

# Impact of Avatar Clothing on Purchasing Decisions

Kang Shen, Giulio Zhu, Chuan Zhe Fu, Zhaoqi Chen, Kirill Kamakaev, Amir Solanki, Anthony Steed



Virtual shopping environment used in the experiment. Participants embodied avatars dressed in different clothing styles: formal and casual, within a simulated retail store.

**Abstract**—This study investigates the impact of avatar clothing on purchasing behaviour in a virtual reality (VR) shopping environment. Participants embodied avatars with distinct clothing styles, and their spending patterns and gaze behaviour were tracked. Results showed no significant difference in spending between formal and casual avatars, and no preference for viewing avatar-congruent clothing. Additionally, embodiment did not significantly influence expenditure and gaze behaviours. These findings suggest that avatar clothing alone may not strongly shape consumer choices in VR, highlighting the need for future studies on social presence and interactive VR shopping experiences.

**Index Terms**—avatars, virtual reality, virtual clothing, VR shopping, embodiment, spending behaviour, consumer choice

## I. INTRODUCTION

As virtual reality (VR) becomes increasingly integrated into social and commercial spaces, understanding the influence of self-representation on user behaviour has become essential. Avatars, as digital embodiments of users, play a key role in shaping both self-perception and social interaction in immersive environments. This study explores the impact of avatar clothing styles, namely formal and casual, on shopping behaviour in a virtual retail setting. By examining how avatar appearance influences purchasing decisions and visual attention, we aim to uncover the relationship between avatar appearance and user behaviour. Our approach involves assigning participants distinct avatar clothing styles, tracking their shopping activity, and analysing patterns of spending and

engagement to assess the extent to which avatar appearance shapes user behaviour in VR.

## II. RELATED WORK

This section examines prior studies on self-representation in VR and its influence on user behaviour. It begins by discussing the role of avatars as extensions of identity, examining how digital self-representation shapes interactions in immersive environments. The Proteus Effect is then introduced, highlighting how avatar attributes, including clothing, influence user perception and conduct. Further, the section reviews how clothing enables identity exploration and social signalling in VR, before addressing inclusivity challenges in avatar customisation. Finally, ethical considerations in virtual clothing representation are discussed to contextualise the broader implications of self-representation in VR.

### A. Self-representation

Self-representation in VR has been extensively studied, particularly concerning digital avatars and their influence on user perception and behaviour. Avatars function as extensions of identity, shaping how individuals perceive themselves and how they are perceived by others. Advances in VR technology have significantly expanded avatar customisation, allowing users to alter various attributes such as gender, body shape, and clothing [1], [2]. Research demonstrates that these virtual

representations influence behaviour, engagement, and social interactions in immersive environments [3].

### B. Avatar Clothing and the Proteus Effect

One important area of avatar customisation is clothing, which can impact social identity, confidence, and interaction styles in both physical and virtual settings [4], [5]. The Proteus Effect, a recognised phenomenon in VR research, describes how individuals naturally change their behaviour to align with the perceived traits of their avatars [3]. Studies show that users with taller avatars tend to exhibit more dominant behaviour, and some users prefer to use avatars to represent their “real” selves [1], [6]. Clothing, as an essential element of avatar design, contributes to this effect by influencing levels of confidence and participation. Research indicates that avatars in formal outfits prompt users to behave more authoritatively in professional settings, whereas casual or fantasy-themed clothing encourages informal and playful interactions [7].

### C. Identity Exploration Through Clothing

Clothing choices also provide a way of identity exploration, allowing users to challenge societal norms, experiment with gender expressions, and reflect personal or cultural backgrounds [8]. In virtual environments, users have greater flexibility in constructing their digital identities, expressing aspects of themselves that may not be as easily explored in real life. Suh et al. [9] describe avatars as reflections of personal identity, significantly affecting emotional attachment, user identification, and perceived usefulness through the principles of self-congruity and functional congruity. Self-congruity pertains to the alignment between an individual’s self-image and avatar appearance, fostering deeper identification and emotional connection. Functional congruity, on the other hand, addresses the practical utility of avatars in supporting specific tasks, such as apparel shopping, enhancing overall user engagement. Moreover, clothing can also serve as a means of self-affirmation, allowing users to feel more comfortable and authentic in their virtual interactions [1].

### D. Social Impact of Clothing

Avatar clothing can serve as a social signal that influences interaction dynamics, making individuals more likely to engage with others who share similar stylistic choices, fostering in-group recognition and community bonding [1]. In social VR platforms, users often engage more readily with those who share similar stylistic preferences, fostering a sense of belonging within virtual communities. Furthermore, Hudson et al. [10] highlight the importance of immersion and social interactions in virtual reality contexts. Their research indicates that interactive virtual environments enhance user immersion; however, increased social interactions can moderate this effect, sometimes reducing the positive impact of immersion on user satisfaction and engagement. Thus, the interplay between immersive virtual experiences and social dynamics may significantly influence consumer behaviours, particularly within virtual shopping scenarios.

### E. Inclusivity and Ethical Considerations

Despite the benefits of avatar clothing customisation, ethical and inclusivity challenges persist. Research highlights the need for more diverse and accessible customisation options to ensure that individuals from all backgrounds feel represented in VR [8]. Although our experiment does not directly investigate these aspects, prior research suggests that more inclusive avatar design options, including diverse skin tones, body modifications such as tattoos, and non-traditional clothes, can enhance user engagement and allow for greater self-expression [1], [2]. Addressing these concerns is essential for fostering a sense of representation and identity in virtual communities.

## III. RESEARCH HYPOTHESIS

Building on these research, this study explores how different avatar clothing styles (formal and casual) influence user shopping behaviours in a virtual reality clothing store.

### A. Definition of Key Variables

The following variables underpin the hypotheses of this study:

- *Independent Variables:*
  - *Avatar Clothing Style:* Assigned as either formal or casual, intended to influence spending behaviour and attention toward congruent clothing styles.
- *Dependent Variables:*
  - *Spending Behaviour:* The total amount of money participants spend on clothing items, reflecting avatar-induced purchasing behaviour.
  - *Attention and Viewing Time:* The duration participants focus on clothing items congruent with their assigned avatar style, indicating visual interest and engagement driven by avatar congruence.
- *Moderators:*
  - *Embodiment:* Participants’ psychological identification with their avatars, hypothesised to moderate avatar-congruent spending and attention behaviours.

### B. Hypothesis Formulation

Based on the theoretical framework, the following hypotheses are proposed:

- *Hypothesis 1: Spending Behaviour*
  - Participants assigned formal avatars are expected to spend more overall compared to those with casual avatars. Formal attire might psychologically prime higher-value purchases [11].
- *Hypothesis 2: Attention and Viewing Time*
  - Participants will spend more time viewing clothing congruent with their avatar’s style (i.e. avatars wearing formal attire are expected to view formal clothings for longer periods of time, vice versa). Avatar appearance is expected to direct visual attention toward congruent products.

- *Hypothesis 3: Embodiment Effect*

- Participants reporting higher embodiment are anticipated to exhibit stronger avatar-congruent shopping behaviours in terms of spending and viewing time. Increased embodiment likely reinforces avatar-congruent influences [11].

### C. Expected Outcomes and Predictions

We anticipate our VR experiment results will support these hypotheses. Formal avatars might prompt greater spending due to perceived higher value. Avatar-congruent viewing behaviours are expected, with attention aligning to avatar styles. Higher embodiment levels are predicted to reinforce these avatar-related shopping behaviours. This study aims to provide insights into how avatar features and embodiment shape consumer behaviours in immersive virtual retail settings.

## IV. EXPERIMENT DESIGN

The experiment employed a between-subjects design in which participants were randomly assigned to one of two avatar conditions: one where the avatar donned formal attire and another with casual attire. Within the shopping mall virtual environment, participants encountered both formal and casual clothing sections, enabling us to observe whether the congruence or incongruence between avatar style and store offerings impacted spending decisions.

### A. Methodology

1) *Software*: The VR software was developed in Unity (version 6000.0.37f1) using a combination of frameworks, SDKs, and assets, allowing us to create an interactive and engaging environment for users. The XR Core modules served as the foundational framework for the implementation of character kinematics, enabling motion tracking, camera control, and body and hand tracking. To further refine avatar movement and interaction, we conducted research on both the Meta Movement SDK and FinalIK. While the former offers high-quality body tracking, FinalIK proved more compatible with our animator due to its flexibility in locomotion animation. We created simple demonstrations using both technologies and compared the results. Ultimately, FinalIK was selected for our body-tracking and animation implementation. Its use of inverse kinematics enabled smooth and natural motion animations. This was particularly critical for ensuring that avatar movements, such as walking and gesturing, appeared lifelike and enhanced users' sense of body ownership. We also implemented a calibration feature to ensure that users can adjust the body tracking when changing positions (i.e. from seated to standing), so that tracking is dynamic and flexible. To ensure compatibility and optimal performance with Meta Quest devices, the Meta SDK was integrated, leveraging Quest Link to enable the use of both Meta Quest 2 and Quest 3. This SDK facilitated essential functionalities such as device-specific rendering, input handling, and performance optimisation, ensuring a smooth and immersive experience for users on these platforms. For avatar creation and integration,

the Ready Player Me SDK was employed, allowing for the generation of highly customisable and realistic avatars that could be easily integrated into the VR environment. The environment, designed as a shopping mall, was enriched using a variety of assets from the Unity Asset Store. We used two asset packs, one for the shopping mall environment, which is called Retail Store, while the other pack, Mens and Womens Clothing, is used for the clothing prefabs.

A custom gaze interactor and timer were implemented to track how long participants looked at each clothing item, based on the gaze interactor by Tomaz Saraiva. The system also logs the names and prices of the items they chose to buy, along with the total amount spent at the end of the experiment.

2) *Experimental Procedure*: Participants were briefed on the experiment's settings, filled out the consent forms, and completed a pre-questionnaire which collected their demographics. After a short familiarisation period with the VR setup and in-game commands, each participant was randomly assigned an avatar (formal or casual). They then entered the virtual shopping mall and were given a set amount of clothings (capped at 4 clothings maximum) to choose to buy.

During the experiment, participants navigated the environment freely, exploring various retail sections. Mirrors were placed in the virtual store to allow participants to observe their avatar and clothing. Metrics such as gaze duration on each clothing item and the total amount spent were automatically logged by the system. After the shopping session, participants completed a post-experiment questionnaire to evaluate their sense of embodiment and to gather insights into factors that may have influenced their purchasing decisions.

### B. Dataset Description/Data Collection

1) *Participant Demographics*: This sections provides an overview of the demographic characteristics of the 19 participants who took part in the VR experiment. The data presented includes gender, age, familiarity with virtual environments, and VR usage patterns.

- *Gender*
  - Men: 63% (n = 12)
  - Women: 37% (n = 7)
- *Age*
  - 18-21 years old: 58% (n = 11)
  - 22-25 years old: 42% (n = 8)
- *Familiarity with Virtual Environment*
  - Not at all: 5.3% (n = 1)
  - Slightly familiar: 47.4% (n = 9)
  - Somewhat familiar: 15.8% (n = 3)
  - Moderately familiar: 26.3% (n = 5)
  - Very familiar: 5.3% (n = 1)
- *VR Usage Frequency*
  - Never: 21.1% (n = 4)
  - A few times a year: 68.4% (n = 13)
  - A few times a month: 5.3% (n = 1)
  - Daily use: 5.3% (n = 1)
- *VR Usage for Shopping*
  - Never: 78.9% (n = 15)

- Rarely: 15.8% ( $n = 3$ )
- Frequently: 5.3% ( $n = 1$ )

**Implications:** In summary, the participant group skews younger (18–25), with a moderate-to-low level of VR familiarity and infrequent usage, particularly for shopping. These demographics suggest that the findings of this study are most relevant to young adult populations.

### C. Metrics

#### • Objective Behavioural Metrics

- **Total Expenditure:** Sum of the costs of all the purchased clothing.
- **Dwell Time by Section:** Total time (seconds) spent looking at formal vs casual clothing

#### • Subjective Experience Metrics

Subjective data was gathered through a post-experiment survey consisting of 20 statements based on the Standardised Embodiment Questionnaire [12]. Participants rated each statement using a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree), chosen for its sensitivity in capturing variation in embodiment, clothing influence, and decision-making.

The questions were grouped into six categories: Appearance, Response, Ownership, Multi-Sensory, Clothing Influence, and Decision-Making. An average embodiment score was computed per participant by averaging responses in the former four categories.

These categories collectively informed the following metrics:

- **Embodiment:** Ownership, identification, and connection with the avatar.
- **Avatar-Influenced Preference:** Influence of avatar appearance on user choices.
- **Shopping Engagement:** Attention and willingness to purchase.

## V. ANALYSIS OF RESULTS

We gathered experimental data from 19 participants split into two groups: those with formally-dressed avatars (10 participants) and those with casually-dressed avatars (9 participants). The sample included 7 females (3 formal, 4 casual) and 12 males (7 formal, 5 casual).

The data collected from the questionnaires and interaction logs enabled us to analyse whether avatar clothing influenced browsing patterns and overall spending behaviour, as well as assess whether embodiment had an effect on shopping behaviours.

### A. Avatar Clothing Influence on Spending Behaviour

Figure 1 compares total spending between the formal and casual groups, showing that participants with formally-dressed avatars ( $M = 333.0$ ) spent more on average than their casually-dressed counterparts ( $M = 263.3$ ). Figure 2 shows the distribution of total spending, revealing that casual avatars' spending was concentrated between £200 and £350, while the

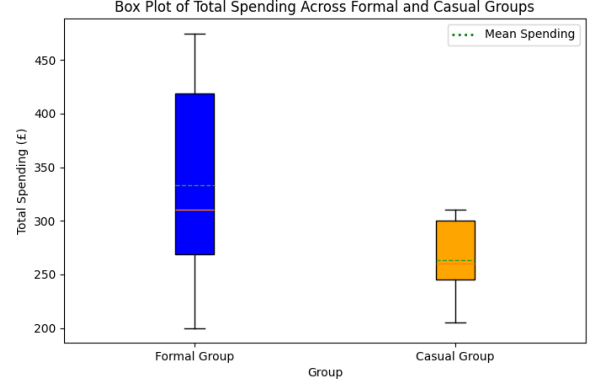


Fig. 1. Comparison of total spending between formal and casual avatar groups.

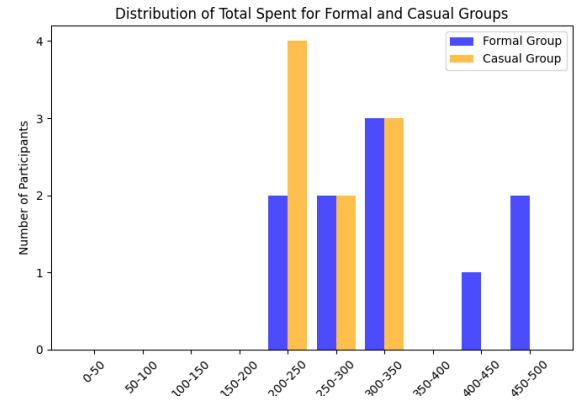


Fig. 2. Distribution of spending within each group.

formal group showed greater variation, with three participants exceeding £400.

A Shapiro-Wilk test ( $W_{\text{formal}} = 0.9095, p_{\text{formal}} = 0.2776, W_{\text{casual}} = 0.9314, p_{\text{casual}} = 0.4952$ ) showed that both groups were normally distributed. An F-test for variance ( $F(9, 8) = 7.96, p = 0.0077$ ) indicated that the two groups had significantly different variances, so a Welch's t-test was conducted. The Welch's t-test ( $t(17) = 2.03, p = 0.058$ ) showed no significant difference between price spent for formal ( $M = 333.0, SD = 97.22$ ) and casual ( $M = 263.3, SD = 34.46$ ) clothing. **Hypothesis 1 is rejected.**

### B. Avatar Clothing Influence on Gaze Patterns

To assess whether participants spent more time viewing clothing that matched their avatar's attire, we calculated the proportion of time spent viewing congruent clothing using the formula:

$$\text{Proportion} = \frac{\text{Time spent viewing congruent clothing}}{\text{Time viewing formal} + \text{Time viewing casual}}$$

Figure 3 illustrates the distribution of gaze time proportion towards avatar-congruent clothing for both formal and casual avatar groups. The mean proportion of time spent viewing formal clothing was  $M = 0.5556$  ( $SD = 0.1932$ ), while the

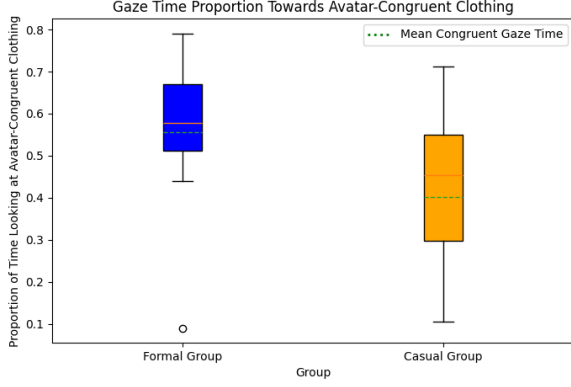


Fig. 3. Comparison of proportion of time viewing congruent clothing between formal and casual avatar groups

mean proportion of time spent viewing casual clothing was  $M = 0.4028$  ( $SD = 0.2051$ ).

A Shapiro-Wilk test ( $W_{\text{formal}} = 0.9095, p_{\text{formal}} = 0.2776, W_{\text{casual}} = 0.9314, p_{\text{casual}} = 0.4952$ ) confirmed that both groups were normally distributed. An F-test for variance ( $F(8, 9) = 1.127, p = 0.8551$ ) indicated that the two groups had equal variances.

An independent sample t-test ( $t(17) = 1.67, p = 0.113$ ) showed that there was no significant difference in the proportion of time spent viewing congruent clothing across avatar groups. **Hypothesis 2 is rejected.**

### C. Embodiment and Avatar-Congruent Shopping Behaviour

1) *Correlation Between Embodiment and Spending:* A Pearson correlation test showed no significant relationship between embodiment and spending behaviour,  $r(17) = 0.39, p = 0.102$ . The correlation was positive but weak, and the 95% confidence interval ranged from -0.08 to 0.715. The proportion of variance explained was small ( $R^2 = 0.15$ ), suggesting that embodiment accounts for only 14.96% of the variation in spending.

2) *Correlation Between Embodiment and Viewing Time:* A Pearson correlation test also showed no significant relationship between embodiment and time spent viewing avatar-congruent clothing,  $r(17) = 0.063, p = 0.797$ . The correlation was near zero, with a 95% confidence interval of -0.403 to 0.503. The proportion of variance explained was minimal ( $R^2 = 0.004$ ), indicating that embodiment score had little to no predictive power for time spent viewing avatar-congruent clothing.

The  $R^2$  values for both tests were low, suggesting that there is no significant correlation between embodiment and spending behaviour, and between embodiment and gaze patterns. **Hypothesis 3 is rejected.**

## VI. DISCUSSION

Previous studies by Cutrigh et al. investigated whether clothing influences spending behaviour in real-world and in non-immersive environments [13]. Their findings suggested that individuals wearing formal clothing tend to spend more than their casually dressed counterparts, a phenomenon attributed

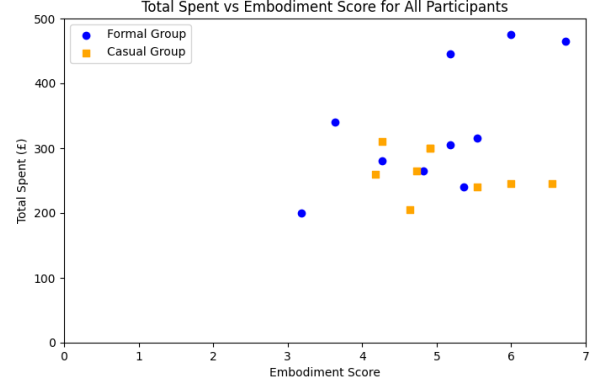


Fig. 4. Relationship between embodiment scores and the number of total amount spent.

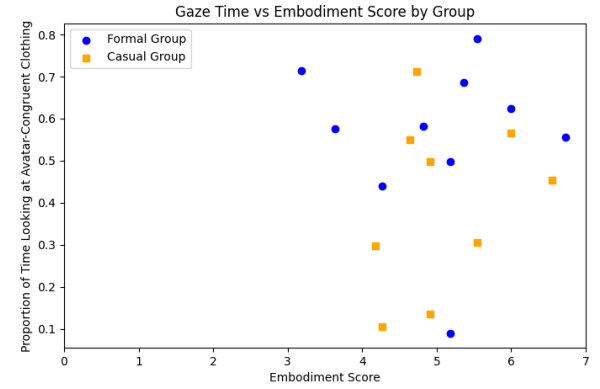


Fig. 5. Relationship between embodiment scores and the proportion of time viewing congruent clothing.

to increased social confidence. Social confidence, as defined in the paper, refers to the sense that one's decisions will be viewed positively by others [13]. Our study aimed to examine whether this phenomenon translates to immersive virtual environments (IVEs).

Contrary to previous research, our results indicate that participants embodying formally-dressed avatars did not spend more than those embodying casually-dressed avatars. We speculate that this may be due to the absence of social confidence cues in the experimental setup. Unlike real-world shopping environments where social presence influences consumer behaviour, our experiment was conducted in an isolated setting, with participants interacting with the environment individually. Without other avatars or virtual agents observing their decisions, participants may not have experienced the same social confidence effects that influence real-world spending. Future studies should explore whether social presence in IVEs (e.g. shopping alongside other avatars or interacting with virtual shop assistants) impacts spending behaviour similarly to real-world retail environments.

Furthermore, our results did not find significant differences in the time spent viewing avatar-congruent clothing, that is, participants did not preferentially view clothing that matched their avatar's attire. This suggests that avatar clothing does not



strongly influence consumer choice, which aligns with findings from Meißner et al. that users in immersive VR environments are more variety-seeking, often exploring brands and styles that differ from their usual preferences [11]. Additionally, most participants (89.5%) had little prior experience in VR, which could have influenced their engagement with the virtual store. It is possible that participants spent more time exploring the environment in general, rather than actively making choices based on their avatar's attire. Our dataset does not distinguish between intentional observation and random gaze, which is a factor worth investigating in future research.

Finally, the rejection of Hypothesis 3 further supports the lack of relationship between embodiment and shopping behaviours. The data showed no significant correlation between higher embodiment levels and increased spending or viewing time, suggesting that higher embodiment does not necessarily reinforce avatar-congruent shopping behaviours.

## VII. LIMITATIONS AND FUTURE WORK

### A. Participant Demographics Limitations

The participant pool consisted entirely of 19 young adults aged 18-25, with 58% between 18-21 years old and 42% between 22-25 years old. Additionally, the majority of participants (89.5%) had little to no prior experience in VR shopping. As a result, the findings may not be generalisable to older adults or individuals with more VR exposure, who may exhibit different shopping behaviours. Future studies should incorporate a more diverse age range and experience levels to achieve more representative results.

### B. Limitations in Experimental Environment

The isolated nature of the shopping environment differs significantly from real-world retail experiences, where social interactions are a key factor. In physical stores, shoppers are often influenced by the presence of others, including peers, other customers, and sales associates. The absence of social interactions in our study may have reduced the potential impact of social confidence on spending behaviour. Future studies should introduce multi-user environments to examine whether shopping alongside others in VR affects decision-making.

### C. Limited Avatar-Clothing Interaction

Another key limitation was that participants could not try on clothing on their avatars. Unlike real-world shopping, where individuals can assess fit and appearance in mirrors, participants in this experiment could only view clothing from different angles but not wear them. Informal experiment feedback revealed that 11 out of 19 participants (57.9%) expressed a desire to try clothing on their avatars, suggesting that virtual try-on capabilities might impact decision-making. Future research should incorporate try-on features and virtual dressing rooms to determine whether wearing clothing in VR influences purchase decisions.

## VIII. CONCLUSION

This study examined whether avatar clothing influences shopping behaviour in immersive virtual environments, particularly in terms of spending and viewing preferences. The results did not show a significant effect of avatar attire on spending or viewing time, suggesting that virtual clothing does not strongly shape consumer choices in IVEs. Additionally, there was no significant correlation between embodiment and shopping behaviours, indicating that higher embodiment levels do not necessarily lead to avatar-congruent shopping choices.

While the findings suggest that social confidence and embodiment effects may not translate directly into IVEs, the lack of social presence and limited avatar interaction in this study may have played a role. Future research should explore socially interactive VR shopping settings to better understand how avatars impact purchasing behaviour in immersive environments.

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## APPENDIX

TABLE I

POST-QUESTIONNAIRE (A: APPEARANCE, R: RESPONSE, O: OWNERSHIP,  
M: MULTI-SENSORY, C: CLOTHING INFLUENCE, D: DECISION-MAKING  
AND PURCHASE INTENT)

ID	Questions
A1	I felt confident in my appearance while wearing the clothes on my avatar.
A2	I felt as if I was buying clothes for myself, not the avatar.
A3	Seeing myself in the mirror helped me assess how well the clothes suited me.
A4	The mirror experience made me more aware of how clothing choices affect my appearance.
R1	I felt a strong connection to my avatar.
R2	I felt a strong connection between my movements and my avatar's actions.
O1	I felt as if the reflection in the mirror was my real reflection.
O2	I felt as if the clothes on my avatar were my own.
M1	I felt as if I were physically present inside the virtual clothing store.
M2	Interacting with the virtual environment almost felt as natural as shopping in a real store.
M3	I felt as if I was personally experiencing the store rather than just observing it through a screen.
C1	I paid attention to clothing details (e.g., colour, fit, price, style) while shopping.
C2	Seeing my avatar's outfit made me think about my own clothing choices.
C3	The VR clothing experience made me think about how different clothing affects my presentation to others.
C4	The outfit on my avatar influenced how I perceived clothing options in the store.
C5	I was more likely to look at clothing items that shared similarities with my avatar's outfit.
D1	The virtual shopping experience affected the types of clothing I was interested in purchasing.
D2	After the VR experience, I was more inclined to buy clothing I normally wouldn't consider.
D3	Seeing my avatar's outfit helped me evaluate whether that style suited me.
D4	I felt more decisive in my clothing choices because of the virtual shopping experience.