

## Customer Purchase Intention in Virtual Shopping Mall

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Received: 2 Jun 2022

Revised: 14 Jun 2022

Accepted: 28 Jun 2022

### Abstract

The virtual shopping mall uses virtual reality (VR) to provide surreal online shopping experience. This study examined each aspect of interface design using a human-computer interface (HC-interface) strategy for taxonomy in V-avenue. This study aims to explore the relationship between interface design, satisfaction, online trust, and purchase intention using hedonic and utilitarian motivation as moderators. The samples were collected from 497 respondents who had experienced V-avenue in Thailand. The empirical result from partial least squares structural equation modeling (PLS-SEM) showed that all aspects of interface design had a significant total effect. The highest effect on the aforementioned variables was from information design, followed by sensory design which was found to have the second-highest contribution to satisfaction and purchase intention. Lastly, interaction design had the second-highest total effect on online trust. However, both utilitarian and hedonic motivations reflected an insignificant moderating effect. Understanding which aspects of interface design affect purchase intention allows for deeper customer insight.

**Keywords:** Virtual shopping mall; Human computer interface; Sensory design; Interaction design; Information design

## การศึกษาความตั้งใจในการซื้อของห้างสรรพสินค้าเสมือนจริง

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doi: xxxxx

วันที่รับบทความ: 2 มิ.ย. 2565

วันแก้ไขบทความ: 14 มิ.ย. 2565

วันที่ตอบรับบทความ: 28 มิ.ย. 2565

### บทคัดย่อ

ห้างสรรพสินค้าเสมือนจริงใช้เทคโนโลยี VR ในการให้ประสบการณ์เสมือนจริงแก่ลูกค้า ในงานนี้มีการศึกษาในแต่ ละด้านของการออกแบบอินเตอร์เฟซของห้างสรรพสินค้าเสมือนจริงบน V-avenue โดยใช้กลยุทธ์อินเตอร์เฟซระหว่าง มนุษย์และคอมพิวเตอร์ ในการจำแนกประเภท โดยที่งานนี้ตั้งใจที่จะศึกษาความสัมพันธ์ระหว่าง การออกแบบอินเตอร์ เฟซ ความพึงพอใจ ความไว้วางใจ และความตั้งใจในการซื้อ โดยใช้แรงจูงใจในด้านสุนทรียรสและด้านอรรถประโยชน์ เป็นตัวแปรกำกับ กลุ่มตัวอย่างที่ถูกเก็บมาในงานวิจัยนี้มีจำนวน 497 คนซึ่งเป็นคนที่ม่ประสบการณ์ในการใช้ V-avenue ในประเทศไทย ผลลัพธ์ที่ได้จากการศึกษานี้แสดงให้เห็นว่าทุกด้านของการออกแบบด้านอินเตอร์เฟซมี ผลกระทบโดยรวมเป็นนัยยะสำคัญ ซึ่งการออกแบบด้านข้อมูลมีผลกระทบโดยรวมมากที่สุดต่อความพึงพอใจ ความ ไว้วางใจ และความตั้งใจในการซื้อ ตามมาด้วยการออกแบบด้านประสาทสัมผัสที่มีผลกระทบโดยรวมต่อ ความพึงพอใจ และความตั้งใจในการซื้อ เป็นอันดับสอง ในขณะที่การออกแบบด้านการปฏิสัมพันธ์ผลกระทบโดยรวมต่อความไว้วางใจ เป็นอันดับสอง แต่อย่างไรก็ตาม

**คำสำคัญ:** ห้างสรรพสินค้าเสมือนจริง; อินเตอร์เฟซระหว่างมนุษย์และคอมพิวเตอร์; การออกแบบด้านประสาทสัมผัส; การออกแบบด้านการปฏิสัมพันธ์; การออกแบบด้านข้อมูล

# 1. Introduction

## 1.1 Purpose of Study

In the present day, online shopping has been widespread and grows exponentially in the market (Kotler, Kartajaya, & Setiawan, 2021) as well as the virtual reality (VR) market. VR has become a tool that can be game-changers in marketing campaigns and product exploration (Kotler et al., 2021). VR might be able to improve customer experience across customer journeys (Kotler et al., 2021) as it can enhance customer sensory and generate value for the customer (Hultén, 2011). Furthermore, VR can overcome the limitations of 2D visuals since 2D visuals are incapable of providing the visual sensory experience in 3D visuals, as Customers may shop in the same manner as if they were at a physical store. (Hsu, Chen, & Chen, 2020; Lee & Chung, 2008). An empirical study by Lee and Chung (2008) stated that user interface of virtual reality online shopping mall impacted customer satisfaction compare to 2D online shopping mall. The result from the study showed that virtual reality online shopping mall offers perceive quality assurance and enjoyment significantly higher than the 2D online shopping mall and VR customer also had significantly higher satisfaction than ordinary online shopping mall. Additionally, Van Herpen, Van den Broek, Van Trijp and Yu (2016) as well studied which conducted by collecting data from a customer panel including regular buyers and regular visitors of supermarket. The study found that customer significant spend more money in virtual reality store than spend in physical store. Lastly, VR might be used to significantly increase the performance of objective information systems (Lee & Chung, 2008).

Virtual shopping mall refers to a 3D digital simulation environment that mimics department stores or shopping centers (Lee & Chung, 2008; Rand, Katz, Shahar, Kizony, & Weiss, 2005; Shin & Shin, 2011). Users can explore the virtual shopping mall in 3D digital simulation shopping mall as VR technology is used. The virtual shopping mall can enhance the customer shopping experience, whereas e-commerce cannot provide the same as virtual shopping mall since virtual shopping mall can imitate the real world (Hsu et al., 2020; Lee & Chung, 2008; Shin & Shin, 2011). Many researchers have been studying using VR in e-commerce, but only a few have studied virtual shopping mall with 3D digital simulation environments in particular (Xi & Hamari, 2021).

Numerous studies have examined various elements of various sets of website characteristics and website stimuli and concluded that interface design is a critical component of online commerce success. Zimmerman (2012) mentioned that interface design is one aspect of website design and suggested that interface design is key to website stimulus as well as the most important predictors of online shopping. According to Wolfinbarger and Gilly (2003) and Ganguly, Dash, Cyr and Head (2010), when customers interacted with online retail or online commerce, they preferred to interact via technical interface and not with employees. Hence, the researchers suggested that interface design was one of the most important components that had an influence on customer satisfaction when considered online retail or online commerce. However, there are only a few researchers that mentioned which factors constitute website design in 3D virtual environment. Ganguly et al. (2010) proposed that there are many websites design factors which may impacts business-to-customer (B2C) e-commerce, hence taxonomy of these factors would result in a greater comprehension of how website design affects consumer trust in online commerce. For instance, in the context of 2D online commerce, many researchers had separated website design into three characteristics: navigation design, visual design, and information design (Cyr, 2008; Cyr & Head, 2013; Ganguly, Dash, & Cyr, 2009; Ganguly et al., 2010; Permatasari & Kartikowati, 2018). Nevertheless, Hsu et al. (2020) suggested that there is a significant difference in shopping environment between 2D websites and VR since 2D websites can quickly give product information, while VR can provide experiences of surreal shopping environments which cannot give shopping information quickly. Hence, applying taxonomy from 2D websites to VR might not be appropriate.

According to Altarteer and Charissis (2019), when interface design is, in the field of 3D online environment or virtual commerce which allows user to interact with product or environment, they recommended using Human-Computer Interface (HC interface) as the main strategy which is more suitable for virtual commerce. HC interface holds three aspects including sensorial design information design, and interaction design (Hsu et al., 2020; Shedroff, 1999). This research aims to thoroughly understand interface design factors, which are critical in online commerce but lacking study in the virtual commerce and virtual shopping mall context, by applying the HC interface strategy to taxonomy.

Furthermore, prior researches have extensively studied on purchase intention in 2D e-commerce and VR commerce. However, there is a lack of study in purchase intention in virtual shopping mall. 2D e-commerce and VR commerce have different characteristics. According to Shin and Shin (2011) and Lee and Chung (2008), VR could provide immersion, interactivity, and presence which 2D e-commerce could not provide, since VR could overcome space and time constraints and create a preferable online virtual environment which was always available for customers (Serrano, Baños, & Botella, 2016; Xi & Hamari, 2021). Consequently, customer feel more immersion, interactivity, and presence which result in different customer experience and customer purchase intention. Consistent with many empirical studies which were conducted and found that purchase intention of 2D e-commerce and VR commerce were different (Kang, Shin, & Ponto, 2020; Lombart, Millan, Normand, Verhulst, Labbé-Pinlon, & Moreau, 2020; Van Herpen et al., 2016). Nevertheless, prior studies in VR commerce did not examine on virtual shopping mall which is different from single VR retail store (Hsu et al., 2020; Kang et al., 2020; Lau & Lee, 2019). Virtual shopping mall provides more variety of retail stores and product types whereas a single VR retail store provides the same product type or brand specifically to the store which affects the purchasing process between customers and products. As a result, the variety of product types and retail stores as well as the purchasing process affect customer decision on the product and gain more information about products which ultimately impacted customer purchase intention (Gourville & Soman, 2005; Sethi, Kaur, & Wadera, 2018).

## **1.2 Research Objectives**

The objective of this research are: (1) To identify the effect of each aspect of interface design to online trust, satisfaction, and purchase intention, (2) To study the moderating effect of hedonic and utilitarian motivation of customer in virtual shopping mall, and (3) To explore the relationship among variables.

## **2. Review of Literature**

Prior studies have defined the definition of VR differently. Thus, Kardong-Edgren, Farra, Alinier and Young (2019) reviewed previous researches on VR and suggested that VR should be defined by using concepts of immersion and presence. Aspects of immersion can be categorized as low, moderate, and high. Low immersion referred to using VR without motion capture, in another word, using a joystick, mouse, or taping the phone screen to control the direction in virtual environment, whereas moderate and high immersion referred to using VR with body segment motion capture. For example, moderate immersive VR used hand or head to move around virtual environment, while high immersion used the full body to control movement in virtual environment. In this study virtual shopping mall are mainly accessed by mobile phone or website base; therefore, aspects of immersion in virtual shopping mall categorized as low immersion.

## 2.1 Related Theory

### 2.1.1 The S-O-R Model

Stimulus (S)-organism (O)- response (R) had been developed from stimulus-response (S-R) theory which utilized to comprehend the influence of environment on individual behavior (Kawaf & Tagg, 2012). Nevertheless, S-R theory was criticized by Lazarus (2013) as this theory reduces human into passive creature that simply responds to stimulus. Afterward, Mehrabian and Russell (1974) had developed stimulus S-O-R which includes “organismic” reaction as the mediator to exclude humans from the machine (Kawaf & Tagg, 2012; Tao, 2019).

S-O-R framework model comprises stimulus which is considered as an independent variable, organism which is considered as a mediator, and response which is considered as dependent variable (Goi, Kalidas, & Zeeshan, 2014; Spies, Hesse, & Loesch, 1997; Tao, 2019; Turley & Milliman, 2000). Stimuli refer to the external environment that surrounds an individual which influences individual’s inner state (Eroglu, Machleit, & Davis, 2001; Hsu, Chang, & Chen, 2012; Kim & Park, 2019). Organism refers to the inner state of an individual which links stimulus and individual’s responses together (Bagozzi, 1986; Eroglu et al., 2001; Hsu et al., 2012; Kim & Park, 2019; Sherman, Mathur, & Smith, 1997). Response refers to the outcome or reaction of an individual to inner state of an individual (Bagozzi, 1986; Eroglu et al., 2001; Hsu et al., 2012; Kim & Park, 2019; Sherman et al., 1997). Mehrabian and Russell (1974) further suggested that environment stimulus influences organism then organism influences response.

This research deployed S-O-R model to systematically analyze the behavioral intentions of individuals. Stimulus environment in online shopping usually revolves around website design (Kuhn & Petzer, 2018); therefore, stimulus environment is interface design which follows the human-computer interface strategy that includes sensory design, interaction design, and information design. Zimmerman (2012) and Zhu, Li, Wang, He and Tian (2020) suggested that satisfaction and trust are part of internal states which are influenced by online stimulus environment. Satisfaction and trust were also regarded as global evaluations, feeling, or attitudes that had impacted on response (Flavián, Guinalú, & Gurrea, 2006; Selnes, 1998). Consequently, this research’s organism consisted of satisfaction and trust. Purchase intention is regarded as an important behavioral outcome and measurement of the success of online platform implementation (Yadav, De Valck, Hennig-Thurau, Hoffman, & Spann, 2013). Zimmerman (2012), Zhu et al. (2020), and Hsu et al. (2012) also used purchase intention as a response variable in online commerce to determine the success of the platform. Hence, this research will consider purchasing intention in virtual shopping mall as response.

### 2.1.2 The Expectation and Disconfirmation Theory

Expectation and disconfirmation theory has been broadly deployed in various fields to understand customer satisfaction (Elkhani & Bakri, 2012; Fan & Suh, 2014). In expectation and disconfirmation theory, the degree of customer satisfaction is attained as a result of the connection between initial expectations and actual outcomes (Flavián et al., 2006). The expectation and disconfirmation theory were used in this study in order to gain a deeper understanding of the connection between interface design and customer satisfaction.

### 2.1.3 Appraisal Theory of Emotions

According to Moors, Ellsworth, Scherer and Frijda (2013), appraisal theories of emotion are used to explain why individuals had different emotions that emerge from the same event. Appraisal referred to the procedure for detecting and evaluating the importance of the environment on one's well-being (Moors et al., 2013). Frijda (1986) and Moors et al. (2013) suggested that one's well-being should be conceptualized as satisfaction. Moors et al. (2013) further stated appraisal processes could be done by using information from environment or event, individual concern, and other sensitivities which involve interaction between individuals

and environment. Accordingly, appraisal processes would develop main causal determinants of the various components that collectively comprise the multicomponent response patterns which are referred to as emotions. Furthermore, appraisal processes are also affected by individual motivation (Lazarus, 1991; Moors et al., 2013). Consequently, Wang, Minor and Wei (2011) summarized that if the goal of an individual matches environmental, it stimuli would result in positive emotions and well-being. Thus, the motivation of customers in virtual shopping mall could influence positive emotions and well-being.

## **2.2 Measurement variable**

### **2.2.1 Sensory Design**

Sensory design is defined as subjective based assessment around user senses including visual, auditory, tactile, gustative, and olfactory. Since virtual shopping mall can provide two types of sensory including visual and auditory design, this study will focus on visual and auditory design. Auditory is sensory that revolves around hearing a sound that captures attention or enhances experience of shopping (Cachero-Martínez & Vázquez-Casielles, 2018). Auditory design, in this research, refers to an approach which deals with sound elements of the website such as music, confirmation sound, and interaction sound (Delle Monache, Rocchesso, Bevilacqua, Lemaitre, Baldan, & Cera, 2018; Gibbs, 2007). Grewal, Baker, Levy and Voss (2003) discovered that music was found to influence customer responses to retail environments. They also conducted empirical study on the effect of store atmosphere in retail stores and found that music can influence store atmosphere evaluations. Visual is sensory that revolves around shapes, colors, article size, distance, digital merchandising, and lighting (Cachero-Martínez & Vázquez-Casielles, 2018). Previous studies defined visual design as approach that deals with the presentation component of the website design and the aesthetic appeal of the website (Cyr, 2008; Ganguly et al., 2009; Ganguly et al., 2010; Ijaz & Rhee, 2018; Permatasari & Kartikowati, 2018). According to Kotler (1973) and Parsons and Conroy (2006), sensory stimuli had a significant influence on customers by using sight, sound, scent, and touch. In addition, Smith and Wheeler (2002) and Petit, Velasco and Spence (2019) also suggested that customers' sense had an impact on decision making, perception, and purchasing behavior.

### **2.2.2 Interaction Design**

Interaction design involves customer attitude towards effective interaction with the object, product, services, or environment. For example, reaction time for each interaction, tapping on an icon will take user to another page, swiping the screen to explore the landscape of a virtual environment, or pinching the screen to zoom in. Although there is a lack of empirical research on the influence of interaction design on online customers, interactivity, which has been defined in some studies in the same manner as interaction design, has been extensively studied. Lin (2007) stated that interactivity is achieved through feedback mechanisms and multiple-choice purchases. Interactivity could be taxonomy as two-way communication, synchronicity, and controllability (Abdullah, Jayaraman, & Kamal, 2016; Akrimi & Khemakhem, 2014; Lowry, Spaulding, Wells, Moody, Moffit, & Madariaga, 2006; Mollen & Wilson, 2010). Two-way communication referred to the bi-directional flow of information that had been established for communication between the communicators (Abdullah et al., 2016; Akrimi & Khemakhem, 2014; Lowry et al., 2006). Synchronicity referred to the timing of information flow between two entities of information exchange (Abdullah et al., 2016; Lowry et al., 2006). For example, the site's capacity to respond quickly to users. Controllability referred to capability of user input and selection, in other word, user ability to alter timing, sequence of communications, and content (Abdullah et al., 2016; Jiang, Chan, Tan, & Chua, 2010; Lowry et al., 2006). In this research, interaction design refers to interface that let user effectively interact with the object, product, services, or environment; therefore, only controllability and synchronicity are concerned from interactivity aspect.

Akrimi and Khemakhem (2014) and Agosto (2002) stated that users desired websites with attractive format content since interaction promotes the sense of being immersed in the environment. Thus, interaction design is concerned as a critical component of any interface's design (Yao, Pang, Liu, & Hu, 2009). In addition, Sicilia, Ruiz and Munuera (2005), and Akrimi and Khemakhem (2014) mentioned that interactivity is a crucial factor since interactivity accelerates the processing of gaining information by removing or lowering the amount of excessive information. Additionally, Sicilia et al. (2005) also conducted empirical study on the effects of interactivity in website by developing two versions of a website. The finding indicated that interactive site leads to increase flow state intensity, more information processing, and higher favorability toward both product and website. Moreover, Jiang et al. (2010) investigated the website by using S-O-R model to investigate the effect of interactivity on the website. The result showed that website with higher controllability would lead to cognitive involvement.

In virtual shopping mall, customers interact with the system to navigate through the virtual shopping mall or gain more information which may not be similar to 2D e-commerce platform. Customers in 2D e-commerce mostly interact with the system by clicking to navigate through website, while virtual shopping mall customers have to slide the screen to see overall environment then click the screen to navigate further. Although the difference of interaction design of virtual shopping mall and 2D e-commerce, the concept of interaction design of virtual shopping mall and 2D e-commerce share the same idea. Thus, the interaction between human and system in virtual shopping mall is an important factor to be considered and studied.

### **2.2.3 Information Design**

Information design had been defined in prior studies and mostly in the same direction. According to Permatasari and Kartikowati (2018) and Cyr (2008), information design refers to website components that transmit inaccurate or accurate information to online users about services or products. Ganguly et al. (2009), Ganguly et al. (2010), and Ijaz and Rhee (2018) argued that information design deals with the information put on web pages and how it organizes. Information design, in terms of virtual shopping mall, refers to creating content and organizing conveyed messages accurately regarding products or services to online users.

Many prior studies mentioned the importance of information and information design. Permatasari and Kartikowati (2018) stated that information should be accurate and kept as simple as possible in order to be easily comprehended, since customers that are dissatisfied with the provided information will abandon the website without completing a purchase (Cyr, 2008; McKinney, Yoon, & Zahedi, 2002; Permatasari & Kartikowati, 2018). In addition, Ijaz and Rhee (2018) exam on online shopping in Korea found that information design had an impact on user trust and website irritation. Permatasari and Kartikowati (2018) study on XYZ e-commerce in Indonesia also found that visual design significantly impacted on online trust. In conclusion, it is important to consider information design for any online commerce.

### **2.2.4 Online Trust**

Online trust in online shopping or e-commerce can be identified as multidimensional which consists of institutional trust, interpersonal trust, and dispositional trust (Ganguly et al., 2010; Tan & Sutherland, 2004). Firstly, dispositional trust means an individual willingness and ability to trust in general or individuals' openness. Secondly, institutional trust refers to individual trust in social constructs such as law or technology. Lastly, interpersonal trust refers to the trust of an individual to another specific party (Ganguly et al., 2010; McKnight, Choudhury, & Kacmar, 2002; Pennanen, Kaapu, & Paakki, 2006; Tan & Sutherland, 2004). Ganguly et al. (2010) suggested that B2C online commerce which the customers and the online retailers were the two parties involved in the transaction which falls under the area of interpersonal trust. The interpersonal trust consists of benevolence, credibility, predictability, and integrity. To start with, predictability refers to the vendor's reputation for offering a high-

quality service or the consistency of behavior and knowing what to anticipate from others based on previous application experience and recent app experience (Ganguly et al., 2010; Tschannen-Moran & Hoy, 1998). Integrity refers to the assumption that the online seller will be trustworthy and stick to established standards (Ganguly et al., 2010). Credibility is defined as the customer's confidence in the online retailer's ability to perform the task efficiently, whereas benevolence is defined as the customer's belief in the online retailer's good intentions (Ganesan, 1994; Ganguly et al., 2010). Ganguly et al. (2010) further suggested that integrity and predictability are associated with consistency and honesty, and both factors contribute to the online store's credibility; therefore, in the present research, online trust explores customer's perception of the online store's credibility and benevolence. To summarize, online trust in online store is the customer's confidence in the online retailer's ability to perform the task efficiently and its good intentions.

### **2.2.5 Satisfaction**

Satisfaction refers to customers' overall contentment with virtual shopping mall experience, including interface design. Numerous studies have emphasized the importance of satisfaction. Customers who were satisfied with service or product are a critical factor for highly competitive e-commerce to survival and success (Szymanski & Hise, 2000); therefore, Petter, DeLone and McLean (2013) and Zhu et al. (2020) regraded satisfaction as one of the common measurement to determine the success or efficacy of information systems. Satisfaction became an important construct in the marketing field (Ball, Coelho, & Machás, 2004; Dash, Kiefer, & Paul, 2021) as well as e-commerce field (Lee, Pi, Kwok, & Huynh, 2003). On top of that, customers' satisfaction is a crucial element for forming a long-term relationship with them by acquiring their purchase intention along with repurchase intentions (Jung, Bae, Moorhouse, & Kwon, 2021; Kim, Chung, & Lee, 2011; Lee et al., 2003; Paiz, Ali, Abdullah, & Mansor, 2020). For instance, Chen and Fu (2015) study found customers who were satisfied tended to repurchase from same brand, recommend their peer to buy from the same brand, and would put the retail shop on positive terms. In the same way, customers that were not satisfied tended to switch brand and resist to form a relation with brand

### **2.2.6 Purchase Intention**

Online purchase intention refers to the willingness of customers to compete for the online transaction while considering all online elements that are related to purchase intention. Numerous prior researches have mentioned the importance of purchase intention as it is a crucial predictor for customer behavior or actual purchasing (Dhingra, Gupta, & Bhatt, 2020; Hsu et al., 2012; Hu, 2011; Paiz et al., 2020). According to Day (1969), Ling, Chai and Piew (2010), and Pu, Chen and Shieh (2015), using customer intention as measurements for capturing customers' minds would be more effective than behavioral measurement since customers may make a compulsory purchase rather than a favored decision. Consequently, purchase intention is regarded as the final cumulative impact of several stimuli for the e-commerce customer (Ganguly et al., 2009; Ganguly et al., 2010; Hu, 2011; Permatasari & Kartikowati, 2018).

### **2.2.7 Hedonic and Utilitarian Motivation**

Hedonic and utilitarian motivations should not be viewed as single motivation, but rather as separate from one another, because hedonic motivation ranges from low to high hedonic, whereas utilitarian motivation ranges from low to high utilitarian. (Adomaviciute, 2013; Babin, Darden, & Griffin, 1994; Tarakci & Yildiz, 2020; Voss, Spangenberg, & Grohmann, 2003). Hedonic customers refer to an individual who had propensity to enjoy spending time shopping and gaining both emotional and experiential benefits while shopping (Wu, Wang, Wei, & Yeh, 2015). Utilitarian customer refers to an individual who shops for a specific task or specific goal with the main concern of efficiency and effectiveness (Babin et al., 1994; Wu et al., 2015). Customers with hedonic motivation would mainly concern with



entertainment, enjoyment, and emotional aspects while shopping (Babin et al., 1994; Chang, Eckman, & Yan, 2011). Prajogo and Purwanto (2020) stated that hedonic customers are more emotional in their purchasing decisions and like to make impulsive purchases whereas customers with utilitarian motivation are mainly concerned on accomplishing the goal (Babin et al., 1994). According to Moe (2003) and Nusair, Yoon and Parsa (2008) mentioned that utilitarian customers, who entered the shop with a certain product in mind, preferred to purchase the product before leaving, contrary to hedonic customers, who entered the store without a specific product in mind, tended to purchase based on the store experience and environmental stimuli. Consequently, Nusair et al. (2008) concluded that the fulfillment of utilitarian and hedonic customers would affect the customer perception on website store. Furthermore, Alzayat and Lee (2021) conducted a study to compare customers with utilitarian and hedonic behavior in VR retail environments and online retail website. The result indicated that hedonic customer prefers VR environment over a retail website.

### 3. Hypothesis

This research uses S-O-R model as a framework to analyze customer behavioral intentions from virtual shopping mall. Stimuli are interface design, including sensory design, interaction design, information design. Stimuli influence on organism. Organism is overall evaluation including trust and satisfaction. Organism impacts response. Satisfaction also influences online trust. Response is purchase intention. Furthermore, customers with hedonic motivation have moderating effect on the relation between sensory design and satisfaction, whereas customers with utilitarian motivation have moderating effect on the relation between information design and satisfaction.

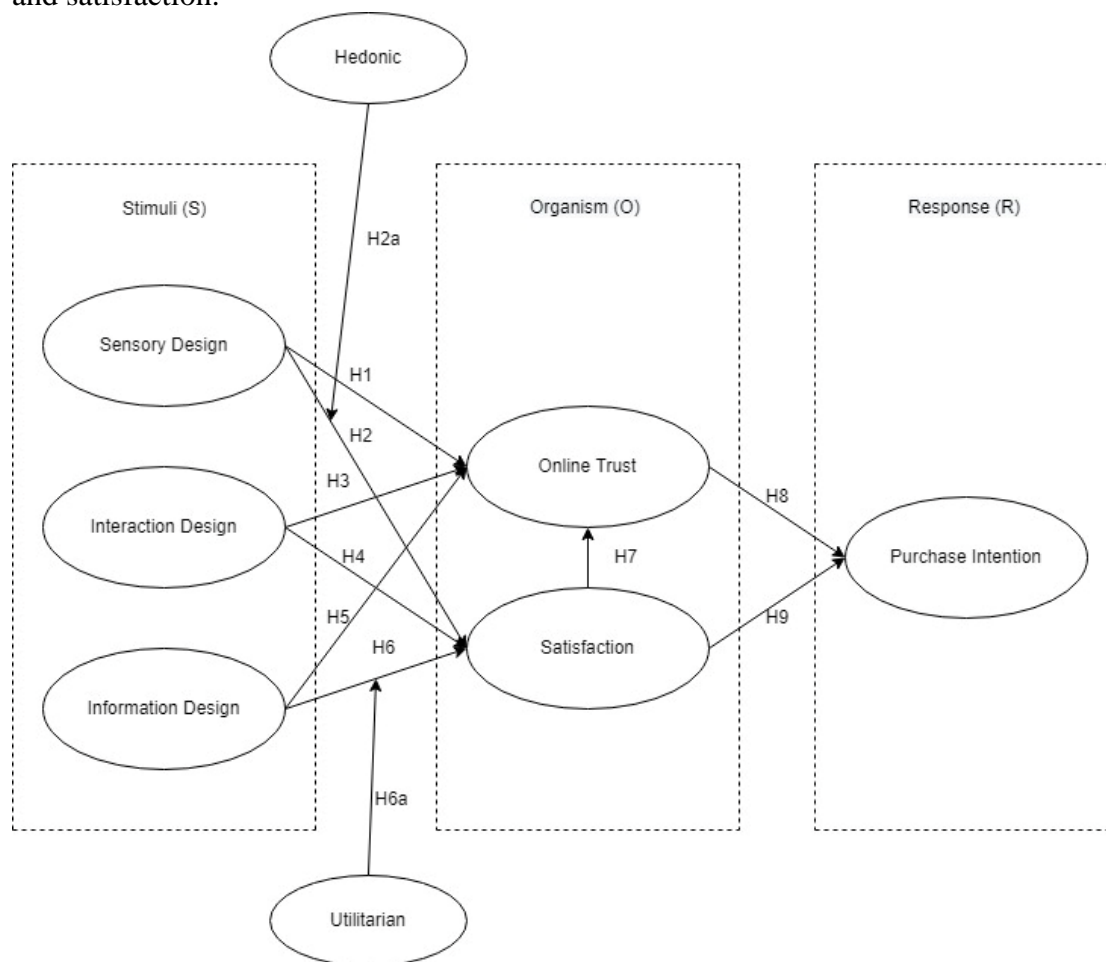


Figure 1 Research framework

Ganguly et al. (2010) and Cyr (2008) mentioned that visual design could provide users with 'overall enjoyment' by appealing to the website's feel and look, as visual design represents the key to website usability. Accordingly, pointing attention to the visual design of a website ought to enhance its usability; thus, reducing ambiguities and boosting the online vendor's trustworthiness. Furthermore, some studies show that the visual design of a website has a positive impact on trust. In addition, Ganguly et al. (2010) conducted a research on e-commerce using visual design as a predictor variable and trust as a mediator. They discovered that visual design has a positive influence on trust. Virtual shopping mall in this study can provide sensory experience by creating proper sensory design to the customers; therefore, sensory design in virtual shopping mall can affect customers. In summary, appropriate visual, and auditory design in online platform positively influenced customer trust. As a result, sensory design in virtual shopping mall affects customer online trust.

*Hypothesis 1: Perceived sensory design positively influences online trust*

According to Lashkova, Antón and Camarero (2019), sensory experience of the customer in purchase or consumption was expected to result in customer satisfaction, and enhancing the customer sensory experience through improved stimulus which would result in increased customer satisfaction. Therefore, improving sensory design would enhance sensory experience, which led to the increase of customer satisfaction. Moreover, Ramírez-Correa, Rondán-Cataluña and Arenas-Gaitán (2018) and Maslow, Frager, Fadiman, McReynolds and Cox (1970) suggested that Maslow's theory of self-actualization could be used to explain the relationship between aesthetics and satisfaction, since aesthetic pleasure is a higher-order need and the demand for aesthetics grows as it is fulfilled. Naturally, this indicates that improving an interface's visual aesthetics from the user's perspective will increase their satisfaction. Therefore, appropriate visual design, which is responsible for the aesthetic appeal of the website and the presentation component of the website design, would ensure user satisfaction (Ramírez-Correa et al., 2018). Thus, sensory design influences customer satisfaction.

*Hypothesis 2: Perceived sensory design positively influences satisfaction*

According to Locke (1967) and Westbrook and Reilly (1983), customer satisfaction is the emotional state, consequence from an evaluation of experience concerning a specific item, activity, or situation. The appraisal theory of emotions describes whether the goals of an individual match environmental stimuli which conceptualized satisfaction through positive emotions and well-being (Frijda, 1986, 1994; Moors et al., 2013; Wang et al., 2011). Therefore, Wang et al. (2011) further stated that a match between online environmental stimuli and the purchase task would result in customer satisfaction. In context of virtual shopping mall, Customers with high hedonic motivation, who shopping for enjoyment, amusement, entertainment, novelty, or sensuality, may enjoy the virtual shopping mall more than customer with low hedonic motivation. The virtual environment is online stimulus which is created by sensory design approach. Virtual environment of virtual shopping mall provided sensuality which match with their motivation. Therefore, the appeal of sensory design in virtual shopping mall has higher impact on the customer with high hedonic motivation than customer with low hedonic motivation. Thus, hedonic motivations had a moderating effect on the relationship between sensory design and satisfaction.

*Hypothesis 2a: Hedonic motivation has a positive moderating effect on the relationship between sensory design and satisfaction.*

Constantine (2006) discussed that predictability was one of the factors crucial for gaining user trust from the interaction design. Predictability based on previous application experience and recent app experience was regarded as a factor that influenced the fundamental level of trust (Tschannen-Moran & Hoy, 1998). Accordingly, Constantine (2006) stated that unpredictable and unexplainable interaction design would decrease user trust. On the other hand, predictable interaction design can promote user trust and inspire users to explore further. Thus, interaction design influences users' trust.

*Hypothesis 3: Perceived interaction design positively influences online trust*

Expectation and disconfirmation theory can be used to describe the connection between interaction design and satisfaction as satisfaction is depending upon the gap between initial expectations and actual outcomes (Flavián et al., 2006; Lowry et al., 2006; Oliver, 1980). Consequently, inappropriate, and hard-to-use interaction design which has a long response time and failing to follow the rule of social interaction would lead to user frustration and dissatisfaction (Huang, 2009; Lowry et al., 2006; Ovans, 1999). On the other hand, a well-designed interaction could enhance the user experience, resulting in increased usability of the system and satisfaction (Elahi, Ge, Ricci, Fernández-Tobías, & Berkovsky, 2015; Wang, 2011). Saariluoma (2005) also highlighted that overly complicated or complex interaction designs with slow speed response times could simply result in user frustration and unsatisfied. Thus, interaction design influences satisfaction.

*Hypothesis 4: Perceived interaction design positively influences satisfaction*

According to Ratten (2012) and Permatasari and Kartikowati (2018), knowledge is a vital factor in how quickly a person acquires new information, which is determined by a person's learning tendency. Flavián et al. (2006) further mentioned that the accumulation of knowledge results in customer trust; therefore, researchers extended that adjusting the information would alter customer trust. Thus, information design in virtual shopping mall is positively influence online trust.

*Hypothesis 5: Perceived information design positively influences online trust*

According to Liu, He, Gao and Xie (2008) and Thongpapanl and Ashraf (2011), information design that provided comprehensive information and higher quality would reduce customers' search cost; therefore, customer gained higher degree of satisfaction. Bai, Law and Wen (2008), Szymanski and Hise (2000) and Muhammad, Yi, Naz and Muhammad (2014) suggested that suitable information design would lead to higher user satisfaction; in contrast, information design that did not provide needed information would lead to user dissatisfy and leave the website. Thus, the information design of a virtual shopping mall has a positive influence on satisfaction.

*Hypothesis 6: Perceived information design positively influences satisfaction*

According to Wu et al. (2015) and Janiszewski (1998), seeking directed information of the task product is goal-driven and revolves around intensive process of online information seeking. Thus, appropriate information design would allow utilitarian customers to efficiently search and collect needed information for task products in order to complete purchasing goals; therefore, information design is crucial for utilitarian customers (Wu et al., 2015). Wang et al. (2011) further proposed the appraisal theory of emotions to describe the moderate effect of

utilitarian customer on the relationship between customer satisfaction and information design. In appraisal theory of emotions, it is explained as a match between appropriate information design and customer with utilitarian motivation which results in customer satisfaction. Thus, utilitarian motivations had a moderating effect on information design and satisfaction.

*Hypothesis 6a: Utilitarian motivation has a positive moderating effect on the relationship between information design and satisfaction.*

Flavián et al. (2006) suggested from the expectation and disconfirmation theory that satisfaction is depending upon the gap between the initial customer expectation and outcome result. Thus, satisfaction would occur when customers perceive the fulfillment of competence, benevolence, and honesty in website. In other words, satisfaction is an element that evaluates fulfillment factors in trust and becomes one source of trust. Consequently, Flavián et al. (2006) concluded that satisfaction could engage increasingly in customer trust. Zhou, Lu and Wang (2009) further suggested another approach to explain the relationship between satisfaction and trust as trust engages from the expectation and fulfillment results are met which reflects customers' attitude toward future behavior of online retailer, whereas satisfaction occurs when past expectation matches the fulfillment results. Accordingly, Kim, Xu and Koh (2004) and Zhou et al. (2009) suggested that trust, which is attitude toward online retailers' future behavior, gain from satisfaction, which is customers' prior perceptions on the results. Thus, satisfaction influences online trust.

*Hypothesis 7: Satisfaction positively influences online trust*

Ratten (2012) and Permatasari and Kartikowati (2018) further stated that the majority of people's behavioral intentions are affected by experience and are determined to achieve the greatest feasible result depending on the available; therefore, Permatasari and Kartikowati (2018) stated that when trust is created, it would result in online purchases. Consistent with Gefen (2000) and Luhmann (1979) suggestion from Luhmann's theory, trust is a main factor in reducing the lack of a guarantee from the store that they would not harm customers in any way. Hence, the presence of trust can positively affect customer purchase intention (Everard & Galletta, 2005; Ganguly et al., 2009; Gefen, 2000; Ijaz & Rhee, 2018). On the other hand, the customer who lacks trust would not share personal information for online transaction and would reduce probability to online purchasing (Bart, Shankar, Sultan, & Urban, 2005; Everard & Galletta, 2005; Meskaran, Ismail, & Shanmugam, 2013). Thus, the degree of trust effects on the degree of purchase intention (Ling et al., 2010). Thus, Online trust positively influences on purchase intention.

*Hypothesis 8: Online trust positively influences on purchase intention*

To begin with, Dash et al. (2021) proposed that customers are satisfied and likely to make a purchase when the perceived value surpasses the price of the product. On the other hand, when perceived value falls to meet or exceeding customers' expenditures, customers would become unsatisfied and drop out of the transaction; therefore Dash et al. (2021) suggested that there is a connection between satisfaction and purchase intention. Moreover, Akhter (2010) stated that when customers express a high level of overall satisfaction, they are more likely to reveal favorable purchase intention. Thus, a rise in overall satisfaction has a positive impact on purchase intentions (Akhter, 2010; Attar, Shanmugam, & Hajli, 2020; Hsu et al., 2012).

*Hypothesis 9: Satisfaction positively influences on purchase intention*

## 4. Research methodology

The equation in this research contains a multiple-way relationship, employing structural equation modeling (SEM) to analyze is appropriate since it can thoroughly impute and examine all hypotheses and variables at the same time. The suitable analysis method is partial least square structural equation modeling (PLS-SEM) which makes no assumptions about the distribution of data. The analytical tool for PLS-SEM is SMARTPLS. In this research, latent variables are sensory design, interaction design, information design, satisfaction, online trust, purchase intention, hedonic motivation, and utilitarian motivation.

The sample in this research are the customers who have experience in V-avenue and did not require purchasing products or services before. According to Goodhue, Lewis and Thompson (2012), rules of thumb is appropriate to apply for calculating samples size of PLS-SEM. There are 49 measurement items from 8 constructs in this study. The recommended sample size for rules of thumb is 10 sample per 1 measurement item; therefore, the minimum requirement is 490 samples. The questionnaire in this quantitative research is a self-administered questionnaire and utilized a 5-point Likert scale as a rating scale and was created in an online version via google form and distributed through online channels such as Facebook, LINE, etc. The pilot test data is collected from 30 participants to analyze the completeness of the questionnaire before distribution to all participants.

## 5. Results and discussion

### 5.1 Statistical Report

According to data acquired between January and March 2022, 522 samples were collected from an online survey platform. The data from respondents who provided suspicious answers, such as answers on the same scales across the whole questionnaire, were vetted to remove inaccuracies. After eliminating the inaccurate data, the total number of suitable data for statistical analysis is 497 samples. The appropriate sample size in this study is 490; therefore, suitable data for statistical analysis is 497 samples are enough to analyze further. Besides, there are no missing values in the surveys owing to the Google Form's requirement that all fields be filled out before submitting.

### 5.2 Demographic of Samples

There were 254 females (51.11%), 233 males (46.88%), and 10 other genders (2.01%) among the total number of respondents. The respondents' ages were classified into different generations. Fourteen respondents (2.81%) of the respondents were aged 18 and below, 221 respondents (44.47%) were aged between 19 and 24, 210 respondents (42.25%) were aged between 25 and 40, 47 respondents (9.46%) aged between 41 and 56, and 5 respondents (1.01%) were age 57 and above. Moreover, 209 respondents (42.05%) had the average frequency used of virtual shopping mall ranging from less than 1 time per month, 154 respondents (30.99%) had an average frequency used of virtual shopping mall once per month, 102 respondents (20.52%) had the average frequency used of the virtual shopping mall between 2 and 5 times per month, 28 respondents (5.63%) had the average frequency used of the virtual shopping mall between 6 and 10 times per month, 4 respondents (0.80%) had the average frequency used of the virtual shopping mall between 11 and 15 times per month. Furthermore, the majority of respondents had used VR for videogame with 277 respondents (55.73%), followed by television and movies with 152 (30.58%), and marketing/promotion with 145 (29.17%). In addition, most of the respondents use the smartphone to access virtual shopping mall, with 384 respondents (77.26%).

This data demonstrates that virtual shopping mall was well-known among younger respondents. According to the respondents, VR was frequently used for the videogame, education, health, marketing and promotional purpose, and television and movies. This indicates that the younger generation uses VR for many purposes and has more experience with VR than the older generation. Therefore, VR and the virtual shopping mall have more potential to grow and expand among the younger generation than the older generation. The demographic result demonstrated that almost 80 percent of respondents use smartphones to access V-avenue. This reflects that the smartphone is the easiest way to access the virtual shopping mall. However, more than 70 percent of respondents spent less than 15 minutes in V-avenue and used V-avenue less than 1 time or once a month. This reflects that V-avenue smartphone platform was unable to keep customers engaged for an extended period of time and revisit. Therefore, the virtual shopping mall should focus more on improving the smartphone platform in order to keep customers engaging. Moreover, Cross tabulation of gender and average time in V-avenue showed that most females spend more time than males as more than 62 percent of females spend time in virtual shopping mall more than 10 minutes, while only 30 percent of males spend time in virtual shopping mall more than 10 minutes. This situation matched with the prior study on virtual reality online shopping (Hsu et al., 2020). Accordingly, Hsu et al. (2020) mentioned that males prioritize swift services and spend less time in virtual reality online shopping, while females spend more time than males when it comes to virtual reality online shopping. Therefore, a virtual shopping mall could develop a specific interface for each gender. The interface design for males is mainly concerned with the swiftness of the interface, while the interface design for females is concerned with the entertaining and aesthetic interface.

### **5.3 Measurement Model Evaluation**

Measurement Model Evaluation consist of Outer Loading test, Reliability test, Convergent Validity test, and Discriminant Validity test. The value of outer loadings of all measurement item fell between 0.4 and 0.7 which was acceptable value. Cronbach's alpha value of all measurement items which reflects reliability, were above 0.7. The AVE value of all measurement items were higher than 50%; thus, all measurement items were statistically significant and convergently valid. The  $\sqrt{\text{AVE}}$  values of all constructs are higher than 0.7 and correlations of other latent variables. This indicated that the Fornell-Larcker criterion was passed. Cross loadings test showed that all items have higher loading on their construct than other constructs. Therefore, all items are discriminately valid.

Table 1 Results of measurement model evaluation

Construct	Scale items	Mean	Outer loadings	AVE	Composite Reliability	Cronbach's Alpha
Sensory Design	SD1	3.831	0.774	0.622	0.920	0.898
	SD2	3.853	0.801			
	SD3	3.753	0.800			
	SD4	3.700	0.814			
	SD5	3.702	0.826			
	SD6	3.662	0.742			
	SD7	3.674	0.758			
Interaction Design	IxD1	3.672	0.793	0.613	0.905	0.874
	IxD2	3.614	0.818			
	IxD3	3.928	0.802			
	IxD4	3.726	0.708			
	IxD5	3.787	0.803			
	IxD6	3.863	0.769			
Information Design	ID1	3.555	0.809	0.678	0.927	0.905
	ID2	3.495	0.848			
	ID3	3.642	0.856			
	ID4	3.569	0.811			
	ID5	3.684	0.800			
	ID6	3.660	0.817			
Satisfaction	S1	3.771	0.860	0.731	0.942	0.926
	S2	3.763	0.872			
	S3	3.761	0.835			
	S4	3.525	0.828			
	S5	3.797	0.892			
	S6	3.561	0.843			
Online Trust	T1	3.744	0.817	0.716	0.926	0.900
	T2	3.831	0.876			
	T3	3.577	0.842			
	T4	3.610	0.837			
	T5	3.751	0.856			

Table 1 Results of measurement model evaluation (Continued)

Construct	Scale items	Mean	Outer loadings	AVE	Composite Reliability	Cronbach's Alpha
Purchase Intention	PI1	3.887	0.896	0.802	0.953	0.938
	PI2	3.811	0.902			
	PI3	3.773	0.897			
	PI4	3.823	0.898			
	PI5	3.877	0.886			
Hedonic Motivation	HM1	3.793	0.805	0.754	0.948	0.934
	HM2	3.738	0.858			
	HM3	3.797	0.896			
	HM4	3.809	0.857			
	HM5	3.835	0.884			
	HM6	3.861	0.905			
Utilitarian Motivation	UM1	3.873	0.727	0.535	0.902	0.876
	UM2	3.984	0.672			
	UM3	3.722	0.724			
	UM4	3.871	0.779			
	UM5	3.573	0.742			
	UM6	3.686	0.640			
	UM7	3.920	0.782			
	UM8	4.087	0.776			

#### 5.4 Structural Model Assessment

The structural model assessment examines the relationship among independent and dependent variables, including coefficient determinant tests and hypothesis testing. Coefficient determinant is used to determine how much variation in the dependent latent variable is explained by the independent variable (s). Online trust's  $R^2$  and  $R^2$  adjusted are 0.469 and 0.464. For satisfaction were 0.715 and 0.711. Lastly, purchase intentions were 0.594 and 0.592. The  $R^2$  value of all dependent variables were higher than 0.25; therefore, the structural model was valid.

Hypothesis testing showed that all path or hypotheses were significant. This indicated that the results supported the hypotheses. However,  $H_1$ ,  $H_{2a}$ , and  $H_{6a}$  had p-value higher than 0.05; therefore, these hypotheses were insignificant. The explanation for insignificant of  $H_1$  was the culture in each country may led to different results as some countries may overlook sensory design when considered online trust. While the explanation for insignificant of  $H_{2a}$ , and  $H_{6a}$  were the measurement items were collected from physical world experience since the concept of moderating the effect of hedonic and utilitarian motivation is relatively new in the virtual shopping mall context. As a result, experience of shopping in the real world and shopping in virtual shopping mall were different. Thus, utilitarian and hedonic motivation in the real world did not fit in a virtual shopping mall.

Total effect analysis showed that information design had the highest total effect on online trust and satisfaction with 0.357 and 0.405, accordingly. Satisfaction had the highest total effect on purchase intention with 0.623. The direct effect of sensory design on online trust is statistically insignificant; however, the total effect of sensory design on online trust was statistically significant. On the other hand, interaction design had the lowest total effect on satisfaction and purchase intention, with 0.095 and 0.129, respectively.



Table 2 Hypotheses test results

Hypothesis	Relationship	Sign	Path Coefficient	T-values	P-values	Result
H <sub>1</sub>	Sensory design -> online trust	+	0.033	0.712	0.477	Not Supported
H <sub>2</sub>	Sensory design -> satisfaction	+	0.276	6.185	0.000*	Supported
H <sub>2a</sub>	Hedonic motivation -> satisfaction	-	0.061	1.663	0.096	Not Supported
H <sub>3</sub>	Interaction design -> online trust	+	0.243	3.972	0.000*	Supported
H <sub>4</sub>	Interaction design -> satisfaction	+	0.095	2.104	0.035*	Supported
H <sub>5</sub>	Information design -> online trust	+	0.269	4.497	0.000*	Supported
H <sub>6</sub>	Information design -> satisfaction	+	0.405	8.120	0.000*	Supported
H <sub>6a</sub>	Utilitarian motivation -> satisfaction	+	0.022	0.852	0.394	Not Supported
H <sub>7</sub>	Satisfaction -> online trust	+	0.218	3.508	0.000*	Supported
H <sub>8</sub>	Online trust -> purchase intention	+	0.287	6.354	0.000*	Supported
H <sub>9</sub>	Satisfaction -> purchase intention	+	0.560	13.194	0.000*	Supported

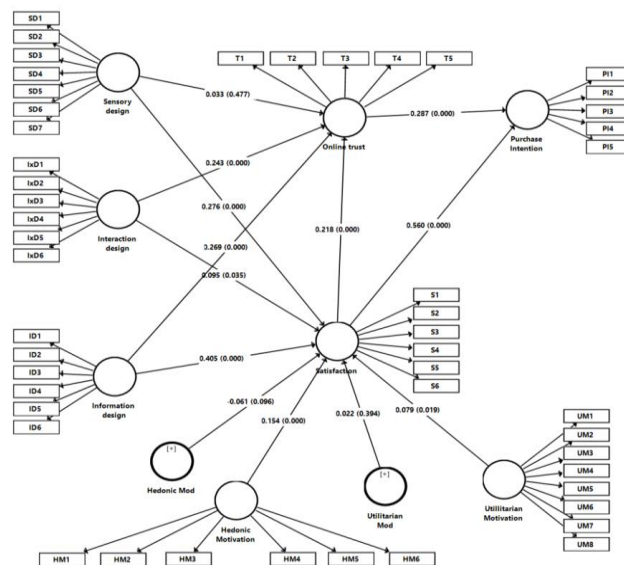


Figure 2 Path coefficients and P-value from path coefficients test

## 6. Conclusions and recommendations

### 6.1 Conclusions

The taxonomy of interface design factors of the virtual shopping mall can help understand how they affect the user experience in the virtual shopping mall. The virtual shopping mall used v-avenue to collect the data. One of the taxonomy methods that fit virtual shopping mall is the HC interface, as it guides customers to understand the company's brand, products, prices, and services more efficiently in the 3D virtual environment (Altarteer & Charissis, 2019; Hsu et al., 2020). Hence, this research has interested in the interface design of virtual shopping mall as how each factor of interface design, including sensory design, interaction design, and information design, affected customer trust, satisfaction, and purchase intentions.

The total effects showed that information design had the highest total effects on purchase intention, followed by sensory design and interaction design. Information design also had the highest total effect on both online trust and satisfaction, while sensory design had the second-highest total effect on satisfaction, and interaction design had the second-highest total effect on online trust. Information design seems to be the most crucial factor among interface design factors as it weighed the highest; therefore, the virtual shopping mall should prioritize on create preferred information design for customers. Lastly, the virtual shopping mall should take sensory design, interaction design, and information design into account since they are all critical variables affecting customer satisfaction, online trust, and ultimately purchase intention.

### 6.2 Theoretical contribution

The empirical result from this study showed that stimulus (sensory design, interaction design, and information design) affected the organism (online trust and satisfaction), and then the organism affected response (purchase intention). Therefore, the S-O-R model theory was supported by empirical evidence in this study and empirical evidence was supported S-O-R model theory. Besides, the S-O-R model theory is still relatively new in the virtual shopping mall context, and not much research applied the S-O-R model theory to virtual reality and virtual shopping mall context. This research successfully applied the S-O-R model theory; therefore, further research could apply the S-O-R model theory in another context of virtual reality to examine whether the S-O-R model theory could be applied.

The empirical findings confirmed the successful implementation of the taxonomy of virtual shopping mall interface design through the use of the HC-interfaces strategy, as each factor of interface design was significant with measurement model evaluation and had a significant effect on online trust, satisfaction, and purchase intention. This research successfully deployed HC-interface to taxonomy interface design which was lacking studies in online commerce and virtual shopping mall context. This opens the opportunity and hopefully encourages further researchers who are interested in the virtual shopping mall to explore and study on taxonomy of interface design in the virtual shopping mall that has different immersive levels in order to gain more insight into the customer.

Based on the empirical result, the relationship between interface design and satisfaction is significant. This supports the expectation and disconfirmation theory. Additionally, the expectation and disconfirmation theory is still relatively new in the virtual shopping mall context, and little research has applied the theory to virtual reality and the virtual shopping mall context. This opens opportunity for further research to apply the expectation and disconfirmation theory in another context of virtual reality and virtual shopping mall.

### 6.3 Practical Implications and Recommendations

The empirical result showed that sensory design had the second-highest total effect on satisfaction and purchase intention; thus, to improve satisfaction and purchase intention of the customer, the virtual shopping mall should focus on the atmosphere in virtual shopping mall first as it had the highest outer loadings value in sensory design. However, to improve the online trust, sensory design should be last prioritized since it had the lowest total effect on online trust. Moreover, Interaction design had the second-highest impact on online trust; therefore, to improve online trust through interaction design, the virtual shopping mall should prioritize customer sense of control over interactions in virtual shopping mall first. However, interaction design should be the last priority to increase satisfaction and purchase intention since it had the lowest total effect on satisfaction and purchase intention compared to sensory design and information design. Lastly, the virtual shopping mall should prioritize information design first since the total effect of information design on trust, satisfaction, and buy intention is the highest. For information design improvement, the virtual shopping mall should prioritize the effectiveness of product and service detail provided by the virtual shopping mall since it had the highest factor loading value.

### 6.4 Limitations and Further Research

During the collection of data through questionnaires, Thailand was undergoing an abnormal situation due to the COVID-19 pandemic; therefore, questionnaires were only acquired through an online platform. The researcher has provided necessary information as much as possible about the questionnaire for the respondent since using only online platform for the questionnaire could increase the chance of misunderstanding the context of the questionnaires. One limitation of this research is the number of people having experience with V-avenue since V-avenue has been recently opened around the second quarter of the year 2021. In the future, collecting the data from customers who experience V-avenue is potentially easier. Further research should also test this model when people have more experience with virtual shopping malls to determine whether the results change from those obtained in this study. Furthermore, the empirical result found that both hedonic and utilitarian motivation had an insignificant moderating effect on the relationship between sensory design and satisfaction and information design and satisfaction. The suspicion was the measurement item which assumed and collected in the physical world, which may have a different experience compared to the virtual shopping mall experience; consequently, this study suggested that further study should study on creating or adjusting the measurement item for hedonic and utilitarian motivation that fits in the virtual shopping mall experience in order to gain more insight into the customer. Thus, further exploring the moderating effect of hedonic and utilitarian motivation is interesting.

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