Avatar Editor for Accessibility in Virtual Reality

INFR 4460U: Special Topics in Game Dev: Emerging Technologies

Jonathan Narine
Ontario Tech University Student
Oshawa, Ontario
jonathan.narine@ontariotechu.net

Ehren Chan
Ontario Tech University Student
Oshawa, Ontario
ehren.chan@ontariotechu.net

***Abstract*—Accessibility is an essential topic in Social VR avatar design, as it relates to avatar diversity for disability and minority representation. In the modern gaming era, the freedom to express oneself allows a player to develop a strong sense of embodiment and personal identity. While its effects on online VR social platforms are researched, little is known about potential solutions to the problem. This project focuses on the customization of VR avatars to address the issue of limited avatar diversity. It will address the issue of inaccessible design through features such as assistive device representation, body customization, and diverse skin tone settings. The process utilized was Design Thinking, which involved researching the subject and empathizing from personal experience. Through a survey, we focused on a few core desired features through opinions and suggestions.**

***Index Terms*—Embodiment, Accessibility, VR, Avatar**

I. Introduction

This project is designed to make virtual reality (VR) avatars more accessible by enabling players to customize them through character editing software. Numerous studies have found that the appearance of VR avatars has a profound impact on players' identities and immersion within games. In a 2017 study, Latoschik et al. [3] identified several psychophysical effects of virtual embodiment, including the Proteus effect (Cited in Yee and Bailenson 2007) and the IVBO effect (Cited in Botvinick and Cohen 1998)[3]. Furthermore, Latoschik et al. demonstrated that realistic human avatars generate a stronger feeling of acceptance for one's virtual body. This suggests that how players look in the game can shape their overall experience, from the sense of embodiment (SoE) to their enjoyment. Stendal et al. (2010)[3] explains that for those with lifelong disabilities, the use of diverse VR avatars allows them to access social interactions from a safe environment in their own home. Furthermore, Stendal et al [3]. stated the beneficial nature of avatar creation, as by being able to create their avatar the way they please, is that users are in control of the situation. This provides opportunities for underrepresented groups to have a digital representation that accurately reflects their self-image. Due to the perceived limited representation of diverse VR avatars (Figure 1) with VR platforms, our solution proposes an in-source character customizer with an emphasis on allowing accessibly designed avatars.

II. Methods

Before starting, one of the biggest problems we foresaw was a lack of organization or attention to scope. As we have limited time to complete this, we decided to establish a plan to keep our priorities in check. To outline our workflow, we organized our project management plan into a Gantt chart [Fig. 2]. This Gantt chart listed our major overarching tasks and key deliverable dates to be met for each task. As each time went on, the Gantt chart will be updated by the project manager to record the progress of our key deliverables.

Identifying the overlying problem and task so we could come up with a problem statement and justification was the next step on the list. Under design thinking, we must first empathize with and understand the desires of users before we can address the problem at hand. We created a survey on Google Forms to gain insight into how users of VR technology are affected by the limited personalization of their virtual avatar regarding accessibility due to disability. Our survey asked users about their thoughts and opinions on topics such as the level of customization in video games and their satisfaction with existing systems allowing for representation with virtual avatars. Additionally, the survey inquired about their thoughts on how meaningful personalized avatars are and how it affects their immersion in a virtual space. Finally, the survey asked users for examples of good or bad customization features as well as elements they would like that are currently not featured in any avatar editors or customizers.

We then used design thinking to come up with our solution based on our survey results and designed an initial prototype that would fulfill the identified needs of the user. We took note of considerations to be taken into account when designing immersive VR avatars when coming up with our solution. Through our research into academic studies, we learn that people with disabilities have different perceptions and preferences when constructing self-images via their avatars. While the option to not display the disability is available, virtual worlds can be used by people with lifelong disabilities, who may have experienced challenges in connecting with their peers without disabilities, to meet others on their terms. [4]

III. Results

From our surveys, we discovered a variety of different responses and opinions on the matter of personalizing their virtual avatar. A majority of users showed their preference towards being able to customize their character to represent them. Yet, over 50% stated how existing systems of customization are too limiting and often leave them unsatisfied as the result often ends up far from a true representation of the user. These preliminary results show how important this matter is to users and how it impacts their experience even outside of VR. From then on, we asked users for examples of elements they would like that are currently missing from existing systems which gave us a myriad of responses. Users noted how there are no options for accessories such as hijabs, and existing accessory options tend to be very limiting (only one design for a pair of glasses or wristwatch). Furthermore, there would often be no way of representing users with disabilities None of this would reflect their real-life selves which causes a disconnect in how the avatar can embody and immerse them.

Based on empathizing and defining the problem, we have identified the gap between the literature review and our ideation process. To pinpoint our desired result while staying in range with scope, we focused on a few core concepts and ideated on the most radical result from the ideas. For body customization, we thought about sculpting and the creation of asymmetrical-sized body parts. The idea of true customization, with fully editable bones that dynamically can be modified with the software. This would include the auto-generation of a rig and free-form modification for character customization. This would include avatar automation and fine-grained customization, which would allow for auto-generation and manual adjustment [5]. This would also include closed captions for all audio information, including all the settings and select options [5]. In addition, this would include conveying avatar design outcomes for VI users. A major limitation of our scope and software knowledge is the inability to provide true accessibility for utilizing the software itself. While the software allows individuals to choose from accessibility options, there is a limitation in the accessibility provided to allow those individuals to utilize the software themselves. Another limitation is the customization of textures, with customized clothing and a large variety of assets. With our limited scope and budget, we can't afford to utilize a multitude of assets in the final prototype but only show the functionality. However, by including some aspect of the radical ideation but making them into concise portions, we can finalize a finished product. The bone editors will allow the players to make granular edits to the body but will limit them to geometry present or importing new objects. The objects included will allow for unique customization and the representation of different disabilities, but not for true customization. For accessibility, we will allow one handed use of the vr controllers as well as colorblind settings for those with visual impairments.

IV. Conclusion

In summary, our findings showcased a breadth of new elements that complements the project's intended purpose. The literature review highlighted the effects of an avatar's appearance and allowed a better understanding of how it affects the user. These considerations include support for invisible disabilities, closed captioning, and facial sculpting. In addition, the design thinking process contributed to our understanding of our user base.Through the survey, our data showed a preference for true customization and a desire for control when creating avatars. This data allowed the project to expand to new features that would benefit a larger demographic. With our limited perspective, the literature review and design thinking enhanced the specifications of the project and our understanding of the topic. While there is limited documented solutions, our prototype accomplishes a unique solution that defines a new way to solve accessible design for VR avatars. For underrepresented communities, it creates an opportunity to allow users to access customizable VR avatar creation. For developers, it showcases a benchmark for innovation within the field and suggests a possible implementation within their own projects. With any luck, this project will incentive radical innovation within the field of accessibility and positively impact the video gaming community.

REFERENCES

[1] Heidicker, P., Langbehn, E., & Steinicke, F. (2017). Influence of avatar appearance on presence in Social VR. 2017 IEEE Symposium on 3D User Interfaces (3DUI). https://doi.org/10.1109/3dui.2017.7893357

[2] Kim, C.-S., Jung, M., Kim, S.-Y., & Kim, K. (2020). Controlling the sense of embodiment for virtual avatar applications: Methods and empirical study. JMIR Serious Games, 8(3). https://doi.org/10.2196/21879

[3] Latoschik, M. E., Roth, D., Gall, D., Achenbach, J., Waltemate, T., & Botsch, M. (2017). The effect of avatar realism in immersive social virtual realities. Proceedings of the 23rd ACM Symposium on Virtual Reality Sofaspectsand Technology. https://doi.org/10.1145/3139131.3139156

[4] Stendal, K., Balandin, S., & Molka-Danielsen, J. (2010). Virtual worlds: A new opportunity for people with lifelong disability? Journal ofinntellectual & Developmental Disability, 36(1), 80–83. https://doi.org/10.3109/13668250.2011.526597

[5] Zhang, K., Deldari, E., Lu, Z., Yao, Y., & Zhao, Y. (2022). “it’s just part of me:” Undone-handed avatar diveVRity and self-presentation of people with disabilities in Social Virtual reality. The 24th International ACM SIGACCESS Conference on Computers and Accessibility. https://doi.org/10.1145/3517428.3544829

APPENDICES

VR Platforms	Avatar type	Avatar Customization	Avatar Realism	Disability Representation
Rec Room				N/A
VRChat				Any uploaded 3rd-party disability features
Horizon Worlds				Hearing aids; cochlear implants
vTime XR				N/A
AltspaceVR				N/A
Bigscreen				Eye patch
Alcove				Hearing aids; cochlear implants
Half-Half				N/A
Horizon Venues				Hearing aids; cochlear implants
Villa				N/A
Arthur				N/A
ENGAGE				N/A
Multiverse				N/A
PokerStars VR				Hearing aids; cochlear implants
Spatial				N/A

Fig. 1. Overview of social VR platform and their avatar creation options [5]

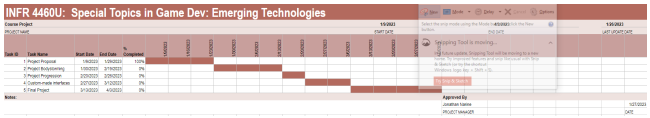

Fig. 2. Gantt chart of project timeline and overview

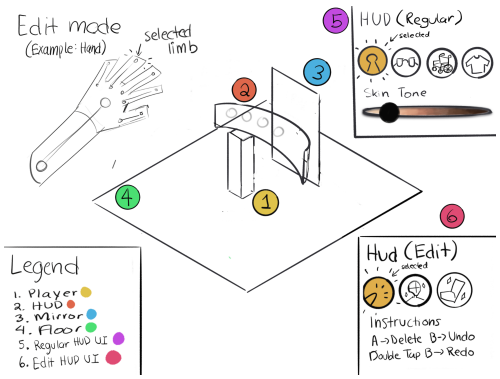

Fig. 3. Prototype Design

Statement of Contributions

Jonathan Narine (Team Leader)

Within the paper, they contributed to the abstract, introduction, conclusion, research from [1] to [5] within the paper, created the survey and drew the Figure 3. Prototype Design

Ehren Chan

Within the paper, they contributed to the write-up of methods and results. creation and overview of the Gantt chart (Figure 2), enforced adherence to the ideation process to the design thinking architecture.