific design attributes.

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