UNIVERSITI TEKNIKAL MALAYSIA MELAKA

THE INVESTIGATION OF VIRTUAL REALITY (VR) TOOL PERFORMANCE FOR 3D DESIGN VISUALIZATION CONSIDERING CULTURAL PREFERENCES

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2023

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A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Manufacturing Engineering Technology (Product Design) with Honours

Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

DECLARATION

I declare that this Choose an item. entitled " The Investigation Of Virtual Reality (Vr) Tool Performance for 3D Design Visualization Considering Cultural Preferences " is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Name : SYAZRIEN EFFENDI BIN GHAZALI.

Date : 20/01/2023

APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Manufacturing Engineering Technology (Product Design) with Honours.

Signature :

Supervisor Name : DR. IHWAN GHAZALI

Date : 20/01/2023

DEDICATION

Firstly, I would like to express my gratitude to Almighty Allah for His kind blessing for giving me a healthy body and mind to finish this project. Next, I would like to express my sincere appreciation to Universiti Teknikal Malaysia Melaka (UTeM) for giving me opportunity to do my Final Year Project (FYP) here. I wish to give my special gratitude to my personal supervisor Dr. Ihwan Ghazali , for the help and cooperation during my project period here and guide me until I completed my research study.

I would like to thank a million to UTeM, for giving me chance to study and distribute my acknowledgement to final year project. Great deal appreciation to all lecturer and staff for the machine handling and briefing about the laboratory security and standard operating procedures of the machine. I really appreciate the helpfulness and cooperation.

Lastly, thank you so much to my beloved family, especially my father, Ghazali Bin Hussin and my mother, Datmawan Binti Md Isa for the kind, understanding and moral support to finish my Final Year Project. Not forget to all my friends, thank you for all the support and sharing knowledge especially Nur Fatin Nabilah Binti Md Fared, Nur Fitrin Binti Zaini, and Nur Liyana Syahirah Binti Che Abd Razak my partners that I always collaborate with them and share input of information together to finish this research study.

ABSTRACT

Virtual reality has received a lot of attention in developing countries. But there may be challenges with users' tastes for virtual reality, which may differ. Some of these discrepancies might be attributed to the effect of cultural values. It's possible that these variables will make it more difficult for designers to include virtual reality tool capabilities into 3D modelling that meet customers' expectations There are currently no standards in place to ensure that cultural values are taken into account in virtual reality. As a result, the study's goal was to develop guidelines for incorporating cultural values into VR products. Customers' and designers' viewpoints on data collection were both utilised. Malaysia was chosen as the research location. A survey was sent out to 60 peoples in order to get information on their preferences. To confirm the questionnaire's reliability and validity, pre-testing was conducted. The acquired data was used for exploratory, confirmatory, and structural equation modelling based on satisfaction levels. It was necessary to gather information from designers about their cultural considerations and design techniques in order to create virtual reality. Data was gathered through the use of in-depth interviews with a variety of various types of designers. The results revealed that the factors of uncertainty avoidance, long-term orientation, and power distance were the most influential in determining consumer preferences in Malaysia. Designers may use a guideline to help them take cultural values into account while creating VR solutions. In order to clarify in greater depth how virtual reality technologies might be used in 3D modelling, a guide was built based on cultural values discovered, designers' opinions, and literature study. The case study was used to verify the guideline's applicability. Virtual reality's creators believed that cultural values should be taken into account while creating the technology. For the most part, designers agreed that the proposed framework helps them to better understand their consumers' requirements while also helping them to construct virtual reality experiences. This study's findings show that customers' preferences for virtual reality qualities may be evaluated by taking cultural values into account. In order to help designers include cultural values into the process of developing 3D models utilising virtual reality tools, a new guideline has been produced.

ABSTRAK

Realiti maya telah mendapat banyak perhatian di negara membangun. Tetapi mungkin terdapat cabaran dengan citarasa pengguna untuk realiti maya, yang mungkin berbeza. Beberapa percanggahan ini mungkin dikaitkan dengan kesan nilai budaya. Ada kemungkinan pembolehubah ini akan menyukarkan pereka bentuk untuk memasukkan keupayaan alat realiti maya ke dalam pemodelan 3D yang memenuhi jangkaan pelanggan Pada masa ini tiada piawaian yang ditetapkan untuk memastikan nilai budaya diambil kira dalam realiti maya. Hasilnya, matlamat kajian adalah untuk membangunkan garis panduan untuk memasukkan nilai budaya ke dalam produk VR. Pandangan pelanggan dan pereka bentuk mengenai pengumpulan data kedua-duanya digunakan. Malaysia dipilih sebagai lokasi penyelidikan. Tinjauan telah dihantar kepada 60 orang untuk mendapatkan maklumat tentang pilihan mereka. Untuk mengesahkan kebolehpercayaan dan kesahan soal selidik, ujian pra telah dijalankan. Data yang diperoleh telah digunakan untuk penerokaan, pengesahan, dan pemodelan persamaan struktur berdasarkan tahap kepuasan. Ia adalah perlu untuk mengumpul maklumat daripada pereka bentuk tentang pertimbangan budaya dan teknik reka bentuk mereka untuk mencipta realiti maya. Data dikumpul melalui penggunaan temu bual mendalam dengan pelbagai jenis pereka bentuk. Keputusan menunjukkan bahawa faktor penghindaran ketidakpastian, orientasi jangka panjang, dan jarak kuasa adalah yang paling berpengaruh dalam menentukan pilihan pengguna di Malaysia. Pereka bentuk boleh menggunakan garis panduan untuk membantu mereka mengambil kira nilai budaya semasa mencipta penyelesaian VR. Untuk menjelaskan dengan lebih mendalam bagaimana teknologi realiti maya boleh digunakan dalam pemodelan 3D, panduan telah dibina berdasarkan nilai budaya yang ditemui, pendapat pereka bentuk dan kajian literatur. Kajian kes digunakan untuk mengesahkan kebolehgunaan garis panduan. Pencipta realiti maya percaya bahawa nilai budaya harus diambil kira semasa mencipta teknologi. Untuk sebahagian besar, pereka bentuk bersetuju bahawa rangka kerja yang dicadangkan membantu mereka untuk lebih memahami keperluan pengguna mereka sambil turut membantu mereka membina pengalaman realiti maya. Dapatan kajian ini menunjukkan bahawa keutamaan pelanggan terhadap kualiti realiti maya boleh dinilai dengan mengambil kira nilai budaya. Untuk membantu pereka bentuk memasukkan nilai budaya ke dalam proses membangunkan model 3D menggunakan alat realiti maya, garis panduan baharu telah dihasilkan.

ACKNOWLEDGEMENTS

In the Name of Allah, the Most Gracious, the Most Merciful

As a student at the Universiti Teknikal Malaysia Melaka (UTeM), I would like to express my sincere gratitude to my supervisor, Dr. Ihwan Ghazali, for his essential guidance, support, and encouragement.

To my wonderful professors, classmates, and family members, I owe a special debt of appreciation for their unwavering encouragement and belief in my ability to complete the degree. Finally, I'd want to thank everyone who helped make this effort a success.

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LIST OF SYMBOLS AND ABBREVIATIONS

AVE	-	Average variance extracted
CB-SEM	-	Covariance based-structural equation modeling
CFA	-	Confirmatory factor analysis
CR	-	Composite reliability
CVSCALE	-	Cultural value scale
EFA	-	Exploratory Factor Analysis
f^2	-	Effect size; a measure to assess the relative impact of predictor construct on an endogenous construct.
HOC	-	Higher-order component
HTMT	-	Heterotrait-monotrait
LOC	-	Lower-order component
n	-	Sample size
PLS	-	Partial least square
Q^2	-	Predictive relevance, to predict model accuracy
q^2	-	a measure to assess the relative predictive relevance of a predictor construct on an endogenous construct
SEM	-	Structural equation modelling
VIF	-	Variance inflation factor; quantifies to severity of collinearity among the indicators in formative construct

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CHAPTER 1

INTRODUCTION

1.1 Background

Technology plays a significant role in transforming our lifestyles (Langridge, 2020). Every day, new technologies emerge; one such technology is Virtual Reality (VR), which is a major actor in this generation, particularly among millennials (Voxburner, 2017). Virtual Reality has a variety of uses, including gaming, education, and 3D design simulation (Castronovo et al., 2019). VR technology is evolving from a desktop-based to a mobile-based platform, with new capabilities such as more involvement and interaction (Wang et al., 2018). People usually use the traditional approach of perceiving items in Virtual Reality, but experiencing Virtual Reality through bodily motions is an interesting new concept to consider. Virtual reality has lately become a cost-effective tool that will aid scientific research (El Beheiry et al., 2019).

Schools and university also believe that incorporating Virtual Reality into education and using it as an alternative method of teaching and learning allows students to effectively exercise their creativity, particularly if they are also designing architectural plans and objects. VR plays an important role in the teaching process because it provides an interesting and engaging method of acquiring information (Kaminska et al., 2019).

Recent study has identified the benefits of merging 3D modelling and virtual reality in a variety of applications. VR is used for spatial planning projects, for example, by using point clouds as source data to produce a 3D model, or -depending on the budget- by using

3D modelling tools to create 3D building models (SketchUp, CityEngine, ArchiCAD, Revit, etc.). Van Rees (2019) there are two forms of VR: active VR, in which the user may move around and transport himself, and passive AR, in which the user can only gaze around while being transported automatically.

New product designers need to keep in mind the impact of cultural values on customer preferences when developing new products. A group or region's collective minds can influence customer preferences, according to Crilly et al. (2020). Researchers Salmi and Sharafuthdinova (in 2008) and Bloch (1995), as well as Bong and Jin (2018), have shown that cultural values can influence consumer preferences for specific products. It is therefore possible that, if the designer fails to understand cultural values, the product may appear less appealing to customers and thus fail in the market in which it is being sold. This could lead to the product's failure.

1.2 Problem Statement

Immersive technologies such as augmented reality (AR), mixed reality (MR), and virtual reality are already in use by businesses (Tuong Huy Nguyen, 2018). However, he estimates that these technologies will take 5 to 10 years to mature. Businesses and educational institutions are already experimenting with virtual reality, but they are hesitant to completely commit. Customers, on the other hand, are enthralled by the new entertainment options, but are hesitant to invest in head-mounted displays (HMDs) because the selection is so limited. Organizations must overcome three primary obstacles in AR and VR hardware and technology to stay up with consumer interest and utilise the benefits of immersive technologies.

Recognizing the choice of a specific customer and setting the design specifications accordingly may be a difficulty for the designers (Soron, 2020). This is due to the fact that a choice may be appropriate for one consumer but not others. Consequently, the market for the developed items may be jeopardised. In order to overcome this issue, the effect of cultural values must be considered as a viable strategy for determining the appropriate virtual reality preferences. However, the effect of cultural values on customer choices in virtual reality has not been studied by prior academics, particularly in Malaysia. Consequently, this study is conducted to solve this issue by giving a guideline to aid designers in incorporating cultural values into the design of 3D models utilising virtual reality tools.

1.3 Research Objective

To achieve the main aim of this research, two research objectives were formulated, which are:

a) To identify the Virtual Reality (VR) tool performance attributes for 3D design modelling in literature.

b) To identify the relationship between the cultural value on Virtual Reality (VR) performance for 3D design modelling.

c) To evaluate the important rating of Virtual Reality (VR) tool performance for 3D design modelling considering cultural value influences.

1.4 Scope of Research

This research was conducted in Malaysia since the country have many cultural value we can consider for our research. This cultural values may provide information in order to

increase the understanding on how Malaysian think about Virtual Reality (VR) tool performance works for 3D design. The scope of this research are use as to:

a) Educational purpose in 3D design in Malaysia.

b) Industrial that related to 3D design modelling.

c) Designers which related to 3D design modelling.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Significant efforts have been made to promote virtual reality in 3D modelling (Ambrosio & Fidalgo, 2020). However, there are issues with customer preferences that might be linked to divergent perspectives on virtual reality-related topics. It has been suggested that cultural values may significantly impact consumer preferences. The purpose of this chapter was to evaluate studies on customer preferences, virtual reality, and cultural values in order to examine in greater depth how cultural values affect customer preferences towards virtual reality. This chapter is divided into the following three sections: The first segment consisted of a survey of the literature about the meaning of the term "customer preferences." This contains the virtual reality's definition, influencing factors, evaluation methods, and the significance of customer preferences for design and development. The second section focused on a literature review pertaining to virtual reality. This includes the identification of the virtual reality's properties and the customer preferences on virtual reality. In the final section, the review was condensed in order to examine in greater depth the cultural values involved. This includes the definition, dimensions, characteristics, and index of cultural values for emerging nations (Malaysia). This chapter also includes a review of relevant studies on the relationship between cultural values and consumer preferences in order to provide additional insight into the manner in which these cultural values have a significant impact on customer preferences.

2.2 Virtual Reality

Created with the aid of computer technology, virtual reality (VR) is a type of immersive virtual reality. VR, as opposed to conventional user interfaces, puts the user right in the middle of the action. Instead of looking at a flat screen in front of them, users can become fully immersed in 3D worlds and interact with them. When the computer mimics as many senses as possible, such as vision, hearing, touching, and even smelling; it becomes a gatekeeper to this artificial world. Virtual reality experiences are limited only by content availability and affordable computing power (Jackson, 2018).

Virtual Reality (VR) has been hotly contested in recent years as a breakthrough technology in a wide range of industries, from entertainment to more professional uses. When the focus is shifted to the design and engineering domains, it's easy to spot a large number of research studies, prototype implementations, and even fully fledged commercial software that clearly demonstrate how far development has progressed in allowing these novel approaches to be integrated into established workflows. More specifically, both hardware and software tools have become widely available and affordable, and they're well-optimized to be used right away without the steep learning curve that is frequently associated with such groundbreaking innovations (Lorusso et al., 2022).

2.2.1 History of Virtual Reality

From the first precursors associated to the early theories of vision, stereoscopy, and anaglyphs, to the present gadgets on the market, there are five major stages in the technological history of virtual reality (Ambrosio & Fidalgo, 2020).