Enhancing Decision-Making: The Significance of Humanized Avatars in Complex Scenarios

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Abstract

In an ever-evolving world, the demand for swiftness and precision has permeated every aspect of our lives. This craving for quick, accurate decision-making has a profound impact on our cognitive abilities, especially as we grapple with the emergence of new and ever-evolving challenges. These challenges often manifest in moderately familiar to entirely unfamiliar contexts, necessitating decisions with far-reaching consequences. These decisions influence our work, education, and various other life domains. The stakes are high, and the urgency to make the right decision becomes a pressing need.

In response to this growing demand, we propose the introduction of a smart assistant, acting as a facilitator to guide individuals through intricate decision-making processes in scenarios ranging from moderately familiar to entirely unfamiliar. This smart assistant takes the form of an avatar enriched with human-like qualities. It possesses the ability to communicate through realistic gestures, speech, and both macro and micro facial expressions. This human-like avatar acts as a virtual facilitator, providing a guided demonstration of viable solutions, rendering the decision-making process more intuitive and user-friendly.

Consider a scenario in the industrial sector where engineers encounter a complex problem. They must make a pivotal decision concerning a manufacturing process they have limited experience with. The stakes are high; an erroneous choice could lead to substantial financial losses. In this situation, the +avatar smart assistant intervenes. It comprehensively presents solutions and options in easily understandable formats, bridging the knowledge gap and helping engineers make informed decisions. This approach significantly mitigates decision fatigue and augments overall efficiency.

To assess the effectiveness of this humanized avatar in decision-making scenarios, we employ the methodology of action research. This research entails time-based tasks that users perform both with and without the avatar. These tasks align with real-world situations where prompt decision-making is crucial. We collect data through a qualitative questionnaire and conduct a comprehensive user study. This research framework allows us to evaluate key performance metrics, including ease of use, ease of learning, cognitive load, and user feedback, which constitute the crux of our qualitative assessment.

A pivotal element in evaluating the success of this avatar-based smart assistant is usability. Interacting with the avatar should be intuitive for users, thereby enhancing the entire decision-making process. We evaluate the system's usability, accounting for the context and users' prior knowledge. Cognitive load is another crucial aspect of the assessment, as alleviating cognitive overload is a primary objective in introducing the avatar-based smart assistant. We aim to assess how effectively the avatar reduces cognitive load and whether it streamlines the decision-making process for users. User feedback plays an integral role in comprehending the user's perspective and discerning how the avatar impacts their decision-making process. User comments and feedback forms shed light on the perceived utility of the avatar and areas where potential improvements can be made.

The results of this study could fundamentally alter how people approach difficult decision-making circumstances. In situations of moderate to novel complexity, the use of a humanized avatar as a smart assistant can greatly improve decision-making processes, reduce stress, and improve outcomes. The avatar-based smart assistant addresses the universal need to make vital decisions more effectively, which makes it an intriguing subject for future research, whether in the industrial sector, education, or any other discipline.

Keywords

XR Avatar, Industrial Metaverse, GenAI, LLM, VR, Speech Interaction

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1. Introduction

In today's rapid universe of technological advancements, smart assistance has become a crucial tool for improving daily interactions and simplifying tasks in different areas. Smart assistants have become a common feature in modern life, helping with tasks like managing schedules and controlling home appliances. Yet, the continuous challenge for designers and developers is to make sure these digital companions correspond to user preferences and needs [2,3].
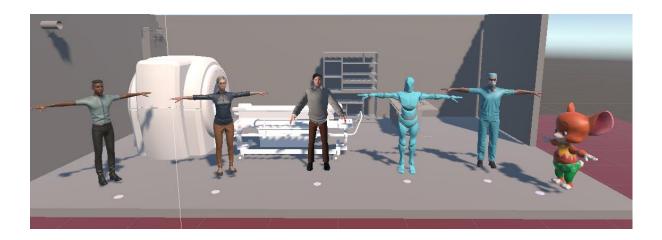
By delving into user experiences and conducting thorough research, we gain valuable insights that help enhance the design and functionality of smart assistance technology [1]. This paper discusses the findings obtained from surveys that inquired about individuals' opinions on various features of smart assistants. It also includes hands-on encounters with avatars and the collection of feedback through post-experiment surveys and semi-structured interviews.

The research presented in this paper highlights the significance of user-centered design in the advancement of smart assistant technology [4]. By gathering feedback directly from users through surveys and interviews, developers can gain invaluable insights into how to tailor their products to better serve the needs and preferences of their target audience. This approach not only enhances the functionality of smart assistants but also fosters a more engaging and personalised user experience that can adapt to different contexts and situations. Ultimately, prioritising user preferences and immersive experiences is crucial for ensuring the continued success and evolution of smart assistance technology in the future [5]. For paragraph, use Normal. Paragraph text. Paragraph text. Paragraph text. Paragraph text. Paragraph text. Paragraph text. Paragraph text. Paragraph text.

2. Methodology

We employed 8 (3 female and 5 male) participants for the experiment from various backgrounds, ranging from designers to engineers. We restricted the number of participants to this as we wanted to cater to the major usability issues of the relatively straightforward tasks assigned to the participants. The participants were asked to interact with different types of avatars in the critical scenario (Figure 1), which is the MRI (Magnetic Resonance Imaging) medical room in our study.

The medical MRI room is deemed critical due to several key factors. A top priority is ensuring patient safety, given that MRI machines produce powerful magnetic fields that can interact with ferromagnetic objects, posing a risk of them becoming projectiles. Failure to follow safety protocols can lead to serious dangers for both patients and staff. Exposure to magnetic fields and radio waves during MRI scans can pose health risks, especially for patients with specific medical implants or devices. In addition, the intricate nature of MRI machines requires experienced operators and careful upkeep to guarantee precise imaging and avoid any issues that could impact patient well-being. During critical situations like unexpected reactions or sudden declines in a patient's health, it is crucial for the MRI room to be prepared to react swiftly and efficiently. It is essential to ensure the integrity, confidentiality, and availability of the important medical data generated by MRI scans for accurate diagnosis and treatment. In the medical MRI room, it is crucial to prioritise patient safety, maintain technical reliability, and protect data integrity during complex medical procedures that rely on advanced technology and expertise [6].

Figure 1. Smart assistant types in a critical setting in a VR setting where participants were assigned a task to interact with all the smart assistants.

2.1. Participants

We tried to employ participants from various fields to capture the maximum variety of perceptions within a limited number. Prior knowledge, mental frameworks, belief systems, and life experiences are just a few examples of the factors that affect an individual's decisions. Societal norms, values, and practices have a substantial influence on decision-making in several aspects of life [7]. Ultimately, the combination of personal origins and cultural influences shapes decision-making and determines the choices individuals make.

These components influence how individuals perceive and comprehend information, guiding them towards conclusions that align with their existing views and ideals. Moreover, emotions and personal interactions significantly [2] impact human decisions, influencing the decision-making process. The complex interaction of these factors ultimately influences the decisions individuals make in various situations [7, 4].

2.2. Task for the participants

Prior to the study, participants filled out a Google form to outline their expectations and views on smart assistance. This proactive step was taken to gather their raw expectations and preferences without influencing their future decisions. The main objective was to gather insights into what participants imagine for a smart assistant. It asked about their current way of doing their work decision making, their level of acquaintance with smart assistants, and the tasks they hoped a smart assistant could help them with. In addition, participants were asked to assess the importance of different aspects and preferences, including voice, gender, facial expressions, personalized suggestions, and device connectivity. Overall, the questionnaire aimed to provide valuable insights into users' expectations regarding smart assistants and how they envision incorporating them into the presented scenario/critical situation.

Post-this, participants were asked to participate in the experiment, where they were asked to wear a virtual reality (VR) device, Meta Quest Pro, so that they could delve into a virtual world to interact with the different types of avatars (smart assistant) that were developed to represent the smart assistants being tested. The participants were able to see and interact with the avatars, who responded to their commands and requests, allowing them to gauge the effectiveness of the different features being tested [5, 8]. The experiment provided a hands-on experience for the participants to truly understand how smart assistants could enhance their tasks and make them more convenient.

Figure 2. Smart assistant types in a critical setting in a VR setting where participants were assigned a task to interact with all the smart assistants.

After the experiment, we had participants complete an additional Google survey, along with a semi-structured interview. This thorough approach aimed to explore participants' perceptions and expectations after their interaction with the experimental setup. The questionnaire and interview were crafted to gather detailed insights into how participants' perspectives may have changed, any fresh perspectives acquired, and whether their initial expectations were fulfilled or changed [11, 10]. Through this iterative process, the goal was to develop a comprehensive understanding of participants' experiences and enhance our insights into their interactions with the technology.

3. Data Analysis

The initial questionnaire series was designed to gather unfiltered participant perceptions regarding smart assistance with parameters like appearance, expectations, and wishes. The feedback collected will be used to refine the design and functionality of the smart assistance technology. This data will facilitate future development and improvements to better meet user needs and preferences. The ensuing data obtained from this endeavor is outlined as follows:

1) Appearance: A significant percentage of the respondents, precisely 29.4%, were in favor of the concept of intelligent assistance exhibiting human-like characteristics; conversely, a minority of 5.9% vehemently opposed this idea. Moreover, among the respondents, 35.3% expressed a preference for intelligent assistance that resembled an automaton, while 47.1% abstained from specifying their gender preference in favor of a sleek, minimalistic design. Notably, 82.4% of the participants expressed a preference for smart assistants to have a welcoming appearance. Furthermore, it is worth noting that 35.3% of the participants expressed a preference for an avant-garde and futuristic appearance, whereas 47.1% prioritized functionality over aesthetics. Regarding the incorporation of smart assistant design into the scenario space, an equivalent proportion of respondents (35.3%) indicated that a distinctive and unconventional appearance was acceptable, whereas the significance of harmonizing aesthetics was emphasized by 35.3%.

Furthermore, 41.2% of respondents emphasized the importance of cultural sensitivity and norm compliance in the design of smart assistants.

Overall, the findings of the survey highlight the wide range of preferences and factors that influence the perception of smart assistance. A considerable proportion of the participants expressed a preference for an appearance that resembled that of humans or was affable in nature, whereas others placed a higher value on functionality and integration with the aesthetics of the space. These findings show how important it is to take a variety of factors into account when creating interfaces for smart assistants, such as user expectations, cultural norms, and design functionality.

2) Expectations: Participants (41.2%) expect smart help to adapt to their preferences and behaviors over time. In terms of communication and involvement, 47.1% of participants emphasized the relevance of smart assistance's capacity to ask follow-up questions and respond coherently. In terms of privacy and security, 35.3% of respondents emphasized the importance of protecting personal information when using smart help. In terms of performance and dependability, 37.3% of participants expect smart help to regularly provide correct and dependable information.

Furthermore, the data presents multifarious expectations for smart assistance. Participants value adaptability to individual tastes, excellent communication capabilities, strict privacy and security safeguards, and constant performance and reliability [8].

3) Wish: Majority of participants (64.7%) stated a desire for the smart assistant to successfully understand and interpret their voice commands. Furthermore, 70.6% preferred that the smart assistant delivers accurate and relevant facts in response to their requests. Furthermore, 52.9% of participants emphasized the relevance of the smart assistant's natural language processing being compatible with their communication styles. Furthermore, 47.1% expressed their anticipation that the smart assistant's comments and recommendations would be useful. Furthermore, a sizable proportion (70.6% of participants) believed that the smart assistant effectively adapts to their tastes and learns from their interactions. Similarly, 64.7% said the smart assistant respects their privacy and manages personal data responsibly. Furthermore, 70.6% said that the smart assistant's interoperability with other devices and platforms met their expectations. In terms of usability, 47.1% said they were comfortable utilizing the smart assistant for a variety of tasks and interactions. Finally, 58.8% of respondents expressed overall satisfaction with the smart assistant's performance and capabilities.

Overall, the aggregate replies reflect people's different wishes and preferences for smart assistant technologies. Participants value aspects such as effective voice command interpretation, precise information delivery, natural language processing alignment with communication styles, and useful suggestions. Furthermore, people value adaptability, privacy, seamless integration, usability, and general satisfaction with the smart assistant's performance.

Following the completion of the preliminary survey, participants are required to put on the device and fully engage with the virtual environment. Within this environment, users interact with a diverse range of avatars, thereby immersing themselves in interactive experiences that replicate real-life situations. By interacting with and experiencing the avatars themselves, participants can gain a more profound comprehension of their operation and the ways in which they could be incorporated into their everyday routines. Through active interaction with the avatars and navigation of the virtual environment, participants can evaluate the functionality, efficacy, and overall user experience of these simulated yet authentic entities. Engaging in this experiential process not only yields significant insights regarding the pragmatic implementation of avatars but also empowers participants to develop more knowledgeable viewpoints and inclinations through direct interaction and active participation.

Participants completed a post-experiment Google questionnaire after task completion, which served as a structured platform for them to ruminate on their experiences, provide feedback, and systematically articulate their thoughts and perceptions. The participants elaborated on their engagement with the task, disclosing their general contentment, perceived merits and demerits, as well as any obstacles confronted.

Following that, the participants were invited to participate in semi-structured interviews, which offered a further chance to delve into and obtain clarification regarding their answers to the questionnaire. The participants conveyed their experiences using their own language, which allowed us to delve deeper into aspects of interest or uncertainty in a natural conversational flow. The interviews' semi-structured format facilitated adaptability and unpremeditation, permitting the revelation of unforeseen insights and viewpoints.

By employing a combination of post-experiment questionnaires and semi-structured interviews, a more comprehensive understanding of the participants' perspectives, inclinations, and sentiments regarding the task was achieved. The utilization of this dual strategy enabled the triangulation of data, which facilitated the ability to validate findings from various sources and perspectives. Furthermore, the comprehensive and nuanced insights derived from the interviews' qualitative character served to enhance the quantitative data acquired through the questionnaire [11].

Several findings emerged based on participants' preferences and choices after completing the task:
A considerable majority, accounting for 71.4% of participants, preferred a medical dress-equipped smart assistant for the given context [4]. Additionally, 57.1% of participants expressed a preference for trusting a smart assistant that resembled a medical professional. Furthermore, 85.7% of participants indicated a preference for an adult smart assistant exhibiting emotions such as patience and empathy [9].

Participants provided specific recommendations and preferences for enhancing user engagement with the medical avatar. These recommendations include:
•   During interaction, the incorporation of head gestures and eye contact.
•   Self-introduction of the avatar.
•   Utilizing multi-modal output and allowing to view/ show question history.
•   Enabling the avatar to provide responses while interacting with the machine.
•   Enhancing the avatar's voice, macro and micro gestures, and expressions to avoid monotony.
•   Implementation of features such as showing around the room and pointing out machine details/parts.
•   Ensuring the avatar's responses are concise and tailored to user needs.
•   Incorporating realistic gestures and human-like movement to improve avatar interaction.
•   Ensuring that the avatar's height is more than me (participant) so that trust can be established and sounds authentic.

Overall, participants emphasized the importance of authenticity, trustworthiness, and effective communication in their interactions with the medical avatar [2, 4,9]. Recommendations for improvement center around enhancing realism, intuitiveness, and customization of responses to optimize the overall user experience [10]. These insights provide valuable guidance for refining the design and functionality of medical avatars to better meet user expectations and enhance engagement in future interactions.

4. Conclusion

Overall, the first set of questionnaires offered valuable insights into how participants view smart assistance, covering aspects such as appearance, expectations, and desires. The input gathered from participants is crucial for improving the design and functionality of smart assistance technology and guiding future development to meet user needs and preferences more effectively. The survey results highlight the wide array of preferences when it comes to smart assistant appearance, as participants showed different preferences for human-like features, automaton designs, sleek minimalism, and avant-garde aesthetics. Just like a diligent investigator, smart

assistance is expected to be adaptable, communicate effectively, prioritize privacy, and deliver reliable performance, meeting a variety of user needs [4].

In addition, participants expressed their preferences for smart assistants, highlighting the significance of voice command understanding, precise information dissemination, compatibility with communication preferences, flexibility, privacy, compatibility, ease of use, and general contentment. These insights highlight important areas for enhancing and advancing smart assistant technology.

After conducting the initial survey, participants were involved in immersive experiences with avatars. They then shared their feedback through post-experiment questionnaires and semi-structured interviews. Using both methods helped gain a thorough grasp of participant viewpoints, providing detailed insights that enhance numerical data.
Participants showed a strong preference for smart assistants equipped with medical attire, emphasizing the significance of trust and authenticity in these situations. The suggestions for improving user interaction with medical avatars highlight the importance of realism, clear communication, and personalized feedback.

Ultimately, the combination of participant input, hands-on experiences, and suggestions provides a clear path for improving smart assistance technology to better meet user needs and boost engagement in upcoming interactions. By integrating these findings into the design and functionality of smart assistants, we can develop more intuitive, reliable, and user-focused solutions that enhance daily experiences.

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