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Accessible Immersive Learning in Art and Design

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Case Study

Virtual Reality as a teaching and learning space:
An exploration of VR technology to facilitate life drawing,
subject revision, and three-dimensional geometry.

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1. Case Study aims

This pairing was informed by each partner having and teaching a traditional practice. While the purposes of our shared practice differed, we found we had many similarities in our approaches to student centred learning. There was a mutual curiosity in how VR and immersive technologies could benefit students of traditional practices with no prior VR experience.

Chernivtsi National University - Fine Art
Within the BA and MA program 023 "Fine Art, Decorative Art, Restoration" students are given an opportunity to choose the specialisation in fine art, which requires the in-depth study of drawing, painting, plastic anatomy. The corresponding specialised disciplines require the understanding of three-dimensional geometry with consideration of light factors affecting objects.

Due to many conditions and individual perception, students often struggle to embrace the concepts of three-dimensional geometry when working on projects in the fine art disciplines. It is one of the core concepts and thus demands thorough analysis and mastery.
It proved to be even more challenging for students to acquire knowledge in three-dimensional geometry and apply it in practice during the pandemic, as the learning process was reduced to a virtual learning environment, where students were forced to master the majority of techniques independently at home due to Covid restrictions. This has been exacerbated by the recent drastic events and Russian invasion of Ukraine. As a result, students had to return to online learning again, which created new difficulties in mastering practical disciplines.

Therefore, it was decided to explore the facilitation of teaching three-dimensional geometry with the use of AR/VR, as this would allow us to connect the virtual and practical worlds and provide a wider range of opportunities for students to apply their skills and get a better understanding of concepts.

Institute of Art, Design and Technology - Life Drawing
Students of Life Drawing and Animation need to develop an understanding of the underlying concepts of tone and how to use light and shade in a composition, to provide essential skills for world-building and visual storytelling in animation and illustration. Therefore I set out to develop the 'Tone Zone' a custom gallery space made with the intention of aiding revision of the principles of tone in drawing and design. Understanding the underlying concepts of tone or how to use light and shade in a composition is essential to world-building and visual storytelling in animation and illustration.

2. Objectives

Fine Art - Oleksandr Toloshniak

The objective of the case study "Creation of the Three-dimensional Geometry of a Model by Taking Light Factors into Account" at ChNu is to acquaint students with the features of drawing and painting by means of immersive technologies, in particular, using a headset, to gain practical experience in creating three-dimensional models, and to master the skills of their transformation, grouping, adjustment and preparation for demonstration.

Life Drawing - Aoife Balfe

I chose the revision principles of tone in drawing and design, as animation students consistently identify tonal work as an area of weakness in their design and life drawing practice, coupled with the response that asynchronous learning was a benefit of the remote learning experience. Many of them actually do have a strong understanding but are not conscious of this fact. Seeing examples of successful tonal study has benefitted students' understanding of tonal principles previously. Most often these examples are viewed through a shared folder or image board like a Google Album or a Pinterest Board. Given that the VR space can be anything, I viewed this as an opportunity to create a space that would be nearly impossible to create in reality. I wanted not only the example images but the space itself to convey the principles of tone. I considered the space to be somewhere one could experience *being* in tone rather than somewhere to study or analyse tone as a concept, which may allow them to realise what they do know through observation.

3. Methodology

In the process of teaching and working in a virtual environment, the following methods were involved:
- the teacher's example method
- method of encouragement
- method of free choice
- method of integration into educational tasks
- method of task differentiation
- method of data evaluation and generalisation.
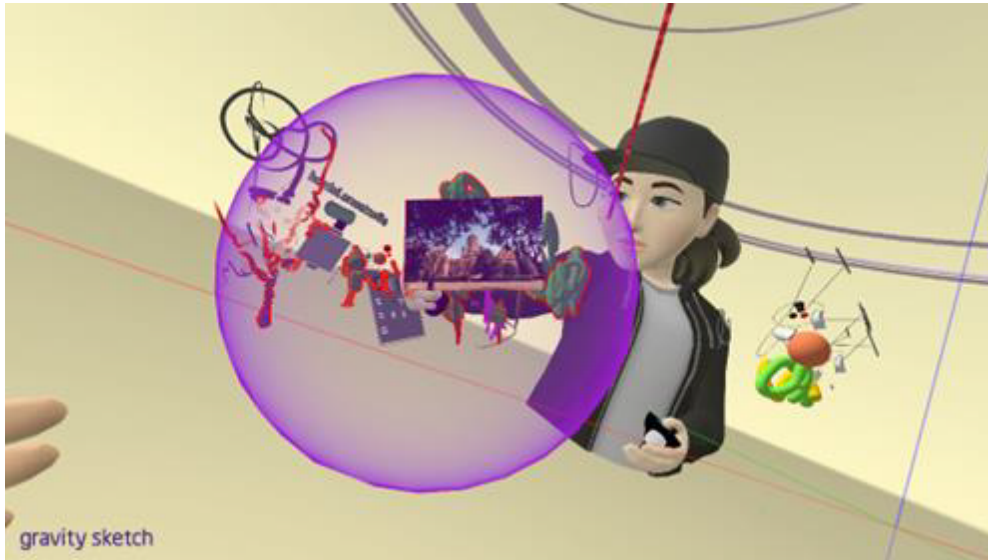
Students in Gravity Sketch session with Charmaine Chau

3.1 Chernivtsi National University: Fine Art - Oleksandr Toloshniak.

Teaching Students with the use of headsets:

In the context of working on the case study, a large number of meetings, workshops and practical classes were held not only with project participants and departmental staff, but also with developers and technical consultants of programs and platforms involved in the project. In particular, a significant contribution to this work has been made by representatives of the company Gravity Sketch with representative Charmaine Chau.

The first acquaintance with Gravity Sketch was as a group, where we experimented with different tools and settings. At the same time, students shared their impressions and knowledge with each other in real time. We were all in the same room, so we could do it easily. After the first meeting with representatives of the Gravity Sketch company, our knowledge expanded significantly. A large number of new settings and methods of import and export became much clearer; all the key processes in the work of 3D sculpting and modelling were described in detail to us.

Screenshot of students work being developed in Frame VR
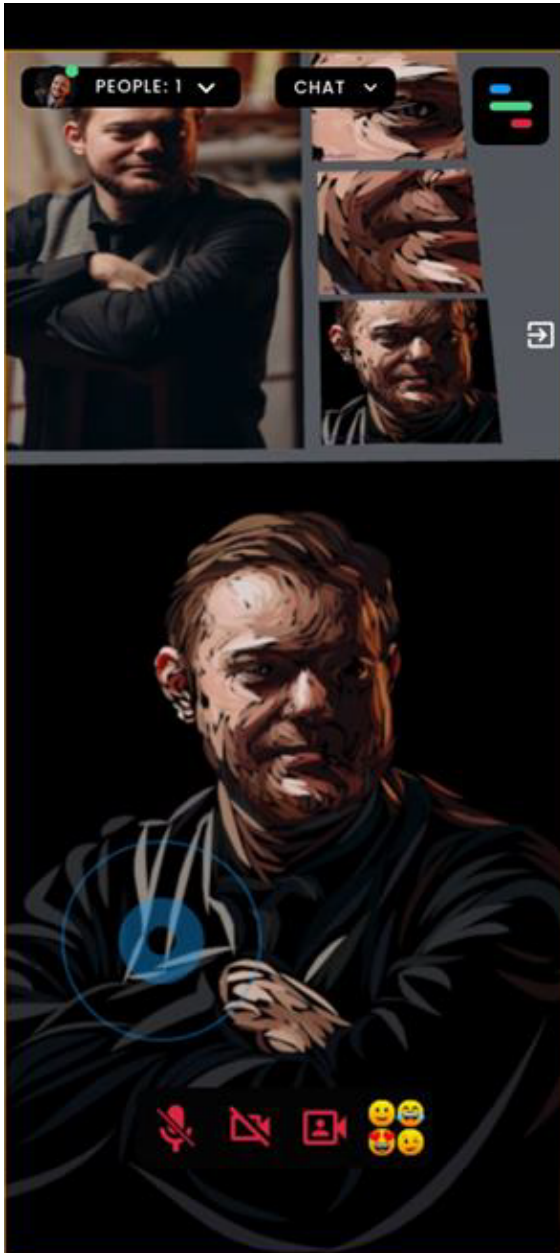
An immense advantage in this case study lay in the wide base of acquired artistic knowledge in traditional art. Each student, while constructing a portrait, arrived at understanding human anatomy, recognized light and shadow nuances, and was able to bring the work to a logical conclusion. Each of them had previously done such work on canvas many times with brushes and paints.

While performing the task, we went through several stages of preparation, execution and equipment selection before the demonstration. Since we could not create a three-dimensional model of the person that we planned to draw, we worked from a photo from which visual or graphic images were already drawn in the Gravity Sketch environment. The work was carried out in collective rooms, where the main method of learning in the virtual space was visual and verbal communication. It allowed us through trial and error to increase the level of knowledge of those who had already worked and to assist those who were working in this environment for the first time.

At the initial stages, all strokes and lines were applied immediately before the image itself so that new students could get used to the dynamics and space. Each of the elements of the future picture was layered next to each other, it had to differ in colour and line direction. We chose a ribbon line with tapers at the beginning and end. It was necessary to control the size of these 'strokes', that should not have been very different from one another. The students created this picture by colour sampling. Persons with more practical experience worked by remote copying of the model, which consists of working from a photo of the model The students worked according to the principle of layering. This is when large planes with an approximate colour proofing are applied first. Afterwards, at each stage, smaller strokes are applied on top, which delineate and detail each element of the canvas. In this method, it is extremely difficult to apply strokes in one plane without making a domed surface. Therefore, quite often we edited underdrawings by grouping elements in space.

Both of these approaches have proved to be very convenient, since when the size of the picture is increased, we simulate the real movements of the hand with the brush. Thus we do not alter the personal techniques developed by the student over the years but only give them another tool for work. This is essential for artists because drawing is first of all a creative process from which the artists derive pleasure and inspiration, and only after that the result, which is already designed for the viewer. If we compare this method with drawing on a graphic tablet, we drive ourselves into limited frameworks and cannot easily draw a free contour line within the latter method. And when switching from non-traditional drawing to a tablet, the artist for a certain time finds himself in a very uncomfortable environment. There is no such feeling when working with a VR headset, which is also a big advantage.

Course Plan:

CREATION OF THE THREE-DIMENSIONAL GEOMETRY OF THE MODEL BY TAKING LIGHTING FACTORS INTO ACCOUNT.

Topic: Painting and graphics in a new spatial solution. A line as a forming element of a three-dimensional image

Objective: Creating the simplest and shortest way for mastering 3D technologies in fine art with the aim of improving the teaching of three-dimensional geometry.

The activity is designed for students of education institutions specialising in art. It is aimed at simultaneous teaching in a group consisting of 5 to 10 students with practical skills of traditional artistic expression, knowledge of composition and basics of colour theory.

Timeframe: Classes are held twice a week for three hours with a ten week break.

Description: The course is designed for maximum assimilation of educational material in the shortest possible time. The main tool is a VR headset, the 3D design platform Gravity Sketch.

Expected results: Upon completion, the students must master new principles and approaches in performing tasks, get a better understanding of three- dimensional geometry, learn VR design tools, get used to the program interface and understand the settings of tools and work environments, understand the methods and form the sequence of task performance, be able to transfer experience to other students.

Course structure - Classes, training and workshops:

Week 1. Introductory class
Explanation of safety techniques when using the headsets. The first attempt to use the headset. Gravity Sketch account registration. The ability to enter the working environment of the program, log in and create a space for work. Trying several tools.

Since the technical part of the project was assigned to me, I followed the method of independent learning, and then it continued in group training. That is, I needed to learn how to set up headsets and then onboard the students, as well as introduce students to basic coordination techniques in the virtual interface of Oculus Quest 2 headsets.

Students in Gravity Sketch

Week 2 Learning more about tools, object capturing, and scaling. Performing a simple task. Practice of importing images and objects and final export of images.

Still life with objects and table in Gravity Sketch

Week 3 Individual creative assignments. Forming an idea. Making a plan for the sequence of the execution of the assignment. Creation of a sketch of the future composition on paper. Transferring the sketch to the program. Experimenting with the composition. Creation of an environment relative to the atmosphere of the composition.

Week 4 Complicated individual assignment. Combined use of different instruments in one composition.

Week 5 Collective work. Collective selection of topics by means of voting. Discussion of the idea and sequence of execution. Distribution of participants' roles. Execution of parts of work. Connection.

Week 6 Joint work with students of the other education institution

Week 7 Reproduction of a three-dimensional shape from an imported image. Three-dimensional drawing of a person's portrait.

Week 8 Joint work with students of the other education institution.

Week 9 Collective assignments with an emphasis on the ability to transfer the acquired experience. Each student chooses a peer student and performs joint work with them in the process of which they teach each other.

Week 10 The final task. Individual topic. The student creates a final composition, which is then presented at a joint meeting.

Creating an Exhibition Space in FrameVR:

The knowledge gained from the project partners played a major role in shaping the exposition of the exhibition on the FrameVR platform. In particular, this has helped to expand the understanding of the use of virtual rooms.

Almost all 3D models placed in the room were created as part of the project. All have joint authorship, namely, they were created either by a group of students or together with a teacher and are educational in nature. Each finished work is supplemented with fragments and stages, which are placed on the walls of the room. The exposition is placed in such a way so that it simulates a real exhibition where additional elements have not been used when creating the interior: partitions, etc. All works are placed on the walls in vertical positions in such a way that the viewer entering the room has visual access to any picture.
Having entered the platform, students will be able to examine, analyse and learn the approaches and methods of implementing graphic and pictorial images in 3D space.
The room has an educational value, not just a demonstration one. Therefore, it is recommended to view the content of the room together with a teacher or a project participant as a guide, which will allow one to familiarise oneself with the specifics of creating an exposition in more detail.

Only proactive students part in the educational and research work at the initial stages of our study of immersive technologies on a voluntary basis. This contributed to effective, productive work and the acquisition of new practical experience. It is important to note that at the initial stages of learning new technologies the student's year of study does not play any role, yet the individual qualities of the student are important.

In contrast, the year of study plays a big role at the last stages of executing creative works (thus, the acquired knowledge, skills and abilities), since the tasks are formed in relation to the program of specialised disciplines.

Link to ChNU virtual room
Link to the interim and final works created within the case study

3.2 Institute of Art, Design and Technology

Building the Tone Zone - Aoife Balfe

The Tone Zone is a custom gallery space made with the intention of aiding revision of the principles of tone in drawing and design. I chose this area as animation students consistently identify tonal work as an area of weakness in their design and life drawing practice, coupled with the response that asynchronous learning was a benefit of the remote learning experience. Many do have a strong understanding but are not conscious of this fact. Seeing examples of successful tonal study has benefitted students' understanding of tonal principles previously. Most often these examples are viewed through a shared folder or image board like a Google Album or a Pinterest Board. Given that VR space can be anything, I viewed this as an opportunity to create a space that would be nearly impossible to create in reality. I wanted not only the example images but the space itself to convey the principles of tone. I considered the space to be somewhere one could experience *being* in tone rather than somewhere to study or analyse tone as a concept, which may allow them to realise what they do know through observation.

I collected a body of student work that exemplified tonal study. I categorised them according to their overall tonal value with the view to arranging them on the gallery wall from light to dark. On the opposite wall I would repeat a set of images with varied tonal ranges to demonstrate how the surrounding tonal value affects how the tonal values within the images appear.

I used Frame VR to create this space. I considered the use of the premade gallery spaces within Frame VR, but they were not customisable and could not be adapted to my purposes. I did opt to use a premade gallery with the same images displayed, as a control, in order to gauge the difference in understanding when the room's function is to recede from the art.
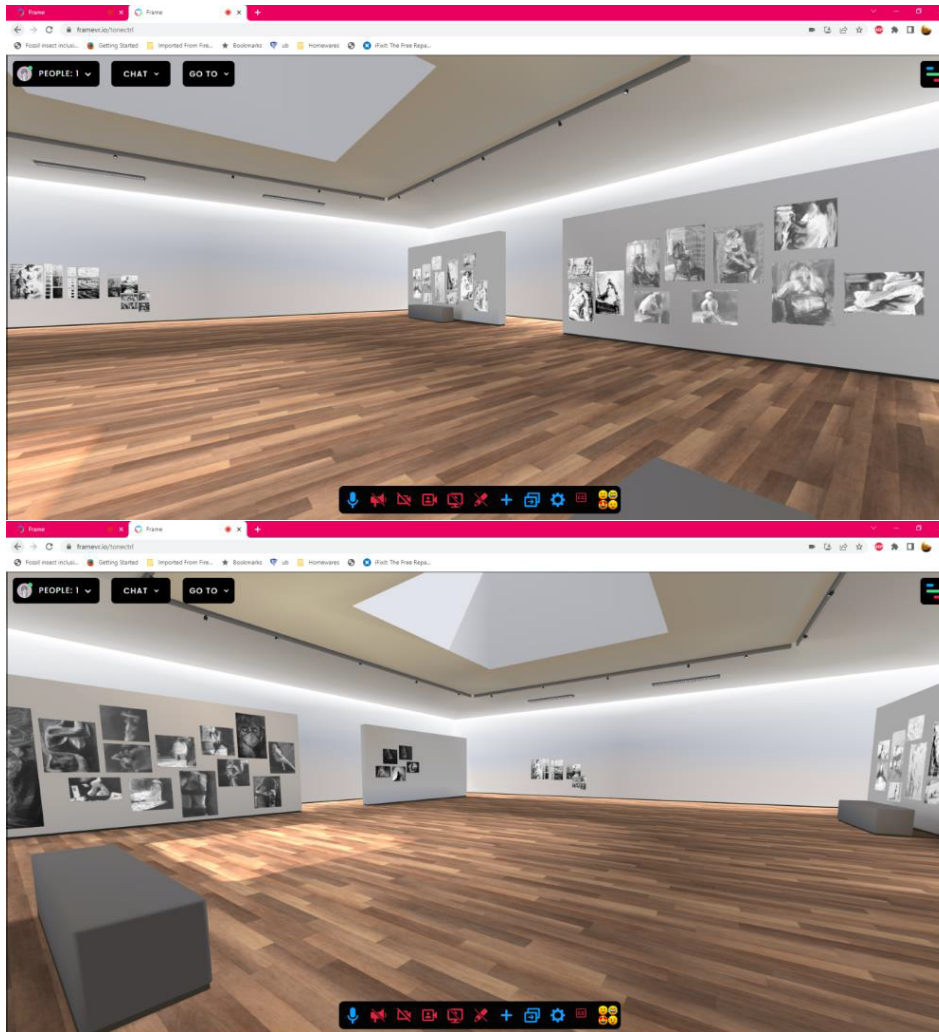
Screenshots showing the Tone Zone

Would my Tone Zone space serve to enhance the work displayed? The premade space had the benefit of easily displaying work with snap-to functions, this could be preferable depending on the purpose of the VR experience being designed.

The experience of building in Frame VR was somewhat frustrating overall. I cannot be sure if the non-intuitive feeling of building within Frame was entirely down to the user interface or if this was exacerbated by my own fundamentally 2D practice influencing my thinking and approaches to creation.

I began in an empty frame. I knew I wanted walls to form blocks of tone, from pure black to pure white. I found a wall in the preloaded assets and placed it in my scene. When it loaded in it had a wooden texture which led to me trying to find how to customise textures on preloaded assets in Frame.
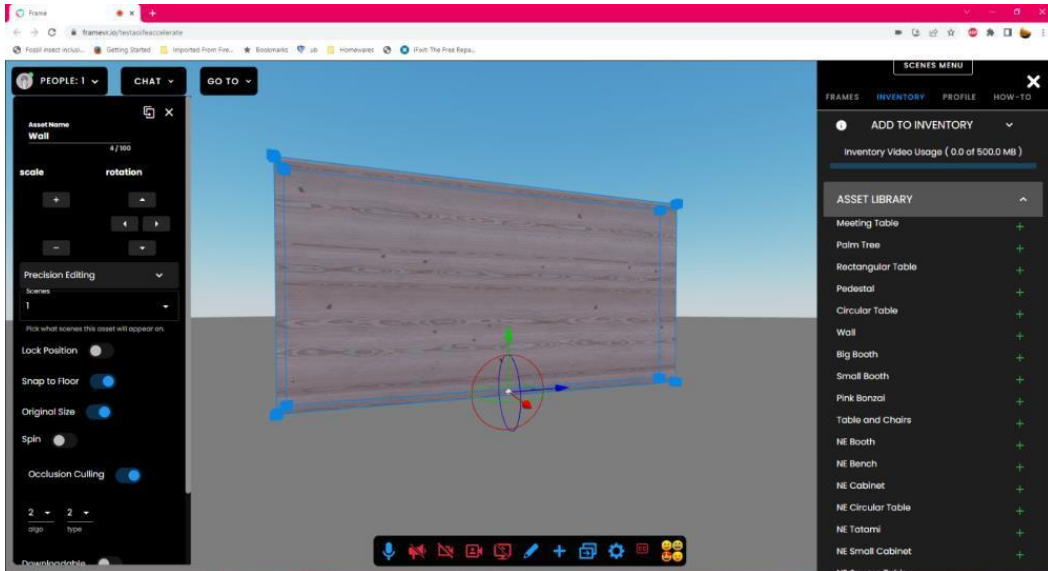
Screenshot showing the development of building a custom space and wall in Frame VR

I found the site had many resources for guidance on navigating through spaces and using them as an online meeting space alternative to Zoom or Teams etc. However, there was not much available for building custom spaces. This lack of guidance can serve to encourage experimentation, trying things out and seeing what the result is to facilitate a sense of play. However, with a specific task in mind it can leave one open to feelings of doubt asking oneself "Am I doing this right?" "Am I missing a much more efficient solution?" "Am I wasting time?"

I knew I could import jpegs and so resolved to make the panels of colour I wanted and use them as walls, even if they would not function as barriers or feature the easy snap-to feature for hanging work. I lined up my jpegs by side stepping with Q or E keys as I imported each image. This was an imperfect workaround, if I accidentally used the wrong movement the position of my next section of wall would not be flush with the previous section. It also would be very difficult to line up a second wall, creating an enclosed, purely tonal space. Having made one wall of jpegs, I was excited to see some Mach Banding on the blocks of tone as they were placed next to each other. This became a feature that I drew attention to in the final result.
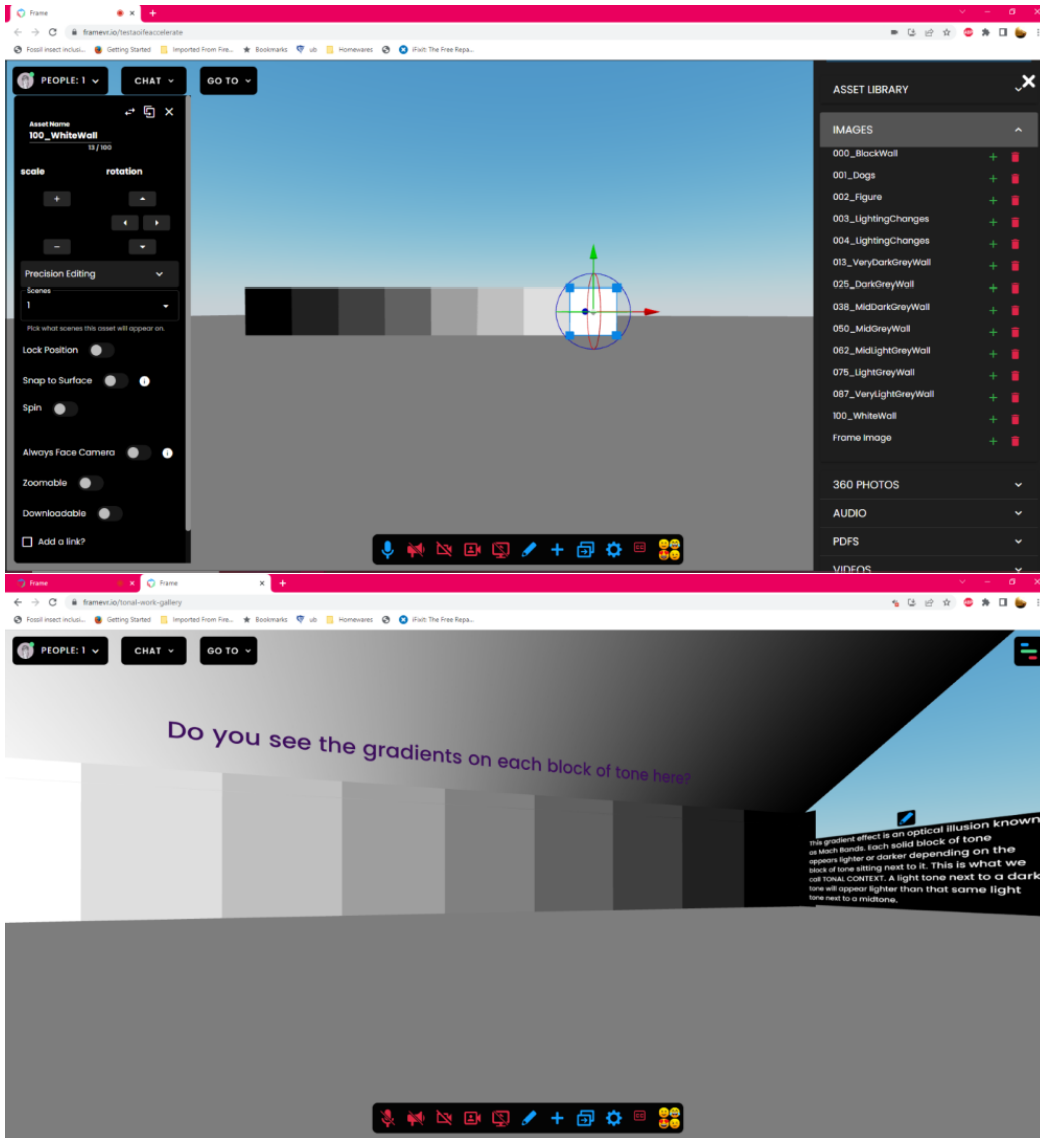
Screenshots showing the building of gradients of tones in Frame VR

Without a headset it was difficult to judge the scale of the wall I had built in the empty featureless space. I found useful the ability to change the setting of a Frame without losing the placement of any objects the user has dropped in. I changed my setting from an empty space to one of the premade galleries with the aim to use the existing structure as a guide for my own creation. It was during this process that I found the precision controls, which became essential to completing the Tone Zone.
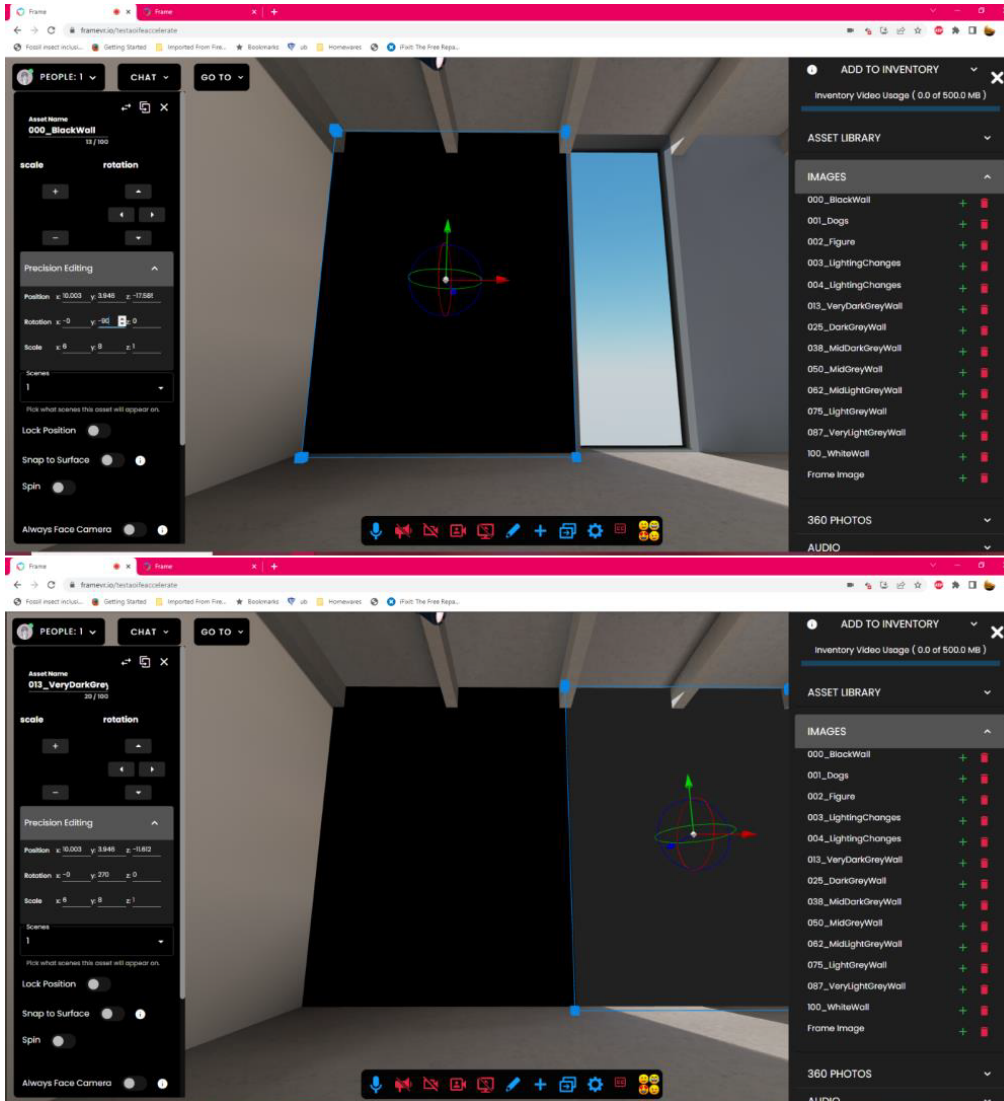
Screenshot showing the use of precision tools to build custom space

After building my wall using the large gallery as a scale and angle reference, I was able to revert to an empty Frame and use the precision controls to line up the second wall. Adding a gradient to use as the floor and ceiling.

By the time I was placing the student work into my space, I had gotten more used to the precision tools and used them to ensure that the work was placed as close to the wall as possible without it beginning to glitch when it interacts with the wall image. This glitching was an issue with .png files that I made with the intention of arranging them together; it was a little disappointing that transparent areas would still cause the images to glitch where they intersected.
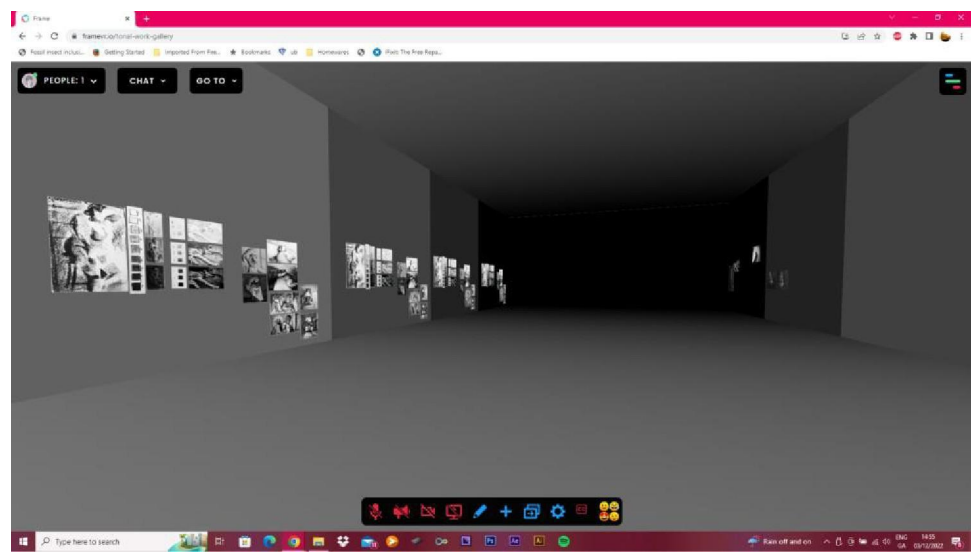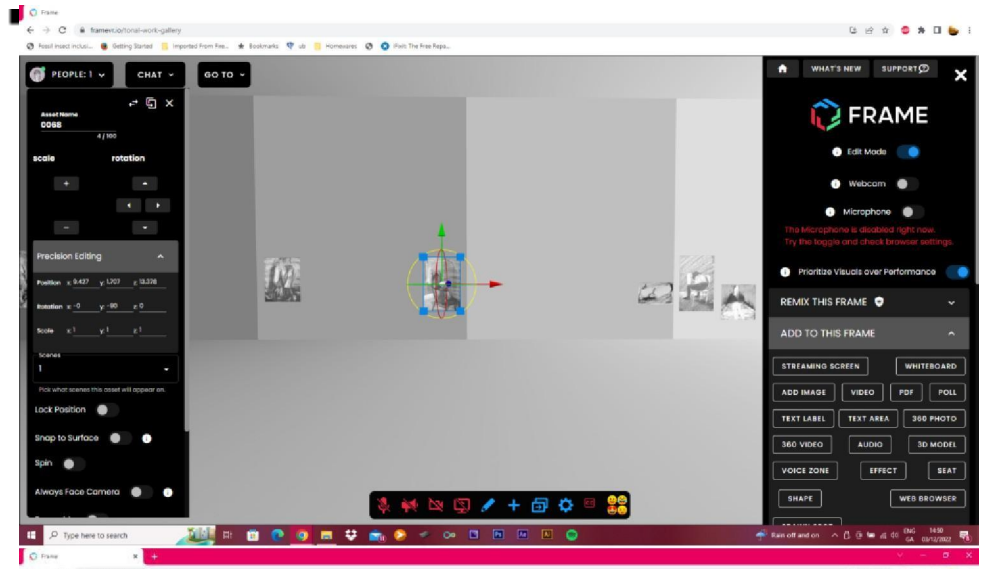
Screenshots showing students work being placed in Frame VR space

I was pleased generally with how my space turned out but was concerned that it was lacking interactivity. At this point I found another menu of assets, different 3D shapes or planes and all of them were colour customisable. I dropped a mid-grey sphere into my space with the intention of having my students carry it from the dark surroundings to the light and observe how the brightness or darkness of the sphere changes depending on the context of their surroundings. I missed a setting that would allow the sphere to be interacted with which meant that students in this space could not carry out this exercise.
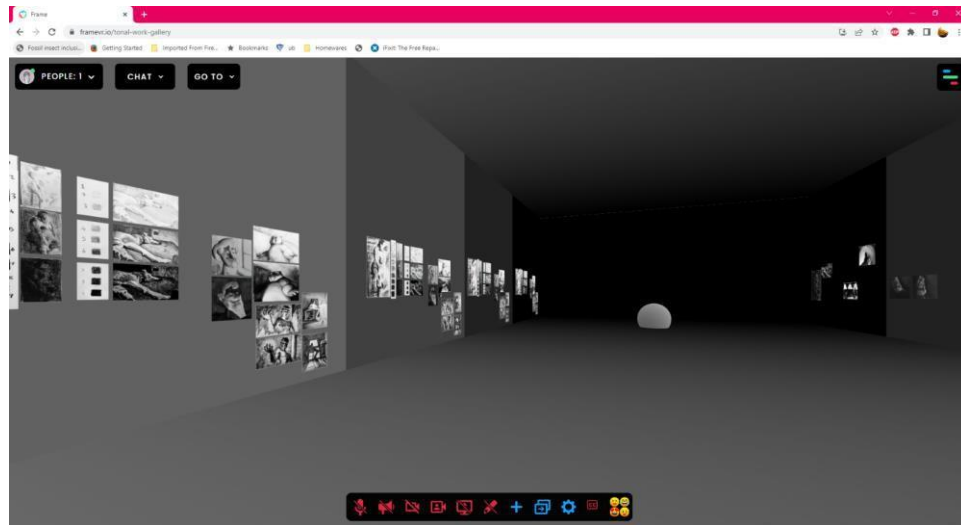
Students work in place in Frame VR space

Overall, I struggled with the interface. The menu layouts meant that I missed things that would have been useful to me earlier in my process. Placing objects with only a single POV camera was frustrating as moving in an unintended direction would disrupt my workflow. It would have been beneficial to me to have multiple fixed viewpoints, or a map with cardinal directions for navigation. I continuously hit Ctrl+Z to undo movements of myself or of objects that were made in error. This became frustrating as FrameVR has no actual undo function and even when I consciously knew it would have no effect my muscle memory could not be stopped. Throughout the build I found myself wanting to be able to draw a 2D floor plan that could be extruded up to create a room. This method could be achieved by using Google Sketch up or another 3D software and then importing your 3D model into the Frame. As someone who is generally unfamiliar with working in 3D it felt like a better choice to persevere with Frame rather than struggle on two fronts. While these issues may be personal to me, they cannot be unique to me. Despite the difficulty experienced I was still able to achieve my goal to a satisfying level.

Tone Zone Student VR Experience

Year 3 animation students were brought into the Tone Zone VR space in December 2022. We

began the session with only one headset and brought in the second headset after the break. Setting up the VR headsets to enter the Tone Zone was a mostly straightforward process. Delineating the safe area and determining floor level sometimes would have to be repeated several times, casting dropped on occasion and the student experience would have to be interrupted to recast. I considered these issues to be standard technical difficulties that could occur with any technology used in the classroom rather than being specific to VR.

Most students who entered the Tone Zone enjoyed the experience and responded positively, pointing out many of the principles that were present without prompt – they could see them. Others who were unable to use the VR headset noted that this did not feel like an impediment to their learning as they were able to see what the headset user was experiencing on the projection screens. However, these students also noted that it was difficult to remain engaged when their only experience was through the screens as there was no novelty in watching through a screen.

IADT Students in VR Headset

IADT Student in VR Headset

One student upon confirming that he could see that tonal context, noted that he was unsure if he could see it because of the space itself or because it had been reiterated so often in the first two years of design and life drawing. He remarked that it may have been more beneficial as an example in first year, but he could not be certain either way. I found this comment particularly interesting as it shows how prior knowledge shapes an experience. I believe that it is important to consider this when applying VR technologies to teaching and to ask whether a certain concept or practice is best initially experienced virtually or not? The answer will vary from subject to subject as well as on an individual student basis.

Student reflections on their remote learning experience gathered before the beginning of term

found that just over half of the group had found remote learning to be either mostly or singularly detrimental to their learning experience. The majority of the students stated that it was their motivation and focus that most suffered during their first two years 2020-2022.

Many also noted that it was specifically the practical classes that presented more challenges in the transition to the remote/hybrid models. Academic lectures were more analogous to the switch, yet students still reported decreased ability to focus or engage with the subject matter. Social connection was also felt to be lacking in this time.

When the second headset was connected, and the students could experience the space two at a time it was interesting how the mood shifted. When a single student was sent alone into the space there was nothing but the work and the space itself for them to engage with, there was a novelty of being in a virtual space and engaging with it. When two students entered the space suddenly the novelty shifted from the space to each other, having a friend to react to/with made this a social experience. This social element could be capitalised on for learning with more activities and exercises to do within the virtual space.

After discussing and showing this space to my case study partner Oleksandr at ChNU, he asked if I was going to make more rooms. I believe that I will, it is an exciting prospect to have several "galleries" of student work each themed to different areas of study within life drawing eg. A colour theory room might have two spaces, one being round and representing the colour

IADT Student in VR headset

Several IADT Students in VR headsets

wheel and another similar to the Tone Zone but showing both a warm and a cool colour spectrum. It could serve as a fun and memorable way to introduce these topics; games could help with student understanding of certain theories and the spaces would remain in place for them to return to as a revision tool at any time.

Barriers to Access

The most obvious and direct barrier to access for our group with the VR headsets is if you have glasses. A sizable portion of the class group needs to wear glasses. This prevented some from being able to use the headsets at all, others tried to fit the glasses inside the headset but in these cases, it became too physically uncomfortable for them to continue use beyond a few minutes. There is advice on using headsets with glasses by using extenders on the viewfinder to increase the space within the headset to accommodate glasses, or to wear glasses that are of specified dimensions, but this was not achievable.

IADT students working in VR Headsets

Other students tried the experience without their glasses which was a blurry sub-optimal experience and could quickly lead to eye-strain. One of these students stated that being unable to see was being unable to experience VR. This highlights how Virtual Reality is an almost *purely* visual experience.

Navigation controls took some getting used to for some students. It was difficult to predict where one would land in the space, though I understand that it would be preferable to a smooth gliding camera that could trigger motion sickness. The innate desire is to walk and navigate the space as one would a real space, but we did not have an indoor area large enough for this. A potential solution to this would be a multidirectional treadmill designed for use with VR. The treadmill carries the downside that it is for single person use rather than a collective solution.

Physical discomfort and pain were additional barriers. The uneven distribution of weight on the headset, even with adjustments to the straps caused fatigue and muscle cramps. Changing one's facial posture to keep the visor in position caused tension in the muscles behind and around the ears, and at the back of the skull. The front-loading of the face caused strain on the neck. This was not a universal problem in the group but experienced on an individual basis.

Since these headsets are aimed more towards at home use, they are unable to connect to WiFi that requires both a username and password. This has meant that we were unable to use our institution's WiFi networks and instead operate from a personal mobile hotspot. This was acceptable when using the headset alone, but it was suboptimal when used in tandem with an online meeting as connectivity would frequently drop.

Testing Gesture VR: Artist Teacher Experience by Aoife Balfe

Gesture VR provides a simulated life drawing experience with 3D scans of real life drawing models for the artist to work from. The experience is intriguing if not entirely comfortable.

I find the headset to be physically taxing, experiencing tension headache, neck pain, and eyestrain. These issues present within the first 10 minutes of wear and gradually build over time. Use was limited to blocks of 40 minutes. I found this detrimental to my focus and it prompted the question: can the flow state or deep focus be achieved in VR healthily? Subsequent to my use I found that it is advisable to take breaks from VR every 30 minutes; is this breaking immersion in one's work? While it is unhealthy to spend hours without breaks, is the frequency of these necessary breaks a bite-size-ification of creative activity? Could it train you into a shorter attention span, and undercut your chances of achieving flow state?

Drawing within Gesture gave the sensation of pretending to draw or miming drawing. It highlighted the pure visual experience mentioned above and gave me a renewed awareness of the importance of kinetic feedback to my experience of drawing. This lack of haptic feedback encourages looking at your drawing over looking at the model, this is something that is actively discouraged in our life drawing classes. When looking between model and drawing in a traditional life drawing set up one should be able to look either to the model or the page by flicking the eyes rather than moving the whole head, because of the VR headset design only the centre of vision is fully in focus, forcing repetitive head movement. Blind drawing is a core exercise that is repeated and returned to throughout the course of life drawing on the animation degree. This technique can often give the sense of not knowing where in the drawing one is but will often result in a drawing of high-quality observation, a record of the act of looking. Within Gesture that sense of not knowing where you are becomes much more literal, without looking at your page you are unable to tell if your drawing implement is in contact with it, you cannot feel the boundaries of the canvas.

Line quality in Gesture lacked nuance, featuring two pressure settings. The first was a solid hard stroke that could be achieved by holding the trigger, this type of stroke could be either 2D or 3D coming off the page and drawing in space similar to drawing in Gravity Sketch. The second was a light stroke that could be made once in contact with the paper, this could be made heavier by pushing through the page but with no resistance it was difficult to judge what the results might be, they were inconsistent and felt almost entirely based on luck. This method of drawing reinforces another bad habit in life drawing which is the 'hairy reiterated' line. I found myself going over the same marks repeatedly, making it difficult to express the pose.

Contrast had to be added through intellectual decisions of where to erase, and where to reiterate, rather than the immediate reactive response that is possible in traditional drawing.

Using a real notebook and pencil while drawing from the model in Gesture was preferable to drawing purely within the app, I could feel my work through my hands and was no longer flailing through air. It did, however, highlight the eyestrain that I was experiencing. Extended looking at the model was uncomfortable, and vision became blurry. In the moment I was unsure if the cause of this was due to the headset shifting position slightly, if it was the resolution of the models, or if it was eye-fatigue. I considered how often students are encouraged to squint at the model to reduce the level of detail seen which can help with seeing the overall pose or action without being distracted by small areas of interest. This does lose merit once it is no longer a choice but a compulsory obstacle.
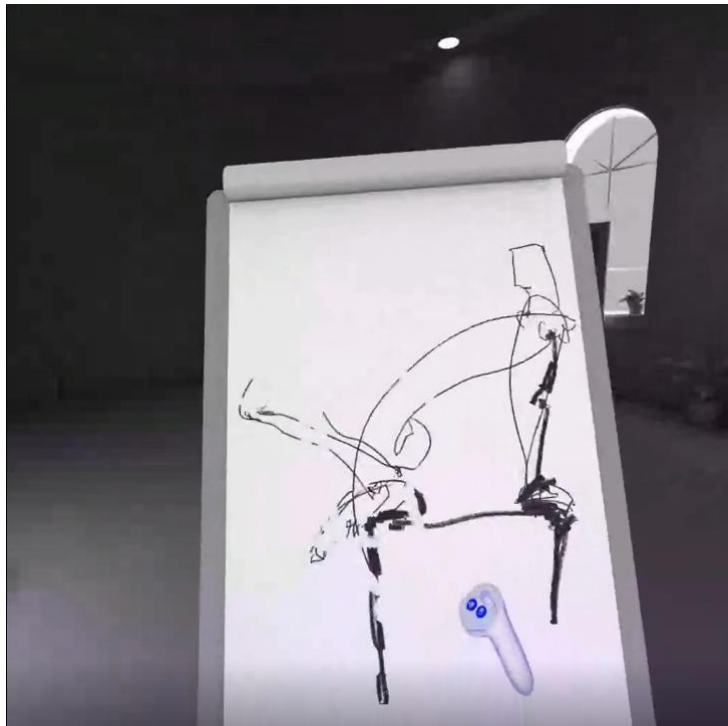
A digital drawing created in Gesture

A drawing in pencil

This app gives the appearance of a life drawing class: it deals with the seen surface of the models and the idea that life drawing is reproduction of this surface detail on a page. To animate something is to bring it to life, looking for action and emotion. We draw not what the body looks like but what the body is doing. The static scan gives us an impressive amount of external information but lacks the internal information that we look for as animators. A slight quiver or shift can tell us so much about the dynamics of a pose – where the weight is, where there is tension etc. Drawing in Gesture is more akin to doing drawing studies of a statue.

Having a customisable light source is a useful feature but in its current form it left me disappointed. You can control the direction of light only, nothing for light intensity or proximity to the model. It is difficult to replicate results. However, it is how the light only affects the model rather than the whole scene that acts as the biggest drawback for this feature and reinforces the bad habit of considering tone only in relation to the body in isolation. Tone on the figure only exists in the context of light and dark for the entire scene in which that figure is situated. Exclusively "shading" the figure is the first habit that I want students to break when we begin tonal study.

Despite my difficulties with Gesture VR, I found myself wanting to go back to try more. It is not an ideal life drawing experience but has potential to serve life drawers who have prior knowledge and experience. I would be reluctant to send a new learner into this space with the purpose of teaching life drawing for animation.

4. Findings

4.1 Chernivtsi National University: Fine Art - Oleksandr Toloshniak
The following conclusions have been made after conducting the Fine Art case study:

As experience shows, the student should always be given freedom of choice in the course of work whether it is the choice of a task with further correction by the teacher, the choice of a model, the choice of an instrument, the colour scheme of the future work or the method of presentation. An artist should feel comfortable as if in a workshop. They can choose the partners they want to work with in the project or even the time when to work. All this has a direct impact on the outcome of the work.

I would like to note that the method of encouragement works at the initial stages of learning, while the effect of novelty and research works. In the future, these technologies can be integrated into the subjects of the main cycle of teaching. That is, for example, the painting assignment of one of the courses will not change, but instead of oil paints and brushes, students will be able to use a VR headset. In this case, productivity will not decrease. However, the student's interest decreases in the extracurricular study of immersive technologies.

In the course of work, we encountered a large number of accompanying difficulties that arose at each subsequent stage of the case study. The first and most difficult task was the problem of displaying fine art using 3D modelling tools. Namely, the usual two-dimensional image had to be converted into 3D. And since the final images still had to remain flat, it was decided to go the other way. We came up with a method where each coloured fragment was a separate 3D object that had its own shape, direction of movement and its own colour similar to strokes in painting, and only the totality of a large number of such objects created a sense of completeness of the work of art. Gravity Sketch tools were more than enough for such a task. Graphic images were reproduced in the same way. Students took photographs of the desired composition and tried to recreate it in the virtual environment.

The advantages of this method are that we can adjust each element at any stage of work. It is also possible to change the inclination of the planes, achieving the effects of changing the density of "strokes" when observing them from different viewing angles. But this effect will work only when viewing a 3D image directly.

When the aforementioned problem seemed to have been solved, we faced another difficulty. During successive export and import, the image changed its optical properties. Due to this, we had to make additional adjustments for these objects in Blender. The object that was uploaded

into Frame VR should have a colour that is not affected by the lighting of the environment in which we place it. Otherwise, each of the fragments will interact with each other and will visually break up the painting. However, the harmony of combinations is significant in fine art, which contributes to generalisation and integrity.

One of the options for solving this problem was uploading a screenshot of the work directly from Gravity Sketch. This method is also convenient for keeping and demonstrating the step-by-step work, which is useful during the educational process.

In general, my view is that the work of only one of these programs cannot be effective. Only with their collaboration is it possible to achieve maximum mastery of the course content by students. For example, Gravity Sketch is more suitable for painting. Students spent about 90% of the time working on tasks in it. It is very convenient, intuitively simple and comfortable. Students immensely liked the possibility of communication in the virtual environment, which is an important factor to take into account. Several people can work at the same time and share experiences while being at home. It was as if we were creating art in the workshop all together, like we used to do it in the good old days. Blender turned out to be an intermediate program used for reformatting and light corrections of the image. Frame VR for us became an exhibition hall that could be open and accessible at any time of the day. It is intended for the audience rather than for the artists themselves. But the main advantage of this platform is the ability to access it from different devices. It is very convenient. While one needs special equipment to work in Gravity Sketch, such as a VR headset, one can use both a headset and a PC, tablet or smartphone in Frame VR.

Finally, workshops, training from the company Gravity Sketch, and online participation in the training were especially valuable for students, after which the students better understood the principle of work in the programs, mastered the key points, and understood further tasks in the process of creating 3D models.

4.2 Institute of Art, Design and Technology: Life Drawing - Aoife Balfe

Throughout this project I have felt that VR technologies could have many useful applications for learning and creation in animation generally eg. Layouts, camera moves, 3D modelling and animation et al. It is difficult to apply this technology to life drawing practice within animation effectively. In order to improve your drawing, the main activity you should do is draw more and when drawing from your own surroundings is so accessible it makes VR feel like a frivolous novelty when it attempts to simulate that experience, it has to be something different. I will

continue to use VR as a supplemental tool, especially to create spaces that embody concepts like the Tone Zone.

Collaboration

In January 2023 partners and students from IADT and ChNU met online. In this meeting the student groups presented previous work and discussed their art practices. This was an exciting opportunity for both students and their tutors who may not regularly see or engage with the work of peers at other institutions. After this introduction, we entered a shared workspace within Gravity Sketch. Students from IADT took turns using the VR headset to work within Gravity Sketch while Oleksandr and his students from ChNU demonstrated how they had been working in the programme over the course of the case studies. This VR experience was the most favourable of the project. Even without prior knowledge of the controls, students from IADT were able to immediately engage with and begin creating in Gravity Sketch. It was exciting to see other practices and approaches happening live in front of one's eyes despite the geographical distance between the viewer and the artist. For best results from VR learning multiple headsets are necessary to facilitate group work and collaboration.

5. References

The concept of inclusive education in art:
https://mkip.gov.ua/files/pdf/%D0%9A%D0%BE%D0%BD%D1%86%D0%B5%D0
%BF%D1%86%D1%96%D1%8F.pdf

Link to the questionnaire (Block 1. Determination of the level of knowledge in the field of VR/AR technologies and students' preferences).
https://docs.google.com/forms/d/1Q5tf-sWBQOWaQbxRSoNKmGO6OfBhvhKkIpdW_QFzwA8/edit?pli=1

Link to the questionnaire (Block 2. Questions to determine impressions from the first use of the headset).
https://docs.google.com/forms/d/1J1rbYNjGAIAtEUJtqReK1glpMrFHhqBj1y631F3AwEA/edit#responses

Link to the questionnaire (Block 3. Questionnaire on working in Gravity Sketch).
https://docs.google.com/forms/d/1qVR8avhHK1DBCb6vS3tPTnfMzW-OMeLJ-iDboA99zkU/edit

Website of the Department of Decorative, Applied and Fine Art.
http://artdeko.chnu.edu.ua/index.php?page=ua

Website of Yuriy Fedkovych Chernivtsi National University
http://www.chnu.edu.ua/index.php?page=ua

FB page of the Department of Decorative, Applied and Fine Art
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Link to the virtual room: https://framevr.io/qsl-trk-kjb

Link to the interim and final works created within the case study:
https://drive.google.com/drive/folders/16yk4rb0amfMT8HYea7TeBR8vBK5t1L0w?usp=share_link

Link to the assistant professor Oleksandr Toloshniak's webpage:
http://artdeko.chnu.edu.ua/index.php?page=ua/02personnel&data[13630][caf_pers_id]=2008&commands[13630]=item
https://www.instagram.com/oleksandr_toloshniak/
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Frame VR – The Tone Zone: https://framevr.io/tonal-work-gallery

Frame VR – The Control Gallery: https://framevr.io/tonectrl

Documentation Unedited Footage and Survey Results:
https://drive.google.com/drive/folders/1ZSMO2LwbpUtmbMUJPOUcZGxCqrW2RK77?usp=share_lin

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