Including the Experiences of Physically Disabled Players in Mainstream Guidelines for Movement-Based Games

AUTHORS: LIAM MASON, JUSSI HOLOPAINEN, KIERAN HICKS, KATHRIN GERLING, PATRICK DICKINSON
SCHOOL OF COMPUTER SCIENCE, UNIVERSITY OF LINCOLN, UNITED KINGDOM
SCHOOL OF COMPUTER SCIENCE, UNIVERSITY OF LINCOLN, UNITED KINGDOM
SCHOOL OF COMPUTER SCIENCE, UNIVERSITY OF LINCOLN, UNITED KINGDOM
DEPARTMENT OF COMPUTER SCIENCE, E-MEDIA RESEARCH LAB, KU LEUVEN, BELGIUM
SCHOOL OF COMPUTER SCIENCE, UNIVERSITY OF LINCOLN, UNITED KINGDOM

ABSTRACT

Movement based games, also known as exergames, provide a great opportunity for encouraging physical activity among players. These games, however, have not accounted for users possessing physical disabilities in the existing design guidelines. Using semi-structured interviews which utilized Interpretative Phenomenological Analysis and an online survey, the guidelines previously established by Mueller and Isbister were refined, and expanded to account for disabled people, based on their various preferences discussed through the study.

METHODOLOGY

THIS RESEARCH PAPER RELIED ON **TWO** DATA COLLECTION METHODS

INTERVIEW

A semi-structured interview involving 6 participants aged 19 to 61 was conducted over **two** stages.

STAGE 1
Firstly, demographic information and individual backgrounds were used to gather perspectives and previous experiences with physical activity, and experience with movement-based games, and games in general.

STAGE 2
The second stage of the interview involved introducing game concepts through a website, using a poster and associated demonstration video containing a wizard of oz prototype and demonstrator to support it. To ensure that participants understood the concepts, follow-up questions were then asked regarding their opinions on each concept.

DATA ANALYSIS

IPA (Interpretative phenomenological analysis- "a qualitative approach that aims to provide detailed examinations of personal lived experience before moving on to more general claims"

The method of analysis chosen by the researchers, IPA prioritized the unique personal experiences to create "rich and detailed descriptions of each participant".

- Firstly, Interviews were first transcribed and read several times by the research lead
- Secondly, Important points were then recorded on each transcription
- Finally, the themes were then identified after systematically exploring the data

Online Survey

An online survey was used, which provided basic information on the study, then collected preferences on gaming and information on physical activity. To collect this information, 1 to 5 Likert scales with one being designated as high were used. Following this, game concepts were presented, and reports on their perspective of it were gathered. Lastly, the respondents were asked to compare the different game concepts to each other, giving reasons for their preferences.

Data analysis

This data was then analyzed using inductive thematic analysis. The main researcher first studied the data, coded it and then identified themes from the coded data. The themes were then reviewed and defined by another researcher before eventually being defined by all authors. The quantitative was processed using SPSS (Statistical program for quantitative data analysis) as seen below

SPSS analysis

"Respondents: Twenty-one people responded to the questionnaire (12 female, 8 male, 1 non-binary; age range 18-64; all from Western societies including Europe, North America and Australia). Sixteen respondents were active wheelchair users (predominantly manual active chairs), and length of use ranged from less than six months to more than ten years, varying between continuous and occasional use. Participants reported medium to high perceived levels of PA (M=1.95, SD=0.84), with a strong emphasis on PA participation for health benefits (M=1.85, SD=1.08). Interestingly, not everyone enjoyed PA (M=2.47, SD=1.17). Participants reported a wide array of activities they take part in, such as basketball, archery, boxing, swimming and hand cycling. Engagement with games was relatively high (M=1.9, SD=0.97, with the majority of participants playing between 7-12 hours per week. Engagement with movement based or exertion games was lower (M=2.9, SD=1.37). Example of movement-based games participants had previously played include Beat Saber [14], Pokémon Go [44], and games on the Nintendo Wii and Switch consoles. Overall, participants reported a high interest in exploring movement-based games to support PA (M=1.28, SD=0.45). "

RESULTS

The key findings of this study are separated into

THREE MAIN ELEMENTS.

Firstly, the recipients noted the importance of a meaningful individual adaptation, which would allow them to for example replace specific movements that are difficult with others. An example of this would be This allows players to each receive an adequate amount of challenge, ensuring that the game is not too trivial for more capable players, and not too difficult for others.

Secondly, the respondents view on social play was not entirely positive, as some people had physical activity experiences that were stigmatizing in nature, whereas others love the idea of social aspects in games. Therefore, careful considerations and decisions must be made when implementing social aspects into these games.

Finally, movement-based games need to be engaging first and physically challenging second, meaning that the game being enjoyable should be the priority, and the physical aspect secondary

Discussion

This paper should assist developers of exergames in creating accessibility friendly experiences for players. It can also spark further research into developing exergames for users impacted by other types of physical disabilities not explored in the paper, and lead to refinement of the guidelines mentioned in the paper.

Limitations

The paper, however, must be viewed with its limitations in mind. A limitation of this paper was the lack of fully developed exergames for the participants to use and try out. Some other notable limitations were the demonstration videos relying on a person without a physical disability and the lack of research into non-wheelchair users.

Conclusion

Movement Based Games provide avenues for physical activity, and with the findings of this paper should be better extended to disabled players. The existing recommendations require adjusting to achieve this goal, with the refined guidelines creating a good starting point for designing game features and mechanics with the nuance required for accommodating physically disabled players, of various body types into mainstream movement-based games.

That's it ☺

STYLETTE: STYLING THE WEB WITH NATURAL LANGUAGE

ABSTRACT

End-users often want to style and customize websites but lack the expertise to translate their high-level styling goals into specific code edits using in-browser developer tools. To address this, we introduce Stylette, a browser extension that allows users to modify website styles by expressing their goals in natural language. Stylette leverages a large language model to interpret user goals and draws from a dataset of 1.7 million web components to generate a palette of CSS properties and values. Users can then apply these suggestions to achieve their desired style.

METHODOLOGY

FORMATIVE STUDY
8 participants who did not have any background in web development. They had to request styling changes using natural language. The goal of this was to understand how people with no knowledge in this area navigate styling changes and learn of their challenges and patterns.

EVALUATION
40 participants were used to compare the performance between Stylette and Chrome Dev Tools.

DESIGN GOALS
Users were provided with multiple styling alternatives to choose from. This ensures that the system could handle vague requests well.

SYSTEM IMPLEMENTATION
The Chrome extension was developed that utilises Natural Language Processing and Computer Vision which interprets user requests.

RESULTS

The Natural Language for styling changes allows for accessibility to those who are not familiar using developer tools or CSS. This allows a larger range of users to participate in the design process.

Improved user satisfaction which shows that users found Stylette easier and more enjoyable to use.

Based on its Iterative Design, it provides multiple alternatives and supports iteration on changes which aligns great with iterative design principles in human-computer interactions.

DISCUSSION

Enhanced Accessibility: By allowing users to make styling changes using natural language, Stylette lowers the barrier to entry for web design. This democratises web development, making it accessible to a broader audience, including those without technical expertise.

Improved User Experience: The higher satisfaction scores reported by users indicate that natural language interfaces can make complex tasks more intuitive and enjoyable.

LIMITATIONS
While Stylette excels with simple and moderately complex styling requests, its effectiveness diminishes with highly complex or specific changes, indicating a need for future improvements.

CONCLUSION

Stylette has transformed web styling and has made it easier for users. By leveraging a large language model and a dataset of 1.7 million web components, Stylette translates user requests into CSS property suggestions, making it easier for users without coding knowledge to customise web pages. The system was found to help users perform styling changes 35% faster than traditional developer tools, and it encourages experimentation and learning through a palette of suggested alternatives.

Are Embodied Avatars Harmful to our Self-Experience?

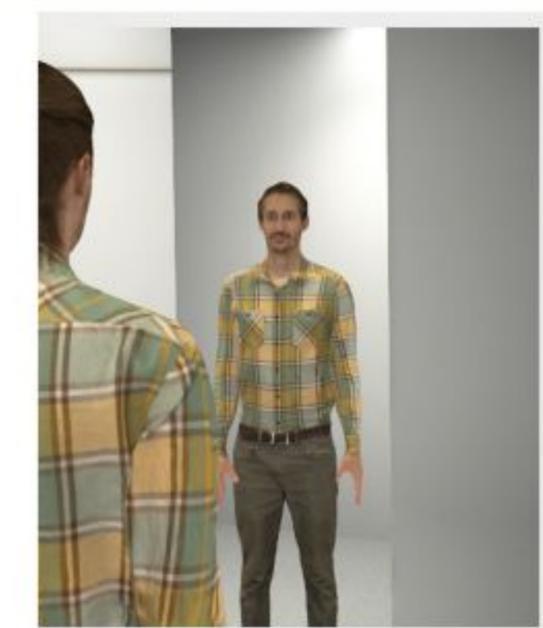## The Impact of Virtual Embodiment on Body Awareness

Authors

Carolin Wienrich - University of Würzburg Würzburg, Germany
Mario Botsch - TU Dortmund University Dortmund, Germany
Marc Erich Latoschik - University of Würzburg Würzburg, Germany
Erik Wolf - University of Würzburg Würzburg, Germany
Nina Döllinger - University of Würzburg Würzburg, Germany

Introduction

Virtual Reality (VR) allows users to represent themselves through avatars, thus influencing their body perception. While the sensation of controlling a virtual body is well-studied, the impact of VR on body awareness is less understood.

In this study, 40 participants performing moving meditation tasks in both VR and reality, findings showed VR negatively impacted body awareness, influenced by the sense of embodiment through avatars. The presence of a mirror also worsened body awareness. These results highlight the importance of assessing body awareness in VR designs aimed at mental health, as realistic scenarios can distract from users' internal bodily signals.

Objective

Discovering in environment as similar to reality as possible, with an avatar moving as congruent to physical movement as possible:

- How does VR impact on body awareness?
- Does a mirror increase the sense of embodiment and affect body awareness?
- To what extent is the sense of embodiment towards the visible body fundamental for experiencing body awareness in VR?

Methodology

Sense of Embodiment (SoE):
- Measured using the Virtual Embodiment Questionnaire (VEQ), assessing body ownership, agency, and change during and after the experience.

Self-Reported Body Awareness:
- Collected via adapted items from the State Mindfulness Scale (SMS), focusing on external/internal cues, body listening, and attention regulation.

Interoceptive Accuracy (IAC):
- Evaluated using a heartbeat-counting task, comparing perceived vs. actual heartbeats.

Control Variables:
- Included body awareness (MAIA), body consciousness (OBCS), simulator sickness (SSQ), and avatar uncanniness (UVI).

Results

Body Ownership
- No significant indirect effects between virtuality and body awareness (internal noticing, attention regulation, visual attention).

Agency
- Agency partially mediated virtuality's effect on attention regulation; higher agency correlates with better attention regulation.
- No mediation found for internal noticing or visual attention.

Change
- Significant indirect effects between virtuality and body awareness through the feeling of change:
  - Virtuality heightened the feeling of change, enhancing internal noticing.
  - Virtuality improved visual attention, mediated by the feeling of change.

Analysis

The study reveals that using photorealistic virtual bodies in VR temporarily impairs body awareness, with participants relying more on visual cues than internal bodily signals. This effect contrasts with previous research showing positive impacts of body ownership on body awareness. Personalized avatars did not improve body awareness and, in fact, reduced it, suggesting that high realism alone does not enhance internal signal processing.

The Sense of Embodiment (SoE) was found to mediate the effects of VR on body awareness. Perceived agency in VR was linked to better attention regulation, while perceived changes in the virtual body led to decreased awareness of internal signals and increased reliance on visual information. This supports the idea that external and internal stimuli compete in VR settings, with external visual signals often overshadowing internal sensations.

These findings indicate that while VR and avatar personalization can affect body awareness, the impact is complex and mediated by SoE. Designers should be cautious with mirror usage and avatar realism, focusing on maintaining user attention to internal bodily signals to optimize VR experiences for mental and physical well-being.

	Range	Mirror M (SD)	No mirror M (SD)	Mirror M (SD)	No mirror M (SD)
Sense of Embodiment (SoE)					
VEQ BO	[1 – 7]	4.82 (1.85)	4.65 (1.55)	6.26 (1.27)	5.95 (1.41)
VEQ Agency	[1 – 7]	5.76 (0.85)	5.66 (0.99)	6.61 (0.92)	6.36 (0.88)
VEQ Change	[1 – 7]	2.84 (1.70)	3.34 (1.48)	2.25 (1.28)	2.67 (1.72)
In-exp. BO	[1 – 10]	5.65 (2.58)	5.3 (2.30)	9.45 (1.32)	8.60 (1.76)
In-exp. Agency	[1 – 10]	6.00 (2.10)	6.4 (2.19)	9.60 (1.10)	8.75 (1.74)
In-exp. Change	[1 – 10]	5.30 (2.85)	5.4 (2.09)	3.55 (3.00)	3.80 (2.97)
Body Awareness					
SMS Body	[1 – 75]	3.67 (0.64)	3.60 (0.68)	3.82 (0.57)	3.67 (0.62)
Noticing External	[1 – 10]	4.55 (2.50)	4.00 (2.20)	4.65 (2.23)	4.85 (2.37)
Noticing Internal	[1 – 10]	7.10 (2.00)	7.35 (1.18)	8.15 (1.23)	7.70 (1.42)
Body Listening	[1 – 10]	6.70 (1.75)	6.90 (1.55)	7.15 (1.18)	7.20 (1.54)
Attention Regulation	[1 – 10]	6.80 (1.96)	7.25 (2.12)	8.10 (1.29)	7.45 (1.84)
Seeing vs. Feeling	[1 – 10]	6.40 (2.35)	3.70 (2.23)	5.25 (2.27)	2.85 (1.87)

Conclusion

Virtual reality (VR) can create a virtual self-representation that impacts body awareness and embodiment. Participants felt less embodied and less aware of internal body signals while using a virtual body compared to their real body. Using a virtual mirror did not improve embodiment, as it shifted focus to appearance over internal signals. The sense of embodiment influences VR's effects on body awareness. Future research should investigate the effects of less personalized virtual bodies and tasks unrelated to body movement or awareness.

Related Literature

Döllinger, N., Wolf, E., Botsch, M., Latoschik, M. E., & Wienrich, C. (2023). Are Embodied Avatars Harmful to our Self-Experience? The Impact of Virtual Embodiment on Body Awareness. CHI '23: Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems. https://doi.org/10.1145/3544548.3580918