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PAINTING WITH LIGHT:

ARTISTIC EXPERIMENTS INTO THE USE OF VIRTUAL REALITY AS AN ANIMATION PRODUCTION ENVIRONMENT

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Abstract

While many researchers have examined the technical characteristics of using VR as a production environment for animation, its artistic potential has only sporadically been investigated. We want to contribute to this line of thought through reflection on a number of expanded animation workshops organized in the context of the Painting With Light project. In this paper we use flow theory in order to discuss the experience of using VR as a 3D prototyping tool. Our findings suggest that this practice can add an improvisatory and co-creative dimension to animation.

Keywords: Virtual Reality, Expanded Animation, Flow State, Co-creation, Hybrid Spaces

Introduction: Virtual Reality As A Design Tool

At this point in history, it is almost impossible to ignore the importance of Virtual Reality (VR), as it has the potential to have a profound impact on society. In the context of the Covid-19 pandemic this tool has surged in popularity during a period when people were cut off from basic human contact (Eccles, 2021). Though VR's transformational abilities initially became apparent within a range of applications in the gaming industry, designers and artists from other audiovisual arts, including animation, have begun to experiment with its different uses, ranging from VJ'ing and music visualization (e.g. VJ visuals painted in VR by Steve Lucin), over animation-installations (e.g. Jon Weinel's Cyberdream) to the creation of embodied 3D environments (e.g. Lost Horizon Festival).

Research has revealed a large number of benefits regarding the use of VR and Augmented Reality (AR) as production environments for animation. The application of spatial technologies provides opportunities for making previsualizations (designs, storyboards) in an intuitive manner (Ardal et al., 2019; Galvane et al., 2019). In the production stage the use of VR-controllers increases the filmmaker's spatial awareness, accuracy and learning curve (Cannavò & Lamberti, 2018). Controller-based animation has therefore been proposed as a 'best of both worlds', combining the benefits of traditional keyframe-based animation and motion capture-based animation (Vogel et al., 2018).

While most research has addressed the technical characteristics of this new practice in animation (e.g. Cannavò et al., 2019) its artistic potential has only sporadically been discussed. Jon Weinel (2019) describes how the combination of VR, Interaction Design and VJ'ing techniques into an integrated animation-installation can facilitate the experience of a collective **flow state**. Given my background as a VJ-artist, I see a large potential in moving virtual animation towards more intuitive modes of creating, which eventually could pave the way for a type of real-time animation, comparable to for instance an improvised music performance. Several artistic works have pursued a similar trajectory, describing how the use of immersive technologies can induce a communal state of embodiment, on the side of both artists and audience. Well known examples are the work of Jordan Wolfson on social-ethical reflection through art (Schwartz, 2017) and Chris Milk's use of animation art to create an 'empathy machine' (Ted, 2015).

We want to contribute to this latter line of thought, through reflection on a number of animation workshops organized in the context of the 'Painting With Light' project. The project aims to add a performative dimension to the production of animation, and to open up the two-dimensional screen by examining how digital animation can be integrated in a physical context (e.g. Pahrulroji et al., 2021). Using a research-through-design method (Nijhuis & Lousberg, 2020) we examine how VR (and by extension Extended Reality (XR)) can be applied to reinterpret animation in our contemporary, digital, media culture.

Painting With Light

The origin of this project lies in a doctoral research project that investigates whether XR, and more specifically VR, can be used as a fully-fledged artistic and production tool for animated film. In the context of this research, the question arose regarding the ways in which creative sessions in VR could be 'shared'. The concept of 'sharing' takes a central role in our research, both on the creation side and the reception side. We accordingly address the following research questions:

RQ1. How can VR be used to develop a production space that facilitates co-creation and adds an improvisatory dimension, bringing the creators of animation in a collaborative flow state?

RQ2. How can VR be used to develop an exhibition space that makes the audience into active participants in this collaborative flow state?

In order to address these questions, the choice was made to organize a collective light painting session in a public space in the form of a video mapping. The performance is a collaboration between three VR illustrators and a music composer who will accompany the experience during a large - partly improvised - performance. The performance specifically addresses a number of sub-questions relating to the artist-audience relationship (RQ2): which elements of the animation creation process can be shared with the audience? How can one share, in a visual and immersive way, the process of concept design in VR? Though a lot of valuable research has already been done on the technical aspects of this question, at least equally intriguing is the artistic aspiration that both the audience, the musician and the VR artists are joined together, in the same artistic flow state.

Painting With Light is meant to be the first chapter in a series of similar experiments that will iteratively build on the insights gained in previous attempts. The performance will take the form of a video mapping on the interior walls of a library in the city of Genk (Belgium) - a building that has been awarded for its architectural qualities. This way, the audience can physically become part of the virtual world, together with the artists. The entire music score will be improvised using digital production tools. The collaboration between visual and musical artists aims to create a new experience, revolving around the experience of the creative process of designing and creating in VR.

Additionally the Painting With Light performance is an artistic experiment that aims to explore the potential of VR as a live-performance tool. The goal is to create a symbiosis, where both artists and audience are invited to experience the flow state that characterizes the creative process: a continuous stream of ideas, sketches, colors and movement should constitute an immersive experience that is informative of the co-creative nature of animation production (RQ1).

The Artistic Flow State

While there exists a lot of literature and research regarding the efficiency of designing in VR, few authors have addressed the flow state that occurs during designing and animating in VR. When a person is completely absorbed in his/her pursuits, one can refer to the mental state defined as 'flow'. Hungarian-American psychologist Mihaly Csikszentmihalyi wrote a seminal series of books on the subject, including *Creativity: Flow and the Psychology of Discovery and Invention* (1996). Flow denotes a mental state in which an artist (or essentially any type of practitioner) is optimally concentrated. They perform as if they are in a dream, taking on the rules and rhythms of a game-like performance. In this state, the artist can perform very effectively and efficiently, but at the same time, also very intuitively and expressively (Csikszentmihalyi, 1990).

Karsten (2010) adds to this that "Both participants experience changes in perceived control over their activity during flow. For both, flow is related to a feeling of less thinking and judgement while at the same time being intensely concentrated, captured in the sub-themes of "focused attention and diminished conscious control". Following this line of thought, it can be said that the flow state enables the mastery of the artists to be called upon instinctively, and therefore, more naturally. It is this type of deep concentration or self-forgetting that Tatiana Chemi describes as having a specific purpose when it comes to artistic processes. It helps trigger and guide the creation of ideas and concepts (Chemi, 2016).

In order to be able to describe a state of 'flow', one or more of the following eight characteristics must be present, according to Csikszentmihalyi: (1) there is a clear goal, (2) the person is in a state of concentration and works purposefully, (3) the person is absorbed in the activity and forgets his/her sense of self, (4) loss of time awareness, (5) direct feedback on success or failure allowing room for adjustment, (6) the activity is

challenging but just exceeds the level of one's own skills, (7) there is a sense of personal control over the situation, and (8) there is an intrinsic reward attached to the activity (Csikszentmihalyi, 1990).

The flow state is often thought of as related to scenarios with a minimum or maximum effort requirement. A person may perform an activity so efficiently that no extra effort is required for it. The conditions for this state are hard to fulfil, and its main characteristics are: focus, absorption, engagement and efficiency (Csikszentmihalyi, 1990). For these reasons the flow state is considered as a driving factor in creativity and innovation.

Flow can occur in various scenarios: while playing games, working on a project or just surfing on the internet, one can find themselves in this optimal mental state. Game designers investigate flow to optimize game play. Jazz musician Butch Morris even devised a series gestures to help fellow band members enter a flow state during improvistation sessions (Morris & Henderson, 1996).

Flow State in VR

Despite the fact that numerous authors have emphasized the immersive potential of VR technologies, research on the connection between VR and flow state remains a fairly uncharted field, especially if we make the link with a live performance experience. Within this specific field one usually comes across the experiments of Jon Weinel mentioned above. However, some research has already been undertaken within related fields. A recent study with 42 undergraduate design students from Bilkent University, Turkey found that the immersive aspect of virtual design environments had a positive influence on the participants' creative process (Obeid & Demerkan, 2020). This was concluded through observation of factors such as flow state and motivation, related to creativity. There additionally appeared to be a strong correlation between motivation and flow state and a weak (but significant) correlation between spatial ability and flow state. Similar findings were reported by Bodzin et al. (2021), describing an increased sense of engagement and flow, with a VR game that helps students to learn about locations. Almost all 57 students participating in this study reported experiencing a flow state in some form while playing the VR game.

Organisation of Preparatory Workshops: Research Method and Results

While preparing the Painting With Light performance we organized three animation workshops aiming to develop insights that will be used in the eventual video mapping experience in public space. We apply a research-through-design method, whereby phases of creation and phases of reflection are continuously being alternated (Shön, 1983), and whereby each artistic creation (workshop) inspires and informs the subsequent creation (McNiff, 1998). Reflection upon the output of specific workshops was organized in three ways. First, the practices and experiences of each workshop were presented to an expert panel consisting of researchers of the Inter-Actions research group at LUCA School of Arts. Second, subsequent to each workshop, short interviews were conducted with the participants, specifically addressing the creative experience and the different characteristics of the flow experience, as described above. Finally, expert interviews were conducted with two industry professionals in order to validate the findings emanating from our artistic practice.

Each workshop targeted a different audience: (1) nonprofessionals (science communication workshop), (2) animation students (student workshop), and (3) professionals and researchers (carbon cycle workshop). The purpose of these workshops was to bridge two worlds: VR and traditional animation. We decided to focus on different aspects of content creation, including concept art, prototyping, layout and 3D modelling.

Nonprofessionals (Science Communication Workshop)

During National Science Day[1], six different 3D models were created during six online (live streamed) workshop sessions, each time within a time span of only 15 minutes. Each model, or at least its subject matter, was suggested by a member of the audience. Using classic 3D programs, creating these models would have taken at least twice as much time.

The workshop provided a valuable first exploration of the intuitive nature and ease of use of the VR creation tool. Taking into account that the workshop leader has mostly experience as a 2D artist, and only limited experience with 3D modeling, the use of hand-controlled sculpting techniques was considered artisitcally inventive (to the animation artist) and informative of the process of animation creation (to the participants). The participants were non-professionals, who had little knowledge of 3D art or animation, but a common interest in using it in the future. They were only able to suggest the objects that would be created and/or ask questions about the proces.

The workshop confirmed that the potential of this tool for rapid prototyping is unprecedented, since traditional 3D programs are designed to be used by professionals. Using VR as a prototyping tool enables non-professionals to create first drafts of objects or scenes, which can further be developed in a later stage. The resulting environments are not complex (in terms of polygons) and are therefore not necessarily suitable to be used in high-polished animation productions. Nonetheless these models allow for easy handling, and have been used in a virtual exposition.

Animation Student Workshop

A similar workshop was subsequently organized with a number of undergraduate animation film students. In this context the participants did not only operate as an audience, but actively participated in the creation of 3D models and spaces. Eight Quest 2 headsets were used, equipped with Gravity Sketch as the software of choice. The students all had some experience with designing creative content. All except two were 2D artists and none of them had ever designed or modelled anything in VR.

The creative sessions consisted of two parts. First, the students were given a brief introduction in the use of the VR headset and were given time to use it comfortably. In the second part of a session a tutorial class was provided on working with Gravity Sketch. The workshop leader quickly modelled a landscape scene with trees to demonstrate the process of 3D modelling in VR. Subsequently, the students had about 3 hours to work on a model of their own choosing.

During the session we noticed that the two students who had prior experience with traditional 3D software, were struggling to find a workflow. One indicated that he had a specific way of working in traditional, mouse-controlled software, and not having his familiar menu system threw him for a loop. Most of the other students reported loss of time awareness, being able to concentrate much more on the designs, and were generally able to adapt very quickly to creating in VR. One participant in this study reported that she had more time to focus on the model without any outside distractions and lost track of time.

1 The Day Of Science is an annual event held in Belgium, putting the spotlight on outstanding research and innovations. The public can attend lectures, experiments, workshops, games, podcasts, tours, shows, and countless other activities organized at universities and research centres all over the country.

Professionals and Researchers (Carbon Cycle Workshop)

In November 2020, the Carbon Cycle project took place at LUCA School of Arts (Campus Ghent). VR was used for this project as a design tool to create 3D models, aiming, as a larger research objective, to illustrate the life cycle of carbon. The results of the project are permanently exhibited in a virtual environment, created in the Sketchfab platform, using a VR headset, computer or cell phone.

The 3D models that can be seen in this virtual space were also created using the program Gravity Sketch. Even more strongly than in the previous workshop, we observed that this program works remarkably differently than conventional 3D programs. Within Gravity Sketch, a 3D model appears spatially present and physically manipulable, making it seem tangible. This one-to-one relationship with the design makes it a very intuitive creation tool because one can use muscle memory stemming from other analog visual techniques such as drawing and sculpting. It helps to think outside the box of a 2D screen and to move the entire creation process into an experienceable 3D space. This method allowed us to create smooth iterations of a design. It helped to break away from the classic hand-mouse workflow and allowed us to design with more creative freedom.

While these cases aimed, in the first place, to showcase the potential of VR as a tool for rapid prototyping, each workshop resulted in creations that were considered as standalone artefacts to be exhibited juxtaposed to each other within the VR environment. As such, the spatial environment does not only operate as a collaborative production space, but also, and most significantly, as a permanent exhibition space.

Technically we observe that designing in VR has a high efficiency and lowers the threshold for practitioners who mainly have a background in 2D art, hereby confirming the findings of previous research. Additionally, we observed that the appeal to the participants' spatial cognition skills (e.g. finger memory) was considered liberating and a catalyst for creativity. Participants also noted, however, that the experience cannot be entirely compared to that of (co-)creation in a fully analogue fashion, due to the cognitive overload of working in a mediated environment. Although it was acknowledged that indeed a state of time distortion can be reached almost as quickly as in the context of performing a physical activity, the importance of taking breaks from the VR space was stressed by several participants. Some creators had the feeling of being lost in the virtual zone, which would result in brain fatigue, reduced focus, and a sense of disorientation after a longer while. This phenomenon was mainly attributed to the current state of affairs in technological processing capabilities, and not neceserarily to the essence of the experience in itself – a finding that was supported in the views of VR professionals (see next section), who forwarded this as an important focal point in future finetuning of the available tools.

Validation Of Results: Interviews With VR Professionals

To further support the preliminary conclusions drawn from these workshops, we conducted two expert interviews with professionals in the broader field on the topic discussed. Daniel Martín Peixe (R1) is a character animator and virtual animator with 11 years of experience at Walt Disney Studios and is strongly involved in the online group Virtual Animation. Lydia Choy (R2) is a developer and owner of Medium by Adobe and recently worked on the new tool Substance Modeler for Adobe's new 3D pipeline. Both on the creative and the developer side, the term flow state was discussed intensively during these interviews.

One important thing to consider, if we study the potential of VR to facilitate a flow state, is that several factors can be counterproductive in achieving a flow state. For Csikszentmihalyi's 8 characteristics to be met the virtual environment should not be made too complex. In animation however, most

modern production pipelines have a high level of complexity and difficulty. Two conflicting requirements seem to clash here. The question is whether VR can make it possible to create & design these complex workflows in such a way that they can become more accessible, which can help in achieving a state of creative flow.

R1 uses Quill, an early VR animation tool developed by the Oculus team. It has been through some revisions, and at first glance does not seem very intuitive to work with. Does this affect the creative workflow? According to R1 the flow state is predominantly a function of how the User Interface (UI) of the software is designed. A lot of actions are achieved through shortcuts and the menus are easy to comprehend. The buttons are big and it is easy to tap them. The tools are simple, but powerful to use. And there is a lot of emphasis on shortcuts. The shortcuts enable the creator to perform actions without reaching out to a menu. That, combined with the possibility of having one's hands completely free in space, is, still according to R1, highly constructive of initiating the flow state. The brain is more focused on creativity rather than on the interface and how to obtain the menu and the buttons that need to be pressed. Once the artists find themselves in the flow state, they are "*just creating"* and not worried about how this is effectuated. The interface becomes transparent, and the illusion of unmediated creation occurs. Another important element is that the artists are essentially enjoying the activity, because they mostly rely on muscle memory without overthinking anything. Most of the artist's attention is dedicated to the creative aspects.

According to R2, flow state has always been the fundamental reason why sculpting in a spatial environment is a compelling and appealing activity, compared to any sort of 3D creation on a desktop platform. "*We always ask that question whenever we add anything to a design: a certain sort of flow between the act of creating, and having to access the UI or doing something peripheral."* R2 further states that there are different dimensions of flow developers have to deal with: being able to step back from the creative process to observe and evaluate the created work, the ability to re-immerse back to the creative flow after e.g. taking a break, and losing track of time. This last characteristic can be considered the one that artists mostly relate to, where one is "*lost in the creative process"*, executing an idea that is already internalized.

R2 adds to this that the key to achieving this is an organic design, made to be transparent, hereby mirroring the argument made by R1. This sense of transparency stimulates the experience of losing track of time and deepened focus - two of the main characteristics identified by Csikszentmihalyi. Most of the really hard interaction problems that designers tackle when they are making tools are related to this aspect: to make the UI match what the users are thinking. At that moment, whether or not something like the size of a stroke needs to be adjusted, this needs to feel as non-disruptive as possible. That is why R2 stresses the importance of fast responsiveness in the User Experience. R2 explains that in the newly developed tools the sculpting experience functions (shaping forms, adding surface detail, etc.) are the most important in that respect. They are designed to be highly responsive so that people are not interrupted when executing them. Less important, and therefore slower in response are the arranging of scenes, switching between different tools, accessing extra UI functions (light adjustments, editing references, etc.). The slowest interactions are related to general application settings (creation of a new scene, exiting the application, file management, etc.). The overall idea, as is clear, is to not compromise the core sculpting interaction loop.

A last element that is considered very important by R2 is to facilitate the step where artists try to find inspiration, by either gathering references or organizing references in a certain way, thereby providing a general structure for the overall design. This functionality is deliberately separated from the 'observe and evaluate' phase, because it is not necessarily something the artist needs to access while in the deepest flow state. Related to this, R2 observes that one of the biggest

future challenges for immersive UI design resides in the question of how artists interact with the rest of their digital workflow, or even their physical workflow, which may even require taking off a headset and reading a book or getting something to drink. Most of the current research is moving in that direction, working towards hybrid forms that combine virtual with real-life activities.

Conclusion

In conclusion we state that the theory of flow, as elaborated in the context of activities such as music improvisation or more recently game play, provides a good base to describe the experiences of artists while using VR as a production environment for animation. In each workshop that was elaborated in preparation of the Painting With Light project, participants (both professionals and non-professionals) reported an increased sense of focus, loss of time, and an intuitive relationship with the virtual objects and spaces being created. The fact that they can rely on muscle memory and that the results of a creative intervention are immediately made tangible and visible, are observed to be important contributors to this. Especially animation students and professionals who mostly had experience with 2D animation, considered it a benefit that a 3D model can be created in a similar way to (physical) drawing or sculpting, which increased their motivation to experiment, and lowered the threshold to engage with 3D software. Indeed, the reliance on muscle memory, which almost every visual artist has developed through training in painting or sketching, adds to the artistic and democratic potential of this practice. These findings, stemming from our reflections upon our own creative practice were furthermore supported by the insights of industry professionals who point out that transparency and immediate feedback are considered key elements in nowadays design of immersive interfaces.

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