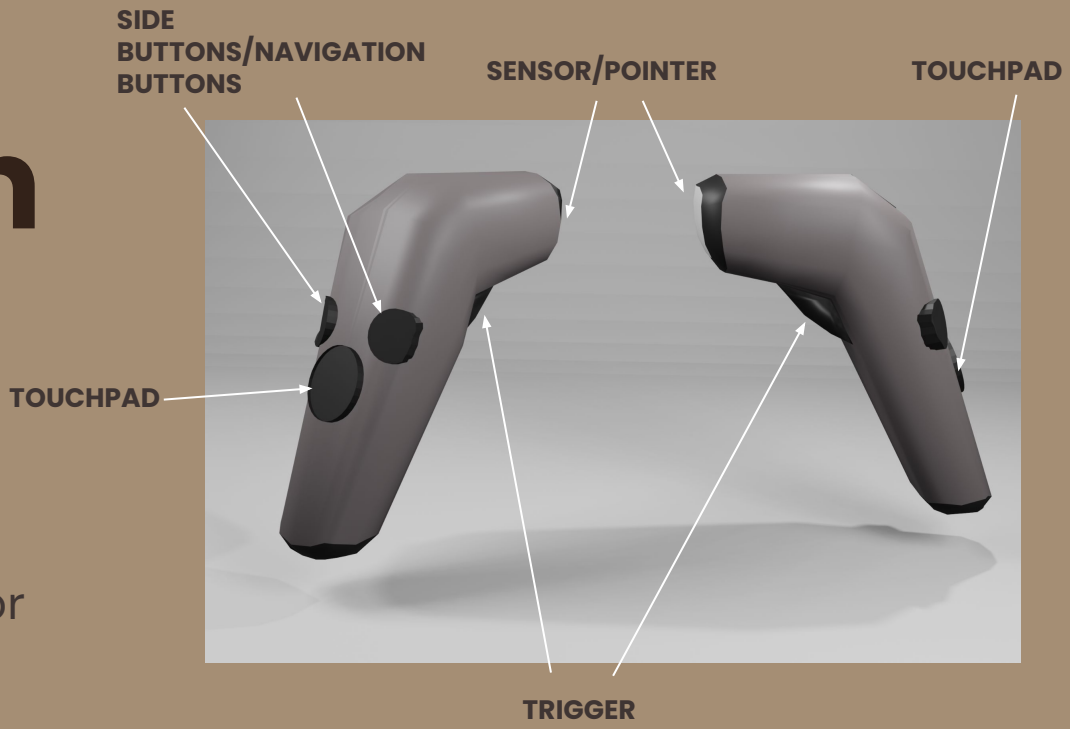
Xpression Brush

Shaan Rehsi

A VR paintbrush designed for therapy



+ + + + +

ABSTRACT

Art therapy is a useful tool to help people overcome many mental health disorders such as anxiety and depression. As a result, there have been a number of studies exploring the implementation of Virtual Reality (VR) as a therapeutic tool for those who suffer from mental health struggles.(Riva et al., 2019) Although VR is already being utilised by psychotherapists, it is fairly new in the field of art therapy. VR allows a person to have an interactive experience in a computer-generated three-dimensional (3D) environment. (Haeyen, S., Jans, N., & Heijman, J. 2021)

When used for art therapy, VR can produce collages, in which images or selected parts of images are used, cut and attached to new work. This new work can be used to share the feelings of the VR user, allowing for the expression and reconnection of different components of the human psyche (Hinz, 2019). This highlights the benefits of VR, it can communicate feelings such as anger, guilt, and confusion.

The VR Paintbrush aims to create an immersive environment for users to be able to paint and create however they choose. They are then able to discuss their feelings and ways of coping with their therapist.

The VR Paintbrush is operated with a head-mounted display (HMD). Users will hold onto the brush controllers and will be guided through an art therapy session. Throughout the session, users are free to create and alter their work using an integrated menu in the VR space while therapists can also access the same menu via an app. A live screening on a monitor will show the user's designs which can also be recorded and accessed in future sessions. The use of immersive displays and control tools in VR can further increase the level of user interaction with the system. (Fahmi, F., et al, 2020)

USER GROUPS

MENTAL HEALTH SUFFERERS

The main demographic would be those facing mental health issues such as panic disorders, schizophrenia, social anxiety/anxiety disorders(SAD), as well as people suffering with trauma and post traumatic stress. Difficulties with interacting in the world are part of many people who face these issues, and recovery would concern being presented with these issue and how they would think, react and respond differently. When working with VR, users are aware they are not in real life situations and therefore have more control over their environment; this allows for extra thought over these certain fears and an ability to try out different strategies. The progress from VR session can then be transferred to real-life situations. (Freeman, D, et al 2017)

ADOLESCENTS

SAD is the third most common mental health disorder after depression and substance abuse, with lifetime prevalence rates of around 12%. Studies show that 90% of all cases occur before the age of 23 and it most commonly emerges adolescence(Kessler et al 2005). Furthermore, a survey, conducted by the Faculty of Education at the University of British Columbia research information and communication technology (ICT) competency related to age of students. This study concluded that younger individuals were more likely to incorporate technology into their learning environment(Autry and Berge, 2011). In order to combat mental health issues from progressing, it is important to work through the issue as early as possible, which is why young people would benefit the most from this product.

PERSONAS

Megan: Aged 14

Problems: Negative body image, social anxiety

Megan is distressed at school most days due to feeling as though she can't fit in with her peers resulting in a strong sense of loneliness. She reports feeling overweight in her body (although she is slender), and usually wears baggy clothing.

Goals for session/Needs: Feeling more confident in herself and gaining a better understanding of how to communicate her feelings.

Likes: Musical Theatre/Dance

How this product will help: Megan's therapist could use her interests in dance and movement, to introduce her to the XpressionBrush. Megan's therapist may guide her around the room and in the virtual space. This will allow Megan to become familiar with the product.

Megan's therapist could then use XpressionBrush to channel Megan's creativity and discover more how she feels in school. This can then lead to conversations about Megan's emotions and how to address these feelings.

Jack: Aged 18

Problems: Depression, struggles with balancing emotions, such as anger

In Jack's first few years of school, he integrated well but exhibited hypersensitivity and had outbursts of anger when he did not get his way. Jack is worried it will continue to affect his adult life and prevent him from making friends at university.

Goals for session/Needs: Gain healthy coping mechanisms, lower his anxiety level, raise his self-confidence

Likes: Gaming and films

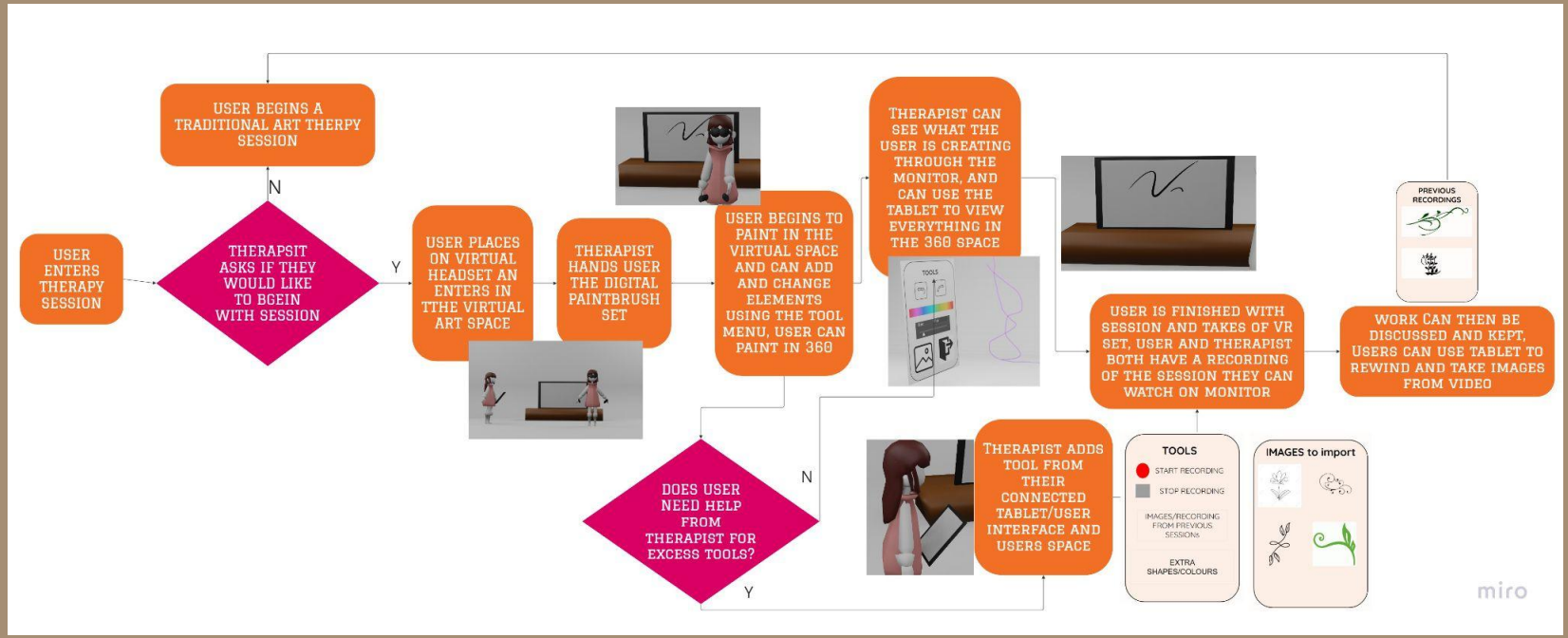
How this product will help: Jack is already familiar with VR due to his interest in gaming and enjoys art. As he struggles to discuss his emotions and feelings, Jack can use XpressionBrush to create art. Jack's therapist can review Jack's art and begin to have conversations with him to better understand how he's feeling.

Jack and his therapist can then work together to review Jack's art and suggest ways Jack can address his struggles.

USER JOURNEY

Important to factor in how the client may want lay out their therapy session e.g. client may want to have verbal therapy before or after using VR.

Here is how a Therapy session integrated with VR would run:



RESEARCH & IMPORTANCE OF ACCESSIBILITY

Many people with disabilities often struggle with the accessibility of technology and often struggle to have the same opportunities as able-bodied people do. 'Virtual Reality technologies have an opportunity to integrate accessibility as a fundamental, developing cross-industry standards and guidelines to ensure high-quality, inclusive experiences that could revolutionize the power and reach of this medium.'(M. Mott et al) There are many possible elements and needs to consider when creating an accessible prototype of a product, especially when it come to VR. Iterative design is an important step in HCI (human-computer interaction), where usability and accessibility needs are considered from the start of the design process. Unfortunately, concerns related to smaller user parties, such as people with physical disabilities are disregarded, thus, resulting in inaccessible user experiences. (M. Mott et al, 2019)

PHYSICAL DISABILITY

'A physical disability is defined as a limitation on an individual's physical functioning.' This limitation may regard mobility, dexterity or stamina. (Maggiorini, D et al 2019). To illustrate, a user with physical limitations using a controller, may not be able to enter specific inputs (or combinations of them) due to inability to press multiple buttons or be able to move between certain buttons ar a quick enough pace. This can create a frustration experience for the user.

LOW VISION & HEARING DISABILITIES

Current VR applications on the market do not support people who have vision impairments or are blind, however, more research is being conducted to try and allow more accessible options for this user group. (Zhao, et al, 2019, May) Microsoft Research released an application named SeeingVR which allows the addition of metadata to alt text in VR. This allows for objects to be described aloud, aiding those with visual disabilities. Haptic techniques such as the rendering of certain objects could also be used for those with visual impairments such as ShapeDisplay. Additionally, metadata with transcribed text for audio content could aid those who are hard of hearing. (M. Mott et al, 2019.)

APPLICATION DIVERSITY

By making VR accessible, it allows for new application areas to emerge such as; skill development, rehabilitation, and other needs of people with disabilities. Examples include, VR supporting travel experiences for people who are homebound or even allow rehabilitation for people who have restricted motor abilities; they are able to perform physical therapy at home and monitored remotely using VR. There are many other therapy tools that could be integrated in VR other than art therapy such as Mirror Box. A users limb maybe absent or motion-restricted (i.e., due to amputation) but could be felt as functional by observing the healthy counter-limb as seen in a mirror; this has been proven to reduce phantom pain and create steps for recovery. Gestalt therapy is also a potential field for VR in which a patient might provide or self-counseling to themselves through a variable time-space inside VR. (Mott, M., et al, October 2019) This proves many potential pathways for the future of VR therapy.

VR APPLICATION 3D USER

VR applications often present users with 3D user interfaces which is easy to understand as well as being accessible for able-bodied users and is often less accessible than traditional 2D user interfaces such as desktop and mobile systems. Studies on the accessibility of current VR systems to people with a range of abilities are important for progressing technology. VR applications often contain 3D interfaces, and can also include voice and gaze-based interaction. These elements can cause limitations for many people with disabilities such as low vision and people hard of hearing and needs further investigation. For example, research into certain interaction techniques with controller design that provide additional stability and control by lowering the need for accuracy, could make virtual objects easier grab when improving 3D interfaces. (M. Mott et al, 2019).

Design Influences

Figure 1. Student using VR to create art Source: ://www.uwplatt.edu/news/students-create-virtual-art-using-google-tilt-brush

I started looking at current VR art controllers in the industry and discovered Google Tilt Brush to be a similar influence to my idea
I wanted to include a standard HMD headset and controllers similar to Tilt brush

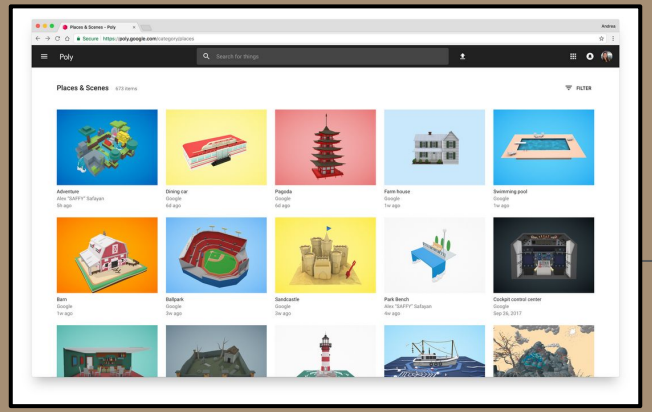


Figure 2. Google Poly Website Features Source: https://blog.google/products/google-ar-vr/poly-browse-discover-and-download-3d-objects-and-scenes/

Tilt Brush also had an add on website where the user could add additional 3D objects into the VR space which I thought was a good idea to create more collaboration between the therapist and user

I liked having an integrated tool section and menu page in the VR space rather than using a controller
It would be easy to navigate using a simpler controller and less buttons for users to need to understand

Figure 3. Tool Menu: Source: https://vrautism.wixsite.com/edtc/instruction-for-construction-use

This is a similar design for the menu that I would like to integrate into the design
A therapist could also have access to this menu using the app in real time

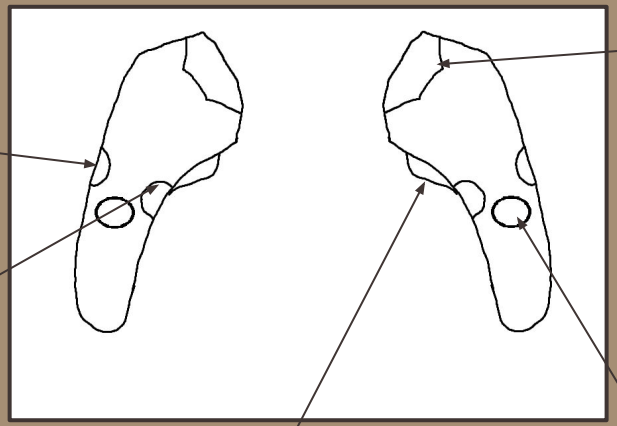
+

Initial Design Plan & Accessibility

When creating a product that would benefit many people mentally, it's important to make sure it is as accessible as possible in order to increase inclusivity. The problem with VR, that there can be many limitations for people with physical and motor disabilities. Through my research, I started to design an initial prototype that could be beneficial to those who may struggle more with physical actions.

Left

Right



SIDE BUTTONS:
Participants in a study described challenges with reaching, and pressing buttons controllers. Additionally, the size of the controllers was an important factor: "I click on this [button] I press both [buttons] at the same time, even though I only intended to press this." Participants also expressed concerns about interactions that required them to press and hold buttons simultaneously. (Mott, M., et al October 2020).

My controller does not require multiple buttons pressing. There are minimal buttons(three). The two side buttons are for navigating menu. buttons on the side close to users grip, so menial movement of fingers is required. For users with mobility issues, the sensor on the front can be used to navigate menu.

The buttons are sensitive to force; they do not have to be held down to be activated to ensure user who find buttons challenging a relief.

PAINTBRUSH SENSOR:
Large flat square surface area which makes it easy for users to point at screen and control. As researched, the larger surface area relaxes precise pointing and allows for less pressure accuracy for user control and an overall simpler user experience.(Mott, M., et al, October 2019)

TRIGGER BUTTON:
Used for grabbing objects such as images. Only one trigger button is required in order to grab an objects to allow for users who struggle with pressing multiple or pressing buttons simultaneously.

TOUCHPAD:
In an investigation of the accessibility of Google Glass a touchpad input system was created to control the device. This was to see if there was an improvement for users with motor disabilities such as Parkinson disease due to an inability to perform tap gestures. (Mott, M., et al, October 2020). Less buttons require a more accessible user experience.

CONTROLLER INFLUENCES & INITIAL SKETCHES

Figure 4 HTC VIVE Controller Source: https://vrautism.wixsite.com/edtc/instruction-for-construction-use

Originally I wanted the design to be similar to a real art brush. I wanted only one hand to be used. However upon research many VR controllers use both hands. Many current ideas on the market consist of a separated controller.
I liked how the Oculus Rift design looked but there are limitations to its accessibility; the buttons are close together and small.

I liked the simplicity of the design of the Google Tilt Brush and the touchpad would be easier to navigate

Figure 5. Oculus Rift VR Controller https://www.roadtovr.com/new-oculus-touch-enter-button-detailed-in-latest-oculus-pc-sdk-1-6-release/

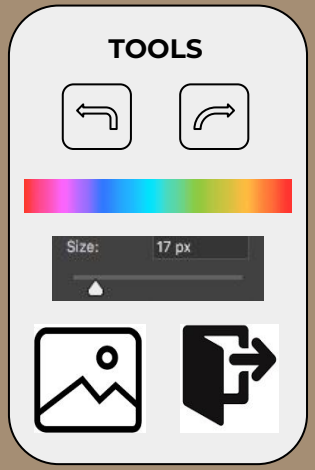
Figure 6. Designer: Yonghwan Kim Source: https://www.yankodesign.com/2018/05/02/reimagining-the-joypad-for-vr/

This controller has a thicker radius which would enable users to have a move comfortable grip when holding the controller.

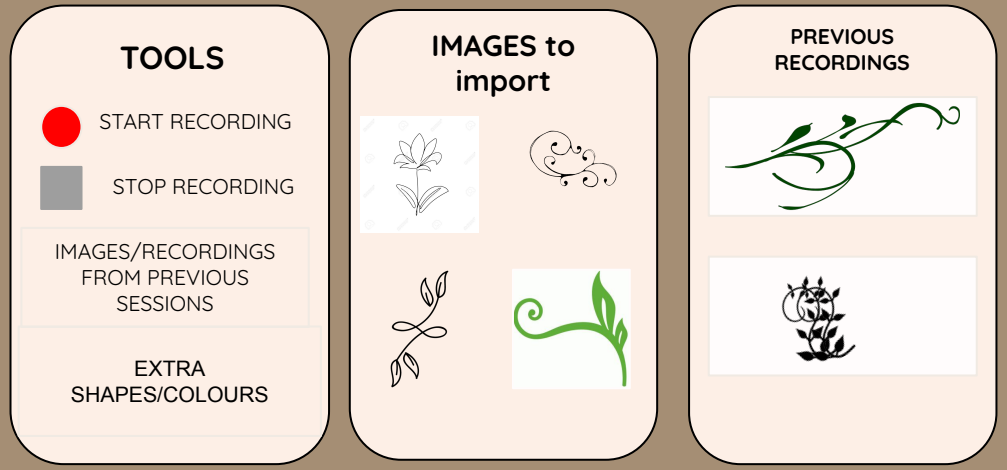
I started sketching how I wanted my controller to look using the influences I researched and add to my initial design idea.
I was unsure where the touchpad would go for the easiest use. experimented with the controller having a smooth circumference or not, as some users struggling being able keep a grip on controller or buttons (Mott, M., et al October 2020). I also experiment with the shape of the sensor; I was inspired by Kims design (see figure 6) as the the flat shape of the sensor allows for a larger surface area, resulting in the lesser need for pointer accuracy by the user.

WIREFRAMES

USER MENU INSIDE VIRTUAL SPACE



THERAPIST MENU

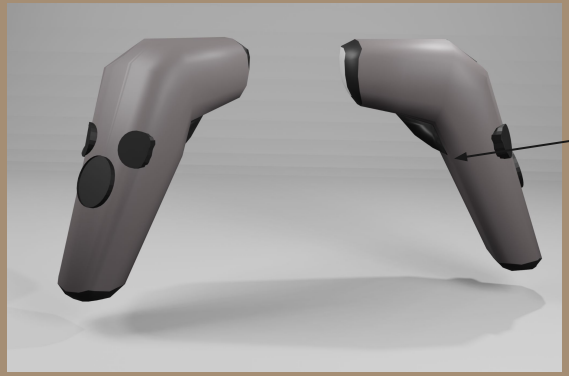


The design takes influence from the Tilt Brush tool menu that is also integrated into the virtual space. Large buttons on menu that are spaced apart allow for easy navigation for people with motor issues, such as tremors, as well as easy readability. The simple design and minimal buttons means it is a quick menu to understand and allows easy communication between the user and therapist. The menu consists of redo and undo buttons, an option to add images, and options for colour changing and brush changing. The exit button easily available incase a user requires a sudden exist from the experience.

The therapist has a user interface link to the VR headset. It is a simple application that not only is used to control the recording of the session, but also enables therapist and user to collaborate and communicate on the users art experience. In A case study, a user would work silently through the Therapy session which resulted in the therapist feeling 'secluded' from the patient. (Shamri Zeevi, L. 2021) This application increase chance of collaborative work between the two, which will improve the relationship and allow the user to get the maximum experience out of the session. Additionally, the recordings also give the opportunity for more discussions and users can carry on work from previous sessions if elements were not finished or spoken about enough.

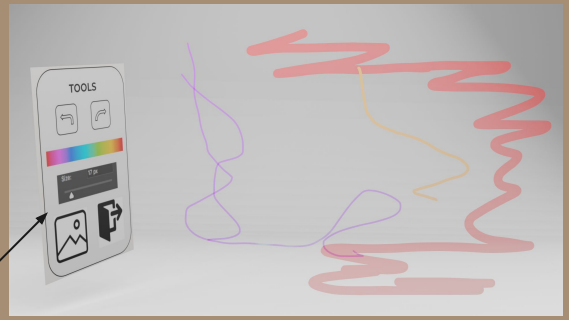
When therapist presses import image, the image will appear in the middle of wherever the user wearing the headset is looking. The user is able to drag and draw over the image however they choose to do so.

PROTOTYPE & SETUP



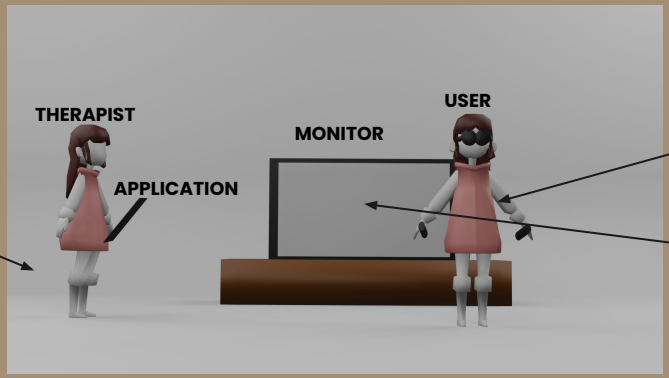
I began modelling my final prototype design on blender. I kept the colours simple, with the buttons contrasting from the main body of the controller. Here is what the product would look like if it was to be created.

Here is what first person view of a users virtual space may look like. As you can see, the menu tool of a user is large and accessible on the screen. The drawings appear next to the monitor anywhere the user is facing when drawing.



+
+
+

The therapist is able to view the user, monitor and has an the application on an interface in front of them. They can add elements onto the monitor as the application is connected, and keep track of what is happening via the monitor. A discussion is therefore able to occur.

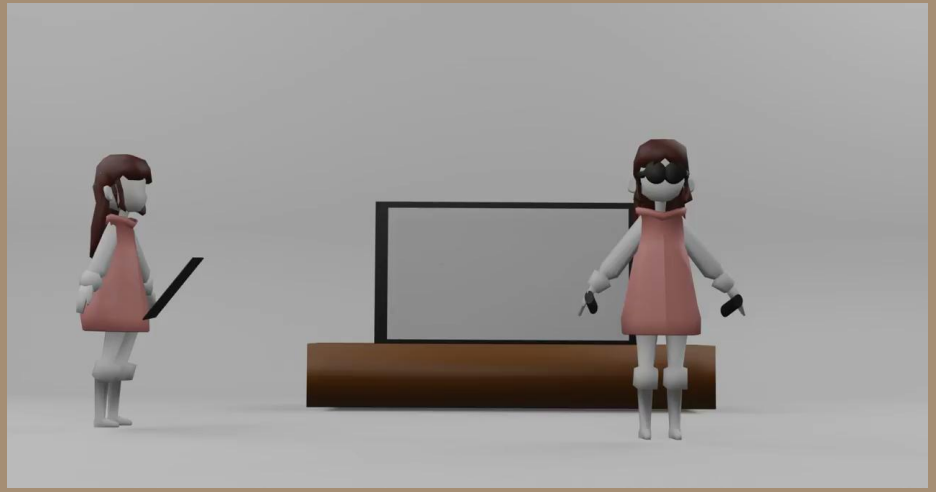


Here is what the layout of a therapy session may look like:

User has headset and is holding both controllers while navigating and creating in the virtual space.

The monitor displays the users work, that the therapist and will be able to view during and after the session. User is able to see their recorded work after session, after they take of the headset.

DEMO

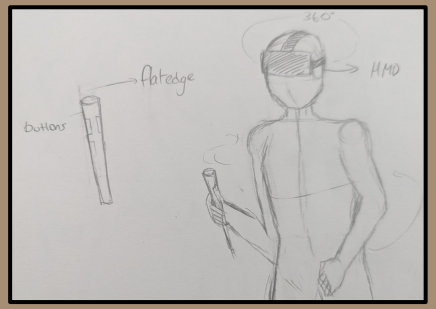


In the video above you are able to see a live example of how a therapy session may look and the the controllers in action. As you can see, as the user user moves the controllers, a drawing is shown on the monitor. The monitor is showing what the user is seeing in the virtual space.

In the below video, is a 360 degree 3D view of how the finalised prototype will look.

DISCARDED IDEAS

The original idea was a brush style controller
It would have been cone shaped - the flat edge would have been where the brush would aim
It would have two buttons on either side to navigate
I liked this idea as I wanted the user to feel creative
These ideas may be difficult to hold after a period of time as they are thin which requires a tighter grip
This would also make the buttons harder to reach and click. I wanted a touchpad in my controller so the design needed to change. These ideas may be difficult to hold after a period of time as they are thin which requires a tighter grip. This would also make the buttons harder to reach and click.



POSSIBLE IMPROVEMENTS & LIMITATIONS

- Accessibility could be developed, in the future, the design could be improved by creating more haptic functions for those with visual impairments. An example could be, users being able to feel what they are drawing.
- I would also like to create an extended controller design for those who have trouble holding their arms up for long. An additional rest could be incorporated.
- The ability to customise the input buttons on the device would also increase accessibility for users. For example, users may prefer more or less sensitivity when pressing buttons. An integrated app or another button added to the tool menu will allow users to alter buttons to their preferred needs.
- One of the limitations of the VR brush is that some users may not be receptive to using art therapy, for example, they may not think they are good at art. However, the VR tool is used as a medium for users to express their feelings. Therefore, it doesn't matter what they produce and their therapy will help them overcome this
- Sessions could also potentially be made completely virtual, the user and therapist may not have to be in the same room which could be useful for users who are homebound. More research and testing would be required to ensure layout would be successful.

BIBLIOGRAPHY

- Autry, A., and Berge, Z. (2011). Digital natives and digital immigrants: getting to know each other. Industr. Commercial Train. 43, 460–466.
- Benko, H., Holz, C., Sinclair, M. and Ofek, E., 2016, October. Normaltouch and texturetouch: High-fidelity 3d haptic shape rendering on handheld virtual reality controllers. In Proceedings of the 29th annual symposium on user interface software and technology (pp. 717-728).
- Fahmi, F., Tanjung, K., Nainggolan, F., Siregar, B., Mubarakah, N. and Zarlis, M., 2020, May. Comparison study of user experience between virtual reality controllers, leap motion controllers, and senso glove for anatomy learning systems in a virtual reality environment. In IOP Conference Series: Materials Science and Engineering (Vol. 851, No. 1, p. 012024). IOP Publishing.
- Freeman, D., Reeve, S., Robinson, A., Ehlers, A., Clark, D., Spanlang, B. and Slater, M., 2017. Virtual reality in the assessment, understanding, and treatment of mental health disorders. Psychological medicine, 47(14), pp.2393-2400.
- Freeman, D., Reeve, S., Robinson, A., Ehlers, A., Clark, D., Spanlang, B., et al. (2017). Virtual reality in the assessment, understanding, and treatment of mental health disorders. Psychol. Med. 47, 2393–2400.
- Google, S. (2022) Painting with Tilt Brush - Tilt Brush Help, Google. Google. Available at: https://support.google.com/tiltbrush/answer/6389712?hl=en#:~:text=On%20your%20painting%20controller%2C%20slide,make%20the%20brush%20stroke%20larger. (Accessed: November 27, 2022).
- Haeyen, S., Jans, N. and Heijman, J., 2021. The use of VR tilt brush in art and psychomotor therapy: An innovative perspective. The Arts in Psychotherapy, 76, p.101855.
- Hinz, L. D. (2019). Expressive Therapies Continuum: A Framework for Using Art in Therapy. Abingdon
- M. Mott et al., "Accessible by Design: An Opportunity for Virtual Reality," 2019 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct), Beijing, China, 2019, pp. 451-454, doi: 10.1109/ISMAR-Adjunct.2019.00122.
- Maggiorini, D., Granato, M., Ripamonti, L.A., Marras, M., Gadia, D. (2019). Evolution of Game Controllers: Toward the Support of Gamers with Physical Disabilities. In: Holzinger, A., Silva, H., Helfert, M. (eds) Computer-Human Interaction Research and Applications. CHIRA 2017. Communications in Computer and Information Science, vol 654. Springer, Cham.
- Mott, M., Tang, J., Kane, S., Cutrell, E. and Ringel Morris, M., 2020, October. "I just went into it assuming that I wouldn't be able to have the full experience" Understanding the Accessibility of Virtual Reality for People with Limited Mobility. In The 22nd International ACM SIGACCESS Conference on Computers and Accessibility (pp. 1-13).
- Riva, G., Baños, R. M., Botella, C., Mantovani, F., and Gaggioli, A. (2016). Transforming experience: the potential of augmented reality and virtual reality for enhancing personal and clinical change. Front. Psychiatry 7:164.
- Zhao, Y., Cutrell, E., Holz, C., Morris, M.R., Ofek, E. and Wilson, A.D., 2019, May. SeeingVR: A set of tools to make virtual reality more accessible to people with low vision. In Proceedings of the 2019 CHI conference on human factors in computing systems (pp. 1-14).