European Project Semester
Games & Media

A Virtual Reality experience to raise awareness of obstacles and barriers people with disabilities face

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Introduction

The current report is intended to follow the development of the European Project Semester that took place during the Winter Semester 2022/2023, by the students of the Game & Multimedia team.

The proposed goal of this project was to design a virtual reality application that increased the awareness of obstacles and barriers people with disabilities were facing in specific environments. The secondary goals consisted of: focusing on the perceptions of persons with visual disabilities and showing ways to realize a more accessible environment.

Regarding technologies, the application would be developed for Oculus Quest 2 using Unity and integrate video documentaries and edutainment elements.

As such, the team proposes the development of a VR experience consisting of two elements:

- A video interview, telling the story of 3 characters with disabilities, with the intention to inform users about each disability by describing what it is, the obstacles and challenges that come with it as well as behaviors that are harmful and how to correct them and be more considerate. The characters and interviews are fictional but based on real-life research, people and interviews conducted by the team.
- An interactive environment based on the St. Pölten UAS, where the user will take on the role of one of the disabled characters with the goal of performing daily tasks. There will be two parts to this experience: navigating the university - with the purpose to face some of the obstacles exposed in the video interview, as well as learning about special accessibility features in the building - and performing various leisure activities - to show that despite the daily struggles, disabled people can enjoy the same hobbies, albeit with some adaptations.

Concept

The first project concept we were asked to come up with to present to our stakeholder was a modular approach with the base idea of a “Task Oriented Day In the Life”, consisting of two game modes (solo or co-op) both with three options of disabilities to be showcased (motor impairment, visual impairment or dyslexia).

For the solo mode, the main idea was to perform the same daily tasks, first as an able-bodied person and then as a disabled person, in order for users to experience the many difficulties that disabled people face and be able to have a good term of comparison.

The feedback received was mainly around the possible misinterpretations of comparing able-bodied to disabled people, as it could signify that able-bodied is “better”, as well as only “victimizing” disabled people and stripping them of their personality and “normal” aspects of their life.

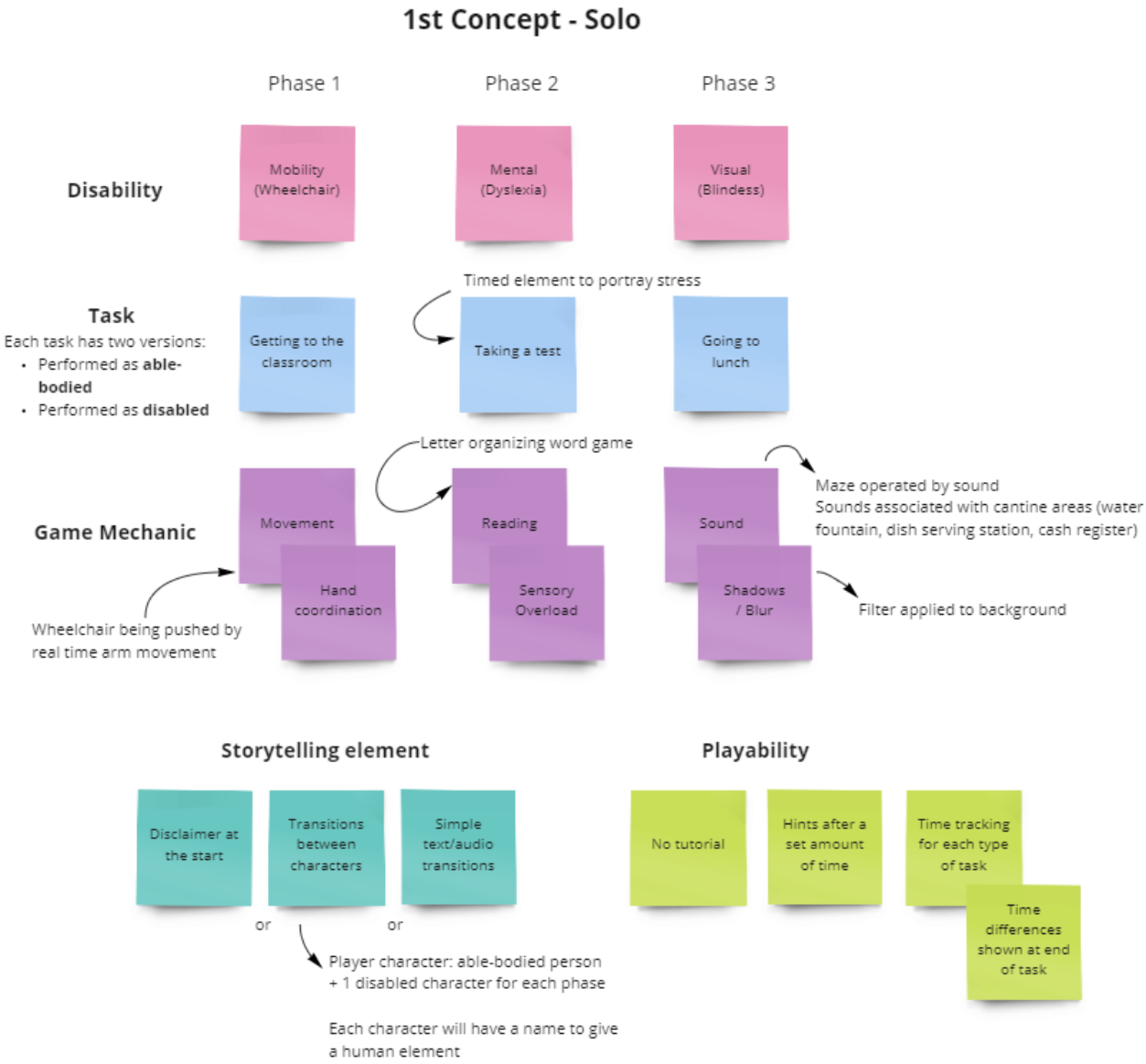

Diagram for the first project concept

For the co-op mode, the main idea was for the game to be played in pairs, with one person using the Oculus headset, playing the disabled person role, and another acting as a guide and helping navigate through the environments by giving instructions, handing objects, collaborating in a quiz, etc. This idea was meant to help people understand not only the daily struggles but also learn how they can and should help in an interactive way.

After receiving feedback, this idea was scrapped based on the complexity of implementation.

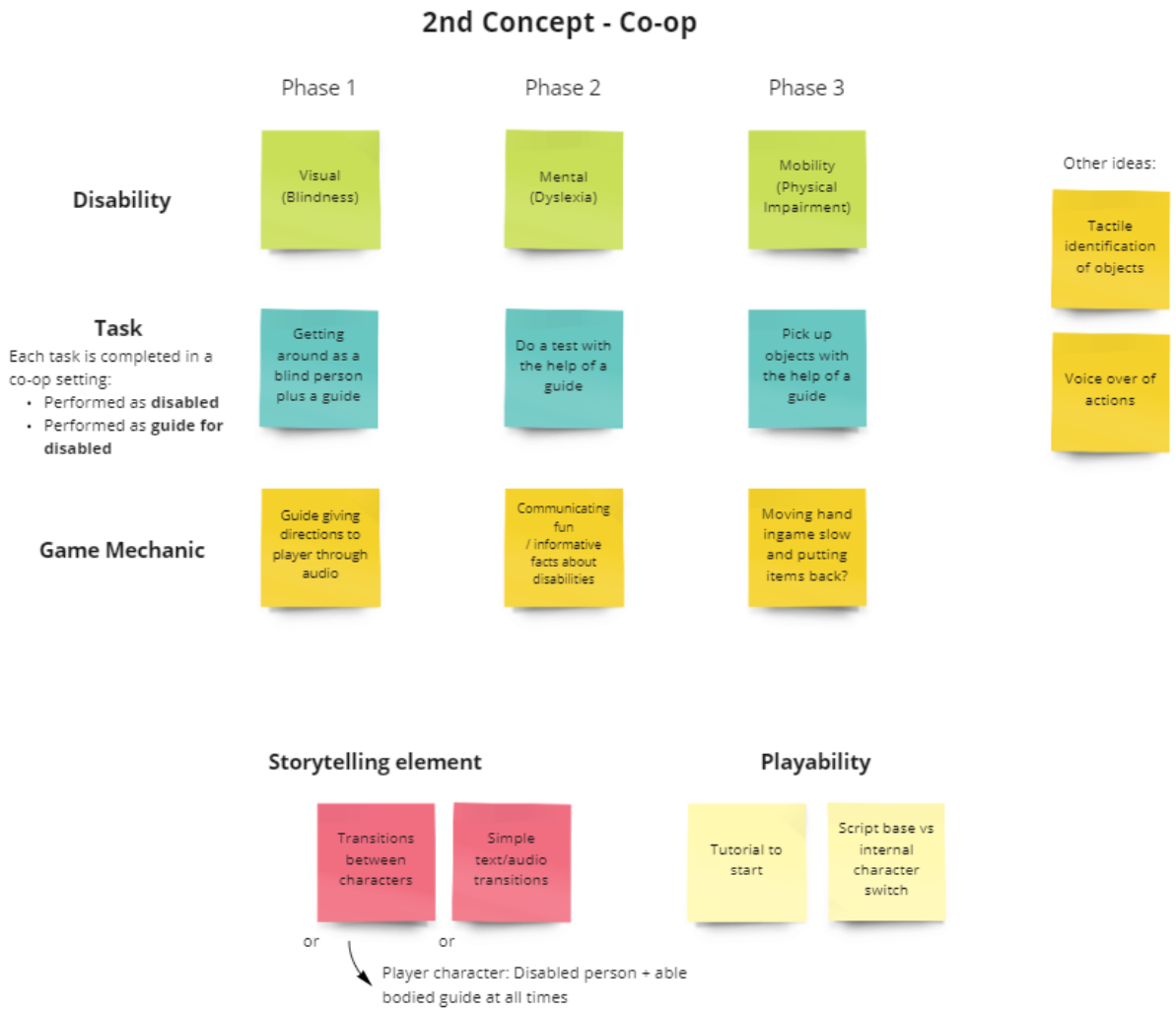

Diagram for the second project concept

Once both concepts had been presented, the team gathered the issues and suggestions and decided to explore the “solo” approach, building on the first concept to reach our final one, with the following changes:

- Replaced the sequential character progression - in which a user had to go through the 3 disabilities in order to finish the game - to a character select logic - in which each playthrough only accompanies one character/disability and the user then has the option to replay the game and choose a different character.
- Added video interviews at the start of each character path, to satisfy project requirements and give a stronger personality and connection with the story.
- Implemented a similar structure across all character paths, by sharing objectives and environments, with the appropriate particularities.
- Added a sandbox environment at the end of each playthrough in order to make the game more enjoyable and “normalize” disabled people as individuals that are able to enjoy and perform many fun daily activities like everyone else.

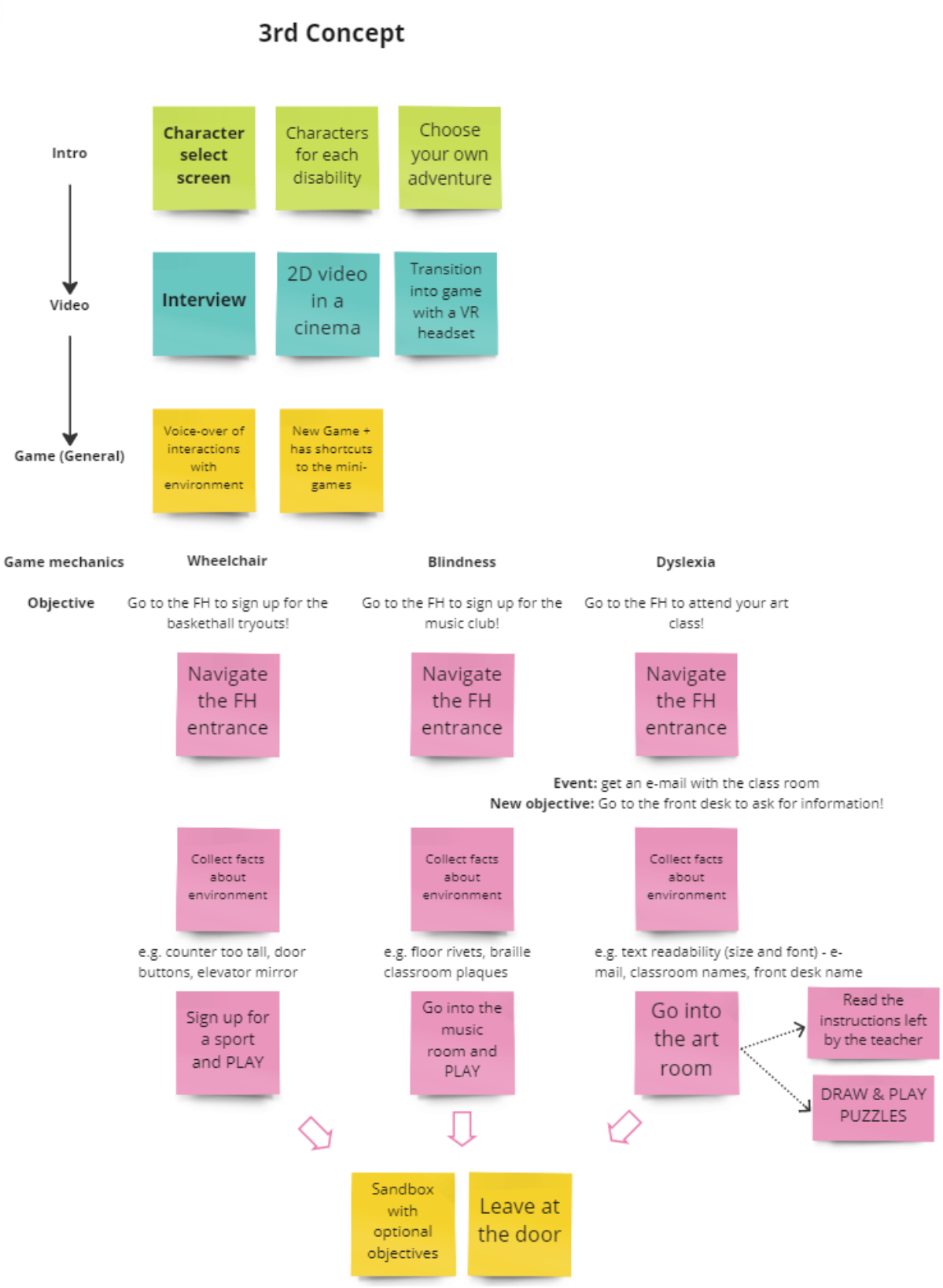

Diagram for the final project concept

This concept also includes the possibility of playing in a physical setting, using a clear area of space to move on your own and using real-life objects such as a wheelchair or a blind

stick. This option was idealized for showcasing the project at the project vernissage, to allow for a more interactive experience, with less motion sickness and increased ease of movement for people not familiar with VR.

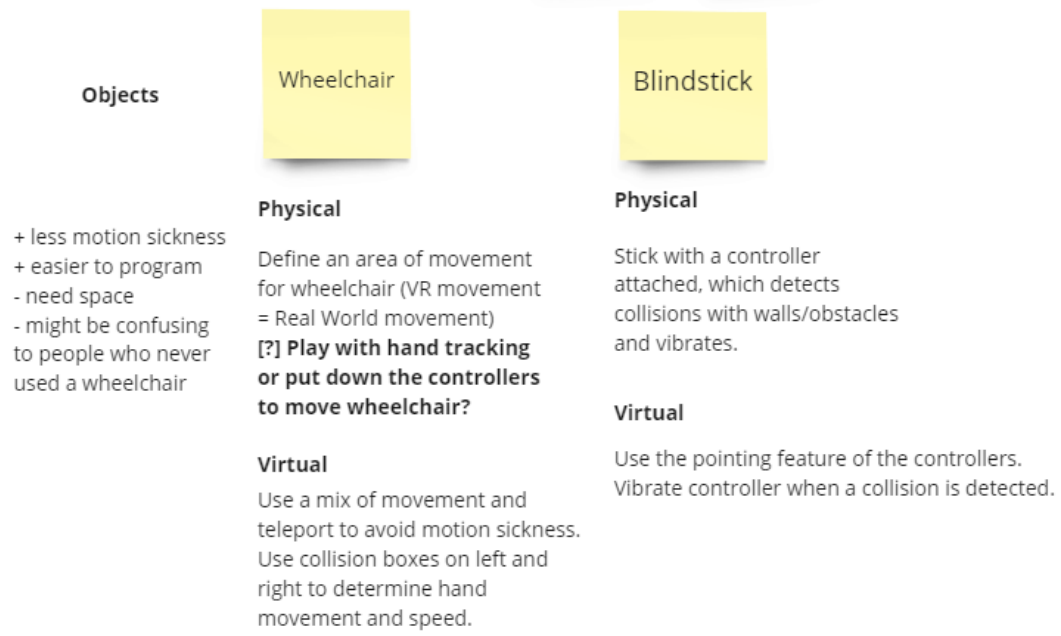

Diagram for the final project concept - Objects section

Special Considerations

Before the start of development, there were some considerations and decisions that influenced the design of the project:

Framework

The team was faced with the choice between two VR frameworks at the start of the semester: Virtual Reality Toolkit (VRTK) or XR Interaction Toolkit.

Ultimately the choice fell on VRTK, since it was a low-code solution with simpler concepts, making it the most beginner friendly. It also had a demo environment already built into it which we could use as our base to build upon.

This proved very beneficial at the start of the project, allowing us to start “playing” with environments and make some progress early on.

However, soon the disadvantages became apparent, since the framework had little to no third-party tutorials available online, forcing the team to rely on the very few official tutorials that showcased the tool's features but not any workarounds or customizations.

We also found that, since the framework was built to be very simple, it either lacked or underdeveloped a lot of features that would be useful to the project, which had to be implemented from scratch - such as scene loading/transitions, teleporting, player barriers, etc.

With the current experience and knowledge about VR, the team would have chosen the XR Interaction Toolkit, aware that it would drastically slow down development at the start of the

project, but would make for faster development towards the end, with more reliable and unique mechanics.

Previous project work

Another decisive factor was the research done on previous EPS projects, particularly the VREPS project, which was also a VR solution set within the St. Pölten FH. Since our team did not have anyone with skills in 3D modeling, we tried to design the game in order to take advantage of the previously created environment.

Available physical space

Since the final project conceptualization, available space was a concern. Before beginning development, we had to ensure an area big enough to comfortably navigate the virtual environments. The team had to define minimum measurements and appropriately scale the 3D environments. Later on in the development though, we were able to develop a solution independent of measurements in order to preserve the realism of the university proportions.

Budget

Our budget consisted of five categories that we deemed crucial to the success of our project, which included: 3D models, audio sources, equipment, software and other. We leaned towards the safer side in our budget because we had not necessarily begun our process yet while this task was completed. In total, we asked for €1,500 and we were accepted for that amount. Up front, we were given €750 to begin the process of our project.

At the time of submitting our budget, we had only one Oculus Quest 2 headset and were unsure of any school-issued Adobe licensing at our disposal. However, shortly after submission we received two more Oculus Quest 2 headsets from the university and received confirmation that the school provided us access to use Adobe products. Also, we sent out a few emails and were able to rent a wheelchair from the nursing department for the duration of our project. These findings immediately became a giant cost saver as we now had an additional €868 as unneeded funding.

In the developmental side of our project, we were looking into 3D assets and audio but we needed really specific items to match our theme and look original to the FH. We used a website called Sketchfab, which is a great resource of free and paid assets and as the project went along, the free assets at our disposal fit more into our theme than the paid ones did. We also had previous assets at our use that we were unsure if we would be able to use which covered a lot of our asset-finding process. Plus, when a specific object was needed, we created it ourselves in Blender.

The actual costs we accrued over the semester included compensation for actors, purchasing batteries for our controllers, purchasing a blind stick as a prop for filming and purchasing team T-Shirts to make us look unified at the Project Vernissage. In total, we spent €202.31 during the process of our project.

Category	Description	Vendor	Cost	Justification
3D Models	Models of various people, a basketball court, a gym building, a classroom, various animations)	Unity Asset Store	150,00€	The 3D virtual reality environment must be populated with various objects to make it feel realistic. While some of the assets will be designed by our team, it is not possible to design every single item due to time constraints.
Audio	Royalty free sound effects and music library	Sounds nap	125€ (6 month license)	To make the environment realistic we also need various sound effects such as the sound of a door opening, footsteps, ambient noises, etc. The team does not currently have audio designers therefore all audio will have to be acquired online.
Equipment	USB 3.0 to USB-C cables	Amazon	33,00€ (3 units)	Cables necessary to connect the Oculus Quest 2 hardware to the development PCs for testing purposes.
	AA Batteries	Amazon	15,00€ (pack of 20)	Batteries necessary to power the Oculus Quest 2 controllers.
	Oculus Quest 2	Media Markt	449,00€	The team considers it necessary to have at least one unit of the Oculus Quest 2 permanently during the semester, for development, which cannot be guaranteed by the renting department of the FH.
	Wheelchair	Amazon	185,00€	Physical element to be used in the project presentation. We intend to create a controlled environment for people to sit and control an actual wheelchair (instead of a virtual one) while experiencing the virtual application.
Software	Editing software license	Adobe Creative Cloud Student	234,00€ (1 year license)	The Adobe license will be used to generate any necessary 2D assets (Photoshop/Illustrator) such as avatars and UI elements and to edit video footage (Premiere Pro).
Other	Catering, travel expenses,	–	309,00€	Includes various travel needs to conduct interviews or capture video

Cost estimation for the project

Berichtsformular (Abrechnung Förderstipendium)

Um uns die Abrechnung zu erleichtern, ersuchen wir Sie, die Belege fortlaufend zu nummerieren und hier in diese Übersicht einzutragen! **Bitte legen Sie auch dieses Dokument Ihren Berichtsunterlagen bei.**
TIPP: Bitte achten Sie auf eine vollständidge Dokumentation und Berichtsabgabe. Beachten Sie zusätzlich dazu die am eCampus veröffentlichte **Checkliste für die Berichtslegung.**

Projekttitel: YES, WE CAN - A VR Disability Awareness Experience

Studiengang EPS Game / Media

Übersicht Rechnungen/ Belege:

NR:	Kurze Erkärung	Summe in €
1	Actor compensation	52.25
2	Batteries for three Oculus Quest 2	11.99
3	Actor compensation	16.75
4	Blindstick prop for game / filming	15.96
5	Six T-Shirts for Group for Project Vernissage	105.36
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	Gesamtkosten des Projektes in €	**202.31**

Zugesagte Förderung:	
Gesamtkosten:	202.31
bereits erhaltene Summe	750
offener Betrag in €:	**-547.69**

Actual cost list for the project

Team

Diana

Scrum Master, Lead Programmer and Developer

Diana was responsible for the team organization according to the Scrum framework, by setting up a schedule of events, such as Sprint Planning, Daily meetings, Backlog Refinement and Sprint Review & Retrospective, enforcing the execution of those events, leading team discussion and consequently registering the results in Jira (our project tracking software).

As one of the project leaders, along with Logan, Diana was a spokesperson for the team, actively taking responsibility for presentations to teachers and stakeholders, as well as being part of the two-person pitch given at the project vernissage.

As a programmer and developer, Diana set up the project structure in Unity as well as the Git repository used for version control throughout the project. She also implemented the main mechanics of the game that, due to being very specific or, even when available as out-of-the-box solutions by the framework, not working correctly, had therefore to be programmed from scratch, such as:

- Custom movement mechanic to be used with a virtual wheelchair, which simulated gripping the wheels and rotating them.
- Custom text effect to be used in the dyslexia game mode, which simulated letters “jumping” around according to research conducted.
- Custom UI highlighting script to be used with the instruments in the music room, which followed a sequence of notes related to a song.
- Custom triggers for voice lines, of three different types: Location-based, Timer-based and Event-based.
- Movement via teleportation, in order to mitigate motion sickness (not functional in VRTK).
- Snap zones when using objects (such as a basketball), for easier interaction with the environment (not functional in VRTK).
- Scene loading and transitions using a fading animation.
- Functional mirror rendering in real-time.

Finally, Diana was responsible for building/compiling the game’s code and testing its mechanics and environments, always reporting the latest features to the team, while also receiving and registering user feedback, which, in turn, was used to polish the game and ensure its quality at all times.

Logan

Product Owner, Project Leader, UI Designer, Sound Designer, Game Environment Designer and Developer

Logan was responsible for the general framework of the team and handling things such as communication between the professors and stakeholder and relaying the information back to

the team, helping assign tasks during Scrum, being responsible for the team budget, and registering for the Project Vernissage. He and Diana worked closely as team leads on the entire project.

As a UI Designer Logan created the general color and typography theme of the game, the menu system, the template in which the UI character is placed, the positioning and timing of the UI characters and the refinement of the instruction screens. He spent time creating such UI in Figma which would then be exported into Unity and placed into the project.

As a Game Environment Design, Logan was responsible for the creation of the basketball court and movie theater from the ground up. Additionally, creating the interior decoration in the menu, FH entrance, basketball, theater and classroom environment. As well as creating the outside environment in each scene to help create a more immersive feeling. All these tasks included looking for assets that fit the theme in SketchFab and if a certain object was needed, using Blender to create an original. He also was in charge of the lighting in every scene.

As a Developer, Logan was responsible for creating the animations and shooting mechanics in the basketball scene, consistently refining environments as needed, creating the framework for the videos and UI to be placed in Unity, acquiring props for filming, finding actors when needed, arranging the recording of voice lines, refining voice line script, recording gameplay footage, producing the gameplay trailer, conducting user testing and game sound design and placement.

David

Media Tech and Narrative Creator

David was the main cinematographer of the group. He was tasked with producing and managing the filming aspects of the project along with Jana. In addition, he handled the managing of the filming equipment, with Christoph Böhm’s supervision. He also wrote the main script with Ysabel's collaboration. He additionally created a few rough trailer concepts with Avid Media Composer and Adobe Premiere Pro.

Ysa

UI/UX Designer, Sound Designer and Developer

Ysa’s responsibilities included designing user interfaces and title cards for the VR experience, collecting and editing environmental sounds for the game, co-writing the video film script as well as early development of characterization. Other responsibilities included designing a call for actors, as well as acting and voice acting in one of the main character roles for the experience. She also wrote the disclaimer text to be displayed before the experience begins, and contributed to the design of the instruction cards.

Ysa designed the user interfaces by first creating rough thumbnail sketches of how the character selection page or instructions may appear. Using this rough thumbnail, several variations of these pages were prototyped and voted on by the group, until the final design was chosen and later iterated on. With a vast experience in audio and podcasting, Ysa carefully selected the final sounds that are heard in the game today by testing them and

editing seamless audio loops from segments that don't interrupt the environment or gameplay. Ysa also designed a poster for the final presentation, highlighting the internationality of our students and the VR aspect of our experience.

Nico

3D Modeler and Developer

Nico designed and created the FH entrance area in Blender from the ground up. For a lot of the scenes we already had something we could use and just edit for our purpose, but we did not have an existing model of the FH so Nico was assigned to create one in Blender and later put it into Unity and fill it with props, light and textures. He also took on some simple scripting tasks for some props of the FH in the entrance scene.

Jana

Media Tech, Post-Production Producer and Video Sound Designer

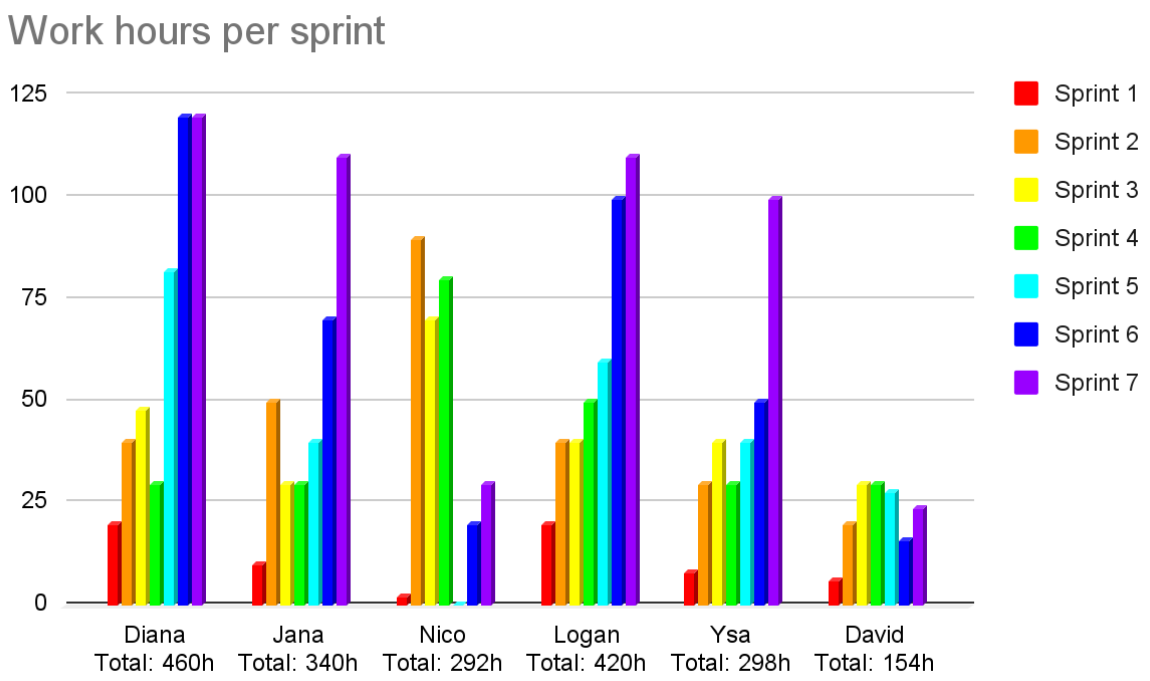
Jana assisted in the filming by giving directions and was also responsible for the complete post-production. For this process, Adobe Premiere Pro was put into use, which she already had experience with. For the small interviews, which give a short impression of the related impairment and introduce the mini-games at the same time, Jana was responsible for finding suitable actors.

She also took over the first design tasks of the entrance of the Fachhochschule by finding the building plan and started to roughly plan and transfer the building on Blender. In addition, she always recorded the work processes with her phone to eventually produce the making of video. She was also responsible for the post-production of the voice lines.

She was always willing to put on the VR glasses and give concrete feedback and also kept involving outstanding people to do so too.

Finally, the pitch was written by her and presented together with Diana. She was also responsible for procuring and purchasing the matching printed shirts that unified the team's look for the project vernissage. The stand in the final vernissage was planned by Jana and prepared with purchased supplies.

Time management and workload distribution



More detailed information, such as tasks assigned per sprint and exact number of work hours per sprint can be found in our scrum diary.

Development

Research

The first week of the project was dedicated to researching the three disabilities chosen for the project, in order to support the conceptualization process. It involved compiling interviews, articles and information from people with each disability and finding insights into the following topics:

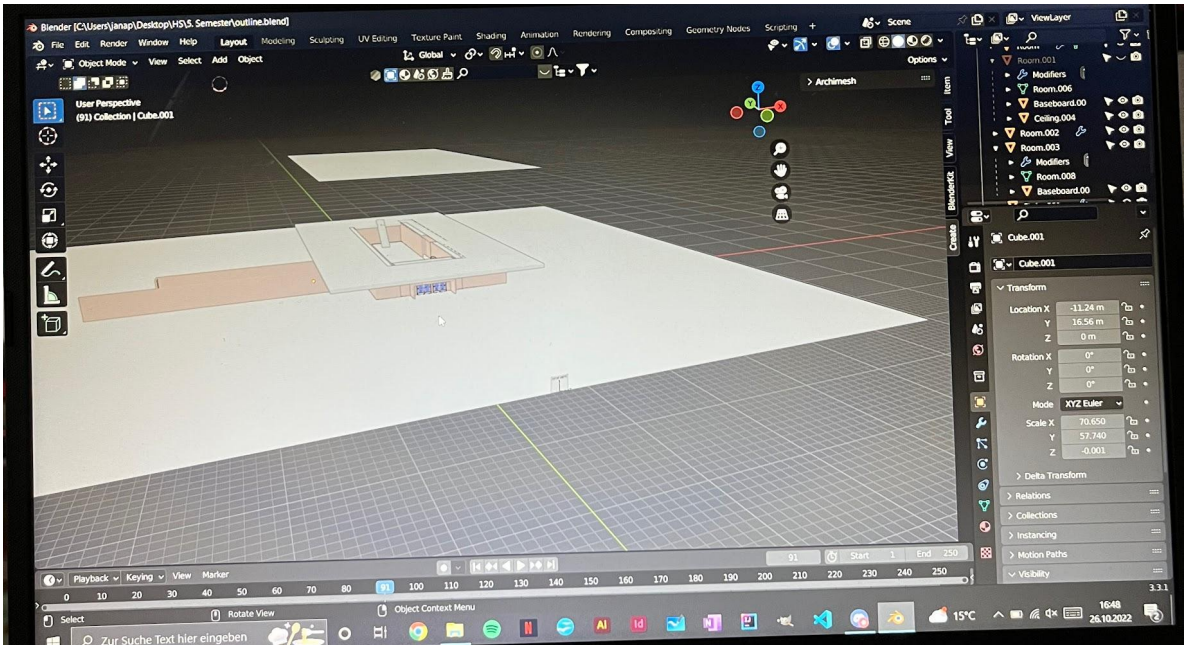
- Getting to know the disability;
- Difficulties of having the disability;
- Advantages (if any) of having the disability;
- What other people see/think;
- How other people behave/should behave.

From this research, we were able to ascertain important aspects that were included in the final game such as the artistic tendencies of dyslexic people due to being good with shapes and patterns, or the musical vocation of blind people due to their heightened sense of hearing, as well as curiosities like elevators having mirrors for wheelchair users to be able to back out of the space safely or the specific fonts or background colors that most impair dyslexics.

Assets

Since the team chose to have the St. Pölten FH as their main location, replicating the university environments became a big focus. Luckily, we were able to recycle 3D assets from previous projects - like a general classroom and an audio room - but were missing the iconic entrance of building B. For roughly 2 months of the project's development, Nico (the member responsible for 3D modeling) took on the job of bringing the FH entrance to life.

At the beginning of the project, a lot of reference pictures of the building were taken and building plans were secured and used as inspiration to create a rough outline in Blender.

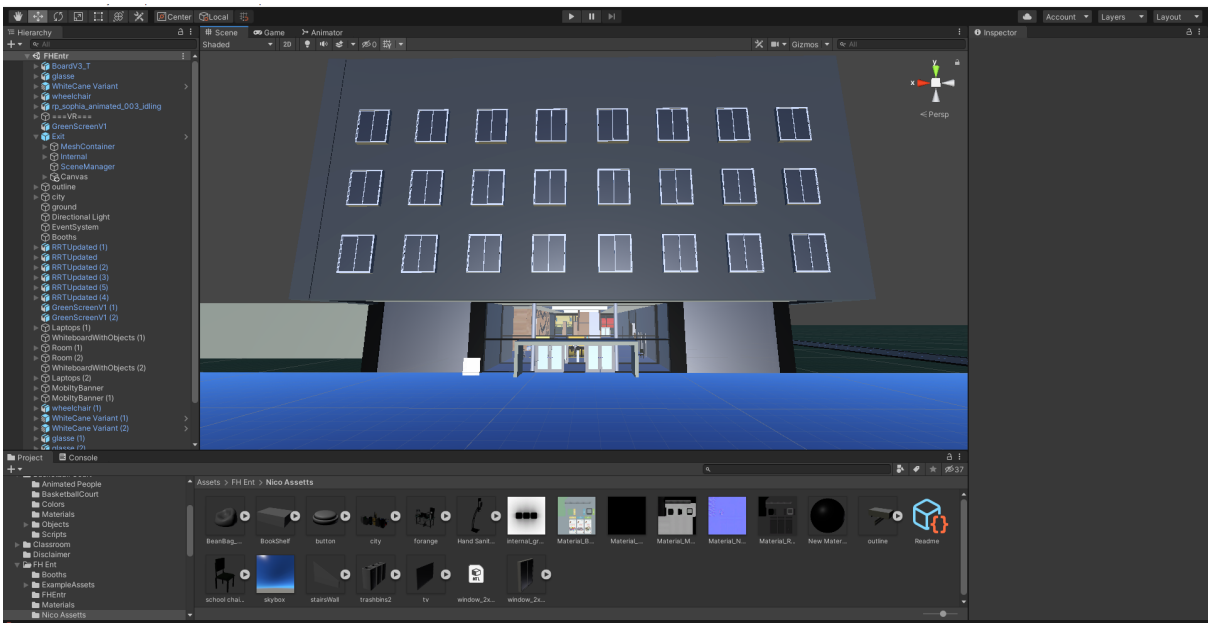


Rough outline of Building B

After the rough outline was done it was time to give the walls and props some color.

In the next sprints, it was time to put the rough outline into Unity. Lighting sources and the first textures were added at this time as well. This task was met with many complications since Nico was not very experienced with Unity and also had to experiment with the different file types of 3D objects Blender could export a project as, and which one was best to work with in Unity.

After this, it was time to start placing more objects in the scene to make it more detailed. Also some walls and the layout has been changed slightly at this point to make the FH entrance look more realistic. A minor script for the entrance door opening animation was added at this point as well.

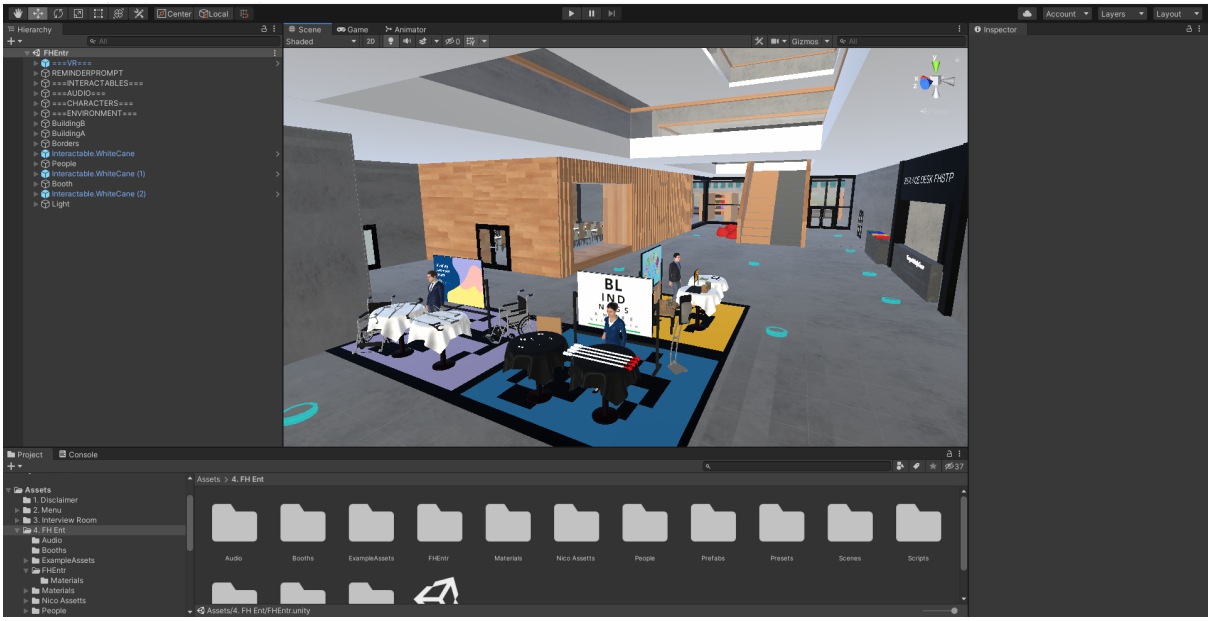


Detailed entrance of Building B

After the interior was a little bit more detailed, the exterior got a little bit more life too. An Asset pack with trees, cars, roads, buildings, etc. was used to give the outside of the FH more detail. This was necessary, as the player starts outside of the university right in front of the entrance and is able to look around.

Inside of the building, rooms the player could look inside but not access, like the library, were also given more detail by placing shelves, chairs and tables. Also, a lot of glass walls were added to the front and backside of the FH to match the glass-heavy architecture of the building and to make it look more realistic and interesting.

Outside view of the final model of Building B

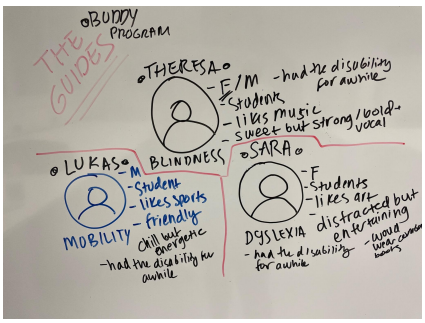


Inside view of the final model of Building B

Narrative Development / Script Writing Process

For the character conception, the research about disabilities was implemented by channeling it into three final characters. Thanks to Ysabel's previous experience with character creation, it was possible to approach it in a way that gave each character-defining traits and passions. The principal manuscript was made with the software Celtx.

About the directing approach, it was necessary to make something that flowed alongside what was needed for the game without taking away the focus of it. For this reason, it was decided to organize the video part as small, isolated interviews that acted as an introduction to the characters and their particular situations. This decision was tied up with the game by making the player see each interview in a simulated theater environment before each respective playthrough.



In creating a VR experience about disabilities, we knew that we had to approach the topic carefully and respectfully. Our first narrative draft included experiencing a day-to-day life with barriers first as an able bodied person and secondly with a disability. With careful review and feedback, we reformatted our experience to highlight the barriers someone with disabilities may face and not the disability itself, as well as focusing on their strengths and passions.

With our three disability tracks in mind, we developed three characters with distinct personalities and interests based on the mini-games each track would offer. We did this by creating small bullet point lists and brainstorming together on a whiteboard what makes each

character unique and how we could bring their personality across through in-game dialogue or actions.

Filming and Post-Production Process

For the interviews, we looked for actors in Austria who already had a bit of experience in that field. For this purpose, calls were started in Facebook groups, for which actors of all ages signed up. The adults were very interesting, but not fitting for our interview, which should be played by students. Unfortunately, we were promised, yet no more responded to it or even showed up to the film set. Finding acquaintances, who would like to be actors in our project was desperately needed. Fortunately, friends of the team members and one of the team members agreed to participate.

The majority of the filming process took place at the ground floor of St. Pölten's University. The equipment was lent days before the actual filming.

Care was been taken to ensure that the background was filled with daylight and there were no people and background noise in the recording to create a credible and reputable image, which is the reason why the filming took place at 8 in the morning on Sundays.

Setup for the first session of filming

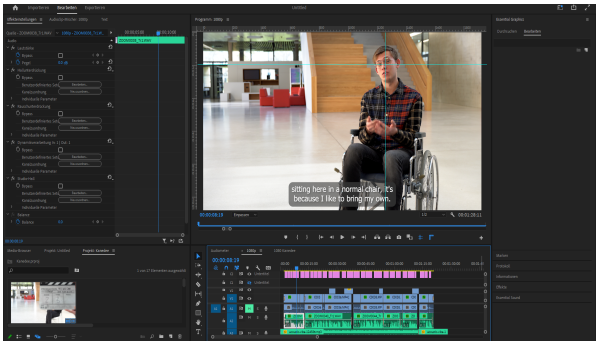
Christoph was entitled to lend certain equipment for a longer period of time, which was in our favor for filming the B-rolls, as we spread it over several days as a precaution.

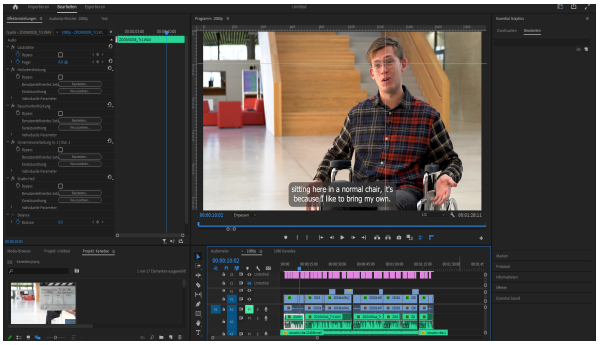
For filming the B-rolls, an attempt was made to hold this directly after filming the individual interviews. Due to long delays and the spontaneity of putting inexperienced actors, it quickly became dark outside, which we wanted to avoid having in the video. All filming took roughly 5 non-consecutive sessions in total.

Only Adobe Premiere Pro was used for post-production. The goal was to cut a one-and-a-half minute video from the footage without losing important information. It was made sure to shoot the footage in 4k quality, so that zooming into double the image when editing the video losing quality will be avoided.

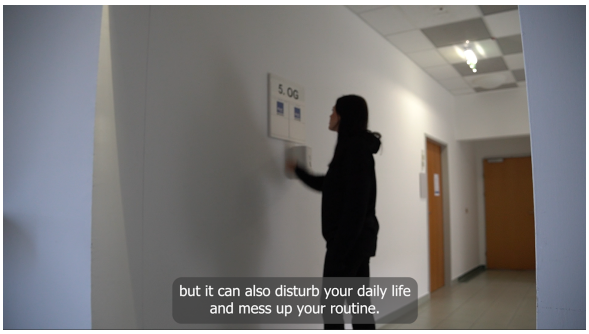
It was noted that the cuts were too jumpy. Christoph supported the production by pointing out to work with guidelines so that the eyes would stay at about the same height in the jumps cuts, which was immediately implemented in the final videos.

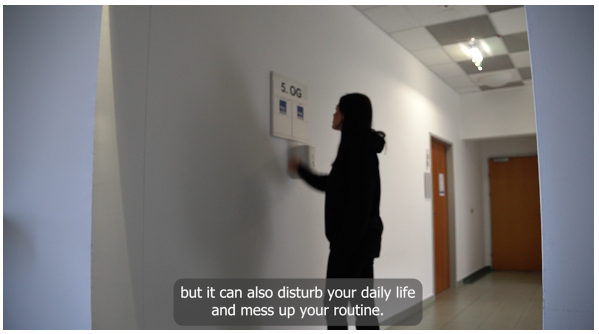
A discussion was made to not put on background music to point out the speaker more. Nevertheless there were some noises appearing in the background while watching these in the game, which were suppressed with quiet background music.





Example of smoother jump cut with guidelines



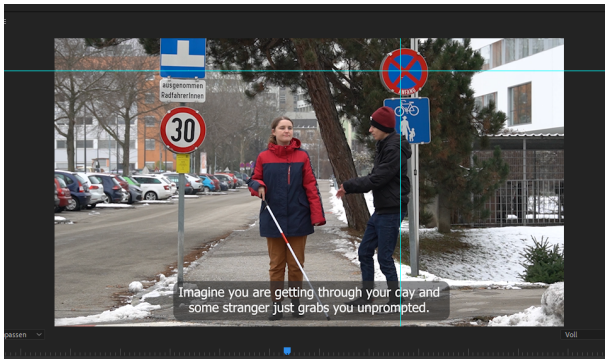


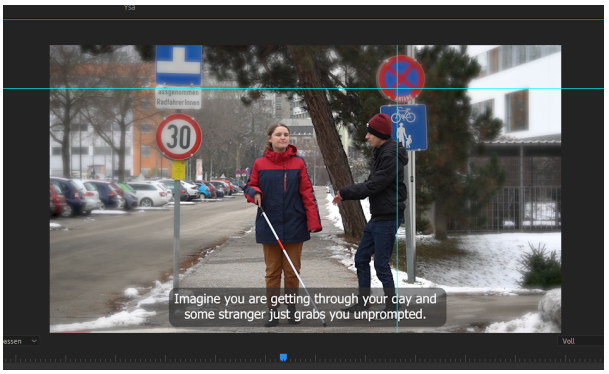
Example of a sharpened scene

Since not enough effort was put into the filming of the B-rolls, some essential scenes were extremely blurry, which we attempted to make less noticeable. Unfortunately, the sharpened and unsharpened effects collided in Adobe Premiere Pro, resulting in noise.

This was used as discreetly as possible to still achieve a better result. Therefore, it is all the more important to review the footage directly after shooting to avoid creating additional work for the post-production members.

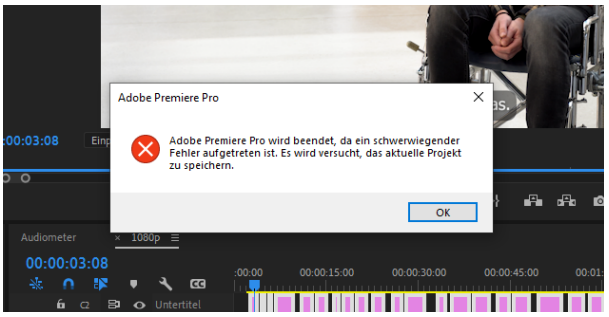
In some shots, the team's film director didn't pay close attention to the surroundings, so there were colorful street signs that drew attention to themselves rather than the actors. For this reason, the colors were toned down and a vignette effect was applied to roughly darken the perimeter of the actors. Since this didn't make a massive difference, a blur was also pushed over, making the result much more vivid.





Example of scene before and after post production

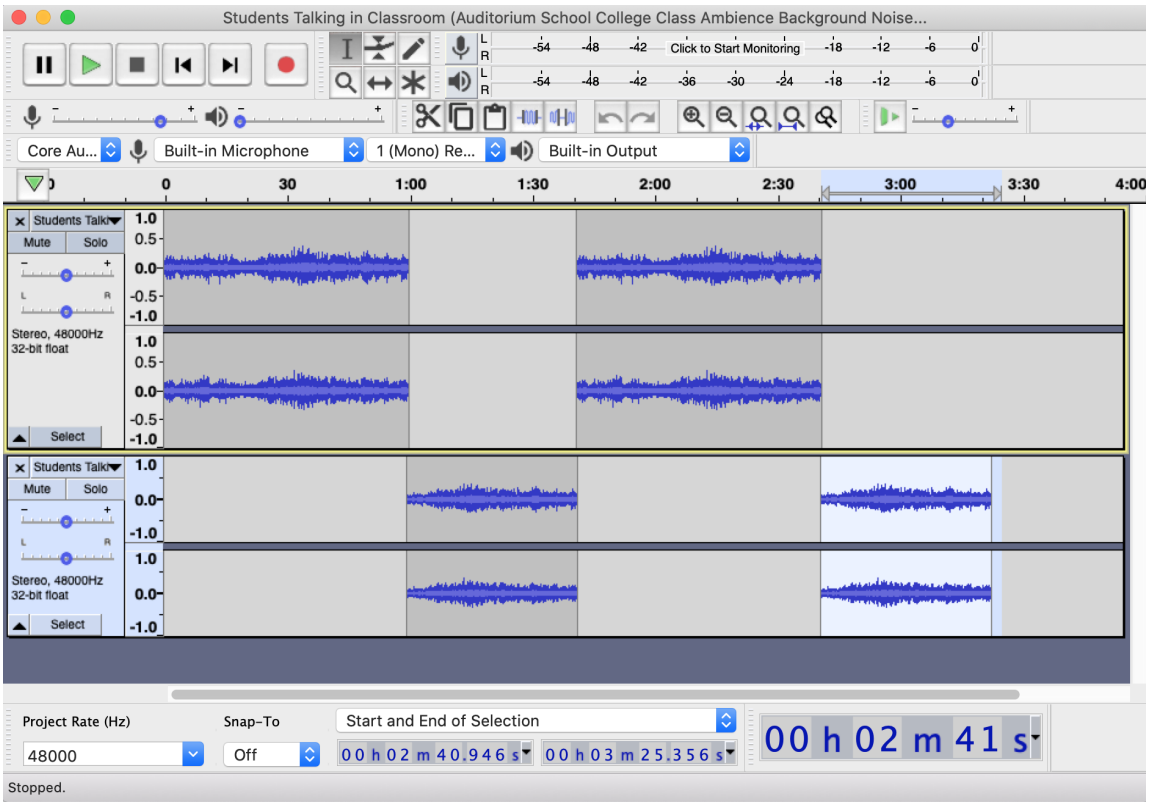
A previously unknown problem occurred only when creating the subtitles: The program closed itself several times. Fortunately, no work steps were lost, since there is the implemented auto save. The reason could not be found. This was luckily only a one time thing.



Adobe Premiere Pro error message

Sound Design Process

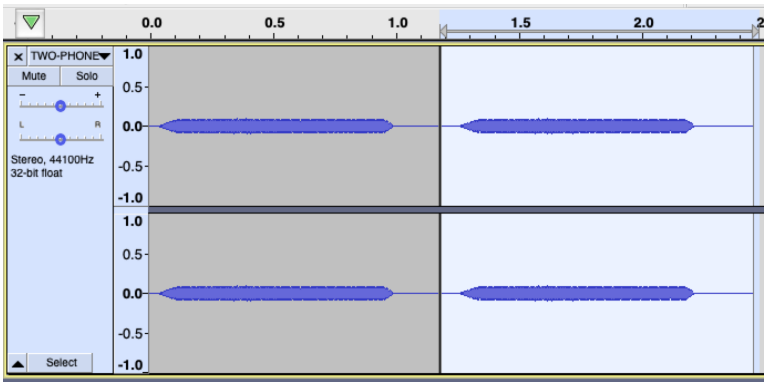
At the early stages of development, it was decided by the team to use essential environmental background sounds such as chatter or chirping birds instead of music. This was to help promote the reality of the experience and the focus of the player, since we did not want to gamify or disrespect the disabled experience. When music was used in some scenes, it was assured that they would have a source (like a speaker or a set of headphones) to not break the realism while still granting an enjoyable experience.



Example of an audio clip of talking in the classroom.

By using Audacity and audio sampling, a seamless environment was created for each of the scenes by blending the points where the audio comes together. Looping audio is essential to make sure the environmental audio does not interrupt the experience.

The search for sounds was a long process, with many different trial sounds utilized before final environment sounds were used. For example, the sound for the button selection went through five iterations and sounds before the final selection. This selection and search was essential to find the best sounds for the game.



This audio clip of a phone buzzing was cut to two buzzes instead of five.

Game Mechanics Process

Movement

Due to including such a wide variety of game modes, movement was probably the most important mechanic the team developed and the one that went through the most iterations.

For the virtual wheelchair movement, our solution attempted to use VRTK's Angular Joint Drive at first but returned rotation values too inconsistent to be used accurately by the script. Later, simple cylinders with RigidBody were used, which proved to not carry sufficient angular momentum. Ultimately it was scrapped and replaced with a simpler script that made the virtual wheelchair follow the player and rotate with them, while they moved using more conventional and intuitive methods such as teleportation.

Original "ghost" mechanic. Rotating the wheels would cause a duplicate of the wheelchair to show the trajectory, and releasing the wheels would teleport the player to the target location.

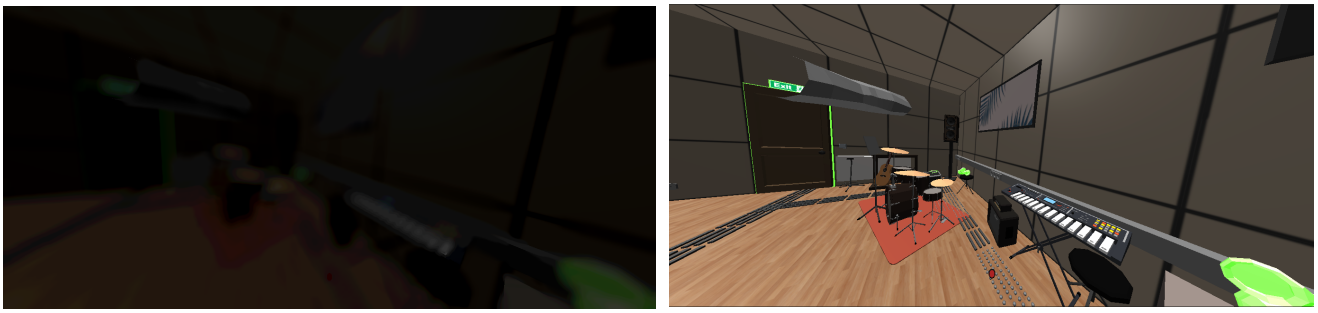
When it came to other forms of movement, a lot of trial and error was necessary to combat motion sickness, especially as a team without prior knowledge in VR and unfamiliar with the common causes of discomfort. We relied heavily on feedback from teachers and testers.

The teleport mechanic evolved from simple free roam (being able to teleport anywhere) to using teleport targets (pre-defined points in the environment to where teleporting was possible). Not only did testing reveal that this solution was far more intuitive, but it also solved two big problems we were having: players going out-of-bounds and focusing player attention on the interactable aspects of the environment.

Blindness

In order to give the player a true sense of visual impairment, the first thought was to use strictly 3D audio to guide the experience but the idea was quickly put aside because of the lack of sound designers in the group as well as the overly ambitious requirement of learning a new tool (Wwise) on top of the already existing challenge with Unity itself.

As an alternative, the team leaned on their research and found out that most legally blind individuals were able to see objects and colors, but their vision was out of focus. On that foundation, we designed a vision filter to simulate that phenomenon and supported it with the use of a virtual white cane for guidance, which implemented haptic feedback to detect collisions and vibrate the controllers as an indication.



Music room environment with and without the vision filter

Dyslexia

Finally, for the dyslexia component of the game, the first concept involved using a colored overlay, which reportedly made text more readable by increasing contrast between the text itself and the background. However, that idea proved a bit complex to implement in the late stages of the project, having the team decided to use a simpler approach of applying a script to jumble letters in a given text, simulating the effect of letters “jumping” around. The idea was inspired by Victor Widell, who created a website meant to simulate a dyslexic’s person reading experience.

User Interface Design Process

Main Menu

We began with creating a menu for our game in just a simple all-white room where the menu would appear in front of the user. We knew we wanted it to be clear, concise and simple to

navigate so we went with three menu selections: Play, Options and Quit. Once hitting play, it would move on to the character selection menu where there are three options to choose from. This allows the user to choose what perspective to experience.

Early screenshots of the main menu

After moving on throughout the project, we decided that this wasn't going to be the final menu environment and move our menu around. We liked the general theme of it with the background and font, but some wording options and menu navigation changed. Therefore, we moved the menu into a classroom setting where it would appear on a projector screen. We opted for taking out the "Options" button and making it into "Extras", where players would have the choice of jumping straight into minigames or interviews without having to go through the entire game progression.

Current screenshots of the main menu

Our game menu was rather easy to design as it would be such a simple theme, but trying to make the buttons accessible to press within VR was a massive challenge at first. There would be more time spent trying to make the buttons work than the actual design process.

Character UI

Starting the UI within the game itself was a challenge from the start. VR is a much different playstyle than a normal video game. We decided the best route to go would be a character icon appearing in front of the players to give vocal instructions and help the immersion of the

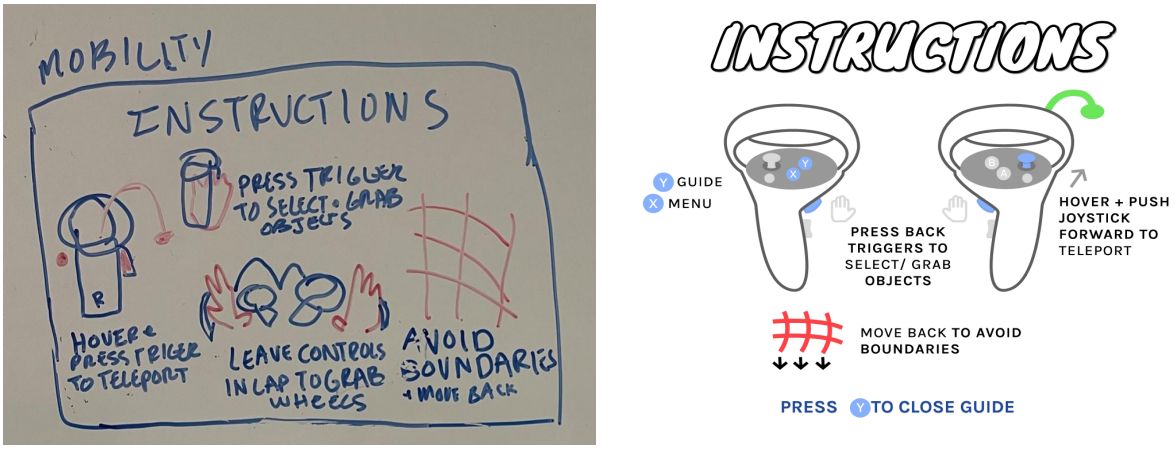
experience. This process was done by recording through Memoji within Apple's text messages. In the beginning, this seemed like a great idea as it showed the mouth movement of our characters and had an attached audio source to it, but once we put it into Unity, we ran into a few problems with the audio only being mono instead of stereo. This process then became a pain as we had to strip the audio from the file and manually convert it to stereo, then re-import it into Unity and attach it to the desired video, with muted audio.

Character UI icons

Instruction UI

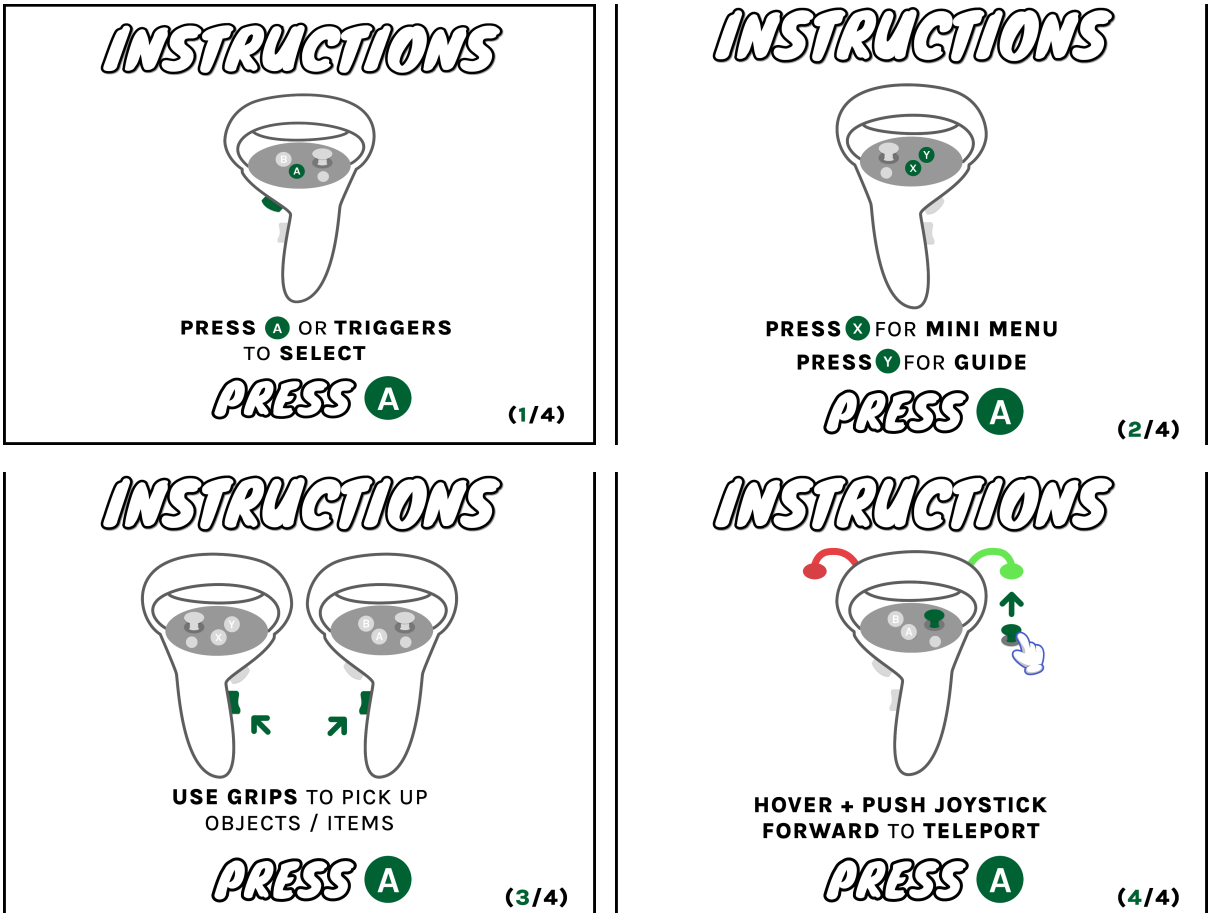
As we began testing on the game, we realized that the players were consistently missing the instructions on how to play. These initial instructions, created by Logan, were placed on a desk and not at eye level, and were shown before the gameplay portion of the experience, therefore forgotten easily.

Our solution was to redesign the instructions in a landscape format and place them at eye level with easy access to the viewer. The design for this solution was inspired by whiteboard sketches of how the instructions could appear to the viewer, depending on what track they were on. Using Logan's initial design, Ysa illustrated the controllers in Figma, and worked collaboratively to complete a better instructive experience for users.



Sketch of the instructions sheet and resulting design

This was a step in the right direction, but something still felt off. We kept having readability issues, controls changing and confusion with users. We then decided to put some more focus into the instructions and split up each control into its own page to reduce clutter and make it easier for the user to read.



Final instructions design used in the game

These instruction sheets are now displayed in front of the user at the start of each screen to ensure that no one gets lost and understands how the game is intended to be played. We also included a HUD that is always on display and shows the buttons X and Y as Guide / Mini-Menu for even more help.

HUD and instructions display

User Testing Method, Feedback and Acceptance

Internal playtesting

In preparation for the Project Vernissage, the team conducted a first series of playtests exclusively with its members as participants. The tests consisted of team leader Logan requesting each member to perform a number of tasks (for example, heading towards the entrance's front desk or exiting a scene), and collecting feedback after each one.

Naturally, this first test was met with a lot of issues, from which we highlighted:

1. Players would not notice/not read/skip instructions that were displayed in-game. This was immediately addressed by redesigning the entire instructions UI, as explained above.
2. Players did not feel the need to use physical movement with the wheelchair to explore their surroundings. The solution we found was to replace the free-roam teleport with strategically placed teleport targets that would be just far away enough from the interactable objects to drive players to move forwards. We also made some improvements to the scaling of the environment so the virtual distance traveled would resemble more closely the actual physical distance.

Closed local playtesting

Soon after the first round of testing, the team moved on to conducting tests with a closed group of international students, who were invited to the BIZ to experience the game after improvements.

Volunteer students testing the game

This time the experience went much more smoothly, allowing us the confirm the success of the new teleport system and instructions, albeit some small adjustments were still needed. The team also decided to alter some of the control bindings, such as replacing the grab action with the grip buttons instead of the trigger buttons since it seemed more intuitive for first time VR players.

Open local playtesting

On the 17th of January, the 17th edition of St. Pölten UAS' Project Vernissage was held. For our stand, a space was provided for exhibition purposes on the ground floor of building A.

The game was tested on a 6x6 meter space, with the user sitting in a wheelchair and navigating the virtual space via the combination of teleporting and in-real-life movement.

Safety instructions were given as the player accommodated and started the experience.

A vertical slice of the final game was played. The users could access the main menu, and the mobility section; with the possibility to play said full section or go directly to the “basketball” part.

Team Bob in front of the stand (left) Diana giving instructions to a player (right)

During the course of the event, a total of 7 persons interacted directly with the experience. Of those 7, 4 had previous experience with virtual reality, while the other 3 had not. It was noted by a few users that they were prone to motion sickness or other experience-affecting issues not directly related to the hardware or software used. One user abandoned the game because of not having the proper eyeglasses to fully enjoy it. Another participant left due to motion sickness.


Jana giving hints to a player (left) Nico translating the feedback in English (right)

Feedback was given during each participation, whether as direct comments or via a dedicated Google forms survey embedded in a QR code. The general consensus was a positive reaction, with an average rating of 4,25 out of 5.

Regarding the game's controls, 4 users claimed to be pleasantly satisfied, while the remaining 3 had more neutral responses. One participant noted that it would be more comfortable if the player could turn around in a more organical way.

Regarding the effect that the game had upon the player, 3 testers asserted that they had learned more about disabilities and 4 affirmed to become aware of the barriers disabled people face.

During the exhibition, some visual glitches were observed due to the inexperienced users unintentionally colliding with an object. At 2 concise times, the product experienced game-shattering bugs that forced a game restart or resynchronization.

By the time of this writing, our team members keep working on polishing the game and making sure it offers the optimal experience as intended.

Results

Overall, the team considers the current project a success as the primary objective of raising awareness about disabilities seems to have been accomplished.

Throughout our work, we allowed people to experience life as a disabled person to some extent, proving how challenging it can be, as well as educating them on many accessibility features that must be respected.

One of the biggest accomplishments, though, was to manage to portray such a serious topic in a light and fun way, intertwining personality through scripted interviews and entertaining mini-games.

The balance between realism and playability was a constant struggle but we strongly believe to have achieved a good equilibrium given the time frame and the experience (or lack thereof) we had with Virtual Reality.

The team dedicated countless hours and effort to this project and hopes to make an impact on the players, the professors that supported us and the disabled community as a whole.