

Information Processing Style and E-commerce Website Design: A Clustering-based Conjoint Approach

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ABSTRACT

In a hypercompetitive e-commerce world, the information presented on websites and how prospective customers process such information become highly crucial for subsequent decisions and transactions. Customers differ by their style of information processing. Extant literature indicates a visual or verbal mode of information processing as distinct cognitive styles, which demand a particular mix of website content.

This study designed and developed an orthogonal set of websites and clustered website visitors based on their cognitive style preferences. The website attributes preferences were identified for a distinct segment of customers through a conjoint study.

This research deployed a novel approach to website design using a combined method of clustering (based on Style of Processing scale) and conjoint analysis to design relevant websites for different segments of customers. We find the ‘call to action phrase’ as the most crucial attribute followed by ‘product information,’ ‘search option availability,’ and ‘product page display’ in that order. The importance of these website elements differed significantly by gender. If the customers predominantly used verbal information processing, the product information was more important but if they are visually oriented, then they depend more on ‘product page display.’

The findings are expected to help e-commerce retailers to optimize the website design based on the style of information processing of customers.

Keywords: Website Design, Style of Processing, Conjoint Analysis, Cluster Analysis, E-commerce

Introduction

The importance of e-commerce websites as a platform and channel of sales has grown over the years. E-commerce models have successfully challenged the traditional model of commerce and are expected to grow multifold. Different e-commerce revenue models include advertising, subscription, transaction, sales, and affiliate (Traver & Laudon, 2009). This article focuses on e-commerce platforms/websites with sales as a revenue model.

Sales from e-commerce websites have two major obstacles; customers cannot physically evaluate the product, and the information is mainly static. These two constraints and different customer information-seeking aspects significantly alter the sales process requiring closure investigation. Broadly, the e-commerce website has information regarding products and services, website look and feel, policies for sales and returns. There are further sub-divisions of these broad information sets. For example, the product information includes the features and characteristics of the products. Websites

also present meta information that helps customers compare past trends and previous buyers' opinions. Customers interact with these aspects to arrive at a purchase or no purchase decision. Nevertheless, the information contained in text, voice, video, and graphics becomes essential to help customers make purchase decisions.

Theoretical Background

Researchers have attempted to develop an integrative model for e-commerce consumer behavior; the role of functional attributes, social factors, experiential aspects of e-shopping, situational factors, consumer traits using the Technology Acceptance Model (Perea y Monswé et al., 2004). The websites are designed consistent with the cognitive fit theory, which indicates that the task and information presentation need to enable superior performance (Hong et al., 2004). Similarly, researchers have used Fishbein, and Ajen's Theory of Reasoned Action model, suggesting that attitude, subjective norms, and perceived behavioral control determine the behavior (Dennis et al., 2009). The Stimulus–Organism–Response (SOR) framework also has been used in several studies indicating that various environmental aspects can become a stimulus to the organism driving a specific response (Chan et al., 2017; H. Kim & Lennon, 2010; Mummalaneni, 2005; Wang et al., 2011; Zhu et al., 2015).

E-commerce consumer behavior and website design elements

Various parameters related to the motivation of a customer to use an e-commerce website have been studied. The informational satisfaction and relational benefit improve users' site commitment and actual purchase behavior (Chung Hoon Park & Kim, 2003). The quantity of information may also cause information load and influence subsequent motivation to purchase (Suri et al., 2003). The website-specific innovativeness and subjective norms influence customer interaction and subsequent decisions (Moshrefjavadi et al., 2012).

Price, discount availability, product details, product availability, delivery time, scarcity or time-limited offer, terms and conditions are essential for customers (Bucko et al., 2018). Furthermore, the information is extended when the customer looks for the social media presence of the product and social proof in terms of product reviews and website reviews (Bucko et al., 2018).

The look and feel, usability, navigation, product availability, and visual appeal influence impulsive online purchase behavior (Liu et al., 2013). The importance of the website on purchasing decisions can be gauged from the fact that the WEBQUAL model was developed similarly to the SERVQUAL model. Webqual 4.0 (Barnes & Vidgen, 2002) was designed to assess e-commerce website quality on five factors under three dimensions (usability, information quality, service interaction quality). Experimental studies have been carried out to design websites/pages based on users' cognitive styles (Belk et al., 2015; Hauser et al., 2009). Website presentation flaws such as poor style, error, and incomplete information adversely affect customers' judgment on website quality (Everard & Galletta, 2005). The relationship between customer shopping style and website attributes has been explored. (Papatla, 2011). Beyond these immediate concerns, customers also have privacy concerns, convenience, and motive of financial gains from using a website (Hann et al., 2007). The logical tradeoff among these factors also influences a customer's decision.

Information processing and decision making by customers

Childers et al.(1985) had developed a 22-item scale to measure visual and verbal style of processing. In a quasi-experimental study, it was observed that users preferred a mix of picture and word descriptions irrespective of the user's style of processing (Lightner & Eastman, 2002). However, in another experimental study, evidence suggested the visual preference heuristics over verbal irrespective of the choice set (Townsend & Kahn, 2014). Information processing strategies adopted by customers in e-commerce environment have been studied; the impact of e-commerce technology in assisting and augmenting customer information processing in an online setting (Punj, 2012), moderating effect of style of processing on the relationship between online product presentation and consumer response (Yoo & Kim, 2014).

The decision-making individual difference inventory (DMIDI) developed by Appelt et al. (2011) lists various scales/measures for consumer decision-making based on risk attitude, cognitive ability, motivation, personality, and other factors. Researchers have studied the consumer decision-making style in an online purchase environment. The decision-making style at the individual level and market level vary (Karimi, 2013). If the customer has been a regular visitor to a specific e-commerce website, the customer can develop a habitual decision-making style compared to rational decision-making in

e-commerce set up (Cheung et al., 2015). The moderating effects of decision-making styles (habitual, rational) on the perceived risk in using a website are also studied (Chang & Wu, 2012). It is also understood that consumer decision style is influenced by the knowledge of the product in the online purchase process (Karimi et al., 2015).

Methodology

Websites can be customized for customer segments based on the website customer's Style of Processing (SOP). Hence, we propose the following two research objectives.

- 1) To understand customer segments based on their Style of Processing of information (Visual vis-à-vis Verbal) using the SOP scale discussed in the previous section
- 2) To understand the preference of customers (overall and segment-wise) for different attributes/elements of a website.

Using an experimental internet research design recommended in previous studies (Chen et al., 2008; Olivier Furrer & Sudharshan, 2001; Reips, 2002), a set of websites were created, and respondents were asked to visit the websites and provide their preference rating for the websites. Regarding the number of customer segments created and minimum sample size requirement, the study had followed the guidelines in previous research of customer-driven website optimization study (Gofman et al., 2009). One hundred and ten respondents participated in the online survey. After removing the missing data, 106 responses were analyzed.

Orthogonal design for creating websites

Conjoint analysis is used in marketing to predict customer preference for different product/service attributes for

designing products/services. The conjoint study method has been used in earlier researches to understand the preference for other website design elements. (Hung et al., 2010; Sebastianelli Rose Tamimi, 2013; Sharma et al., 2019).

However, it becomes difficult to test all the combinations when the number of attributes and elements increases. Hence orthogonal design (Malhotra & Dash, 2010; Shi & Li, 2016) is utilized to create manageable profiles (combination of attributes) which respondents can rate/rank as a part of the conjoint study. Based on earlier research studies (Blake et al., 2017; Constantinides, 2004; Cox & Dale, 2002; Garaus, 2018) and discussions with e-commerce industry experts, the following attributes and levels (Table 1) were finalized for constructing different web pages.

Since attribute-level combinations create 36 webpage profiles, which is tiresome for respondents to rank/rate based upon their overall preference, the orthogonal design was utilized to reduce the number of potential profiles to 9 profiles/websites, as shown in Table 2 below.

Based on the nine profiles designed through orthogonal design, nine websites were created that simulate the web environment of an e-commerce website that deals with Mobile phones. On the webpage, ten top-selling mobile phones in India have been displayed.

In the below Picture 1, a snapshot of Website 3 is shown. It includes different website attributes/elements; Image+ Net Price+ Description+ Reviews+ Delivery & Return Policy, CTA: Buy Now, Search option Availability: Yes, Product Page Display: Multiple products at a time.

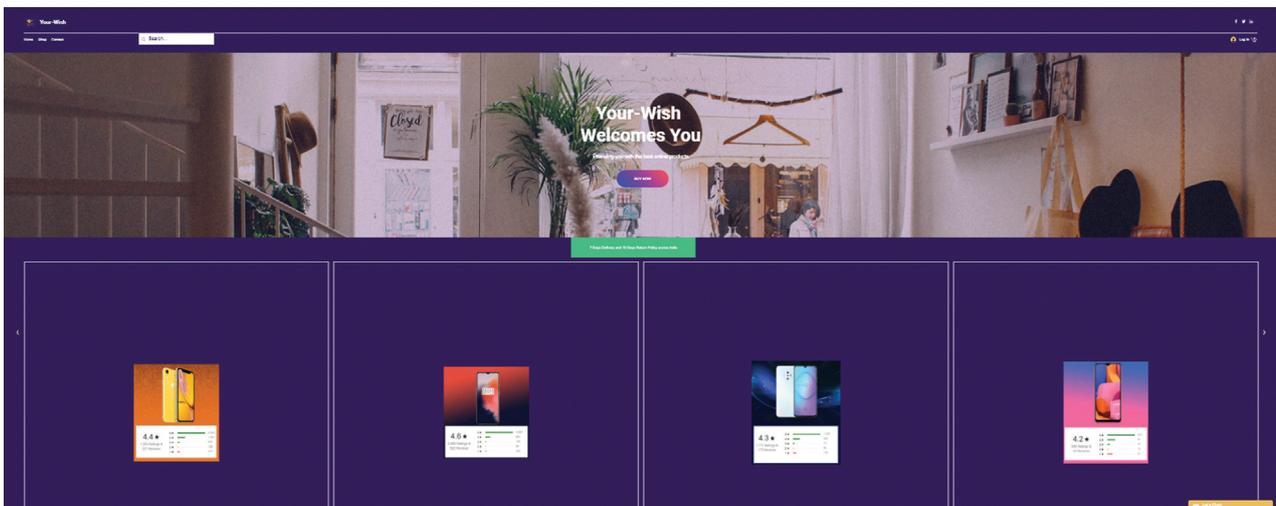
In the below Picture 2, a snapshot of Website 4 is shown. It includes different website attributes/elements; Image+ Net Price+ Description, CTA: Buy Now, Search option Availability: Yes, Product Page Display: One product at a time.

Table 1: Website Attributes and Levels

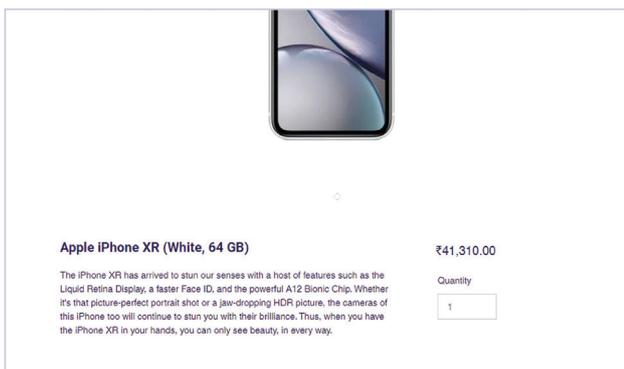
Factors/Website Attributes	Levels		
Product Information (3 levels)	Image+ Net Price + Detail description	Image+ Net Price + Detail description +Reviews	Image+ Net Price+ Detail description+ Reviews+ Delivery & Return Policy
Call-to-action (CTA) Phrase (3 levels)	Buy Now	Deal of the day	Save today
Search option availability (2 levels)	Available	Unavailable	
Product Page display (2 levels)	One product at a time	Multiple products at a time	

Table 2: 9 website profiles created using orthogonal design

Website ID	Product Information	Call to Action Phrase	Search option availability	Product page display
1	Image+ Net Price +Description+ Reviews	Deal of the day	Available	One product at a time
2	Image+ Net Price+ Description+ Reviews+ Delivery & Return Policy	Deal of the day	Available	One product at a time
3	Image+ Net Price+ Description+ Reviews+ Delivery & Return Policy	Buy Now	Available	Multiple products at a time
4	Image + Net Price+ Description	Buy Now	Available	One product at a time
5	Image + Net Price+ Description	Save today	Available	One product at a time
6	Image+ Net Price+ Description+ Reviews+ Delivery & Return Policy	Save today	Unavailable	One product at a time
7	Image+ Net Price +Description+ Reviews	Buy Now	Unavailable	One product at a time
8	Image+ Net Price +Description+ Reviews	Save today	Available	Multiple products at a time
9	Image + Net Price+ Description	Deal of the day	Unavailable	Multiple products at a time



Picture 1: Snapshot of Website 3.



Picture 2: Snapshot of Website 4.

Questionnaire

Style of Processing (SOP) scale, developed by Childers et al., is a self-reported questionnaire with 22 items to measure the style of processing (visual and verbal). SOP scale was used, as it is, for our research purpose. The SOP scale span is between 1 to 4 (1=always true, 4=always false). Few negative statements are reverse coded during

analysis. The overall scores provide a continuum from verbally oriented (overall low scores on the scale) to visually oriented (overall high scores on the scale). Also, respondents were requested to browse through each of the nine websites and provide a rating on a scale of 1 to 10 (1: Least likely to make any purchase on the website, 10: Most likely to make a purchase on the website).

Additionally, respondents were requested to provide demographic variables such as age, gender, income group, and behavioral variables such as the number of e-commerce websites used, frequency of purchase, and online spend amount (Pandey et al., 2015). For this study, we have considered two Age (in years) groups (up to 25, above 25) and three annual income groups (Less than \$ 6500, Between \$ 6500 and \$ 13000, above \$ 13000). The average order value in online shopping is around \$ 128 (Ogonowski, 2020). Hence, we considered two levels for average online spend per month (Less than \$ 130, More than \$ 130). Furthermore, approximately 62% of online buyers shop once a month, whereas 26% shop once a

week (Mohsin, 2020). Hence, we considered two levels for purchase frequency in a month (less than five times, more than five times).

Cluster Analysis

Cluster Analysis is a multivariate data analysis method to group elements based upon variables defined in the research, and K-means clustering is the most favored method (Hair et al., 2019). Cluster-based analysis has been used earlier to study purchase patterns/intentions in different consumer groups (Belk et al., 2013; Chang Hee Park, 2017). Based on the clustering analysis, 106 respondents are segmented into two groups (Cluster 1- 75 respondents and Cluster 2- 31 respondents). Cluster 1, with an overall average score of 2.72, represents visually-oriented individuals, and Cluster 2, with an average overall score of 2.48, represents verbally oriented individuals.

Findings and Discussions

SPSS 25.0 software was used to carry out overall conjoint analysis to elicit the importance of various attributes. The high correlation coefficient (Pearson's R, Kendall's tau) indicates a good model fit. As shown below in Figure 1, for all the respondents, the most crucial attribute emerged to be 'Call to Action phrase' followed by 'product information, 'search option availability,' and 'product page display' in that order.

After overall conjoint analysis, we ran the cluster-wise conjoint analysis for different clusters to understand the cluster-specific importance of attributes.

The comparison of attributes by averaged importance score for clusters/segments defined based upon Gender (Male and Female) is shown below in Figure 2.

The attribute importance scores for 'Call to action phrase' and 'product information' is more for Females than Males, whereas importance scores for 'Search option availability' and 'product page display' are more for Males in comparison to Females.

The comparison of attributes by averaged importance score for clusters/segments defined based upon Age (up to 25, above 25) is shown below in Figure 3.

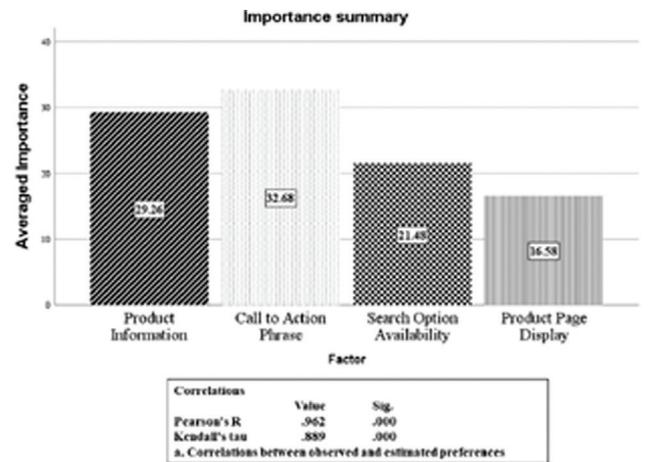


Figure 1: Overall attribute importance summary.

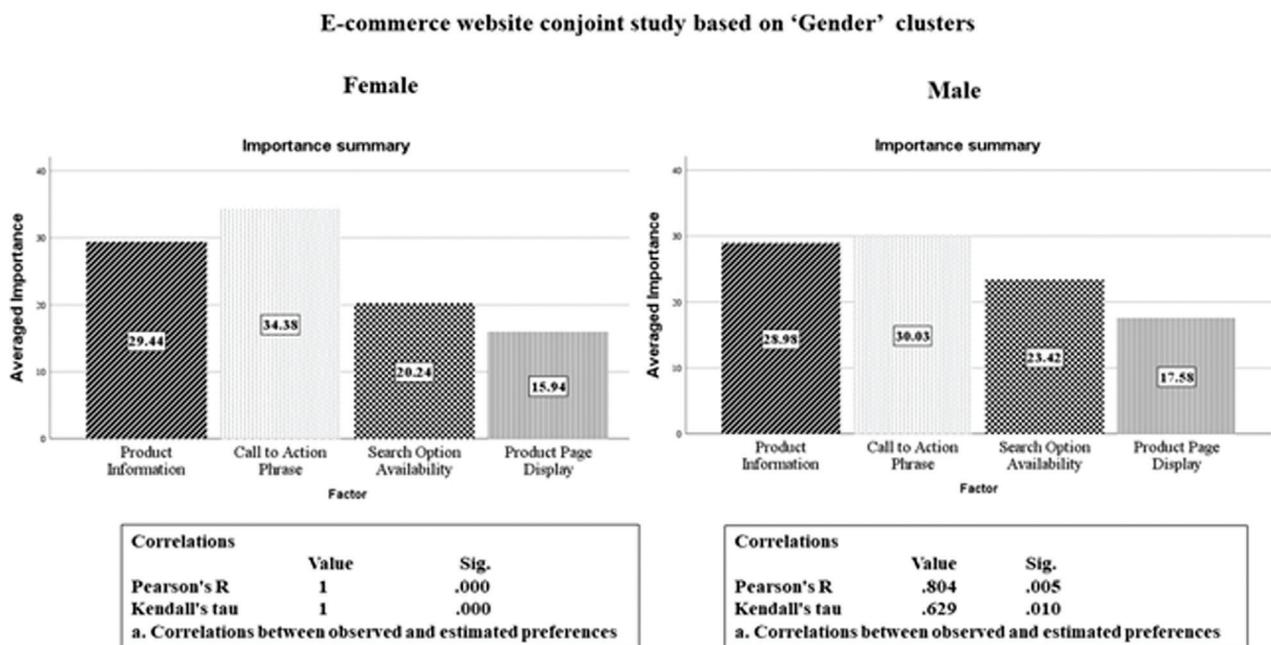


Figure 2: Attribute importance comparison (Gender).

The attribute importance scores for the ‘Call to Action phrase’ and ‘product information’ were approximately similar for both the age clusters. In contrast, the importance score for ‘Search option availability’ was higher for respondents up to age 25, whereas the importance score for ‘product page display’ was more for respondents above age 25.

The comparison of attributes by averaged importance score for clusters/segments defined based upon annual income groups (Less than \$ 6500, between \$ 6500 and \$ 13000, above \$ 13000) is shown below in Figure 4.

For respondents with annual income below \$ 6500, ‘product information’ emerged as the most important

attribute followed by ‘Call to Action phrase,’ ‘Search option availability’ and ‘Product page display.’ For respondents with annual income between \$ 6500 and \$ 13000 and with annual income above \$ 13000, ‘Call to Action phrase’ emerged as the most important attribute followed by ‘Product Information,’ ‘Search option availability’ and ‘Product page display.’

The comparison of attributes for clusters/segments defined based upon average online spend per month (Less than \$ 130, More than \$ 130) is shown below in Figure 5.

The attribute importance scores for ‘Call to Action phrase’ and ‘Search option availability’ were

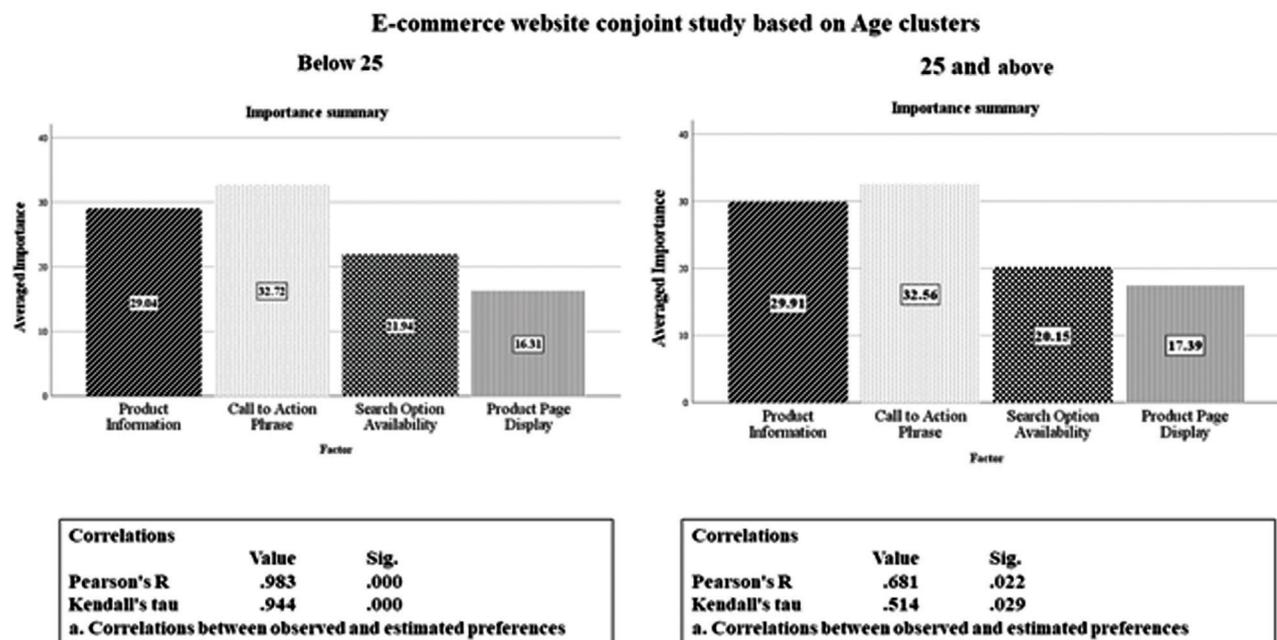


Figure 3: Attribute importance comparison (Age).

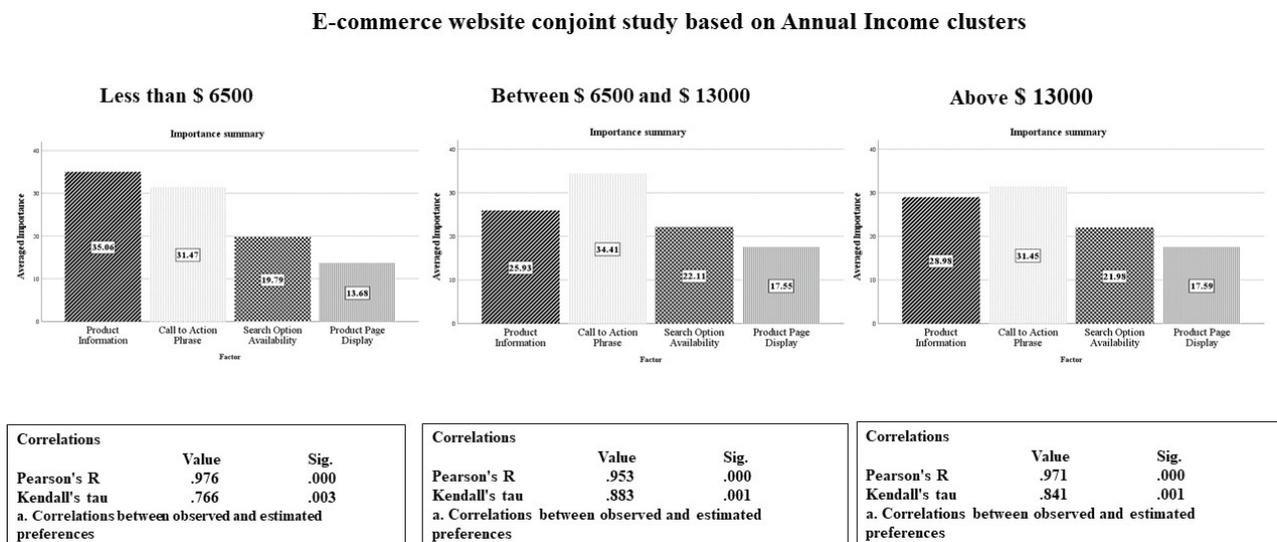


Figure 4: Attribute importance comparison (Annual income groups).

approximately similar for both the clusters, whereas importance scores for 'product information' was higher for respondents with a monthly average spend amount less than \$130, whereas the importance score for 'product page display' is more for respondents with a monthly average spend amount greater than \$130

The comparison of attributes by averaged importance score for clusters/segments defined based upon purchase frequency in a month (less than five times, more than five times) is shown below in Figure 6.

The attribute importance scores for 'Call to Action phrase' and 'product information' were approximately similar for both clusters. In contrast, the importance score for 'Search option availability' was higher for respondents with a monthly purchase frequency of less than 5. In contrast, the importance score for 'product page display' was more for respondents with a purchase frequency of more than 5.

The comparison of attributes by averaged importance score for clusters/segments defined based upon Style of (information) Processing clusters (Visual, Verbal) created

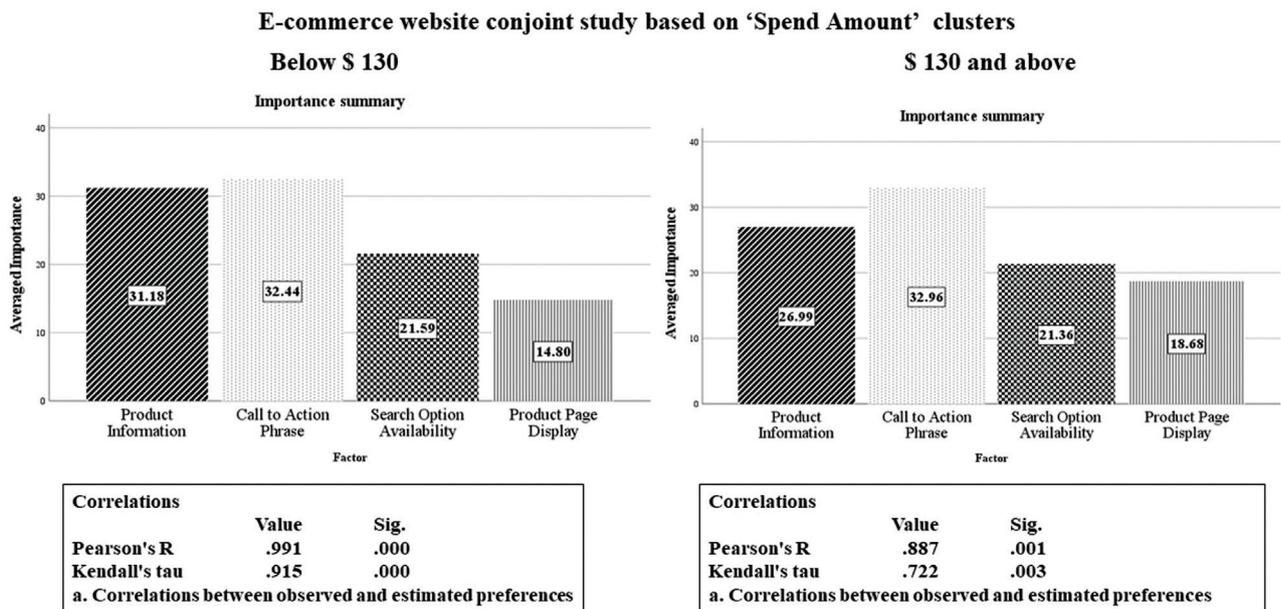


Figure 5: Attribute importance comparison (Average monthly online spend).

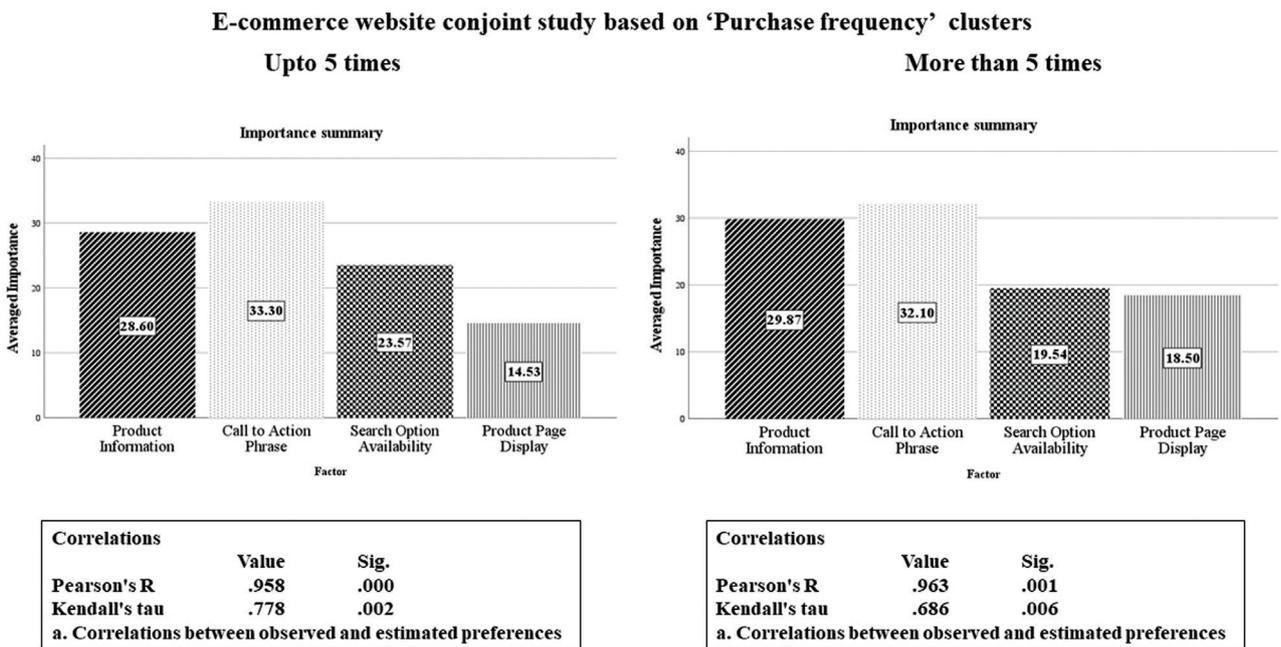


Figure 6: Attribute importance summary comparison (Purchase frequency in a month).

E-commerce website conjoint study based on ‘Style of Information Processing’ clusters

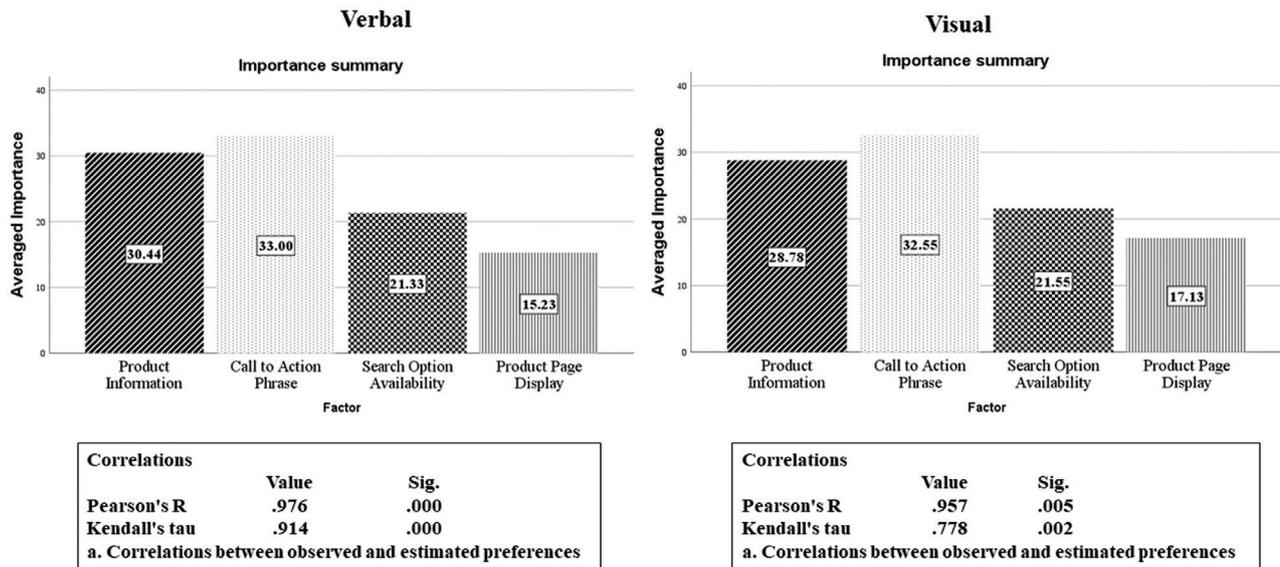


Figure 7: Attribute importance comparison (Style of Processing).

through k-means clustering as explained in the earlier section is shown below in Figure 7.

The attribute importance scores for ‘Call to Action phrase’ and ‘Search option availability’ were approximately similar for both the clusters. The importance score for ‘product information’ was higher for respondents with the verbal style of information processing, whereas the importance score for ‘product page display’ is more for respondents with the visual style of information processing.

Limitations

In this research, respondents had to fill up the style of processing questionnaire and then rate the attributes of nine websites individually—this introduced respondents’ fatigue. Secondly, more sample size could have given better results for conjoint analysis. Thirdly, though the websites were designed around mobile phones as products, the customers did not actually have to buy from this website. Thus, the behavior exhibited on these websites may not represent the behavior when a customer actually decides to purchase from an e-commerce website.

Conclusions and Scope for Future Research

Our study supports the earlier finding that men and women defer in their information processing styles.

Hence, the websites need to be designed considering distinct information processing styles of both genders (Arcand & Nantel, 2012). Furthermore, our findings support an earlier study (M. Kim & Lennon, 2008) on the positive influence of detailed product descriptions on the consumer shopping experience. As shown in the earlier section, for customers whose style of information processing is ‘verbal,’ ‘product information’ was more important than ‘product page display’ whereas for customers whose style of information processing is ‘visual,’ the product page display was more important than product information details. Hence, website designs can be optimized to the style of processing of individual website visitors.

The novelty of this paper rests on the usage of the Style of Processing (SOP) scale to create customer clusters/segments and carry out segment-wise conjoint analysis to optimize website design for e-commerce companies. As most companies worldwide are adapting to the online channel of selling, it becomes pertinent that companies design the websites considering the style of information processing of customers

Future research can be carried out with a larger sample of customers, including additional attributes and levels for website elements for conjoint design and other clustering variables to understand customer segments better.

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