Shy vs. Confident: The Role of Virtual Human Personalities in Shaping Well-Being and Addiction

Abstract

This research investigates the influence of virtual human personalities on user well-being and addiction in a social media context. The quantitative study engaged 550 Instagram users, focusing on contrasting shyness and confidence appeals. The participants were asked to fill up a survey via online link in a controlled environment. Then, structural equation modelling was used to test hypotheses and multi-group analysis was employed to compare the shyness and confidence effects. The results indicate a positive link between the antecedents and the consequences of telepresence. The study also underscores the implications for businesses, offering employees and stakeholders an immersive virtual experience for safety practices and productivity development. This investigation sheds light on the psychological impact of virtual human interactions, guiding strategies to create engaging virtual experiences within today's vast social media landscape.

Keywords: Virtual humans' personalities, User Wellbeing, Telepresence, Interactivity, Shyness and Confidence

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1. Introduction

Virtual worlds have revolutionized communications technology, offering unique experiences and opportunities on social media platforms. Using avatars, people can engage in interactions that might not be possible in the physical world, establishing relationships and experiences that exist beyond physical borders (Dickenson, 2022; Halvorson, 2010). Social media has transformed from a marketing tool into a crucial source of marketing intelligence, allowing firms to analyse and predict consumer behaviours (Korgaonkar, Becerra, & Londoño, 2024). Additionally, it serves as a communication tool, fostering peer-to-peer interactions and expanding social networks within peer groups (Whitla, 2009; Zhang & Daugherty, 2009; Ho, 2014; Filo et al., 2015; Sanderson, 2023; Li et al., 2023). Marketing on social media platforms is considered one of the most effective growth tools in modern marketing, with 4.88 billion active users (Hootsuite, 2020). The rise of virtual influencers, such as computer-generated personas, underscores the growing need to study their impact on user's perceptions, especially in social media marketing. In addition, different virtual influencers have stunning effects on users such as “Lill Miquela” has 2.7 million followers on Instagram, and “Imma gram” was created by Tokyo-based CG Company Modelling Café, with 79.7k Instagram followers.

Furthermore, virtual worlds are electronic settings resembling diverse visual worlds, allowing users to lead parallel and independent lives (Bainbridge, 2007; Paul et al., 2022; Madakam et al., 2022). Personality traits are dimensions of individual differences in tendencies to show consistent patterns of thoughts, feelings, and actions across a wide range of human domains and different situations and contexts (McCrae & John, 1992). Consistency is a crucial element of personality traits over time, as situations create unique attributes for each individual (Borkenau et al., 2013). Therefore, it is of paramount importance to determine the role of individuals’ personality’s traits. The ocean traits or Five-Factor model proposed by Costa and McCrae (1978) identifies five personality characteristics, "openness to experience, extroversion, and agreeableness are the positive personalities; and conscientiousness and neuroticism are negative personalities". Recent work has revealed that these personality traits are equally important in the social media context (Cheng et al., 2024). Researchers have shown that individuals with different personality traits display distinct reactions to external stimuli, including interactions with Virtual Influencers (El

Hedhli et al., 2023; Franke, Groeppel-Klein, & Müller, 2023). This study assumes that users with different personality types will react differently during interactions, influencing the vividness of their memories through telepresence. To create an engaging virtual world, marketers should identify the most addicted user segments and enhance their well-being by leveraging social media platforms like Instagram.

While discussing research gaps first, prior research has extensively examined human personalities (McCrae and Costa, 1997; Ali et al., 2022), yet there is a noticeable gap in understanding the traits and characteristics of virtual humans within a consumer context. This gap offers an opportunity to examine the differences among different virtual human personalities (Extraversion, Agreeableness, Conscientiousness, Openness-to-experience and Neuroticism). Previous literature has focused on real-life personalities and their influence on consumer behaviour (psychological well-being and virtual addiction) (Smith et al., 2023; Ali et al., 2022; Steenkamp & Maydeu-Olivares, 2015) but has not observed the virtual humans' personalities and their impact on consumer behaviour. Most of the users may prefer alike virtual personality. Table-1 shows recent studies on virtual humans and evidenced that no study till date has examined the virtual human personality. So, there is a significant void in the literature for virtual human personalities, even a couple of studies can't filled this gap.

Second, Personality traits have been identified as significant antecedents that influence individuals' inclination to engage with virtual entities (Lee et al., 2019; Leveau, & Camus, 2023). The telepresence is increasingly gaining popularity in social media context. Most of the studies used telepresence, vividness and interactivity in social media context for interaction purposes (Kim et al., 2021; Lucia- Palacios et al., 2021). But the impact of virtual human personality on telepresence, vividness and interactivity is still not examined. The interplay between virtual human personality traits and interaction in a technology-driven environment has been a focal point in understanding the antecedents and consequences of telepresence. The further impact of these interactive variables; telepresence, vividness and interactivity; has been observed for consumer reaction like attitude toward VR and behavioral intension in retail (Kim et al., 2021), interactivity with intrusiveness (Lucia- Palacios et al., 2021), Telepresence with consumer brand engagement (Zahid et al., 2024); user control and media richness (Hopkins et al., 2004); motivation (Park et al., 2010); entertainment and in formativeness (Choi et al., 2016); vividness with user responses (Zhu et al., 2024), but the studies ignored the user psychological wellbeing and addiction simultaneously. The

gap, virtual interaction and its effect on psychological wellbeing and addiction, still exists in the literature and need an exclusive research as social media interaction with virtual humans is an emerging trend.

Third, Previous research used individual traits, such as shyness and confidence, to examine robots' gestures in virtual interviews, aiming to identify individual traits (Pan et al., 2015), but this study uses them as comparative factors in a larger model. Researchers have documented various types of appeals since the 1920s. For example, Copeland (1924) studied advertising appeals, marketing appeals, shopping appeals and the direct effects of personality characteristics have been widely studied. The researchers encouraged to discuss various appeals (shyness vs. confident) for the personality traits (smith et al., 2023). As afore discussed the virtual human personality is a rarely researched domain and appeals for the virtual humans has not been studied so far. Hence, this research seeks to better understand how shyness and confident virtual human personality impacts the individual behaviour.

To fulfil the above-mentioned gaps, the aim of this study is threefold. First, this study aims to explore whether users of different personalities (i.e., Extraversion, Agreeableness, Conscientiousness, and Openness to experience and Neuroticism) show differences in their perceptions of virtual influencers. Second, this study aims to elucidate the impact of virtual human personality traits on interactivity, telepresence and vividness within virtual environments, and their influence on consumer behaviour, specifically focusing on psychological well-being and virtual addiction outcomes. Third, it examines comparison between two appeals that is shyness and confidence of virtual humans and observes their role on proposed framework (figure-1).

The findings of this study offer various managerial implications, particularly from individuals' perceptions of virtual influencers with distinct personality traits. This study contributes how virtual world user experience and interface design can improve shyness and confidence. Personality-driven interface design can improve virtual experiences. Individual user experiences based on personality can boost gaming, virtual education, and workplace engagement and happiness. These findings can help industry managers create more successful and engaging virtual experiences that meet the psychological needs of various user groups while promoting healthy human-technology interactions.

2. Literature Review

2.1. UTAUT Theory

This study employs Unified Theory of Acceptance and Use of Technology (UTAUT) as a theoretical lens as it serves as a popular technology adoption paradigm (Venkatesh et al., 2003). This theory has been widely used in examining technology and user behaviour. UTAUT examines customer behaviour and intention to use new technologies (Betts, 2022; Rachmawati et al., 2020) in different social contexts. Additionally, UTAUT may provide a structured approach to understanding telepresence user acceptance. UTAUT theory can also be applied to virtual world telepresence by measuring how well these technologies imitate human personalities.

This theory also helps to understand, corporate and for adoption of new technology. Choudrie et al., (2018) found that customers are less likely to use new online transaction methods without confidence. UTAUT was also extensively used in studies examining cross-cultural differences. When comparing technology acceptability in the US and China, the model acknowledged geographical differences (Ahmad et al., 2021). Fewer moderators explain more behavioural intention variance (Venkatesh, Thong & Xu, 2012). Likewise, the intensity of links differed in Korea and the US, but importance was consistent (Im, Hong, & Kang, 2011). Cross-cultural evaluations of the UTAUT model in individualistic vs collectivistic societies showed differences in association strength, underlining culture's considerable moderating influence on model trajectories (Udo, Bagchi & Maity, 2016). UTAUT (Huang, 2023) helps build virtual tech that mimics human features, affecting how users interact and accept these interactions and harmonising tech design with human preferences.

Table 1: An overview of research studies on virtual influencers

Study	Context	Theory	Variable	Limitation	Future research
Kim et al., (2024) JBR	Virtual influencers (USA)	Avatar marketing and ambivalence theories	**IV:** Virtual influencers, (utilitarian, personal, relational traits) **Med:** avatars, consumers' ambivalent emotions **DV:** form realism and behavioural realism	· VIs' interface designs as VI marketing performance, · Recognizing consumers' ambivalent emotions used as mediators in relationships.	· ambivalence affects VI marketing effectiveness · Consumers' intentions to follow the VI and make purchases.
Cheng et al., (2024) VW	virtual world (Switzerland)	Big five model	**IV:** Outfit factor (colour, design, type) of virtual characteristics **DV:** Big five personalities	· Procedurally generate digital humans in neural radiance fields. · To integrate outfit guidelines into human asset generation pipelines.	· To outfits, virtual characters' visual appearance would be an interesting research topic. · Accessories provide personality information and need to be further explored.

			Final DV: virtual interaction		
Xygkou et al., (2024) IJH-CI	AI Chatbot (Japan)	Social penetration theory, Double-empathy theory, Theory of Mind	**IV:** Autistic and non-autistic adults **Med:** Social interaction (i.e., trust, friendship, emotional response) and social connectedness **DV:** Conventional virtual human (CVH) and human-human interaction (HHI)	· Small sample size can offer initial insights, that can impact generalizability · To conduct subgroup analyses, for understanding nuanced behaviors or trends.	· The long-term effects of Chatbot interactions on the social skills, mental health, and overall well-being of autistic adults should be carried out.
Spais et al., (2023) JCB	AI marketing (Greece)		**IV:** AI marketing and AI promotions **DV:** Consumer behaviour and avoidance of	_	· Use TCMADO synthesis, and future research directions primarily for AI CB researchers

			consumer autonomy threats **(DV)**		
Deng et al., (2023) JRCS	social media influencers (China)	Uncanny valley (UV) theory, Social comparison theory	**IV:** Image of influencer (both HI & VI) **Med:** State appearance **DV:** Individual Appearance anxiety	· One influencer was selected · Para-social and celebrity worship were not perfectly avoided by controlling the number of followers. · Using an online research platform such as Credamo to contact participants	· Different media forms different effects on individuals' appearance anxiety. · In-depth discussion on text-based media) is needed in the future.
Sakuma et al., (2023) Frontiers in VR	VR environment (Japan)	Virtual humanoid models	**IV:** Participants personality **Med:** psychological characteristics **DV:** appearance of avatar (same, different and 2D)	· Avatar information provided to the participants in advance · Participants sensed the body of the avatar as their own	· Background of the avatar must be conveyed to participants. · Designing a strong immersive experience for participants
Felnhofer et al.,	virtual humans,	Threshold Model of Social	**IV:** Actual vs. perceived virtual agency	· Perceived agency on social responses in populations	· Match between a virtual entity's and a user's sex, ethnicity

(2023) IJH-CI	AI, (Germany)	Influence; Media Equation Concept	**DV:** Social responses (such as social presence experiences, social behaviours, physiological reactivity, and interaction) **Mod:** self-relevance	· Divergent characteristics may likely respond differently to virtual entities.	· Physical appearances should be taken into potential confound
Patotskaya et al., (2023) C & G	Non-VR based (France)	Big Five personality theory	**IV:** Character Personality (body and facial motion) **Med:** Social presence **DV:** Behavioural responses	· Just included gender in the analysis but no other possible characteristics which could affect their behaviour	· Virtual models, diverse in appearance, · More subtle and complex body motions in a realistic virtual environment
Barreda et al., (2022) frontiers in VR	virtual reality based on addiction	hedonic management model of addiction	**IV:** Prevalence of addiction **Med:** Time spend and type of VR app	· Cross-sectional nature demonstrates a causal relationship between addiction and the predictor's considered.	· Future research could address technical characteristics and applications of interest.

	(Netherlands,)		**Mod:** age; gender etc. **DV:** Spatial presence and embodiment	· Other factors that may predict addiction risk	
Pauw et al., (2022) CHB	computer based virtual humans (USA)	Social Self-Preservation Theory, Goniometer Theory, ; Temporal-Need Threat Model of Ostracism,	IV: Cognitive and emotional support **Med:** perceived support efficacy and experienced closeness **DV:** Emotional distress	· A virtual human effectively reduces the emotional intensity of shared emotional experience, · Speaking to virtual humans 'potential about short-term emotional relief.	· Application of virtual humans is still in its infancy, · With technology rapidly improving, · Artificially intelligent virtual humans are being built that are capable of controlling computer-generated bodies
Stein et al., (2022) NM & S	Video Streaming platform (Germany)	Parallel mediation model	**IV:** Par asocial interaction (human vs. digital streamers) **Med:** (a) visual human-likeness; mental human likeness and	· Any indicators of social interaction to remove a potential confound. · Limitation does not take away from the main results of our mediation analyses.	· Encouraged to replicate our experiment with different types of online celebrities

			(b) perceived similarity; wishful identification **DV:** experience and engagement		
Chen et al., (2021) P & M	Virtual marketing (Japan)	_	**IV:** Descriptive information (descriptive evidence & narrative evidence) **Med:** Immersive media experience **DV:** Telepresence, transportation	· Narrative-induced transportation strengthened attitudinal outcomes, and enhanced telepresence boosted this effect. · Our studies disentangle the impacts of VR-induced telepresence on cognitive processing · Effects of narrative-induced transportation on persuasive outcomes.	· Findings point to a medium-message matching strategy to achieve marketing goals.
Tsai et al., (2021) P & M	chatbot vs humans (USA)	_	**IV:** perceived agency: Chatbot vs. human	· Computers as Social Actors paradigm · Strategic guidelines to capitalize on advantages of	_

			Med: Affect elicitation embarrassment, anger, neutral) **DV:** Consumer interaction	Chatbot versus human representatives.	
Arsenyan et al., (2021) IJH-CS	social media influencers (France)	Social identity theory; Interpersonal theory	**IV:** Virtual influencer Vs. humans **Med:** Users reaction **DV:** User engagement	· Different context and individual characteristics to develop potential contextual boundary conditions. · Availability of such agents restricts the potential foci and sample size of such studies.	· Users' understanding of the virtual agent's true nature, · User reaction when presented with varying levels of human like content from a non-human entity
Chiou et al., (2019) C & E	virtual learning (USA)	Social agency theory	**IV:** Quality of virtual voice **Med:** Learning perception **DV:** Trust	· Learning materials used were of short duration · This learning material allows for cross-study comparison of specific constructs.	· Learners in the real world will not have the option to use or not use a virtual human agent · Learners designed to be the case in the current study.

Song et al., (2014) CHB	Games (south Korea)		**IV:** Social physique anxiety and self-presence **DV:** Exercise exergue experiences	· Only one avatar was created in each group, · Players' perception that ''my avatar's body image is not different from others'', so eliminate the possibility of perceiving that one's avatar looked heavier than other avatars.	· May be different (or the same) when each player uses an avatar of their choosing. · Should be conducted in a variety of group exercise settings.
Author's work (2024) P & M	Virtual Human Personalities	UTAUT theory	**IV:** Virtual human personalities (Extraversion, Agreeableness, Conscientiousness, Openness-to-experience and Neuroticism) **Sub-DV:** Interactivity, Telepresence, Vividness	. Teaching and mentoring materials, virtual experiences . Empowering product designers throughout the design process	. May check other appeals like curious vs. enthusiastic etc. . May examine other outcomes effect like other dimensions of wellbeing (life or emotional) well-being, emotional well-being in mataverse . May examine other influencer's personality

			DV: Psychological wellbeing, Virtual addiction		

Note: JBR = Journal of Business Research, VW = Virtual World, IJH-CI = International Journal of Human-Computer Interaction, JCB = Journal of Consumer Behaviour, JRCS = Journal of Retailing and Consumer Services, F. VR = Frontiers in Virtual World, C & G = Computer & Graphics, CBH = Computer in Human Behaviour, NM & S = New Media & Society, P & M = Psychology & Marketing, IJH-CS = International Journal of Human-Computer Studies, C & E = Computer & Education, IV: Independent Variable, DV: Dependent Variable, Med: Mediator(s), Mod: Moderator(s)

2.2. Shyness and Confident

Utilizing different personality appeals such as shyness and confidence act as catalysts in shaping virtual personalities, thus allowing for the creation of multifaceted and relatable virtual characters as well as their appeal and resonance with varied users' preferences within virtual environments. Researchers have documented on different appeals since the 1920's, for example Copeland (1924) worked on advertising appeals, marketing appeals and shopping appeals etc.), whereas the research on personality appeals is still young and growing. The present study demonstrates that people have different personality appeals and both shyness and confident act as drivers of virtual personalities. Those virtual human personalities that are labelled as "shy" were intended to exhibit social anxiety, while the "confident" character was designed to exude social confidence (pan et al., 2015). These appeals were compared within the framework of the present study. These appeals help in identifying user personalities, shedding light on their interactions with virtual humans, which both enhance their well-being and potentially drive them towards addiction.

2.3. Hypothesis Constructions

2.3.1. Personality's traits with interactivity, Telepresence

The Big Five personality theory states that people vary in their feelings, associations, emotions, actions, reactions, and physiological behaviours (McCrae & Costa, 1985). The personality traits (OCEAN) theory supports it since it influences customer personality. Individuals' interactions with others may change with each personality attribute (Li et al., 2016). Interactivity, a fundamental aspect of digital communication, has garnered scholarly attention (Yang & Shen, 2018). The following are proposed;

H1a: openness to experience has a positive effect on Interactivity; Shyness Vs. Confident

H1b: Conscientiousness has a negative effect on Interactivity; Shyness Vs. Confident

H1c: Extraversion has a positive effect on Interactivity; Shyness Vs. Confident

H1d: Agreeableness has a positive effect on Interactivity; Shyness Vs. Confident

H1e: Neuroticism has a negative effect on Interactivity; Shyness Vs. Confident

Retailers have adopted virtual world technologies in electronic commerce to boost consumers' telepresence. The personality characteristics have been found to influence how telepresence affects virtual human personality. Human behaviour and new technology have been shown to mediate telepresence. The academically sound unified theory of acceptance and use of technology

(UTAUT) has been empirically supported in consumer activities and technology. Venkatesh et al. (2003) created UTAUT to assess emerging technologies. According to hypothesis, we suggested:

H2a: Openness to experience has a positive effect on Telepresence; Shyness Vs. Confident

H2b: Conscientiousness has a negative effect on Telepresence; Shyness Vs. Confident

H2c: Extraversion has a positive effect on Telepresence; Shyness Vs. Confident

H2d: Agreeableness has a positive effect on Telepresence; Shyness Vs. Confident

H2e: Neuroticism has a negative effect on Telepresence; Shyness Vs. Confident

2.3.2. Personality Traits and Vividness

Psychologists often ask respondents to score their thought memories (or conceptual images) for this feature. Personalities are patterns and features of mental and emotional processes that affect how people interact with their physical and social environments (Back, 2021). When they face many events throughout their lives, personality attributes show that morale is consistent and coherent. Personality qualities may affect sexual behaviour, music consumption, and technology use, notably the Internet (Flayelle et al., 2023). Thus, it was suggested:

H3a: openness to experience has a positive effect on Vividness; Shyness Vs. Confident

H3b: Conscientiousness has a negative effect on Vividness; Shyness Vs. Confident

H3c: Extraversion has a positive effect on Vividness; Shyness Vs. Confident

H3d: Agreeableness has a positive effect on Vividness; Shyness Vs. Confident

H3e: Neuroticism has a negative effect on Vividness; Shyness Vs. Confident

2.3.3. Interactivity, Telepresence, and Vividness

The extant literature reveals that telepresence requires media vividness and engagement (Kamvar, 2003; Steuer, 1992). The number of perception techniques and media data correctness affects vividness (Gibson, 1966; Kamvar, 2003). A higher sensory and cognitive excitement on a website increases the experience of "being there" (Mollen & Wilson, 2010; Witmer & Singer, 1998). Interactivity allows interface users to change and adapt to the virtual world in real time (Rafaeli, 1988). Although Novak et al. (2000) suggest that interactive speed increases telepresence; there is a lack of research on user active engagement with online groups. Thus, we propose the following;

H4: Level of interactivity will have highly positive the perception of Telepresence in a virtual environment

H5: Level of vividness will have highly positive the perception of Telepresence in a virtual environment

2.3.4. Interactivity with Psychological Well-Being and Virtual Addiction

Huppert (2009) defines psychological well-being as performing well and feeling good. It also shows how people create ideas about how to be happier (Cardak, 2013). Surprisingly, the current mechanisms of addiction are unknown. Place and setting (home, bar, restaurant, or party), social signals, time of the week, emotional state, gender, and ageing can cause cravings (Dubin et al., 2015). For instance, a person with good mental health can focus on their goal to acquire respect and support rather than perusing Instagram. Thus, psychological well-being and requirements may affect Instagram addiction. This justification suggests the following hypotheses:

H6: Level of interactivity will have highly positive affect the psychological well-being of users in a virtual environment

H7: A higher level of interactivity will have highly negative affect users due to virtual addiction

2.3.5. Telepresence with Psychological Well-Being and Virtual Addiction

The user's ability to be psychologically transported into another area, as per Steuer (1992), directly experiencing reality results in presence whereas the simulated perception of the same reality results in telepresence. With unique characteristics of 3D interactive features (i.e. Telepresence), consumers can follow different psychological evaluative processes (Javornik, 2016; Lee and Xu, 2021). Technology can foster negative impacts on the adolescents' mental health and severity of addiction (Fontana, 2023). Interestingly, as digital technologies enormously developed from the beginning of the twenty-first century, research has found different variables to help understanding this phenomenon in adolescence (Spada, 2014). Hence, following are proposed:

H8: Telepresence of users has a highly positive effect on psychological well-being.

H9: Telepresence of users will have a highly negative effect on consumers' virtual addiction.

2.3.6. Vividness with Psychological Well-Being and Virtual Addiction

One difference between memories and future thoughts is that experiences are more vivid and evoke an increased feeling of experiencing (Cole & Berntsen, 2016). Past and prospective cognitions have been linked to mental health many times. Stress is associated with poor mental health (Cox, 1987). Focusing on many targets may be needed for prolonged effect.

H10: Level of vividness will have a highly positive affect the psychological well-being of users in a virtual environment

H11: vividness will have a highly negative affect consumer due to virtual addiction

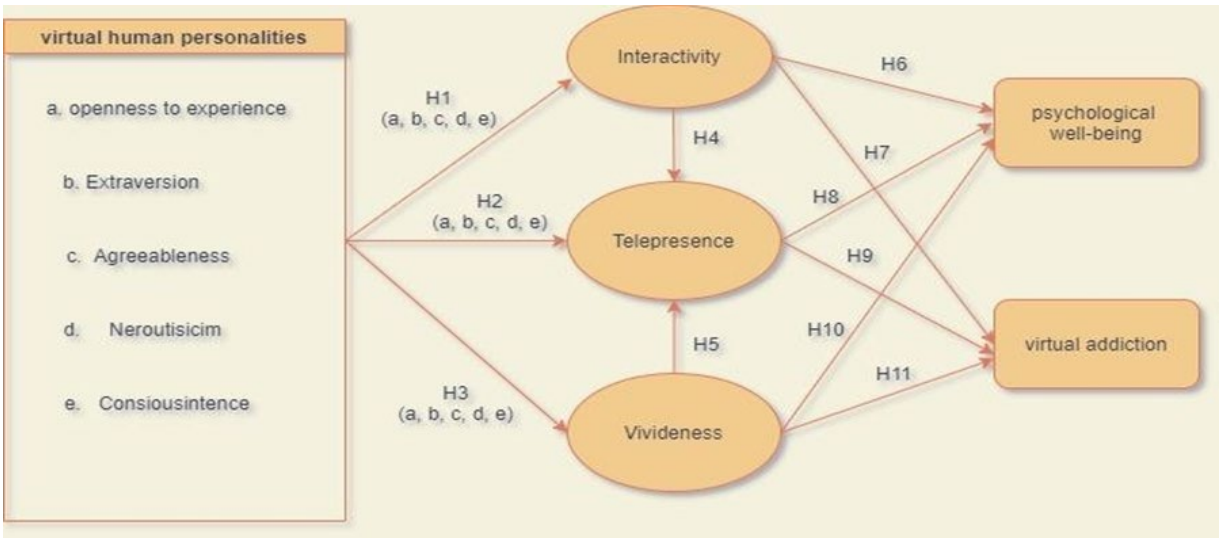

Figure-1: conceptual framework

3. Research Methodology

3.1. Research Design

This study follows a three-step approach: by examining the virtual personalities and their effects on users; also investigating the link between personalities, interactivity, and telepresence (Yim et al., 2017) and exploring how virtual personalities enhance consumers' psychological well-being and contribute to addiction (Pawlikowski et al., 2013). A survey report (https://www.virtualhumans.org/) was checked the most prominent virtual influencers' personalities.

3.2. Human-like virtual influencer (HVI)

Virtual agents on social media such as bots, targeted ads, etc. are not a new phenomenon. However, with the advancement of digital technologies, computer generated images (CGI) are more and more humanlike and virtual agents are increasingly capable of simulating human content (Arsenyan & Mirowska, 2021). By 2019, human-like virtual influencers (HVI) are gaining popularity, with the appearance of additional accounts. In order to select our focal HVI, we identified five virtual influencers who portrayed a similar personality to humans.

Fig. 2: Human like virtual influencers (HVI)

https://www.virtualhumans.org/human/miquela-sousa#

https://www.virtualhumans.org/human/code-miko

https://www.virtualhumans.org/human/imma-gram#

https://www.virtualhumans.org/human/thalasya

https://www.virtualhumans.org/human/lucy

A team of 5-7 members was employed to conduct the survey. Participants were gathered in a controlled setting to observe a selection of virtual influencers linked with social media. During this process, they were given a QR code linking to a close-ended questionnaire created on Google forms. To examine virtual personalities, virtual humans were followed on Instagram. A direct or indirect interaction with virtual humans was used as a screening criterion to qualify as participants (Correa, Hinsley, & De Zuniga, 2010). Virtual human ads were displayed according to personalities appeal (i.e., shyness and confident) with coding five traits personality (101, 201, 301, 401, 501 etc.), Besides, these traits influenced the user's mind and also include Instagram links of virtual for visiting their account through this people rely on they actually exist in this world (see in figure 2). Furthermore, the questionnaire comprised two sections; the first contained the participants' demographics, whereas the second comprised the questions aligned with the proposed variable. This questionnaire was designed to capture their observations and perceptions of the specific virtual influencers presented. Additionally, detailed information about these virtual influencers was provided alongside their displays on screens in front of the participants. This setup aimed to ensure that participants comprehensively understood the influencers they were evaluating. This process repeated multiple times to obtain the data. A total of 650 questionnaires were distributed. After removing 45 incompletes and 55 erroneous responses (multiple options marked against one question), 550 usable responses were analysed. Cluster sampling gathers people by shared traits like Instagram type and regular interacting with virtual human characters. Cluster sampling selects random clusters for inquiry. Production, cost, and population representation are achieved using this strategy. Researchers can reduce practical issues by collecting social media user data in clusters. Instead, survey everyone on the site; they may target interest or demographic groups. This technique optimises resource allocation and ensures

population-representative data. Researchers can learn about social media user groups' preferences by surveying cluster members. This concentrated approach streamlines data collection and increases study quality and relevance.

3.3. Measures

Previous studies were used to develop virtual personality tests that measured OCEAN Traits (Ali et al., 2022Yoo & Gretzel, 2014; Jani & Han, 2014). Interactivity and vividness were measured using items from established scales from Miller et al. (2000) and Yim et al. (2017) respectively. Telepresence was measured by using items from Huang and Liao (2015). The virtual addiction and psychological well-being were assessed using established measurement scales (Pawlikowski et al., 2013; Robinson, 1978).

4. Results

4.1. Sample characteristics

Table 2 shows the demographic profile of study's participants. Most of the participants were female (55.6%) and the majority were 21-25 years (30.9%) and 26-30 years old (27.8%). Majority of them identified themselves as having extraversion (40.7%) and openness-to-experience characteristics (23.8%). In virtual influencer personality, 27.1% responded that they are attracted by Conscientiousness personality trait and 23.1% are attracted towards neuroticism trait

Table-2: Demographic variables

Demographic Information	Frequency	Percentage
Gender of the respondent		
Male	244	44.4
Female	306	55.6
Age of the Respondents		
20 below	42	7.6
21-25	170	30.9
26-30	153	27.8
31-35	110	20.0
36-40	65	11.8
40 and above	10	1.8
Education		

Matriculation	49	8.9
Intermediate	87	15.8
Graduation	161	29.3
Master	148	26.9
M.Phil.	89	16.2
Ph.D.	16	2.9
Profession		
Student	115	20.9
Self-employed	176	32.0
Employed	193	35.1
Other	66	12.0
Personality best describes you		
101(Openness to experience)	131	23.8
201 (Extraversion)	224	40.7
301 (Agreeableness)	98	17.8
401(Neuroticism)	67	12.2
501 (Conscientiousness)	30	5.5
Personality Appeals		
1a (Shyness)	103	18.7
1b (Shyness)	166	30.2
2a (Confident)	188	34.2
2b (Confident)	93	16.9
Virtual Influencer Personality which attracts you more		
101(Openness to experience)	89	16.2
201 (Extraversion)	111	20.2
301 (Agreeableness)	74	13.5
401 (Neuroticism)	127	23.1
501(Conscientiousness)	149	27.1

4.2. Measurement model

We followed Anderson and Gerbing, (1988) suggestions to test the fit of the measurement model. The results of factor analysis yielded a good fit of the data to the model (χ^2/df = 2.032, RMSEA = 0.043, GFI = 0.864, AGFI = 0.845, CFI = 0.974; TLI = 0.970, IFI = 0.974, NFI = 0.949) (Hu & Bentler, 1999). We also analysed the data for convergent and discriminant validity. Three indicators were used to examine convergent validity: factor loadings, composite reliability (CR) and average variance extracted (AVE). The factor loadings values ranged between 0.901 and 0.981, which were above the cut-off of 0.70 (Hair, Babin, & Krey, 2017). The AVE values were above the threshold of 0.50, ranging between 0.776 and 0.924. The composite reliability scores also surpassed the threshold of 0.70 (0.925–0.985) (Table 3). Next, the discriminant validity was tested. The square roots of AVE should be greater than the construct's correlation with other constructs in the model, as Fornell and Larcker (1981). This requirement was also fulfilled, so the discriminant validity was achieved (Table 4).

Table-3: Convergent validity

Variables	**Items**	**F.L.**	**C.R**	**AVE**	**Cronbach's Alpha**
Openness to experience	O1	.934	0.969	0.861	0.968
	O2	.949			
	O3	.941			
	O4	.943			
	O5	.945			
Extraversion	E1	.938	0.969	0.862	0.969
	E2	.946			
	E3	.937			
	E4	.951			
	E5	.943			
Conscientiousness	C1	.964	0.960	0.889	0.960
	C2	.960			
	C3	.962			
Neuroticism	N1	Deleted	0.925	0.860	0.952
	N2	.952			

	N3	.956			
Agreeableness	A1	.901	0.933	0.776	0.947
	A2	Deleted			
	A3	.911			
	A4	.901			
	A5	.913			
Interactivity	INT1	.981	0.961	0.924	0.960
	INT2	.981			
Telepresence	TEL1	.971	0.969	0.911	0.969
	TEL2	.969			
	TEL3	.970			
Vividness	VIV1	.953	0.962	0.895	0.971
	VIV2	.967			
	VIV3	.958			
	VIV4	Deleted			
Psychological Well-Being	PSY1	.925	0.984	0.837	0.984
	PSY2	.913			
	PSY3	.922			
	PSY4	.927			
	PSY5	.924			
	PSY6	.914			
	PSY7	.924			
	PSY8	.931			
	PSY9	.918			
	PSY10	.922			
	PSY11	.929			
	PSY12	.918			
	VA1	Deleted	0.985	0.869	0.988
	VA2	.940			
	VA3	.936			

Virtual Addiction	VA4	.941			
	VA5	Deleted			
	VA6	.938			
	VA7	.941			
	VA8	.942			
	VA9	.935			
	VA10	.942			
	VA11	.928			
	VA12	.937			

Notes: OP = Openness to Experience, E = Extraversion, C = Conscientiousness, N = Neuroticism, A = Agreeableness, INT = Interactivity, TEL = Telepresence, VIV = Vividness, PSY = Psychological Well-Being, VA = Virtual Addiction

Table-4: **Discriminant validity**

	AVE	A	E	C	N	OP	INT	TEL	PSY	VA	VIV
A	0.776	**0.881**									
E	0.862	0.832	**0.928**								
C	0.889	0.801	0.817	**0.943**							
N	0.860	0.823	0.827	0.856	**0.928**						
OP	0.861	0.854	0.825	0.815	0.841	**0.928**					
INT	0.924	0.787	0.755	0.756	0.766	0.769	**0.962**				
TEL	0.911	0.808	0.774	0.770	0.790	0.789	0.721	**0.955**			
PSY	0.837	0.806	0.771	0.751	0.790	0.774	0.732	0.735	**0.915**		
VA	0.869	0.825	0.775	0.788	0.808	0.817	0.737	0.766	0.682	**0.932**	
VIVD	0.895	0.870	0.808	0.792	0.810	0.818	0.735	0.796	0.757	0.773	**0.946**

Notes: CR stand for Composite Reliability, AVE = Average Variance Extraction, OP = Openness to Experience, E = Extraversion, C = Conscientiousness, N = Neuroticism, A = Agreeableness, INT = Interactivity, TEL = Telepresence, VIV = Vividness, PSY = Psychological Well-Being, VA = Virtual Addiction; All diagonal bold values are square root of AVE.

4.3. Multi-Group Analysis

Several multi-group factor analysis invariance tests were performed (Cheah et al., 2023). Maximum likelihood approach was used to estimate necessary analyses. Contextual and metric invariance tests were undertaken to confirm that the instruments used in this study worked identically in these two

groups (klesel et al., 2022). Configural analysis developed a foundation model. The baseline model (shyness and confidence) used the entire sample. The model fit indexes were used to evaluate whether it meets the suggestions. The following fit indexes assessed customisable invariance in this study: To determine metric invariance, researchers devised the 2-difference test (Steenkamp et al., 2015). Further research showed that alteration tests in grouping with two difference tests are more reliable for Cumulative Fit Index (CFI) (Cheung & Rensvold, 2002; Byrne, 2010; Teo et al., 2009). A step-by-step technique was utilised to contrast an uncontrolled and totally restricted model using constrained regression weights. The study (Δχ2 ¼ 51.3, p ¼ 0.090, ΔCFI ¼ 0.951) showed that measurements are consistent across groups.

Model Fit Values		
	Results	**Threshold value**
CMIN/DF	2.182	< 3
GFI	0.854	>0.9
AGFI	0.836	>0.9
CFI	0.969	>0.9
NFI	0.945	>0.9
RMSEA	0.046	<0.06
IFI	0.969	>0.9

4.4. Hypotheses Testing

The analysis was run using SPSS AMOS Graphics. Researchers suggested that CB-SEM is best choice with larger data sets (Dash & Paul, 2021). Covariance Based - Structural Equation Modelling (CB-SEM) is ideal for testing hypotheses within a well-defined theoretical framework (Dash & Paul, 2021). Its ability to manage multiple latent variables and their interconnections enables researchers to thoroughly evaluate measurement models and model fit indices, offering deeper insights into the relationships between latent constructs relevant to this study. We tested the fit of the proposed model using SEM **(See in appendix-2)**. The results showed a good model fit: $\chi^2/df = 2.182$, RMSEA = 0.046, GFI = 0.854, AGFI = 0.836, CFI = 0.969; IFI = 0.969, NFI = 0.945. First, the covariance between the independent variables of personality traits (OCEAN) was

examined. After that, independent factors (interactivity, telepresence, and vividness) and dependent variables (psychological well-being and virtual addiction) were linked.

Table-5: Hypothesis testing

Hypothesis	Description	Groups	S.E	Results
H1 (a)	O → INT	Overall	0.157	Accepted
		Shyness	-0.019	Accepted
		Confident	0.221	Accepted
(b)	E → INT	Overall	0.120	Accepted
		shyness	0.413	Accepted
		confident	0.350	Accepted
(c)	A → INT	Overall	0.299	Accepted
		Shyness	0.303	Accepted
		Confident	0.109	Accepted
(d)	N → INT	Overall	0.156	Accepted
		Shyness	0.090	Rejected
		Confident	0.189	Accepted
(e)	C → INT	Overall	0.162	Accepted
		shyness	0.144	Accepted
		confident	0.001	Accepted
H2 (a)	O → TEL	Overall	0.132	Accepted
		Shyness	0.102	Rejected
		Confident	0.147	Accepted
(b)	E → TEL	Overall	0.092	Accepted
		Shyness	0.240	Rejected
		Confident	0.168	Rejected
(c)	A → TEL	Overall	0.218	Accepted
		Shyness	0.282	Accepted
		Confident	0.235	Accepted
(d)	N → TEL	Overall	0.162	Accepted
		Shyness	0.310	Rejected

		Confident	0.175	Accepted
(e)	C → TEL	Overall	0.108	Accepted
		Shyness	-0.083	Accepted
		Confident	0.102	Rejected
H3 (a)	O → VIV	overall	0.114	Accepted
		Shyness	0.041	Accepted
		Confident	0.273	Rejected
(b)	E → VIV	Overall	0.123	Accepted
		Shyness	0.183	Rejected
		Confident	0.039	Accepted
(c)	A → VIV	Overall	0.483	Accepted
		Shyness	0.647	Accepted
		confident	0.515	Accepted
(d)	N → VIV	Overall	0.131	Accepted
		Shyness	-0.043	Rejected
		Confident	0.080	Accepted
(e)	C → VIV	Overall	0.106	Accepted
		Shyness	0.119	Rejected
		Confident	0.064	Accepted
H4	INT → TEL	Overall	0.044	Accepted
		Shyness	-0.083	Accepted
		Confident	0.056	Accepted
H5	VIV → TEL	Overall	0.171	Accepted
		Shyness	0.170	Accepted
		Confident	0.056	Accepted
H6	INT → PSY	Overall	0.310	Accepted
		Shyness	0.376	Accepted
		Confident	0.189	Accepted
H7	INT → VA	Overall	0.276	Accepted
		Shyness	0.254	Accepted

		Confident	0.238	Accepted
H8	TEL → PSY	Overall	0.238	Accepted
		Shyness	0.166	Accepted
		Confident	0.405	Accepted
H9	TEL → VA	Overall	0.300	Accepted
		Shyness	0.403	Accepted
		Confident	0.257	Accepted
H10	VIV → PSY	Overall	0.349	Accepted
		Shyness	0.363	Accepted
		Confident	0.286	Accepted
H11	VIV → VA	Overall	0.340	Accepted
		Shyness	0.259	Accepted
		confident	0.439	Accepted

Notes: SE = Standardized Estimates; OP = Openness to Experience, E = Extraversion, C = Conscientiousness, N = Neuroticism, A = Agreeableness, INT = Interactivity, TEL = Telepresence, VIV = Vividness, PSY = Psychological Well-Being, VA = Virtual Addiction

5. Discussion and Implication

The exploration of personality traits within interactive environments presents a paradigm-shifting opportunity. By examining this complicated dynamic between personality traits and interactivity, researchers can refine existing theories like UTAUT and even propose novel frameworks. This deepened understanding could challenge the conventional view of personality as static, revealing its adaptive nature in response to varying interactive contexts. Comprehending the interrelationship between personality traits and interactivity holds immense potential for real-world applications. For researchers, this implies a need for further exploration into how these factors translates into specific interactive preferences and behaviors, potentially leading to a more nuanced understanding of this relationship.

Based on the studies, it was concluded that personality traits exhibit a significant tendency to remain stable over time. However, as noted by Borkenau et al., (2006) and Bleidorn & Klimstra (2013), circumstances influence the development of individual characteristics. One of the most widely used frameworks for assessing personality traits is the Five-Factor Model, which includes traits (openness to experience, extraversion, conscientiousness, neuroticism, and agreeableness)

these traits has significantly impact on interactivity, telepresence and vividness too. All the hypotheses have been accepted. The one side of the framework revealed that personality traits of virtual human are strongly impact when they interact with users & vivid or resembles their memory through the 3D environment (Telepresence). The other side of the framework shows that when users interact with a virtual environment through telepresence, it not only enhances their well-being but also leads some users to become addicted to these virtual personalities. These hypotheses have a strong impact on users' well-being and addiction. So, study proved that people personalities not only addicted however, some personalities also amplify their well-being.

5.1 Theoretical Implications

Theoretical implications of virtual personalities in users' contexts suggest a transformative shift in human-computer interactions, blurring the lines between reality and digital simulations. These virtual personalities raise ethical questions concerning privacy, consent, and identity in online spaces. However, they challenge traditional notions of self and interpersonal relationships, opening avenues for in-depth studies on the impact of immersive digital experiences on human behaviour and social norms. User personalities matter in virtual worlds. These investigations split the model into shyness and confidence. It's vital to recognise individual variances within broad personality traits. The H1a emphasises that openness-to-experience supports interactivity and the acceptance of confidence and shyness, emphasising the significance of embracing these various personality traits. The favourable effect of extraversion on interactivity (H1b) suggests that meaningful linkages and careful support of personality elements in the user's setting are possible. Shyness and confidence themes and appeals complement (H1c) conscientiousness's impact on interactivity, providing a helpful user experience. According to H1d, strong Neuroticism causes social problems and lowers involvement. Accepting faith and rejecting shyness as interactive elements show how personality qualities shape communication dynamism. Neuroticism may produce shyness in some contexts; however Hassan et al. (2023) found that it does not always diminish interactivity. This rejection of shyness reveals a deeper understanding of how Neuroticism affects social interaction. Empirical findings evidenced a support for the impact of agreeableness on positive interactivity (H1e). Acceptance of shyness and confidence show how individual behaviours affect positive social engagement.

Examining the intersection of personality traits with telepresence opens a gateway to profound theoretical insights. It prompts a review of established personality theories in the context of

immersive digital environments and also contribution in theory. The UTAUT has a solid academic foundation and has been empirically supported in the context of technology and user behavior (Baptista & Oliveira, 2015). The understanding of how traits influence one's sense of telepresence, alter perceptions of self and others in virtual spaces, challenges traditional psychological patterns. Previous research has also found that people like the fact that telepresence robots can help them to connect socially with friends and reduce their sense of loneliness (Johannessen et al., 2023). So based on the H2a: openness-to-experience has a significant impact on telepresence, and this hypothesis has been widely accepted. However, research findings from appeals indicate that people tend to exhibit more confidence than shyness in telepresence contexts. This underscores a shift towards recognizing confidence as a more influential factor in facilitating interaction within telepresence settings, thereby challenging traditional assumptions about the inhibitory effects of shyness (Gao et al., 2023). H2b: Extraversion has a significant impact on telepresence, and this hypothesis has generally been accepted. However, contrary to expectations, both appeals of shyness and confidence have been found to be unsupported in the context of telepresence. Due to their extroverted nature, individuals rely heavily on their innate personality traits, resulting in reduced reliance on external appeals and fewer interactions with them. H2c: Agreeableness has a significant impact on telepresence, and this hypothesis is generally accepted. H2d: The impact of neuroticism on telepresence is well known yet appeals show greater confidence than shyness. H2e: Conscientiousness's effect on telepresence is largely accepted, however appeals show that shyness is accepted but confidence is denied. Contrary to expectations, Conscientious people tend to have very impulsive behaviour, which is why they often feel better when they are alone. Compared to confident individuals, those with a shy and conscientious appeal tend to adapt more quickly to telepresence or 3D environments, as it aligns with their psychological mind-set.

The relationship between personality qualities and vividness is rich in theory. It challenges psychology beliefs by showing how individual qualities make real and imagined experiences intense. Theoretical understanding of personality traits and vividness is promising. Hypothesis was designed to bridge theoretical advances. H3a: Openness to experience improves vividness, as generally recognised. However, appeals show that shyness is acceptable, but confidence is not. According to Johnson et al. (2020), confidence appeals may be ignored because they can overwhelm individual expression and prevent true interaction in some circumstances. H3b: Extraversion boosts vividness, as usually acknowledged. Appeal shows that shyness is rejected

but confidence is accepted. H3c: Agreeableness has a significant impact on vividness, and it is not only widely accepted overall but also supported by appeals examining shyness and confidence. H3d: The impact of neuroticism on vividness is significant and widely accepted but appeals indicate that individuals tend to exhibit more confidence than shyness in this regard. H3e: Conscientiousness's impact on vividness is generally accepted but appeals reveal that shyness is rejected while confidence is accepted. Overall study explores that vivid personality people extend their confidence level more because memory resemblance enhances their cognitive ability that shyness does not make.

In this study, the hypothesis posited that a higher level of interactivity increases telepresence volume in a virtual setting. Contrary to initial expectations, the results now confirm the existence of the relationship (H4). Upon further examination, appeals exploring shyness and confidence have solidified this positive relationship. Interactivity emerges as a crucial feature of websites, and the results affirm the adequacy of these constructs in verifying this relationship. This study highlights the significance of exploring relationships across diverse contexts and strongly encourages future researchers to delve into these constructs' relationships in various settings and scenarios. Investigating this phenomenon across different contexts not only fortifies our understanding but also provides valuable insights into the universal or context-specific nature of these associations. It challenges existing cognitive theories by probing how the vividness of experiences is influenced in technologically mediated environments. Understanding how individual differences, including personality traits, interact with the vividness of telepresence experiences can lead to the development of novel cognitive frameworks. So H5 Vividness has been widely accepted to have a positive impact on telepresence, which is supported not only by overall findings but also by appeals.

The virtual world affects people both positively and negatively, according to studies. The findings showed that interacting with a computer-generated or mediated atmosphere improved psychological stability, but certain individuals became reliant upon them, which tragically harmed their mental health. If a learning environment is tailored to respondents regarding improve their mental health. Moreover, addictions are common and difficult to treat. Social media addiction is a developing issue that affects students' mental, physical, and social health. To ensure safe and healthy Instagram use, preventive actions must be taken. Interactivity has been widely accepted to have a positive impact with psychological well-being, and with virtual addiction (H6, H7), which

is supported not only by overall findings but also by appeals. The positive impact of telepresence on psychological well-being and virtual addiction has been widely accepted (H8, H9), with support from both overall findings and appeals examining shyness and confidence. Vividness has garnered widespread acceptance for its positive impact on psychological well-being and virtual addiction (H10, H11), with support not only from overall findings but also from appeals specifically addressing shyness and confidence. But this study verifies that people's personalities are not only addictive, but some personalities also amplify their well-being.

Online techniques tailored to personality profiles improve user behaviour and digital experience. Personality-based optimisation by gaming and virtual conferencing firms may boost participation and reduce addiction. Immersive learning environments for different personalities increase mental health and virtual education participation.

Virtual workplaces with personality-driven design boost interaction, cooperation, and job satisfaction, enhancing mental health. Marketing and advertising that matches personality traits increases engagement and reduces digital addiction by matching material to preferences. This understanding helps creative write stories that suit diverse psychological needs and foster a healthy relationship between individuals and technology that is interactive across industries.

5.2. Practical Implications

Understanding personality traits and interactivity improves mental health and reduces addiction. Online techniques tailored to personality profiles can improve user behaviour and digital experiences. Personality-based virtual reality gaming and conference app optimisation can boost engagement and decrease addiction. Virtual education can promote mental health and engagement by establishing immersive learning environments for different personalities. Virtual workplaces with personality-driven design boost interaction, cooperation, and job satisfaction, enhancing mental health.

The increasing use of virtual avatars in various digital interactions has brought about societal challenges, such as low engagement and interaction quality between users and avatars. Current practitioners report difficulties in fostering meaningful connections through these digital representations. Additionally, studies indicate a growing concern regarding user wellbeing, with many perceiving a decline in mental health due to the overuse of avatars, often linked to high levels of addiction. These societal issues underscore the importance of addressing these problems, and

this paper contributes by offering insights and potential solutions to enhance avatar-based interactions and mitigate negative impacts on user wellbeing.

Personalised advertising and marketing that matches personality profiles enhance engagement and prevent digital dependency by matching media to interests. This information guides creative tales that fulfil diverse psychological needs throughout sectors. Understanding how virtual influencers are seen lets marketers tailor ads to Extraversion, Agreeableness, Conscientiousness, Openness to Experience, and Neuroticism. Understanding the relationship between personality and telepresence can help design engaging remote communication tools and platforms.

The study also reveals how virtual world user experience and interface design can boost shyness and confidence. Personality-driven interface design can enhance virtual experiences and boost consumer engagement and loyalty across industries. Personalising user experiences by personality can improve gaming, virtual education, and workplace engagement and happiness. These findings can assist industry managers build more successful and engaging virtual experiences that fulfil the psychological needs of diverse user groups, fostering healthy human-technology interactions.

5.3. Societal implications

The rise of virtual avatars in digital communication has introduced a range of societal challenges that are becoming increasingly difficult to ignore. One of the key issues practitioners face is the low level of interaction between users and their virtual avatars, which often hampers the effectiveness of these digital tools in fostering genuine human connection. Research highlights that many users struggle to form meaningful bonds with avatars, leading to a sense of detachment during virtual interactions. Furthermore, there is growing concern about the broader impact on user wellbeing. Many studies suggest that prolonged use of avatars can contribute to negative mental health outcomes, such as anxiety or reduced social fulfilment, and some even point to the addictive nature of these technologies. The combination of these factors not only raises questions about the effectiveness of avatars but also highlights the potential long-term societal risks. This paper aims to address these critical issues by offering a deeper analysis of user-avatar interactions and proposing strategies to improve user interaction, mitigate addiction, and enhance overall wellbeing, thereby making a significant contribution to this emerging field of study.

6. Conclusion

Virtual personality traits go beyond humans according to modern marketing research. Moreover, this study identifies the role of psychological well-being and addiction on personalities. The

relationship between personality qualities and numerous outcomes suggests broad life patterns. Conscientiousness and agreeableness increase mental health, while neuroticism does not. Personality individual impact on life's swings is nuanced and coupled to external factors. Innovative approaches, self-organization thoughts, and pervasive technology enable spontaneous virtual world involvement, the study finds. This interaction reveals personalities, attitudes, and preferences. The research predicts that virtual encounters will combine with memories to improve e-community involvement. Virtual addiction, which involves harmful involvement despite negative outcomes, is serious. Virtual addiction is diagnosed by psychologists using stringent criteria.

However, this study shows that personality factors predict telepresence interaction and vividness. It illuminates the complex interplay between personality traits, virtual interactions, and digital repercussions, highlighting the tremendous impact of virtual identities on psychological well-being and addiction.

6.1. Limitation and Future Recommendations

In this study first, till date, there has been no research on virtual personalities. Our single study cannot fill the gap in understanding how users interact with virtual human personalities, as this area is still very limited. More studies in future should explore virtual human personalities in depth. Second, we employed two appeals, shyness and confidence, for multi-group analysis. It is possible that this study employed other appeals such as human vs. virtual human, curious and enthusiastic, Humor vs. Intelligence, Creativity vs. Assertiveness etc. which should be evaluated with regard to personalities. Third, we focused on how interactions with virtual personalities might enhance users' psychological well-being. Our study is limited with only considered psychological well-being as an outcome. Future research could explore additional outcomes, such as impacts on life well-being and emotional well-being. Fourth, Limitation of our study is that our time span was limited; we collected data only once to assess users' psychological well-being, making this a cross-sectional study. For future research, we suggest examining data over different time spans to reveal the longitudinal effects on users' psychological well-being. The growing role of virtual human personalities presents significant opportunities for future research. One area of interest is their potential to boost economic productivity by enabling the development of human-cantered machinery, tools, and interactive systems, advancing industries like manufacturing and technology. Virtual humans also have the potential to revolutionize education and training,

offering immersive teaching, mentoring, and virtual experiences. In healthcare, their use in telemedicine, surgical planning, and medical training could save lives by improving accuracy and accessibility.

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Appendix-1

Variables	Items	References
Personalities traits	**a. Openness to experience:** ● I get excited by new ideas ● I enjoy thinking about things ● I enjoy hearing new ideas ● I enjoy looking for deeper meaning ● I have a vivid imagination **b. Extraversion:** ● I talk to a lot of different people at parties ● I feel comfortable around people ● I start conversations ● I make friends easily ● I do not mind being the center of attention **c. Agreeableness:** ● I sympathize with others' feelings ● I am concerned about others ● I respect others ● I believe that others have good intentions ● I trust what people say to me **d. Conscientiousness:** ● I pay attention to details ● I am always prepared ● I make plan and stick to them **e. Neuroticism:** ● I get stressed out easily ● I fear for the worst ● I am filled with doubts about things	Jani & Han, 2014
Interactivity	● While browsing the app, I was in control of my navigation through virtual technology ● While browsing the app, I had some control over the content of virtual technology that I wanted to see	Yim et al., (2017)
Vividness	● Vivid-vague ● Clear-unclear ● Sharp-dull ● Fuzzy-well defined	Miller et al., (2000)
Telepresence	● I had a sense of being in the scenes displayed ● I felt I was visiting the places in the displayed environment ● I felt that the virtual characters and/or humans could almost be touched	Huang & Liao (2015)

Psychological well-being	● Have you recently been able to concentrate on whatever you're doing ● Have you recently been able to enjoy your daily activities ● Have you recently felt constantly under pressure ● You lost much sleep over worry recently ● You have felt that you are playing a useful part in things ● You have felt capable of making decisions about things ● You have felt you could not overcome your difficulties ● You have been able to face up to your problems ● You have been feeling unhappy and depressed ● You have been losing confidence in yourself ● You have been thinking of yourself as a worthless person ● You have been feeling quite happy with all things considered	(Goldberg, 1978)
Virtual addiction	● How often do you find that you stay on-line longer than you intended? ● How often do you find yourself saying ''just a few more minutes'' when on-line? ● How often do you neglect household chores to spend more time on-line? ● How often do you try to cut down the amount of time you spend on-line and fail? ● How often do your grades or school work suffer because of the amount of time you spend on-line? ● How often do you lose sleep due to being online late at night? ● How often do you choose to spend more time on-line over going out with others? ● How often do you try to hide how long you've been on-line? ● How often do you snap, yell, or act annoyed if someone bothers you while you are on-line? ● How often do you feel depressed, moody or nervous when you are off-line, which goes away once you are back on-line? ● How often do you feel preoccupied with the Internet when off-line, or fantasize about being on-line? ● How often do you become defensive or secretive when anyone asks you what you do online?	(Pawlikowski, Altstötter-Gleich, & Brand, 2013)

Appendix-2

Co-Variance Based SEM (Structural Equation Modelling)