Why do people use VR (games)? A study of continued use and spending

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ABSTRACT
Virtual reality (VR) applications, including games and play, have received significant warranted and unwarranted hype, especially under the label of "metaverse". Nonetheless, adoption of VR remains relatively modest, and many VR users are demotivated to continue their VR use despite its growing offerings and affordability. Several reasons have been postulated to hinder VR adoption such as cybersickness, affordability, and low usability. However, few empirical studies investigated continued use of and spending on VR. In this study we utilized factors originating from uses and gratifications theory as well as unified theory of acceptance and use of technology to investigate and understand continued VR use and spending through survey data (n = 681). The results indicate that VR use continuance and spending are positively connected to perceptions of utility, facilitating conditions, enjoyment, price-value, and experiences of embodiment, but are negatively connected to (current) visual aesthetics. These findings guide future VR research, development, and marketing.

Keywords
Virtual Reality, Metaverse, VR games, technology acceptance, continued use, player experience, SEM

1.INTRODUCTION
Recent advances in display and haptic technologies have made head-mounted Virtual Reality (VR) relatively more accessible and affordable for most consumers and companies. VR has been utilized for various purposes such as education (Chen et al. 2016; Lai et al. 2009; Slater and Sanchez-Vives 2016), health management (Diemer et al. 2015; Huygelier et al. 2019), and especially for entertainment purposes such as gaming (Disztinger et al. 2017; Kim and Hall 2019; Manis and Choi 2019). VR has additionally provided highly malleable yet controlled research spaces for investigating human behavior (Diemer et al. 2015; Slater and Sanchez-Vives 2016). The current promise of VR has been so significant that the metaverse, a virtual space that can encapsulate the human experience, is thought to be closer to realization than ever in human history.

Optimistic expectations have predicted that VR experiences, applications and games will soon become a daily consumer product (Hassan et al. 2020a; Slater and Sanchez-Vives 2016). While many commercial headsets are relatively affordable and easy to use (Anthes et al. 2016; Diemer et al. 2015; Disztinger et al. 2017; Huygelier et al. 2019), adoption and continued use of VR technologies have not lived up to expectations (Hassan et al. 2020a; Manis and Choi 2019). This disparity in VR adoption has been

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attributed to various reasons, such as to cybersickness that some individuals experience from VR use (Anthes et al. 2016; Huygelier et al. 2019), the cognitive and physical resources needed to use VR (Chen et al. 2016; Kim et al. 2020; Manis and Choi 2019) as well as aspects connected to content quality, such as image fidelity and sharpness (Disztinger et al. 2017; Kim et al. 2020). Paradoxically, regardless of these factors, we also find many individuals who have passionately adopted head-mounted VR, utilizing it extensively for various purposes. Research, however, has been lacking holistic explorations of the factors influencing VR adoption, continued use and spending (Hassan et al. 2020a; Huygelier et al. 2019; Manis and Choi 2019; Mütterlein and Hess 2017) which could guide future research, development, and marketing of VR technologies. This research, similar to previous research investigating the adoption of media-based technologies (Lin and Chen 2016; Ruggiero 2000), employs theory on technology adoption (Venkatesh et al. 2012), and uses and gratifications (Katz et al. 1973; Ruggiero 2000) to approach the phenomenon understudy. Survey data was collected (n = 681) from frequent head-mounted VR users and data was analyzed through Structural Equation Modeling (SEM), to *investigate what media gratifications and technology-related factors explain and can hence predict continued use of and spending on VR technology*?

2.BACKGROUND

Motivations for why individuals adopt and continue to use technology, in general, vary. Perhaps most widely known; the Technology Acceptance Model (TAM) outlined technology use as a function of perceived usefulness and perceived ease of use (Davis 1989). This initial understanding of technology adoption has been expanded to include additional variables, such as social influence, and various hedonic motivations (Davis et al. 1992; Venkatesh et al. 2012) amongst other variables that can facilitate or hinder technology use. The Unified Theory for Acceptance and Use of Technology (UTAUT) emerged in an attempt to combine these variables in a unified theory of technology adoption (Venkatesh et al. 2012), positing that utility, enjoyment (hedonic motivations), social influence, effort, facilitating conditions, and price-value, amongst other variables, are core influencers of technology adoption and predictors of future use.

On the other hand, as media content and mediums continued to develop from paper, to TV, to VR, the uses and gratification theory emerged as means to investigate why individuals consume different media and adopt its facilitating technologies (Katz et al. 1973; Ruggiero 2000). Consumption of many of these media forms is, however, not a mere question of the gratifications that the media can provide but is additionally a question of the adoption of the underlying facilitating technologies. The use of Augmented Reality (AR), for example, is a function of not only the utility or gratifications it can provide (e.g., exercise, social activity, self-expression, entertainment, etc.) (e.g., Nov et al. 2010; Lin and Chen 2016; Rauschnabel 2018), but it is additionally a function of its perceived ease of use, utility, facilitating conditions, price-value, and social influence impact (Lin and Chen 2016; Venkatesh et al. 2012) amongst other such technology factors that influence adoption.

Accordingly, the adoption and continued use of new technologies that facilitate media consumption is complex. If the facilitating technologies are not acceptable or usable, it is unlikely that individuals will use it to consume said media. Similarly, if individuals draw little gratification from the technology, they are unlikely to adopt or use it, especially in today's world of overabundance. The same influences hold in the context of VR (Kim et al. 2020). Investigating VR use and spending requires an understanding of consumer perception of VR technology itself as well as the gratifications it can offer.

Understanding these perceptions and gratifications can positively influence VR production and consumption (Katz et al. 1973; Lin and Chen 2016).

VR can facilitate various activities that are classically considered *utilitarian* and often foster the adoption of technology (Davis et al. 1992; Davis 1989; Venkatesh et al. 2012). For example, VR can support education, cultural experiences and well-being which facilitate its adoption and utilization as research indicates (Chen et al. 2016; Disztinger et al. 2017; Kim and Hall 2019; Lai et al. 2009; Manis and Choi 2019). On the other hand, hedonic experiences drive the use of most technologies (Chen et al. 2016; Kim et al. 2020; Venkatesh et al. 2012). VR is also seen as a means for hedonic experiences such as *enjoyment* (Kim et al. 2020; Mütterlein and Hess 2017) amongst other experiences, which drive its use as is significantly seen in the VR gaming and entertainment industries (Simon and Greitmeyer 2019; Slater and Sanchez-Vives 2016). *Social influences* impact most human activity through, for example, peer influence and subjective norms (Lee et al. 2015; Nov et al. 2010; Venkatesh et al. 2012; Webster and Martocchio 1992). Social norms around VR use have not been intensely researched yet, however, VR is seen in pop culture as a futuristic technology and has several communities of enthusiasts, which, taken together, might create a social influence for its use (Chen et al. 2016).

The perceived *effort* associated with the use of technology influences its adoption and continued use (Chen et al. 2016; Kim et al. 2020; Venkatesh et al. 2012). The more a technology, including VR, is perceived as easy to use, or requiring little effort to use, the more individuals are likely to continue their use of and spending on it (Chen et al. 2016; Huygelier et al. 2019; Kim et al. 2020; Manis and Choi 2019). Furthermore, *facilitating conditions* for the use of technology, such as the availability of personal resources and knowledge to utilize the new technology, influences its adoption and use (Chen et al. 2016; Kim et al. 2020; Venkatesh et al. 2012). VR requires several facilitating conditions to be utilized (e.g., space, tech-savvy-ness, headset, compatibility with existing technology). The scant research on VR's facilitating conditions does indicate that some of these outlined facilitating conditions, such as one's belief in their ability to utilize VR is important for its use (Chen et al. 2016; Kim et al. 2020) and can, hence, be expected to impact the continued use of VR. The perceived *price-value* of a technology is often calculated relative to the effort and investments needed to utilize it, thus the higher this perception, the more likely individuals are to use the technology (Venkatesh et al. 2012), including VR (Manis and Choi 2019), as research indicates.

In terms of the gratifications from VR; perhaps most anecdotally; presence (Mütterlein 2018; Rauschnabel 2018), embodiment (Bourdin et al. 2017; Weibel at al. 2015), visual aesthetics (Disztinger et al. 2017; O'Brien and Toms 2010), playfulness (Chen et al. 2016; Kim et al. 2020; Webster and Martocchio 1992) and social interaction (Kim et al. 2020; Lee et al. 2015; Rauschnabel 2018), are often discussed in popular culture and research as key gratifications from VR. Such anecdotal assumptions have rarely been investigated in relation to continued VR use or spendingm in general, and in games and play in specific (Mütterlein and Hess 2017).

VR is especially anecdotally linked with being able to afford an immersive experience – a sense of *presence* as in 'being there' (Mütterlein 2018; Mütterlein and Hess 2017; Rauschnabel 2018; Ruggiero 2000; Simon and Greitmeyer 2019). This immersion is linked with *embodiment*, i.e., the degree to which a user feels to be acting through their virtual representation in the VR environment (Bourdin et al. 2017; Weibel at al. 2015). To facilitate presence and embodiment, *visual aesthetic* and the sensory experience of VR are intended to be immersive, "real", and sharp (Disztinger et al. 2017; Kim et al. 2020; Lai et al. 2009) so that they are pleasing (O'Brien and Toms 2010; Simon and

Greitmeyer 2019) and better able to facilitate positive, interactive experiences that drive VR use (Kim et al. 2020; Mütterlein and Hess 2017).

VR also allows individuals to engage in interactive/playful activities that they may not be able to engage with in reality (Diemer et al. 2015; Kim et al. 2020; Mütterlein 2018; Rauschnabel 2018; Webster and Martocchio 1992). For example, VR museums allow individuals to manipulate/touch artefacts that they would not be able to touch in real life. VR is, hence, often posited as a *playful* technology that facilitates spontaneous interactions (Chen et al. 2016). Through its ability to portray individuals in interactive 3D renditions (Bourdin et al. 2017), VR has been expected to revolutionize how we *socially interact* with each other (Mütterlein and Hess 2017). It is already being used by many companies and social groups to facilitate more natural, face to face meetings, as well as to facilitate connections between friends and family (Slater and Sanchez-Vives 2016), that can drive VR use and spending (Kim et al. 2020; Lee et al. 2015; Nov et al. 2010; Rauschnabel 2018).

Based on this brief discussion of the technology acceptance-related variables influencing continued use and spending on technology, as well as some of the popular uses and gratifications from VR, we hypothesize the following:

H1: Positive perception of utility from VR use is positively associated with VR continued use intentions (H1a) and spending intentions (H1b).

H2: Positive perception of effort in VR use is positively associated with VR continued use intentions (H2a) and spending intentions (H2b).

H3: Positive perception of social influence to VR use is positively associated with VR continued use intentions (H3a) and spending intentions (H3b).

H4: Positive perception of facilitating conditions to VR use is positively associated with VR continued use intentions (H4a) and spending intentions (H4b).

H5: Positive perception of enjoyment from VR use is positively associated with VR continued use intentions (H5a) and spending intentions (H5b).

H6: Positive perception of the price-value of VR use is positively associated with VR continued use intentions (H6a) and spending intentions (H6b).

H7: Positive perception of playfulness gratification from VR use is positively associated with VR continued use intentions (H7a) and spending intentions (H7b).

H8: Positive perception of embodiment gratification from VR use is positively associated with VR continued use intentions (H8a) and spending intentions (H8b).

H9: Positive perception of presence gratification from VR use is positively associated with VR continued use intentions (H9a) and spending intentions (H9b).

H10: Positive perception of social interaction gratification from VR use is positively associated with VR continued use intentions (H10a) and spending intentions (H10b).

H11: Positive perception of visual aesthetics gratification perception from VR use is positively associated with VR continued use intentions (H11a) and spending intentions (H11b).

Figure 1 depicts the investigated research model and hypotheses. Virtually, there could be an endless variety of gratifications and factors that predict VR use, however, in this study, we attempted to find a balance between width and breadth by focusing on key variables from both technology acceptance and users & gratification theory.

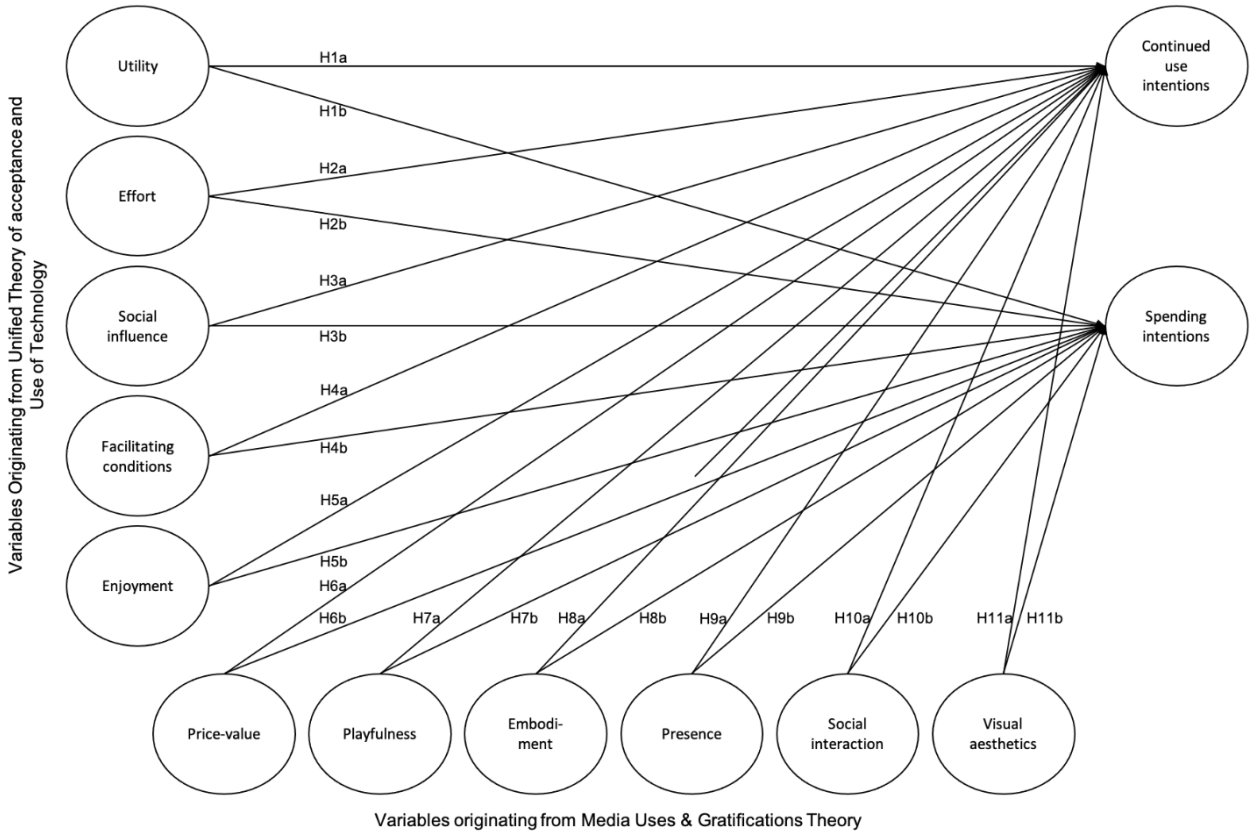

Figure 1: Research model.

3.DATA AND METHODS

3.1.Participants

A sample of 681 individuals, who had previously used VR, completed an online survey for this study. Participants were asked to report their use of different VR content, and the majority of the respondents played single player VR games frequently (41.4%) or multiple times a week (32.3%). Also, respondents played multiplayer VR games frequently (25.3%) or multiple times a week (24.5%), making these two game-related content types the most frequently consumed VR content type amongst the research participants. Attention checks were utilized to ensure only data from those who passed said checks were included in further data analysis. Most of the participants were male (73.3%). Most held at least a bachelor's degree and had a mean age of 33 years. The participants varied in their spending on VR hardware and software. The 25% of participants who did not spend any money on VR content were included in the study due to the current popularity of free VR content. These participants are most likely using VR mainly through free content and they represent a significant portion of VR users who do the same. Table 1 details the demographics of the study participants.

Table 1: Demographics of study participants.

Variable		#	%	Variable		#	%
Age	–20	33	4.8	**Employment**	Full-time	499	73.3
	20–29	259	38.0		Part-time	57	8.4
(SD = 9.69)	30–39	251	36.9		Student	65	9.5
(Mean = 32.76)	40–49	97	14.2		Unemployed	31	4.6
(Median = 31.00)	50–59	30	4.4		Retired	8	1.2
	60–	11	1.6		Other	21	3.1
Content types used (frequently)	Single player games	282	41.4	**Gender**	Male	508	74.6
	Multiplayer games	172	25.3		Female	163	23.9
	Educational content	62	9.1		Other	10	1.5
	Adult entertainment	67	9.8				
	360-degree video	70	10.3				
	Work-specific content	53	7.8				
	Traditional non-3D content	80	11.7				
	Social applications	93	13.7				
	Virtual desktop applications	83	12.2				
Spending on VR content	$0	170	25.0	**Annual income**	Less than $19,999	251	36.9
	$1 to $99	188	27.6		$20,000 to $39,999	143	21.0
	$100 to $199	107	15.7		$40,000 to $59,999	118	17.3
	$200 to $399	118	17.3		$60,000 to $79,999	76	11.2
	$400 to $599	41	6.0		$80,000 to $99,999	37	5.4
	$600 or more	57	8.4		$100,000 - 119,999	19	2.8
Spending on VR hardware	$0	133	19.5		$120,000 - $139,999	6	0.9
	$1 to $99	102	15.0		$140,000 or more	26	3.8
	$100 to $199	65	9.5		Refused to disclose	5	0.7
	$200 to $399	87	12.8				
	$400 to $599	125	18.4	**Education**	High school	148	21.7
	$600 to $799	34	5.0		Bachelor's degree	335	49.2
	$800 to $999	35	5.1		Master's degree	129	18.9
	$1000 or more	100	14.7		Doctoral degree	16	2.3
					Other	53	7.9

3.2.Measurements

A survey was utilized in this study as it affords a way to measure latent psychological experiences (Fransella 1981). Table 2 outlines the variables investigated in the study (according to the research model in Figure 1) and the scales used to measure them. A seven-point Likert scale was employed, through which the participants communicated their degree of agreement with the utilized items based on their previous use of VR.

Four items in total were removed from data analysis (pertaining to facilitating conditions, playfulness, embodiment, and visual aesthetics) to improve construct reliability. All remaining items have a loading of at least 0.7 with the variables they are measuring, with the exception of two items measuring embodiment and facilitating conditions respectively. Considering the sample size of the study and the thresholds outlined by Hair et al. (2011), the data meets the item loadings threshold, meaning that the employed statements for each variable show similar levels of variability amongst them, indicative of being similar measures of the variable label assigned to them.

Table 2: Measurement items, loadings and sources.

Variables	items	Loading	Source
Utility (UTL)	I find VR useful	0.781	Venkatesh et al. (2012)
	Using VR increases my chances of achieving things that are important to me	0.835	
	Using VR helps me accomplish things more quickly	0.779	
	Using VR increases my productivity	0.815	
Effort (EFR)	Learning how to use VR is easy for me	0.801	Venkatesh et al. (2012)
	My interaction with VR is clear and understandable	0.755	

	I find VR easy to use	0.830	
	It is easy for me to become skillful at using VR	0.819	
	People who are important to me think that I should use VR.	0.921	Venkatesh et al. (2012)
Social Influence (SOIN)	People who influence my behavior think that I should use VR.	0.909	
	People whose opinions I value prefer that I use VR.	0.925	
	Important people in my life would like me to use VR.	0.934	
	I have the resources necessary to use VR.	0.848	Venkatesh et al. (2012)
Facilitating conditions (FCON)	I have the knowledge necessary to use VR.	0.805	
	VR is compatible with other technologies I use.	0.617	
	Using VR is fun	0.865	Venkatesh et al. (2012)
	Using VR is enjoyable	0.913	
	Using VR is very entertaining	0.891	
Enjoyment (ENJ)	The process of using VR is pleasant.	0.821	Nov et al. (2010)
	VR is reasonably priced.	0.795	Venkatesh et al. (2012)
	VR is a good value for the money.	0.901	
	At the current price, VR provides a good value.	0.923	
Price value (PVAL)	Currently, VR is clearly worth the money	0.901	
	I feel spontaneous when using VR	0.773	Webster and Martocchio (1992)
	When using VR, I feel imaginative	0.830	
	While using VR, I feel mentally flexible	0.780	
	I am creative when I use VR	0.854	
	I would characterise myself as original when I use VR	0.786	
Playfulness (PLAY)	I feel inventive when I use VR	0.863	
	I felt as if the body or body part (for example hand) I was seeing in VR was my own	0.880	Bourdin et al. (2017)
	I felt a connection with the body or body part (for example hand) I was seeing in VR, as if I was looking at myself	0.894	
Embodiment (EMB)	I felt as if I had an invisible body while in VR	0.643	
	When I use VR, I feel as though I am physically present in the VR environment	0.837	Weibel at al. (2015)
	While using VR, it seems as though I actually take part in the action in the VR environment	0.832	
	When I use VR, it feels like I am actually in the VR environment	0.874	
	When using VR, it feels as though my true location shifts to that of the VR environment	0.819	
Presence (PRES)	The VR environment feels real to me.	0.831	Improvised
	VR allows me to interact with a number of people	0.883	Lee et al. (2015)
	When I use VR, I can maintain a good relationship with others	0.757	
	VR lets me keep in touch with friends and family	0.718	
	Communicating with friends and family is possible through VR	0.708	
Social interaction (SOCZ)	VR allows me to connect with people who share similar interests	0.860	
	VR content is visually attractive	0.793	O'Brien and Toms (2010)
	VR content is aesthetically appealing	0.848	
	I like the graphics and images used in VR	0.839	
Visual aesthetics (AES)	VR appeals to my visual senses	0.830	

	The user interfaces in VR are visually pleasing	0.794	
Continued use intention (CONT)	I intend to continue using VR in the future.	0.881	Venkatesh et al. (2012)
	I will try to use VR in my daily life	0.701	
	I plan to continue to use VR frequently.	0.921	
	I aim to continue using VR in the future.	0.905	
Spending intention (PINT)	I will definitely spend money on VR in the near future	0.940	Yoo and Donthu (2001)
	I intend to spend money on VR in the near future	0.959	
	It is likely that I will use money on VR in the near future	0.955	
	I expect to spend money on VR in the near future	0.961	

3.3.Validity and reliability

Three measures; Average Variance Extracted (AVE), Composite Reliability (CR), and Cronbach's Alpha (α) were utilized to evaluate convergent validity and reliability. As presented in Table 3, AVE values are greater than 0.5, CR greater than 0.7, and Cronbach's Alpha greater than 0.7, with the exception of FCON (facilitating conditions) that is quite close to 0.7. The measures are, hence, within the bounds of commonly accepted thresholds (Fornell and Larcker 1981).

Discriminant validity was evaluated by examining the square root of the AVE of all variables (the bolded diagonal line in Table 3) to ensure that it at least equaled 0.9 and is larger than the correlations between that variable and the rest of the variables in the model (Chin 1988; Fornell and Larcker 1981). The present study is oriented towards exploring factors that can predict continued use of VR, including VR games, and spending rather than attempting to find a best fitting model. Hence, model testing was conducted through component based (Anderson and Gerbin 1988; Chin et al. 2003) Partial Least Squares Structural Equation Modeling (PLS-SEM) suitable for prediction-oriented studies. The number of participants for this study were within acceptable bounds of sample sizes as it is ten times greater than the number of inner model construct paths (Anderson and Gerbin 1988; Chin 1988), and each construct is mirrored with more than five participants (Bentler and Chou 1987).

Table 3: Convergent validity and reliability

	α	**CR**	**AVE**	**EMB**	**PRES**	**AES**	**CONT**	**UTL**	**PVAL**	**ENJ**	**PLAY**	**PINT**	**SOIN**	**SOCZ**	**EFR**	**FCON**
EMB	0.739	0.852	0.662	**0.814**												
PRES	0.895	0.922	0.704	0.751	**0.839**											
AES	0.879	0.912	0.674	0.465	0.647	**0.821**										
CONT	0.875	0.916	0.734	0.530	0.597	0.522	**0.856**									
UTL	0.828	0.879	0.645	0.562	0.519	0.433	0.580	**0.803**								
PVAL	0.904	0.933	0.776	0.479	0.529	0.542	0.572	0.605	**0.881**							
ENJ	0.896	0.928	0.762	0.464	0.634	0.696	0.757	0.397	0.485	**0.873**						
PLAY	0.898	0.922	0.664	0.629	0.644	0.585	0.576	0.713	0.570	0.549	**0.815**					
PINT	0.967	0.976	0.910	0.509	0.557	0.439	0.833	0.537	0.609	0.636	0.504	**0.954**				
SOIN	0.941	0.958	0.850	0.440	0.396	0.406	0.427	0.701	0.550	0.292	0.593	0.412	**0.922**			
SOCZ	0.849	0.891	0.622	0.491	0.467	0.473	0.511	0.683	0.609	0.401	0.609	0.504	0.689	**0.789**		
EFR	0.815	0.878	0.643	0.390	0.542	0.573	0.672	0.376	0.441	0.733	0.507	0.538	0.269	0.364	**0.802**	
FCON	0.638	0.804	0.583	0.344	0.469	0.501	0.661	0.359	0.451	0.626	0.392	0.571	0.247	0.385	0.739	**0.763**

α = Cronbach's Alpha, CR = Composite Reliability, AVE = Average Variance Extracted, EMB = Embodiment, PRES = Presence, AES = Visual aesthetics, CONT = Continued use intentions, UTL = Utility, PVAL = Price value, ENJ = Enjoyment, PLAY = Playfulness, PINT = Spending intentions, SOIN = Social influence, SOCZ = Socialization, EFR = Effort, FCON = Facilitating conditions.

4.RESULTS

Table 4 presents the results of model testing, with significant results, at $P < 0.05$, bolded. The variables investigated accounted for 73.0% of the variance in continued VR use intentions and 60.4% of the variance in VR spending intentions. Perceptions of utility, facilitating conditions, enjoyment, price-value, and embodiment were, each, significantly, and positively associated with the dependent variables, supporting H1a, H1b, H4a, H4b, H5a, H5b, H6a, H6b, H8a, and H8b, while visual aesthetics was significantly negatively associated with the dependent variables, lending partial support to H11a and H11b on account of a significant relationship but not in the hypothesized direction. Data failed to support H2a, H2b, H3a, H3b, H7a, H7b, H9a, H9b, H10a, and H10b.

Hypothesis		β	P	CI (2.5%, 97.5%)	
H1a: Utility ->	**Continued Use Intentions (R^2 = 0.730)**	**0.221**	**0.000**	**0.143**	**0.280**
H2a: Effort ->		0.077	0.092	-0.016	0.162
H3a: Social influence ->		0.029	0.366	-0.039	0.090
H4a: Facilitating conditions ->		**0.214**	**0.000**	**0.131**	**0.296**
H5a: Enjoyment ->		**0.511**	**0.000**	**0.433**	**0.592**
H6a: Price value ->		**0.101**	**0.008**	**0.026**	**0.172**
H7a: Playfulness ->		-0.024	0.501	-0.104	0.052
H8a: Embodiment ->		**0.088**	**0.016**	**0.014**	**0.160**
H9a: Presence ->		0.017	0.698	-0.070	0.102
H10a: Social interaction ->		0.019	0.550	-0.048	0.078
H11a: Visual aesthetics ->		**-0.194**	**0.000**	**-0.264**	**-0.119**
H1b: Utility ->	**Spending Intentions (R^2 = 0.604)**	**0.147**	**0.002**	**0.059**	**0.234**
H2b: Effort ->		-0.030	0.585	-0.137	0.074
H3b: Social influence ->		0.016	0.705	-0.070	0.094
H4b: Facilitating conditions ->		**0.203**	**0.000**	**0.116**	**0.293**
H5b: Enjoyment ->		**0.420**	**0.000**	**0.321**	**0.508**
H6b: Price value ->		**0.273**	**0.000**	**0.172**	**0.362**
H7b: Playfulness ->		-0.074	0.148	-0.172	0.030
H8b: Embodiment ->		**0.100**	**0.028**	**0.017**	**0.190**
H9b: Presence ->		0.087	0.129	-0.028	0.197
H10b: Social interaction ->		0.062	0.151	-0.022	0.147
H11b: Visual aesthetics ->		**-0.245**	**0.000**	**-0.339**	**-0.159**

Table 4: Model testing results.

5.DISCUSSION

Our results indicate that considerations of *perceptions of utility, facilitating conditions, enjoyment, and price-value*, are key in the design of VR hardware and software. As is often acknowledged in VR industries, there is a need to offer headsets, technologies, and media content that are easily usable, affordable and are compatible with different operating systems, devices, and physical spaces that consumers have. VR hardware manufacturers often do, and perhaps should continue to, produce different models of VR headsets, that balance complexity, compatibility, price-value, and ease of use

differently for different target groups (Anthes et al. 2016; Diemer et al. 2015; Hassan et al. 2020a).

The positive association between the perceived price-value of VR and intentions to continue using and spending on VR perhaps indicates consumers' willingness to shoulder the relatively high price of VR hardware and content if they positively perceive the value of the offerings compared to its price (Manis and Choi 2019). This result is especially encouraging for VR industries, when taking into consideration the demographics of the study participants, where more than 50% of the participants fell towards the lower ends of income levels. It does appear that these participants do potentially already see the price-value of VR, however, if wider adoption is to take place, the industry would need to continue with its undergoing effort to lower prices of VR headsets. Marketing campaigns can also help in highlighting the value of VR, especially in light of its price. Similarly, VR games and game-based applications that offer a variety of uses and gratifications, can be especially suited to facilitate adoption of VR, as games especially combine the outlined mix of variable that contribute to VR adoption. For example, while VR educational applications do offer utility, they might not necessarily be entertaining. Games, however, depending on how we define utility, can offer experience of entertainment that are of utility to consumers, and game-based applications can more malleably combine different uses and gratifications.

On the other hand, our results seem to offer a surprising and puzzling finding on VR aesthetics and their contribution towards VR utilization and spending. Surprisingly, visual aesthetics were found to have a significant, albeit negative relationship with intentions to continue VR use and spending. Previous research indicates that the more sharp and visually pleasing VR content is, the more individuals intend to engage with it (Kim et al. 2020; Mütterlein and Hess 2017). Furthermore, good aesthetics are thought to be the basis upon which further experiences, such as those of presence, enjoyment or embodiment could be facilitated (O'Brien and Toms 2010; Simon and Greitmeyer 2019). In fact, our results do indicate that embodiment, as hypothesized (H8a, H8b) had a positive association with intentions to continue using VR and spending on it. These experiences of embodiment are potentially essential to most types of VR content, games included, as a great portion of said content requires the user to interact with the virtual reality they are in, at least using a hand. It is unlikely that individuals would continue their VR use if this interaction felt disjointed. Positive experiences of embodiment in VR, however, are essentially facilitated through sharp aesthetics that can contribute to suspension of disbelief and create realities that feel real for individuals to feel that they embody their virtual body parts (Bourdin et al. 2017; Weibel at al. 2015). Paradoxically, our results indicate that this same pleasing aesthetics could contribute to negative intentions to continue using and spending on VR.

The negative association between visual aesthetics and VR use and spending can perhaps be explained by a habituation effect that is a core part of human psychology and behavior (Rankin et al. 2009). While unexpectedly realistic VR aesthetics with increased fidelity could have initially facilitated novel, realistic and positive VR experiences that initially spiked the use of and spending on VR, overtime, however, users in general, and the participants of our study in specific, may have gotten habituated to these experiences that these positive aesthetics were no longer a key contributor to their utilization of VR or spending on it. Similar phenomenon has been experienced amongst gamers and consumers who acquire higher-grades of home theaters, and audio or visual output devices, where, after an initial appreciation of the aesthetics these devices provide, over time, the newly pleasing aesthetics became normalized and no longer attracted consumers to interact with said devices as they initially used to (Berg and Leffold 2015; Howard and Crompton 2003). Habituation,

however, can explain a lack of a relationship between aesthetics and the dependent variables, but not the observed negative association.

The negative association between aesthetics and continued VR use and spending could have stemmed from that, perhaps, the more realistic the VR experience was, through higher fidelity aesthetics, the more unsettling these experiences became for users, resembling a phenomenon similar to the uncanny valley (Mori et al. 2012), where when a robot closely approaches but fails to reach full real life-like performance, it becomes unsettling. To discern the impact of habituation or an uncanny valley effect in connection to higher fidelity VR aesthetics, future research could explore connections between tenure, i.e., length of VR use and perception of VR aesthetics. A habituation effect could perhaps materialize with a change in aesthetics perception from positive to negative as use tenure increases. An uncanny valley effect could materialize in negative perceptions of higher fidelity VR aesthetics from the early days of interacting with VR.

Nonetheless, this finding between aesthetics and continued use and spending is encouraging for mobile, low-grade and light VR game manufacturers and content producers. These observations overall lend support to the development of lighter VR hardware and content that may not offer the heights of visual aesthetics but could, perhaps, offer more ease of use, or price-value balance, important to VR adoption.

Finally, perceived enjoyment from VR is the strongest predictor of continued VR use and spending. This perhaps reflects the larger societal interest in hedonic experiences and enjoyment as exhibited by societal and industry movements to gamify different activities of life (Hassan et al. 2020b, Morschheuser et al. 2018). Intuitively, in today's world of overabundance of media and technology, consumers can pursue the same gratifications and experiences through different means. It is hence more likely that, when all else is equal, they would gravitate towards mediums that provide a higher degree of enjoyment along with good performance. This highlights the notion that even utilitarian VR applications, such as those tailored to education or business communications, should be enjoyable to ensure continued use and spending.

6.LIMITATIONS AND FUTURE RESEARCH

This study employed a survey that asked participants to holistically reflect on their previous VR experiences, without investigating the mediating role of VR content or hardware types. Different content elicits different experiences and gratifications and the same holds for hardware and the quality of experiences it can render (Bourdin et al. 2017). Furthermore, we did not investigate the role of demographic variables, such as age, gender disability, and education, on VR acceptance, and use and spending intentions **(**Venkatesh et al. 2012). Future research is encouraged to investigate the influence of these variables amongst others.

Additionally, while surveys are appropriate methods to gauge individuals' subjective perceptions of reality, the sample is self-administered and several limitations are traditionally associated with surveys, as with any research method (Fransella 1981). Future research on VR adoption is encouraged through different research methods such as interviews that can offer nuanced understanding or experiments that can offer controlled settings for establishing causation.

In this research, we investigated the gratification that are posited to be most commonly associated with VR use. More research into the gratifications from VR is especially important to understand what individuals are getting out of it that could increase its perceived value, adoption, and spending. Especially more research is needed to understand the gratifications, or lack thereof, associated with visual aesthetics of VR to

discern the positive or negative impact of aesthetics and different aesthetic experiences on VR adoption.

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