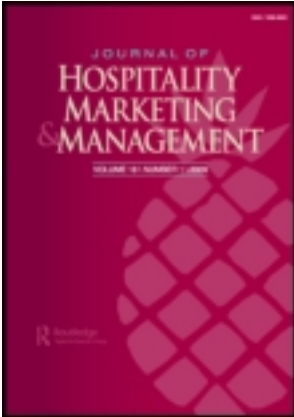


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### Personality Differences and Hotel Web Design Study Using Targeted Positive and Negative Association Rule Mining

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## **Personality Differences and Hotel Web Design Study Using Targeted Positive and Negative Association Rule Mining**

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*As people have unique tastes, the way to satisfy a small group of targeted customers or to be generic to meet most people's preference has been a traditional question to many fashion designers and website developers. This study examined the relationship between individuals' personality differences and their web design preferences. Each individual's personality is represented by a combination of five traits, and 15 website design-related features are considered to test the users' preference. We introduced a data mining technique called targeted positive and negative association rule mining to analyze a dataset containing the survey results collected from undergraduate students. The results of this study not only suggest the importance of providing specific designs to attract individual customers, but also provide valuable input on the Big Five personality traits in their entirety.*

**KEYWORDS** *association rule mining, Big Five personality, web design, user preference*

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## INTRODUCTION

The Internet is generally considered to be the most cost-effective and efficient marketing channel in the past decade (Ip, Leung, & Law, 2011) and any tourism organization that cannot be found on the Internet could be treated as though it “does not exist” (Sigala, 2011). This is especially true for the tourism industry because the majority of target customers who access tourism websites are nonlocals. At present, the Internet can provide an almost unlimited repository of information that is always available and accessible on demand from virtually anywhere in the world.

Tourism enterprises are increasingly using the Internet as a marketing tool (Schmidt, Cantalops, & dos Santos, 2008). According to the annual U.S. Census (2009), 23% of the sales revenue from tourism and reservation services was earned online. There are also a growing number of tourists who use the Internet for travel planning (Pan & Fesenmaier, 2000; Tjostheim, Tussyadiah, & Hoem, 2007). According to Internet World Stats (2010), the world's total number of Internet users has increased fivefold in the past decade, from 360 million to 1.96 billion. Moreover, the Travel Industry Association of America (2006) has reported that the percentage of Americans buying tourism products online was 31% in 2004, rising to 64% by the end of 2010 (Zickuhr, 2010). Thus, the online tourism business clearly has a strong potential to increase business volume.

Robbins and Stylianou (2003) divided web design into two core features: presentation (how the content is presented on the web page) and usability (how the user interacts with that content). The presentation first attracts a user's attention and usability affects the user's perception of the website. The visual design affects the perception of usability. However, different people have different design preferences, therefore, human-computer interaction (HCI) design takes into account individual differences arising from different personality traits, cater for various users' needs (Chung & Ahn, 2007; Cunningham, Thach, & Thompson, 2008; Pocius, 1991). If users are not satisfied with a website, they will not return to the website (Kao, Louvieris, Powell-Perry, & Buhalis, 2005). Previous research has found that customers' personality traits can influence marketing outcomes (Chen & Lee, 2008; Vazquez-Carrasco & Foxall, 2006). Amichai-Hamburger (2002) and Marcus, Machilek, and Schutz (2006) pointed out that most web designers ignore human personality factors when designing web applications. Therefore, Tractinsky, Cokhavi, Kirschenbaum, and Sharfi (2006) recommended that future research should investigate the factors that influence users' perceptions of website design. A key to success in e-commerce would be to understand people's preferences in website design such as color, layout, and the use of text and images. Web designers can subsequently create an eye-catching website for each individual or one that is preferred by the majority. To bridge these gaps, this study proposes to include human personality as

a factor in hotel website evaluation. We examine the relationship between individuals' personality differences and their design preferences, and propose a design template for different personality types. The Internet is the most cost effective and efficient distribution channel, which the tourism industry has widely adopted for promoting their products. As accommodation is one of the most important sectors of the tourism industry, a hotel website plays an important role in attracting business. This study, therefore, focuses on hotel websites and data mining was adopted to examine the relationship between human personality and web design preferences. Our objectives in this study are to:

- adopt association rule mining to examine the relationship between personality and web design preferences;
- contrast the likelihood of design preferences with different levels of personality traits; and
- provide suggestions that should help web designers to create an attractive web interface to attract people with different personality traits.

## LITERATURE REVIEW

### Personality and HCI

Benyon, Davies, Keller, Preece, and Rogers (1993) suggested, "the goals of HCI are to develop and improve systems . . . so users can carry out their tasks safely, effectively, efficiently, and enjoyably. These aspects are collectively known as usability" (p. 14). Due to its multidisciplinary nature, researchers in a range of academic disciplines, including anthropology, visual design, information architecture, human factors, and usability, have become interested in studying HCI. Clearly, human beings constitute one of the factors that may affect the design of a user interface (Benyon et al., 1993; Forsman, 2007); thus, personality factors should be incorporated into HCI design (McNeese, 2003). Because end-users' perceptions represent the success or failure of the system, their opinions should be included at the system design stage. Any negative perception can make an easy task seem harder; whereas a positive perception can make a hard task easier (Norman, 2002). Commercial websites, therefore, must provide high-quality information efficiently to meet consumers' needs (Blanco, Sarasa, & Sanclemente, 2010). To present their products, most websites use visual and/or textual information, which both exert significant effects on information processing and decision-making (Kim & Lennon, 2008). Several researchers have pointed out that Internet designers overlook human personality factors when designing web applications. For instance, Mitchell (2000) examined hundreds of documents that provide advice on building effective and user-friendly websites and found that less than five documents mentioned the term "personality." However, these

studies examined the “website personalities” rather than human personalities, which prompted Amichai-Hamburger (2002) to highlight the necessity of incorporating individual personality differences in future interactive system designs.

Human beings represent the main components of the tourism industry. Countless personal interactions are involved between tourists and service staff. Therefore, understanding personality differences could help industry practitioners better understand consumer behavior. One of the main foci of personality studies is to develop an understanding of individual differences. Leung and Law's (2010) review of more than 200 journal articles on personality in the hospitality and tourism field found the most commonly adopted models of personality are the five-factor model (Barrick & Mount, 1991; Goldberg, 1990; McCrae & Costa, 1987) and the Myers-Briggs Type Indicator (MBTI; Myers, 1962). The five-factor model, also known as the “big five” model, categorizes a large number of traits into five groups: neuroticism, extraversion, openness, agreeableness, and conscientiousness (Barrick & Mount, 1991; Goldberg, 1990; McCrae & Costa, 1987). In hospitality and tourism research, the big five model is commonly used to examine the performance of frontline staff and customers' buying behavior.

Several studies have found that the way in which users interact with computers is influenced by their personalities (Isbister & Nass, 2000; Nass & Moon, 2000; Nass, Moon, Fogg, Reeves, & Dryer, 1995; von der Pütten, Krämer, & Gratch, 2010). Therefore, individual differences should be considered when designing a system interface. Hamburger and Ben-Artzi (2000) found that people with high degrees of extraversion and neuroticism exhibit different patterns of behavior when accessing the Internet, which suggests that the Internet should not be perceived as a general and undifferentiated medium. However, these studies just analyzed the dominant personality, which is the single personality trait with the highest score in the personality test. The remaining personality traits were ignored. John (1989) indicated that the five-factor model outlines the personality categories in a hierarchy of all traits and the person is a set of scores on generic traits. As a result, the respondents' actual personality may be overlooked because minor personality traits were excluded. As such, these studies may not truly reflect users' personality characteristics.

Cunningham et al. (2008) presented a conceptual model for matching website design with MBTI personality type, but their model was based purely on the findings of extant studies, and their model was not empirically tested. Leung, Rong, Li, and Law (2011) recently adopted Kohonen's network model and found that people with different personality characteristics have different web design preferences. However, the study only categorized Internet users into nine clusters, and for this reason, it is impossible to examine individual personality combination's characteristics and to identify contrasting design preferences.

## Attractiveness of Website

Research has confirmed that providing more illustrations, rather than text, can enhance website attractiveness (Schenkman & Jonsson, 2000). Abdinnour-Helm and Chaparro (2007) examined nine factors that may affect the attractiveness of a website, including clear and readable text, a clean and uncluttered page, easy to read hyperlinks, sufficient contrast between background and text, colors that improve visual appearance, pictures and images that reinforce the text, good quality photographs and images, an effective and appealing background, and the effective use of page space. Further to that, Kim and Fesenmaier (2008) found destination websites that emphasize scenic beauty (using visual-, auditory-, and/or imagery-oriented features) have the strongest influence on first impressions, and information richness, interactive features were very helpful to first-time users (Tanrisevdi & Duran, 2011).

The role of a website is to draw people's attention for the purposes of marketing, especially on product information distribution (O'Connor & Frew, 2002). "A website is a powerful medium offering unique marketing, advertising, product and service information and communication opportunities between a business and its customers or potential customers" (Kasavana, Knutson, & Polonowski, 1997, p. 35). A poor website design can thus drive away potential customers (Nielsen, 1999). Generally speaking, web design can be divided into two core areas: visual presentation and usability (Robbins & Stylianou, 2003). Visual presentation includes the content, information architecture, and graphic design (O'Connor, 2004), and usability refers to the ease-of-use and navigability. Research has shown that the visual perception of a website can affect the perception of its usability (Michailidou, Harper, & Bechhofer, 2008; Sutcliffe, 2002; Tractinsky, 1997). The user with more favorable attitude to a website, the more likely it will be perceived as usable (Kim & Fesenmaier, 2008). Therefore, creating visually attractive websites should be the main goal for web designers.

O'Connor (2004) highlighted two contrasting points of view in relation to web design. Many researchers emphasize graphic design, and entertainment (Engholm, 2002; Moshagen & Thielsch, 2010; Siegel, 1997); whereas others focus on functional design with simple text, layout, language, and style (Chang & Su, 2011; Hasan, Morris, & Proberts, 2011; Nielsen, 1993, 2000; Park & Noh, 2002). Since individuals have different preferences, web design should cater for various needs. The most common web-design components include information architecture, navigation, layout, color, image, and multimedia (Au Yeung & Law, 2006). Identifying individuals' preferences thus allows web designers to create different styles to match individual needs.

Although search engines utilize a complicated ranking algorithm to ensure search results can meet users' requirements, many users find the

results may not be exactly what they are looking for. Many users randomly click on the results list (Craswell, Zoeter, Taylor, & Ramsey, 2008), and their direct feelings of a website may directly affect their intention to continue browsing or to close it immediately and search for another one (Clark, Ezell, Clark, & Sheffield, 2009). Lindgaard, Fernandes, Dudek, and Brown (2006) found that users take less than one minute to judge whether a website is acceptable. If a website does not satisfy a user's expectations, the user will search for an alternative. However, individuals have unique perceptions, it is important for web masters and web designers to fulfill different users' needs as much as possible by providing different designs.

## Web Design Attributes

### INFORMATION ARCHITECTURE

Content and information architecture are the key elements that affect communication with Internet users. Users want clearly written travel-related information in conjunction with graphical illustrations (Buhalis & Law, 2008; Hanna, 1997; Morkes & Nielsen, 1997). Information should be adequate, complete, and relevant to the needs of users (Choi, Lehto, & O'leary, 2007; Gretzel, Yuan, & Fesenmaier, 2000; Kasavana, 2000) to enhance the attractiveness of the product (Alba et al., 1997; Braddy, Meade, & Kroustalis, 2008). Although the richness of information may help customers better understand a business, web designers should avoid information overload and maintain a reasonable amount of text. Therefore, the recommended length of a website page is no more than three full screens (Nielsen & Tahir, 2002).

### COLOR, LAYOUT, AND NAVIGATION

Color is an important attribute in design. Websites tend to have at least two color combinations. The choice of color plays a critical role in design, advertising, and marketing (Moshagen & Thielsch, 2010; Nielsen, 2000). An experiment conducted by Sperry and Fernandez (2008) on text readability on websites found that light gray text on a dark gray background was rated as the easiest to read and most appealing; whereas white text on a green background was rated the most difficult. Navigation tools within the website help users locate information. Because the main activity on the Internet is navigation, providing a good interface allows users to access the required page quickly (Xiang & Fesenmaier, 2004). Navigation design may directly affect users' perceptions of usefulness through the use of hypertext (Dieberger, 1997; Flavian, Gurrea, & Orus, 2009), which usually lacks a perceivable structure. The location of navigation tools also influences how users locate information. Designers should ensure a website's usability is suitable for people with different levels of technology operation skill (Chang & Su, 2011).



## IMAGES AND MULTIMEDIA

The first generation of text-based websites was very simple and straightforward. Following the adoption of graphical user interfaces in the early 1990s, the importance of images increased dramatically. Images can affect the impression of a product, and incorporating multimedia features into websites can increase the tangibility of the Internet (Voss, 2000). Spremic, Jakovic, and Bach (2008) found that including more multimedia items on hotel websites provides potential clients with better insight into the hotel, and Jeong and Choi (2004) confirmed that customers tend to have a more positive attitude toward hotel websites that include photographs of people. Although adopting multimedia and good-quality photographs and images can enhance user satisfaction (Baloglu & Pekcan, 2006; Nicol et al., 1999), the drawback is the decrease in downloading speed; thus, it is important to consider the balance between these two factors.

## METHODOLOGY

### Data Collection

In June 2010, a total of 80 year-one hospitality and tourism undergraduate students in Hong Kong were invited to participate in the study. There were two reasons for recruiting students as participants. First, year-one students are in the same age group and have a similar educational background (Furrer, Liu, & Sudharshan, 2000), and hence any differences in their design preferences should be mainly due to differences in personality rather than in demographics or background. This can minimize various demographic backgrounds that might affect the respondents' web design preference. Second, because students of this age have grown up with the Internet and have had substantial experience in accessing different websites, we believe they should already have web design preferences in mind. A total of 76 students (57 female and 19 male) voluntarily completed the online questionnaire, representing a 95% response rate. All but one of them was Asian. Each data sample is represented by a set of 20 attributes, including five personality-related attributes and 15 web-design-related attributes, as shown in Table 1.

An online self-administered questionnaire which contained 15 questions on website design preferences, and 10 Big Five personality questions adapted from Rammstedt and John (2007) were developed. A database for indicating hotel web design characteristics was generated. The fields in the database included the web design attributes in Table 1, as well as hotel names with their URLs. This study adopted Hong Kong hotel websites as the study scope. At the onset of this study, there were 108 member hotels of the Hong Kong Hotels Association (2009). All hotel names and their URLs were

**TABLE 1** Attributes in the personality dataset

Attribute description	Label
Web-design related attribute	
Language selection: Do you prefer the hotel home page to have a language selection page?	Q1: Language selection page Q1: Neutral
Introductory movie: Do you prefer the hotel home page to contain an introductory movie?	Q1: No language selection page Q2: Introductory movie Q2: Neutral
Background and font color: Which website's background and font color combination do you prefer, dark background with light text or vice versa?	Q2: No introductory movie Q3: Dark background with light text Q3: Neutral
Pop-up window: Do you prefer to have a pop-up window on the web page?	Q3: Light background with dark text Q4: Pop-up Q4: Neutral
Menu bar location: Where do you prefer to have the menu bar, on the top or left of the web page?	Q4: No pop-up Q5: On the top Q5: Neutral
Image size/quantity: Do you prefer one single large image or several small images on the web page?	Q5: On the left Q6: One single large image Q6: Neutral
Slideshow: Do you prefer to have a slideshow of the hotel photos on the web page?	Q6: Several small images Q7: Slideshow Q7: Neutral
Scrolling text: Do you prefer to use scrolling text to show promotional information?	Q7: No slideshow Q8: Scrolling text Q8: Neutral
Background music: Do you prefer background music to be played when you are visiting hotel websites?	Q8: No scrolling text Q9: Background music Q9: Neutral
Video: Do you prefer to watch a video shown on the web page?	Q9: No background music Q10: Video Q10: Neutral
Staff in photo: Do you prefer to have the hotel staff in photos shown on the web page?	Q10: No video Q11: Staff Q11: Neutral
Guest in photo: Do you prefer to have the hotel guests in photos shown on the web page?	Q11: No staff Q12: Guest Q12: Neutral
Staff or guests in photo: What do you prefer to have in photos on the hotel web page, the staff or the guests?	Q12: No guest Q13: Staff Q13: Neutral
Hotel building/interior design image: Do you prefer to have the hotel building images or the hotel's interior design on the web pages?	Q13: Guest Q14: Hotel building Q14: Neutral
Rich hotel information: Do you prefer to have rich hotel information or only the selection menu on the hotel home pages?	Q14: Interior design Q15: Selection menu only Q15: Neutral
	Q15: Rich text

*(Continued)*

**TABLE 1** (Continued)

Attribute description	Label
Personality attributes	
Agreeableness: Tendency to be compassionate and cooperative	A (weak)
High scorer: Soft-hearted, trusting, helpful, forgiving, gullible, straightforward	A (neutral)
Low scorer: Cynical, suspicious, irritable, rude, uncooperative, vengeful	A (strong)
Conscientiousness: Tendency to show self-discipline and aim for achievement	C (weak)
High scorer: Organized, reliable, hardworking, self-disciplined, punctual, neat	C (neutral)
Low scorer: Aimless, unreliable, lazy, careless, lax, negligent, hedonistic	C (strong)
Extraversion: Tendency to seek stimulation	E (weak)
High scorer: Active, sociable, talkative, optimistic, person-oriented, fun-loving	E (neutral)
Low scorer: Reserved, sober, unexuberant, aloof, task-oriented, retiring, quiet	E (strong)
Neuroticism: Tendency to experience unpleasant emotions easily	N (weak)
High scorer: Worrying, nervous, emotional, insecure, inadequate	N (neutral)
Low scorer: Calm, relaxed, unemotional, hardy, secure, self-satisfied	N (strong)
Openness: Tendency to curiosity, unusual ideas, and adventure	O (weak)
High scorer: Curious, broad interests, creative, imaginative, untraditional	O (neutral)
Low scorer: Conventional, down-to-earth, narrow interests, inartistic	O (strong)

extracted and stored in the database. There were 10 hotel websites reload the browser before it display, and this would redirect the questionnaire back to the first page, as a result, these 10 websites were dropped from our list. Thereafter, each hotel website was assessed by the researchers and two other web users. Each of these web users, including the researchers, independently categorized the hotel websites on all design attributes by rating them either for “Group A” or “Group B.” Records were stored in the database marked either “A” or “B.” For example, if the website contains introductory movie, the field for question two was marked B, otherwise A was marked indicating introduction movie is not available on that website. If a website did not have certain attributes, the corresponding fields were left blank. After all websites were evaluated, results from the researchers and the two web users were compared. In case of discrepancies, results with majority votes were taken. The final results were uploaded to the Internet server for the online questionnaire. Each of the 15 design questions was associated with at least one pair of hotel websites that contain contrasting designs and were randomly

displayed to respondents on screen. Each question randomly displayed two Hong Kong hotel websites with contrasting designs (display website with an A on the left and B on the right) on the screen and students were asked to indicate their preferences.

Students were asked to indicate on a 5-point scale which of the two hotel website designs and styles they preferred (1 = *prefer A*; 3 = *no preference*; 5 = *prefer B*). The questions are presented in Table 1. The questionnaire also assessed students' personality characteristics according to the Big Five personality categories: agreeableness, conscientiousness, extraversion, neuroticism, and openness. The strength of each personality category was measured for each individual and labeled as weak, neutral, or strong. For example, a set of personality labels such as "agreeableness = neutral, conscientiousness = strong, extraversion = neutral, neuroticism = weak, openness = strong" would be given to a person who is hard working and open minded but not particularly sensitive to other external effects. In this way, the personality of a user is not simply represented by the strongest trait with the highest score, but as a mixture of five personality characteristics that provide a more holistic representation of personality.

### Association Rule Mining

Tourism and hospitality practitioners need to understand travelers' behavior, such as their choice of future destination and motivation for travel, to help them develop appropriate plans and increase service quality, which can potentially attract travelers' attention and thus increase profits. Currently, one efficient way of discovering travelers' characteristics is to apply data-mining techniques. Association rule mining is a pattern extraction method that identifies correlations between items. An association rule is an implication of the form " $X \Rightarrow Y$ " which is interpreted as, "If one has a selected item  $X$ , then there is a high probability that this person will also be interested in item  $Y$  under the same situation." Here,  $X$  indicates the precondition of the occurrence of  $Y$ ; while  $Y$  is the consequence if  $X$  happens. Among the available data-mining methods, association rule mining is one of the most popular approaches for discovering the relationships between items in a transaction database.

### POSITIVE, NEGATIVE, AND TARGETED ASSOCIATION RULES

Traditional association rule-mining algorithms have been established as a popular data-mining method that represents positive associations between the purchases of different products. However, there are two major challenges that prevent the technique from being widely adopted by the tourism industry. First, a strong requirement of association rule mining is that the item-sets must be frequent. Any infrequent item-sets are discarded without

further consideration. Second, traditional association rule-mining methods are able to generate only positive rules. To overcome the second challenge, Wu, Zhang, and Zhang (2004) proposed the concept of negative association rules. This concept has the potential to improve market analysis, for instance, by identifying products that conflict with or complement one another. However, any item in a frequent item set can potentially be included in the consequence part of a rule, which not only leads to extensive computational cost in the evaluation of candidate rules, but may also produce rules that are not targeted to the application.

One way to improve the efficiency of association rule mining is to limit the consequence part of the discovered rules—that is, to limit the rule to explicit target items, such as “Travel to overseas destinations” or “Travel to mainland China.” Accordingly, association rules in which users specify the consequence part as a target item are generally considered targeted rules. Comparing with the traditional association rule mining, it is more efficient to generate only these targeted rules directly, for instance, by identifying which group of customers is interested, or not interested, in certain products.

In this article, we present an efficient method that has been developed specifically for targeted positive rules in the form of  $A \Rightarrow T_j$  and targeted negative rules in the form of  $A \Rightarrow \neg T_j$ , where  $A$  is the personality combinations item set, and  $T$  is an individual web design attribute with possible values of  $T_1, T_2, \dots$ , et cetera.

#### TARGETED POSITIVE AND NEGATIVE ASSOCIATION RULE MINING (TPNARM)

In positive rule mining, item sets are considered promising only when they are frequent, which means that their support is greater than a predefined threshold value. As there are many potential negative rules, the method for targeted rule mining differs from that for positive rule mining. In negative rule mining, infrequent item sets also have the potential to be promising, and thus it is necessary to identify promising yet infrequent item sets. Our method for achieving this can be decomposed into two major steps: identification of promising item sets (generate all promising item sets that are useful for constructing targeted rules) and rule extraction (generate all rules that have a confidence larger than the threshold in the positive rule and negative rule categories).

#### IDENTIFYING PROMISING ITEM SETS

The measure of support used to check the frequency of an item set is: when  $supp(A) \geq \delta_s$ , both rules  $A \Rightarrow T_j$  and  $A \Rightarrow \neg T_j$  can be of potential use. Two lists of item sets are maintained, one for promising positive item sets and the other for promising negative item sets. The process for identifying promising item sets is as follows:

1. The data are scanned, and all frequent one-item sets  $F^{(1)} = \{A_1^{(1)}, A_2^{(1)}, \dots\}$  are identified.
2. Each item set  $A_i^{(k)}$  in the frequent k-item sets  $F^{(k)}$  is considered together with different values,  $T_1, T_2, \dots$  of the target attribute  $T$ . If  $\text{supp}(A_i^{(k)} \cup T_j) \geq \delta_s$ , then  $A_i^{(k)} \cup T_j$  is called a candidate promising positive item set; otherwise,  $A_i^{(k)} \cup \neg T_j$  is a candidate promising negative item set.
3. Those item sets with leverage greater than a user-specified threshold  $\delta_l$  are retained, and two item sets are then obtained: a promising positive item set  $F^{(k)}$  and a promising negative item set  $L^{(k)}$ .
4. From the promising positive item sets  $F^{(k)}$  and the frequent (k+1) item sets  $F^{(k+1)}$ , we remove the target attribute item  $T_j$ . Step 2 to Step 4 are then iterated until no further promising item sets can be generated.

Although the a priori heuristic can be used to prune the search space (Ceglar & Roddick, 2006), the foregoing process will still generate a large number of candidate item sets. To filter out any unpromising item sets, Step 3 adopts the leverage measurement to estimate how many more times an item set  $A$  is independent of the target attribute.

1. For a candidate promising positive item set,  $A \cup T_j$  is promising if

$$\text{leverage}(A, T_j) = |\text{supp}(A \cup T_j) - \text{supp}(A) \text{supp}(T_j)| \geq \delta_l,$$

where  $\delta_l$  is the user-specified minimum leverage.

2. For a candidate promising negative item set  $A \cup \neg T_j$ , the corresponding target negative rule  $A \Rightarrow \neg T_j$  is promising if

$$\text{leverage}(A, \neg T_j) = |\text{supp}(A \cup \neg T_j) - \text{supp}(A) \text{supp}(\neg T_j)| \geq \delta_l.$$

#### EXTRACTING PROMISING RULES

Two lists of item sets will be generated from the foregoing steps: a list of promising positive item sets  $F^{(1)}, F^{(2)}, \dots$ , and a list of promising negative item-sets  $L^{(1)}, L^{(2)}, \dots$ . Among them, each promising item set can generate one targeted association rule, although not all corresponding rules are necessarily strong enough to represent a significant association.

A confidence measure can be used to identify strong rules by evaluating the conditional dependency among item sets, although it cannot reflect whether the dependency is positive or negative. To evaluate the strength of the dependency, this research adopts the conditional-probability increment ratio (CPIR) proposed by Wu et al. (2004).

For an item-set  $A_i^{(k)} \cup T_j$  in a promising positive item set  $F^{(k)}$ , the dependency corresponds to a positive rule  $A_i^{(k)} \Rightarrow T_j$ , for which the measure of CPIR will be evaluated as:

$$\begin{aligned}
 CPIR(A_i^{(k)} \Rightarrow T_j) &= \frac{p(T_j | A_i^{(k)}) - p(A_{ij})}{1 - p(T_j)} \\
 &= \frac{\text{supp}(A_i^{(k)} \cup T_j) - \text{supp}(A_i^{(k)}) \text{supp}(T_j)}{\text{supp}(A_i^{(k)})(1 - \text{supp}(T_j))}.
 \end{aligned}$$

For an item set  $A_i^{(k)} \cup \neg T_j$  in a promising negative item set  $L^{(k)}$ , the dependency corresponds to a negative rule  $A_i^{(k)} \Rightarrow \neg T_j$ , for which the measure of CPIR will be evaluated as:

$$\begin{aligned}
 CPIR(A_i^{(k)} \Rightarrow \neg T_j) &= \frac{p(\neg T_j | A_i^{(k)}) - p(\neg A_{ij})}{1 - p(\neg T_j)} \\
 &= \frac{\text{supp}(A_i^{(k)} \cup \neg T_j) - \text{supp}(A_i^{(k)}) \text{supp}(\neg T_j)}{\text{supp}(A_i^{(k)})(1 - \text{supp}(\neg T_j))}.
 \end{aligned}$$

Here,  $\neg T_j$  indicates the negative of a target item  $T_j$ , and the support for  $\neg T_j$  is obtained as  $\text{supp}(\neg T_j) = 1 - \text{supp}(T_j)$ . In particular, for an item-set  $A_i^{(k)} \cup \neg T_j$ , its support is  $\text{supp}(A_i^{(k)} \cup \neg T_j) = \text{supp}(A_i^{(k)} \cup T_j)$ .

The value of the CPIR is between  $-1$  and  $1$ . When it is close to  $0$ , the related items are close to being independent of one another. When the CPIR is positive, the related items are positively dependent, and when it is negative, they are negatively dependent.

When the absolute value of a rule's CPIR is greater than a predefined threshold value,  $\delta_c$ , the association between the conditional items and the targeted item is considered to be strong. Accordingly, the targeted rule is selected for inclusion in the final results.

In tourism and hospitality, association rule mining has been employed in a number of successful applications. Emel, Taşkin, and Akat (2007) employed association rule mining to profile the Turkish tourism market in Bursa. Tourists were questioned and then profiled to provide suggestions for tourism practitioners. Zhou, Du, Zeng, and Tu (2008) implemented distributed-sampling association rule mining to analyze travelers' holiday destinations and their behavior. With regard to targeting customers, it would be more economically efficient for industry practitioners to target only those customers who meet certain criteria, rather than all customers. Liou and Tzeng (2010) employed the dominance-based rough set approach to identify customer behavior patterns in large datasets to facilitate managerial decision-making in the airline market. As direct marketing has become a modern business activity that helps maximize the profits that stem from marketing efforts, it is important to select a suitable subset of customers to maximize returns while minimizing costs. Association rules have been employed to develop a mailing list of customers who are most likely to respond (Wang,

Zhou, Yang, & Yeung, 2005). In terms of customer satisfaction and preferences, tourism businesses are responsible for developing services that fulfill customers' needs in order to increase competitiveness, attract more customers, and increase profits. Liao, Chen, and Deng (2010) applied the a priori association-rule algorithm together with cluster analysis to mine customer knowledge, which allowed them to propose suggestions and solutions for new developments and to improve customer relationship management. Zhou et al. (2008) tracked tourism emergency information and analyzed patterns in the data by constructing a tourism word set.

## EMPIRICAL RESULTS

We analyze our data by applying our targeted positive and negative association rule mining (TPNARM) algorithm to the personality dataset. The 15 web-design-related attributes were set as the target items and the five personality traits were combined to form the input item sets. The expected output of the experiment is a set of association rules in form of  $M \Rightarrow N$ , where  $M$  contains the particular combination of personality attributes, and  $N$  contains the corresponding website design preference. The experiment was implemented with the support threshold setting as 0.1, and the leverage threshold as 0.01. This means the candidate item sets with support greater than 0.1 are considered as candidate frequent item sets; otherwise, they are infrequent item sets. If these candidate item sets have a greater leverage than 0.01, then they become the promising item sets; otherwise, they will be discarded from the process.

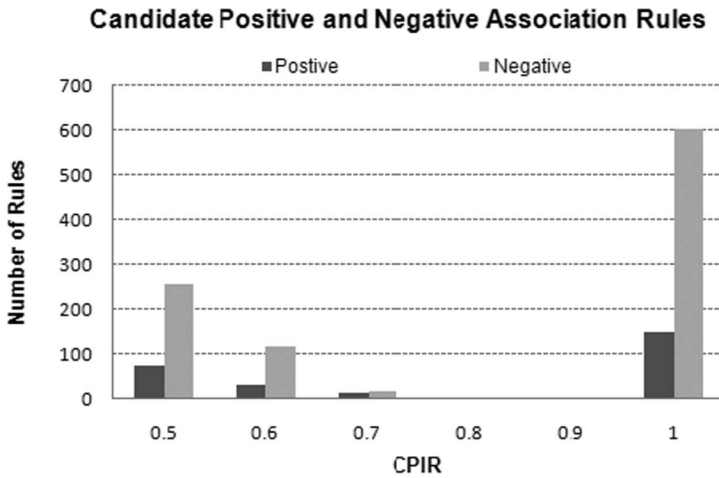
The results generated by TPNARM model returned a total of 1,264 candidate association rules, 270 of which were positive and 994 were negative (as shown in Figure 1). As the neutral response option indicates no particular design preference, the analysis focused on the strong positive and negative responses for each website design question.

To focus on the strongest rules, we discarded the weak rules and kept only those rules with a CPIR of at least 0.70. We further selected the most significant association rules from the remaining set, and the results are reported in the following section.

### Common Preferences for Website Design in Relation to Personality Traits

We selected 25 strongly positive and 24 strongly negative association rules that show the relationship between personality traits and website design preferences. For people with certain personality traits or combinations of personality traits, the reported positive association rules provide estimated preferences for a series of website design issues. From these rules, we can





**FIGURE 1** Candidate positive and negative association rules with a conditional-probability increment ratio over 0.5.

summarize the common website design preferences for each corresponding personality combination. This summary is also expected to provide a set of guidelines for website designers and developers to meet the specific requirements of individual visitors.

The first four association rules, as indicated in Table 2 (R1 to R4), show very strong associations between the expression of individual personality traits and website design issues. We can state with a high degree of confidence that someone who is weak on conscientiousness (R1) or strong on neuroticism (R3) will prefer to watch an introductory movie on the hotel’s homepage (Q2, introductory movie). For those weak on extraversion (R2), regardless of other personality traits, there is more than a 90% possibility that web pages containing images of hotel buildings will be more attractive than other images (Q14, hotel building images). Among these four rules, R3 (N, strong) and R4 (O, weak) are stronger than the other two.

The specific website design preferences of individuals with a mixed personality—a combination of more than one personality trait—are also clearly indicated by the selected association rules listed in the table. For example, R7 to R9 show that those with strong agreeableness and strong conscientiousness prefer to have a menu bar on the left-hand side of the web page (Q5); they feel comfortable reading promotional information by scrolling text (Q8); they are happy to obtain information in a straightforward way, for example, by watching videos (Q10); and they would like to see photographs of people such as the hotel staff or guests (Q11 and Q12). Individuals with neutral conscientiousness (R12 to R15) also prefer the menu bar to be located on the left, prefer promotional information to be displayed in scrolling text, and to see photographs of people, especially

**TABLE 2** Common website design preferences

Targeted association rules	Rule ID no.
C (weak) → Q2 (introductory movie)	R1
E (weak) → Q14 (hotel building images)	R2
N (strong) → Q2 (introductory movie), Q6 (several small images), Q (slideshow), Q9 (background music)	R3
O (weak) → Q2 (introductory movie), Q3 (dark background with light text), Q6 (several small images), Q14 (hotel building)	R4
A (neutral), C (strong), N (weak) → Q1 (language selection page), Q4 (no pop-up), Q5 (on the top), Q9 (no background music), Q15 (selection menu only)	R5
A (neutral), E (weak) → Q3 (dark background with light text), Q6 (several small images), Q15 (selection menu only)	R6
A (strong), C (strong), E (strong) → Q4 (pop-up), Q5 (on the left), Q8 (scrolling text), Q11 (staff), Q12 (guest), Q13 (guest), Q15 (rich text)	R7
A (strong), C (strong), N (weak) → Q3 (dark background with light text), Q8 (scrolling text), Q10 (video), Q11 (staff), Q12 (guest), Q14 (hotel building images)	R8
A (strong), C (strong), O (strong) → Q5 (on the left), Q8 (scrolling text), Q10 (video), Q12 (guest)	R9
A (strong), E (weak), N (neutral) → Q2 (no introductory movie), Q5 (on the left), Q8 (scrolling text), Q13 (guest), Q15 (selection menu only)	R10
A (strong), N (weak), O (strong) → Q4 (pop-up), Q5 (on the left), Q8 (scrolling text), Q10 (video), Q11 (staff), Q12 (guest), Q13 (guest), Q15 (rich text)	R11
C (neutral), E (weak), N (neutral) → Q2 (no introductory movie), Q5 (on the left), Q8 (scrolling text), Q13 (guest), Q15 (selection menu only)	R12
C (neutral), E (weak), O (neutral) → Q2 (no introductory movie), Q5 (on the left), Q8 (scrolling text), Q13 (guest)	R13
C (neutral), N (strong) → Q5 (on the left), Q10 (video), Q11 (staff), Q12 (guest), Q15 (selection menu only)	R14
C (neutral), O (weak) → Q5 (on the top), Q10 (video), Q11 (staff), Q12 (guest), Q15 (rich text)	R15
C (strong), E (strong), O (strong) → Q4 (pop-up), Q5 (on the left), Q11 (staff), Q12 (guest), Q13 (guest), Q15 (rich text)	R16
C (strong), E (weak) → Q11 (staff), Q13 (guest), Q15 (selection menu only)	R17
C (weak), N (strong) → Q11 (staff), Q12 (guest), Q14 (hotel building images)	R18
C (weak), O (weak) → Q11 (no staff), Q12 (no guest), Q15 (rich text)	R19
E (neutral), O (weak) → Q1 (no language selection page), Q5 (on the top), Q10 (video), Q11 (staff), Q12 (guest)	R20
E (strong), N (weak), O (strong) → Q4 (pop-up), Q5 (on the left), Q11 (staff), Q12 (guest), Q13 (guest), Q15 (rich text)	R21
E (strong), O (strong) → Q8 (scrolling text), Q10 (video), Q14 (hotel building images)	R22
E (weak), N (weak) → Q1 (language selection page), Q3 (dark background and light text), Q4 (no pop-up), Q6 (several small images), Q8 (no scrolling text)	R23
E (weak), O (strong) → Q11 (staff), Q13 (guest), Q15 (selection menu only)	R24
E (weak), O (weak) → Q8 (no scrolling text), Q13 (staff), Q15 (rich text)	R25

the hotel staff; however, they are not at all interested in watching an introductory movie (Q2). People with strong extraversion and strong openness accept pop-up windows (Q4) and rich textual descriptions (Q15) on hotel websites (R16 and R21).

In some cases, some characteristics did not purely happen in personality types. There are always some cases that may fall into one or several categories. Using our study as an example, R36 in Table 3 indicates people with strong or neutral personality trait in both extraversion and neuroticism like video. Accordingly, we can only say that this person has a “not weak” personality in neuroticism and extraversion, notated as  $\neg(N, \text{weak})$  and  $\neg(E, \text{weak})$ . Therefore, in addition to the aforementioned positive association rules, we include a set of negative association rules to describe the potential relationships between individuals’ website design preferences and “fuzzy” personalities (Table 3). In this study, there were 24 negative association rules generated (with CPIR of at least 0.70). Except Q6 (image size and quantity), and Q7 (slideshow), all remaining design attributes have at least one personality combination that prefers to have the item appear on the

**TABLE 3** Targeted negative rules for visitors’ website design preferences

Targeted negative association rules	Rule ID no.
A (neutral), C (strong), $\neg N$ (strong) $\rightarrow$ Q1 (language selection page)	R26
$\neg A$ (weak), C (strong), O (neutral) $\rightarrow$ Q1 (language selection page)	R27
$\neg A$ (weak), E (weak), $\neg N$ (strong) $\rightarrow$ Q2 (no introductory movie)	R28
A (neutral), $\neg E$ (neutral) $\rightarrow$ Q3 (dark background with light text)	R29
A (neutral), $\neg C$ (weak), O (strong) $\rightarrow$ Q4 (no pop-up)	R30
A (strong), $\neg E$ (neutral), $\neg N$ (strong) $\rightarrow$ Q5 (on the left)	R31
$\neg C$ (weak), $\neg E$ (neutral), $\neg O$ (weak) $\rightarrow$ Q5 (on the left)	R32
$\neg A$ (weak), $\neg C$ (strong), N (weak) $\rightarrow$ Q8 (no scrolling text)	R33
$\neg C$ (weak), E (neutral), $\neg N$ (strong), O (strong) $\rightarrow$ Q8 (no scrolling text)	R34
$\neg A$ (weak), $\neg C$ (weak), O (strong) $\rightarrow$ Q10 (video)	R35
$\neg E$ (weak), $\neg N$ (weak) $\rightarrow$ Q10 (video)	R36
$\neg E$ (weak), $\neg O$ (neutral) $\rightarrow$ Q10 (video)	R37
$\neg E$ (strong), $\neg O$ (neutral) $\rightarrow$ Q11 (staff)	R38
$\neg C$ (strong), $\neg E$ (neutral), N (weak) $\rightarrow$ Q12 (no guest)	R39
$\neg C$ (weak), $\neg E$ (neutral), $\neg O$ (weak) $\rightarrow$ Q13 (guest)	R40
A (neutral), C (strong), $\neg E$ (weak), $\neg N$ (strong) $\rightarrow$ Q14 (interior design)	R41
A (strong), $\neg C$ (weak), N (weak) $\rightarrow$ Q14 (hotel building images)	R42
A (neutral), $\neg C$ (neutral), N (weak) $\rightarrow$ Q15 (selection menu only)	R43
A (strong), $\neg C$ (neutral), $\neg E$ (neutral) $\rightarrow$ Q15 (rich text)	R44
A (strong), $\neg E$ (strong), $\neg N$ (strong) $\rightarrow$ Q15 (selection menu only)	R45
$\neg C$ (strong), O (weak) $\rightarrow$ Q15 (rich text)	R46
$\neg C$ (neutral), E (neutral), N (weak) $\rightarrow$ Q15 (selection menu only)	R47
$\neg C$ (neutral), N (weak), O (neutral) $\rightarrow$ Q15 (selection menu only)	R48
E (weak), $\neg O$ (weak) $\rightarrow$ Q15 (selection menu only)	R49

Note. The symbol “ $\neg$ ” = not.

hotel websites. Unlike the positive rules that summarize the website design preferences for a certain personality combination, the negative association rules focus only on one specific website design preference.

### Contrasting Preferences for Website Design with Personality Traits

The aim of the contrast preference study was to discover which personality traits mostly influence web visitors' preferences regarding particular website design issues, as differences in the level of expression of a personality trait can lead to completely opposite preferences. A list of association rules that represent the differences in website design preferences in relation to personality traits is summarized in Table 4.

The most controversial question arising from these selected association rules is whether rich hotel information text should be provided on the homepage beside the selection menu (Q15), because people with various combinations of personality traits respond differently to this question (RP23 to RP30 in Table 4). The second place is shared by Q2 (introductory movie; "Do you prefer the hotel home page that contains an introductory movie?") and Q8 (scrolling text; "Do you prefer to use scrolling text to show promotional information?"). However, for some website design issues, it is quite clear that people with particular personalities have strong preferences, for example, menu bar location (Q5), image size/quantity (Q6), video (Q10), staff in photo (Q11), guests in photo (Q12), staff or guests in photo (Q13), and image of hotel building/interior design (Q14). Individuals with different personality traits will have extremely different preferences relating to these seven issues.

Extraversion and conscientiousness are the two most significant Big Five personality traits that affect website design preferences. Extraversion affects whether individuals prefer to have an introductory movie on the homepage of a hotel website (Q2). Generally, if two people have different levels of extraversion, even if their other personality traits are the same, they will have extremely different attitudes to the introductory movie (RP1 to RP5 in Table 4). The same situation is found for other preferences. For example, those with different levels of conscientiousness are quite sensitive to photographs of people on the hotel's web pages (Q11 and Q12 in RP15 to P19).

## DISCUSSION AND IMPLICATIONS

Hamburger and Ben-Artzi (2000) have shown users with high degree of extraversion and neuroticism have different behavior when accessing the Internet. This also matched with the findings in this study. From the result listed in Table 4 on users with contrasting personality, over one-third of the

**TABLE 4** Contrasting website design preferences

Contrasting targeted association rules	Rule ID no.
A (strong), <b>E (neutral)</b> , N (neutral) → <b>Q2 (introductory movie)</b>	RP1A
A (strong), <b>E (weak)</b> , N (neutral) → <b>Q2 (no introductory movie)</b>	RP1D
A (strong), <b>E (strong)</b> , O (neutral) → <b>Q2 (introductory movie)</b>	RP2A
A (strong), <b>E (weak)</b> , O (neutral) → <b>Q2 (no introductory movie)</b>	RP2D
C (neutral), <b>E (strong)</b> , O (neutral) → <b>Q2 (introductory movie)</b>	RP3A
C (neutral), <b>E (weak)</b> , O (neutral) → <b>Q2 (no introductory movie)</b>	RP3D
<b>C (neutral)</b> , <b>E (weak)</b> , N (neutral) → <b>Q2 (introductory movie)</b>	RP4A
<b>C (strong)</b> , <b>E (neutral)</b> , N (neutral) → <b>Q2 (no introductory movie)</b>	RP4D
<b>E (neutral)</b> , N (neutral), O (strong) → <b>Q2 (introductory movie)</b>	RP5A
<b>E (weak)</b> , N (weak), O (strong) → <b>Q2 (no introductory movie)</b>	RP5D
A (neutral), <b>C (strong)</b> , N (weak) → <b>Q5 (on the top)</b>	RP6A
A (neutral), <b>C (neutral)</b> , N (strong) → <b>Q5 (on the left)</b>	RP6D
A (strong), <b>C (weak)</b> , O (neutral) → <b>Q6 (one single large image)</b>	RP7A
A (strong), <b>C (strong)</b> , O (neutral) → <b>Q6 (several small images)</b>	RP7D
<b>A (strong)</b> , C (strong), <b>E (strong)</b> → <b>Q8 (scrolling text)</b>	RP8A
<b>A (neutral)</b> , C (strong), <b>E (neutral)</b> → <b>Q8 (no scrolling text)</b>	RP8D
<b>A (strong)</b> , N (weak), O (strong) → <b>Q8 (scrolling text)</b>	RP9A
<b>A (neutral)</b> , N (neutral), O (strong) → <b>Q8 (no scrolling text)</b>	RP9D
A (strong), <b>C (strong)</b> , N (weak) → <b>Q8 (scrolling text)</b>	RP10A
A (strong), <b>C (neutral)</b> , N (weak) → <b>Q8 (no scrolling text)</b>	RP10D
<b>E (strong)</b> , N (weak) → <b>Q8 (scrolling text)</b>	RP11A
<b>E (weak)</b> , N (weak) → <b>Q8 (no scrolling text)</b>	RP11D
<b>E (strong)</b> , O (strong) → <b>Q8 (scrolling text)</b>	RP12A
<b>E (weak)</b> , O (weak) → <b>Q8 (no scrolling text)</b>	RP12D
<b>C (neutral)</b> , N (strong) → <b>Q10 (video)</b>	RP13A
<b>C (strong)</b> , N (strong) → <b>Q10 (no video)</b>	RP13D
N (strong), <b>O (neutral)</b> → <b>Q10 (video)</b>	RP14A
N (strong), <b>O (strong)</b> → <b>Q10 (no video)</b>	RP14D
<b>C (strong)</b> , E (weak) → <b>Q11 (staff)</b>	RP15A
<b>C (weak)</b> , E (weak) → <b>Q11 (no staff)</b>	RP15D
<b>C (neutral)</b> , O (weak) → <b>Q11 (staff)</b>	RP16A
<b>C (weak)</b> , O (weak) → <b>Q11 (no staff)</b>	RP16D
A (strong), <b>C (strong)</b> , <b>E (strong)</b> → <b>Q12 (guest)</b>	RP17A
A (strong), <b>C (weak)</b> , <b>E (weak)</b> → <b>Q12 (no guest)</b>	RP17D
<b>C (neutral)</b> , N (strong) → <b>Q12 (guest)</b>	RP18A
<b>C (weak)</b> , N (strong) → <b>Q12 (no guest)</b>	RP18D
<b>C (neutral)</b> , O (weak) → <b>Q12 (guest)</b>	RP19A
<b>C (weak)</b> , O (weak) → <b>Q12 (no guest)</b>	RP19D
A (strong), E (weak), N (weak) → <b>Q13 (staff)</b>	RP20A
A (strong), E (weak), N (neutral) → <b>Q13 (guest)</b>	RP20D
E (weak), <b>O (weak)</b> → <b>Q13 (staff)</b>	RP21A
E (weak), <b>O (strong)</b> → <b>Q13 (guest)</b>	RP21D
<b>A (strong)</b> , <b>C (neutral)</b> , E (neutral), O (neutral) → <b>Q14 (hotel building images)</b>	RP22A
<b>A (neutral)</b> , <b>C (strong)</b> , E (neutral), O (neutral) → <b>Q14 (interior design)</b>	RP22D
A (strong), <b>E (neutral)</b> , N (weak) → <b>Q15 (selection menu only)</b>	RP23A
A (strong), <b>E (weak)</b> , N (weak) → <b>Q15 (rich text)</b>	RP23D
A (strong), E (weak), <b>N (neutral)</b> → <b>Q15 (selection menu only)</b>	RP24A
A (strong), E (weak), <b>N (weak)</b> → <b>Q15 (rich text)</b>	RP24D
A (strong), N (weak), <b>O (neutral)</b> → <b>Q15 (selection menu only)</b>	RP25A
A (strong), N (weak), <b>O (strong)</b> → <b>Q15 (rich text)</b>	RP25D

(Continued)

TABLE 4 (Continued)

Contrasting targeted association rules	Rule ID no.
C (neutral), E (weak), <b>N (neutral)</b> → <b>Q15 (selection menu only)</b>	RP26A
C (neutral), E (weak), <b>N (weak)</b> → <b>Q15 (rich text)</b>	RP26D
C (strong), <b>E (neutral)</b> , O (strong) → <b>Q15 (selection menu only)</b>	RP27A
C (strong), <b>E (strong)</b> , O (strong) → <b>Q15 (rich text)</b>	RP27D
C (weak), <b>E (neutral)</b> , N (weak) → <b>Q15 (selection menu only)</b>	RP28A
C (weak), <b>E (weak)</b> , N (weak) → <b>Q15 (rich text)</b>	RP28D
E (strong), N (weak), <b>O (neutral)</b> → <b>Q15 (selection menu only)</b>	RP29A
E (strong), N (weak), <b>O (strong)</b> → <b>Q15 (rich text)</b>	RP29D
E (weak), <b>O (strong)</b> → <b>Q15 (selection menu only)</b>	RP30A
E (weak), <b>O (weak)</b> → <b>Q15 (rich text)</b>	RP30D

*Note.* The bold text shows the preference options for the relevant website design issues and their corresponding personality traits.

rules indicated users with contrasting personality have different design preferences. Prior studies using the Big Five personality concept primarily focused on a single dominant trait. These studies highlight or compare the behavioral differences of individuals with high scores on up to three personality traits. However, in reality, we cannot simply classify people into a few categories. In our study, personality is represented by a combination of five traits. Therefore, we need to consider both the combination of traits and the strength of each trait. We employed three methods to present the findings. First, we used positive associate rules to identify the attractiveness of 15 design styles according to different personality combinations. Second, we used negative association rules to present participants' design preferences. The advantage of using negative rules is that they may reveal some hidden scenario that users did not respond in the survey. Third, we employed contrast association rules to help identify the contrasting preferences for different combinations of personality traits. The findings from these three viewpoints reveal that individuals with different personality combinations have diverse web design preferences; simply examining single personality traits cannot present the complete picture.

Our study makes several theoretical and practical contributions to the literature. First and the foremost, the major contribution that this study makes is on methodology. Specifically, it introduces a novel approach to incorporate association rule mining to personality types and hotel website design. Findings indicate that people with different personality characteristics have different web design preferences. Second, as mentioned, the five factor model exists as "polyglot generic arenas with fuzzy, overlapping boundaries" (p. 340), McAdams (1992) pointed out that many researchers have overlooked this point and personality study should focus on "whole person." John (1989) indicated that studies investigating personality should consider all five traits in combination. Association Rule Mining appears to be a good data mining tool for analysis of large quantities of data to extract previously

unknown interesting patterns (Ali & Wasimi, 2007), therefore, further studies on analyzing combinations of personality trait could consider adopting association rule mining as a tool. Finally, web designers could design different styles based on different target customers to attract users or avoid design combinations that are attractive only to certain personality types. To remain competitive, website owners should not only evaluate their own websites but should also pay attention to those of their competitors.

## CONCLUSIONS AND LIMITATIONS

Unless users have conducted a personality test, their personality could not be easily obtained by the time this study was conducted and the web server could not be able to provide the appropriate design template to suit the personality style. However, many search engines have started to develop personalization search. Using Google as an example, it launched the service “Web History” in 2007 (Google, 2007). It firstly captured and analyzed the search activities from the users and then provided personalized keyword search result. This personalized search algorithm could be further extended to personalize website design. By using the framework provided in this study and the search history stored in their databases, Google could analyze the user’s time spent on each web page and to identify the user’s favorite web design, and the users’ personality combinations could be predicted from their favorite design features. Search engines can then use the predicted personality results to select the website design template that match the personality preferences. In the future, each hotel domain could have multiple website design templates, and search engines could make use of this proposed framework to examine each website’s characteristics and pick the proper design template that matches each customer’s personality.

This study has several limitations. First, the sample size was relatively small and only consisted of undergraduate students in a hotel and tourism management course. Therefore, the results cannot be generalized to the general population. Second, the survey included only Hong Kong hotel websites for the participants to evaluate. These 98 hotel websites did not include all possible attributes. For example, all the websites used similar font sizes, and we were unable to offer the choice of a contrasting scenario. As a result, we dropped certain design attributes from the survey. Finally, because the sample size was relatively small, some personality trait combinations included only one or two cases. As a result, we dropped these combinations from the data analysis.

Although the sample size was not large, the findings show that people from a similar background (students in a hotel and tourism management course) and age group have significantly different web design preferences. Future studies should increase the sample size, vary the demographic

background of participants, and increase the number of web design attributes. Although our findings cannot act as general web design guidelines, we strongly believe that the method which we propose in this study would be useful in future personality-related research studies.

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