Faculdade de Design,
Tecnologia e Comunicação
Universidade Europeia

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EXPERIMENTAL ROTOSCOPING METHODS VIA EBSYNTH

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Projeto apresentada ao IADE - Faculdade de Design, Tecnologia e Comunicação da Universidade Europeia, para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Design e Cultura Visual realizada sob a orientação científica do Doutor Hugo António Bernardo Santa Bárbara Passarinho, Professor Auxíliar da Universidade Europeia.

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Keywords Animation, Rotoscoping, Experimental, EbSynth

abstract

This paper focuses on creative, experimental or unconventional uses of EbSynth. Utilising non-parametric texture synthesis, this tool allows for many different functions to become more time efficient; rotoscoping, masking, stylization, tracking and mass editing. These advantages and their disadvantages are examined while comparing these new methodologies to historical exemplars and similar research in the academic sector. The primary experimental method being nonlinear representation, i.e. rotoscoping a video of something different than the drawn subject, utilising mimicry, for example using a video of a poached egg to represent a human eye. The final product for this project is a creative video whose visuals are a demonstration of the methodology's possible output. The visuals presented and how to attain them, are explained throughout this text. This methodology is suitable for animators of all experience levels, as the technology being discussed is extremely new with lots to explore and does not require many resources to use.

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Introduction:

Premise:

From the earliest cave paintings to the well known exit sign. Art represents what it is not. When you look at an exit sign you see a simplified person running out a door. If you were to describe this to a friend, you wouldn't say you saw "white paint in straight lines on top of green paint with a light behind it". Creating powerful or efficient representations is often the goal of art. Whether that representation is to inform or to affect. Similar to this, in sound design we use alternate methods to mimic the sound we are trying to represent. When you hear an arrow flying in a movie or animation, it's likely a balloon deflating. The sound of a bone being broken is of course not the actor's bone actually being broken, but a substitute sound.

Why then when rotoscoping do we often make one to one comparisons with our efforts? The most common usage of rotoscoping is to animate actors so that they fit within a 2D animated world. Usually, the representations of the actors are still very similar to the video taken of them. Other non-figurative uses of rotoscoping include direct translations of environments to match the art style of the animation and save time. Both of these typical use cases can be seen in the animated anthology *"Heavy Metal"* (Gerald Potterton, 1981).

Figure 1. Example of typical figure rotoscoping technique from the movie *Heavy Metal* (Gerald Potterton, 1981).

These use cases are the reason rotoscoping exists at all. In this paper we seek to outline alternative and experimental representation utilising rotoscoping. Representing the things we want to, with mimicry, rather than converting something from live action to 2D. With the dawn of A.I. art tools there are many image-to-image translation programmes that can assist an animator who wishes to

rotoscope. Rotoscoping all frames by hand is an extremely time-consuming activity. With tools such as EbSynth (*Styling Video by Example,* Ondřej Jamriška, 2019), the number of hand drawn frames needed is greatly reduced, speeding up the process and saving a huge amount of time. Ironically EbSynth is not powered via A.I., neural networks or machine learning, but via a jigsaw-like process known as non-parametric texture synthesis algorithms. Actually, this is where EbSynth gets its name from, Example Based Synthesis

Figure 2. Example of rotoscoping in an early official EbSynth tutorial (*Styling Video by Example,* Ondřej Jamriška, 2019). With keyframe pictured on top, synthesised frame on lower left, and frame from original video footage on lower right. Notice EbSynth allows for detailed textures to be synthesised in the rotoscoping process, in comparison to the flat simplified rotoscoping in previous fully hand drawn sequences.

With traditional rotoscoping it is hard to make many iterations for the sake of experimentation due to its time consuming nature. Image to image translation tools are an ideal tool for such experimentation. These tools are not without caveats. When using these tools in a traditional manner, the software. can make "mistakes" or behave in manners that are unpredictable. Often undesired artefacts will appear in the resulting video if strict rules are not followed. There are methods to ensure a predictable outcome when employing traditional structures. For example, high camera frame rates (recording slow motion is especially effective (*5 Tips for Making EbSynth Action Scenes*, *FrozenFresh*, 2022). Other methods include, colour blocking different elements of the video, ensuring high colour/light contrasts in original video, and most importantly that all elements of the video are represented in the keyframe. If an element of the video is not addressed

in the keyframe the results can be extremely unpredictable. Movement within the original footage is also a huge factor in determining the consistency of the synthesised video.

Figure 3. Example distortions and artefacts caused by simple movement and improper techniques with EbSynth, as displayed and explained by Joel Haver in his famous EbSynth rotoscoping tutorial (*How I Animated this Video,* Joel Haver, 2021). This animation tutorial video inspired countless creators to adopt a similar style and use it to make their own content, becoming the *Joel Haver Animation Style*.

Figure 4. Screenshots demonstrating slow motion camera technique described by YouTuber Frozen Fresh (*5 Tips for Making EbSynth Action Scenes*, *FrozenFresh*, 2022). This high frame rate method to create consistency in video footage with lots of movement is very effective, screenshots are from a single take of a jumping double kick that involves lots of movement. With this high frame rate method distortions are avoided.

These rules are important to follow if one wishes to use EbSynth in a traditional one to one comparative manner. In this project we aim to utilise these same rules, but in the opposite direction. Leaning into the unpredictable mistakes, finding interesting ways to create video artefacts, taking advantage of the *errors* the tools are capable of producing, to find new methods of representation.

Rotoscoping Origins:

The invention of rotoscoping is credited to Max Fleischer in 1915, and was used to give more effective motion to the characters within his animated series *"Out of the Inkwell" (*Max Fleischer, 1919).

The first ever use of his patented rotoscoping technology was to rotoscope his brother Dave Fleischer who was working as a clown in Coney Island at the time. This character Koko the Clown has a very straightforward form and his shape is a one to one comparison of the rotoscoped video. Fleischer mixed this rotoscoped video with live action footage of himself in his studio, drawing the characters and their situations to life, before said drawings themselves start interacting with the real world.

Figure 5. Footage of *Koko the Clown* being "drawn to life" by creator Max Fleischer (*Out of the Inkwell: The Clown's Pup,* Max Fleischer, 1919).

Later this rotoscoping method became less exact in its mimicry of form in video. Allowing for more abstract interpretations of the rotoscoping and focusing on the movement instead of the exact shape or silhouette. Using videos of people moving and dancing in different scenarios, Fleisher animated simplified yet extremely effective "rubber hose" characters by tracing the movement of the live action actors frame by frame.

Figure 6. This version of *Koko the Clown* was based on Cab Calloway's movement while performing, and utilised a looser form of rotoscoping, copying key movements rather than the entire shape or silhouette (*Betty Boop in Snow White,* Max Fleischer, 1933).

Figure 7. Comparison of Cab Calloway dancing with rotoscoped ghost that follows his movement. This along with many other parts of *Betty Boop in Snow White* can be seen as huge milestones in animation, similar to the milestone of the original iteration of *Koko the Clown,* who also appears in this animated feature, but in the rubber hose animation style (*Betty Boop in Snow White,* Max Fleischer, 1933).

Rotoscoping could be seen as a natural evolution from previous artistic tools such as the camera obscura, a dark room with a single small hole for light to enter, which was used to project real life images onto the interior wall for an artist to trace. The usage of a camera obscura is similar to

rotoscoping a single frame from a video. More direct predecessors can be seen in the work of Eadweard Muybridge and his chronophotographic sequences from the 1880s onwards. These sequences were painted on glass, tracing images from photographs projected onto the glass. Photographic sequences in essence, are the same as live action video, only the method of compilation is different here, as photos took time to process and camera frame rate was too low to create video directly. Instead, a series of photos at different timings were compiled to give the illusion of video. By 1902 a similar methodology was being used to make "kinematographs" by toy companies in Nuremberg, now utilising live action film footage.

Fleischer ceased using rotoscoping for fluid animation in 1924, relying instead on the experience of animator Dick Huemer. Until in 1930 returning to the technique in order to capture the complicated dance and movement in cartoons such as *Popeye* and *Betty Boop*. Fleischer's patent expired in 1934 and other studios began using it. Walt Disney studios used it for referencing in *Snow White and the Seven Dwarves.* Other major studios from the time sometimes made use of rotoscoping, but rarely.

Fleisher's use of rotoscoping for his 1941 series *Superman* allowed for animated characters to become more realistic than they ever had been before. At the same time animation in other countries was finding ways to utilise this growing technology. Such as the first Sino-Chinese animated feature *Princess Iron Fan,* (Wan Brothers, 1941). Interestingly, there are moments within the rotoscoping animation of this Chinese film that look very similar to the modern rotoscoping of figures by Joel Haver in the 2020s. Particularly the thick black outlines of the characters and the flat coloured shading which accompanies them.

Figure 8. Left is a cropped screenshot from *Princess Iron Fan* (1941), right is a cropped screenshot from Joel Haver's *Hearing Enemy Music in an RPG* (2023). The primary similarity being the very thick black outlines.

The Soviet Union produced a series of animated features utilising rotoscoping to retell various Russian tales. Such as Alexander Pushkin's *The Tale of the Fisherman and the Fish* (Tsekhanovsky, M. 1950). Which demonstrates a fine artistic technique, despite lagging behind its US counterparts. Parts of these Soviet animations foreshadow similar styles to be seen much later in Western animation such as Ralph Bakshi's *Wizards* (1977), *The Lord of The Rings* (1978), *Fire and Ice* (1983), and the Moebius inspired anthology *Heavy Metal* (Gerald Potterton, 1981) and by extension *The Spine of Night* (Morgan King, 2023).

Figure 9. Top left *Tale of the Fisherman and the Fish* (1950), top right *Fire & Ice* (1983), bottom left *Heavy Metal* (1981), bottom right *The Spine of Night* (2021). Notice the similarities between these features and their chronology.

Another essential figure of Russian animation who utilised rotoscoping at times was Vladimir Tarasov. His sci-fi short movies employed varying artistic styles with adjusted rotoscoping. Rotoscoping characters with limited colour palettes and simplified yet elegant shading, particularly in *Contract* (1985).

Figure 10. Screenshot from Vladimir Tarasov's *Contract* (1985), notice the lack of outline and linework in favour of solid shape colours.

An extremely creative early use of rotoscoping can be seen in the 1949 music animation *Begone Dull Care*, (Lambart, E., McLaren, N., 1949). Canadian artists Norman McLaren and Evelyn Lambart used an oscilloscope to visually record the frequencies present in the music of jazz musician Oscar Peterson. From here they enlarged the images and painted directly onto the frames to embellish and animate the oscilloscope recordings. This usage of rotoscoping to make an abstract motion graphic is extremely impressive considering the editing tools and technology available to the creators at the time. Even more so when one considers that all of this was done by hand, by two people.

During the second half of the 20th century, most rotoscoping projects lead back to Ralph Bakshi and his keen ability to create stunning projects with very little budget. Then in 2001 Richard Linklater took another step forward, with the mesmerising *Waking Life*. Linklater's team developed their own form of interpolated rotoscoping techniques to create this dream-like reality in the first ever fully rotoscoped feature length film. Linklater's use of rotoscoping lends itself to a very appealing aesthetic, but is also a clever utilisation of the technique to create various special effects.

This rotoscoping technique led to the creation of *Rotoshop* (2006) by Bob Sabiston. An interpolated rotoscoping software, which interpolates the animations between the keyframes by calculating vector movements. Rotoshop is currently not available for use outside of Flat Black Films. Craig Staggs rotoscoped in Linklater's other features, *A Scanner Darkly* (2006) and later

with Steph Swope as Minnow Mountain for *Apollo 10 ½* (2022) and *Undone* (2019) utilising EbSynth for the latter two.

Figure. 11 Behind the scenes (left) and screenshot (right) from Richard Linklater's rotoscoped movie *Apollo 10 1/2* (2022).

Further into the 21st century and also created by Minnow Mountain, *Undone* (2019) ties an interesting premise into a fully rotoscoped TV series. The use of editing, composition and combination of methods allows for some truly inspiring media. These clever uses of cinematography and compositing harken back to Linklater's *Waking Life.* In saying this however, it is worth noting that Minnow Mountain employ different animation techniques and styles on a case by case basis, this creates a unique identity for each of their projects.

Then in 2021 YouTuber content creator Joel Haver demonstrated the power of EbSynth as a rotoscoping tool. Haver created a tutorial video on how to achieve the same animation style that he uses, the same tutorial video referenced at the intro to this paper, *How I Animated this Video* (2021). This one video has led to a huge number of other EbSynth based animation YouTube channels. To such an extent, that the loose humorous animation style has become synonymous with Haver's name, often referred to as "Joel Haver Animation Style". Haver comes from a background in directing and considers himself a video maker first and foremost. Joel Haver having zero experience with animation before this, is emblematic of the robust nature of EbSynth as well as its ease of access. The number of creators that Haver has inspired is countless but to name a few: Goat on a Stick, Trendead, Joel IT, Winter is Coming, FrozenFresh.

Contrary to this style, the clean, detailed rotoscoped animation style seen in 2021's *The Spine of Night* is a 100% hand drawn, frame by frame adult animated feature. *The Spine of Night* released after taking seven years of hand-drawn work at 12 frames per second and having no connection to Haver or EbSynth. There is also a clear connection between the style of *The Spine of Night* and Ralph Bakshi's adult fantasy animations, particularly *Fire and Ice*. There are many fantastic scenes in *The Spine of Night,* but perhaps the most impressive part of *The Spine of Night*, is the artist's use of rotoscoping for gore special effects. This movie shows there is certainly still a strong audience for these styles of adult animation, as well as the control that fully hand drawn rotoscoping allows for.

Another modern creative use of rotoscoping can be seen in the 2017 horror video games *FAITH: An Unholy Trinity*. Using rotoscoping with a retro pixelated aesthetic to create the cutscenes throughout the game. Rotoscoping has been used in video games for some time now, as far back as *Karateka* (1984) and most famously with the original *Prince of Persia* (1989).

Figure 12. Screenshots from the survival horror game *FAITH: The Unholy Trinity (2022).*

EbSynth:

The 2020s so far have shown us the incredible power of A.I. supported tools. The variation and implementation of all various tools would be too great to list here, but the ones used to help create this project were *ToonCrafter* and *Luma Dream Machine*. In this paper there will be a focus on "Image to image translation" tools. EbSynth was the primary chosen tool to experiment with, due to its robust capabilities, lack of guardrails, and popular usage across industries. Ironically, EbSynth is not powered via A.I., neural networks or machine learning. But instead utilises "non parametric texture synthesis algorithms".

EbSynth was developed by SCRT WPNS (Secret Weapons) and made publicly available in 2019, gaining popular usage in 2021. Co-founders Šárka Sochorová and Ondřej Jamriška met at the Czech Technical University in Prague. With backgrounds in computer science and traditional animation, as well as publications related to style transfer (*Stylit: illumination-guided example-based stylization of 3d renderings*, J Fišer, O Jamriška, M Lukáč, E Shechtman, 2016). EbSynth should actually be seen as a culmination of various research publications from these developers. Such as the style transfer papers published earlier.

EbSynth is a free to use tool which can be used with any form of image sequence and due to this it is extremely flexible as to the varying industries that can utilise it, including but not limited to animation, video, and 3D renders. Anything that can be separated into an image sequence, can take advantage of it as a tool. To synthesise, at least one image from an image sequence must be chosen to act as a keyframe.

This chosen keyframe can then be drawn on using image editing software such as Adobe Photoshop, GIMP, MS Paint or so on. The keyframe folder and the image sequence folders are placed into the EbSynth module in their indicated slots. EbSynth synthesises a new image sequence, rotoscoped based on the keyframe. This image sequence can then be compiled using various software to create a video in whatever format the user wishes.

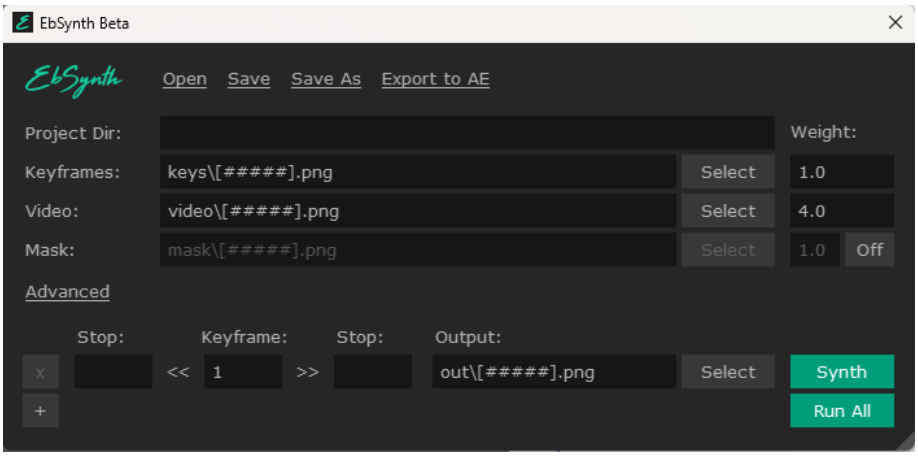

Figure 13. View of Beta EbSynth application, newest version of the application at the time of writing (*Styling Video by Example,* Ondřej Jamriška, 2019).

One of the first uses of EbSynth was as a style transfer, or rotoscoping tool. The artist/researcher creates one or more keyframes using standard digital painting tools, the stylization is then automatically propagated to the rest of the images (*Styling Video by Example,* Ondřej Jamriška, 2019). This research set the groundwork for all manner of new uses for the tool.

Soon after there was more work on using EbSynth for "hybrid animation", displaying pros and cons of its use versus traditional animation. The researcher used 3D animation, and using drawn keyframes input through EbSynth added linework and texture to the 3D models (Jerina Kivisto, 2019). The primary pros found by Kivisto were; EbSynth was time saving, required less effort, and "eased the workload immensely". Cons being that the animation lost some accuracy and fluidity, and when compared side by side the hand drawn counterpart was cleaner. Remember these two images use the same 3D model, lines and textures were added on top of the model, but one was propagated by EbSynth based on the artist's example (keyframe), and one is a hand drawn frame.

Figure 14. An output frame produced by EbSynth (Left), compared to a hand drawn animation frame (right). (*Hybrid Animation: The Process and Methods of Implementing 2D style in 3D Animation*, Jerina Kivisto, 2019). Notice how the synthesised frame on the left has distortions in the line work and shading, specifically the white lines in the hair and on the hat.

There are many other tools that use "text to video" either for editing or for image generation, that can be seen as similar to EbSynth, however, EbSynth is truly unique in its structure and the creative freedom that it allows its users. At the time of writing this, there are no other image to image translation tools that focus on non-parametric texture synthesis for video creation via artist's keyframe in the same manner that could be found.

Methodology:

Literature Review:

EbSynth as a multi-purpose rotoscoping tool has entered the academic sphere, with various uses, some traditional and others more experimental and unconventional. Though this technology is still very young, starting in 2021 EbSynth was utilised in what is now one of its more common usages. To transform live action video of actors into stylised oil paintings for a digital recording of the opera piece *Die Zaubeflote (Constrained Creativity: a digital presentation of Mozart's Die Zauberflöte,* Abraham Marinus Spies, 2021*).* In the project the workflow was as follows: filming actors, separating into image sequences, choosing keyframes, stylising the keyframes via A.I. application *DeepArt.io*, synthesising a video based on that keyframe with EbSynth.

Rotoscoping was also used to create coloured backgrounds greenscreen style (though the colour often being black), to allow the stylised videos of the actors to then be masked via keying onto 2D backgrounds. This method of first stylising the keyframe via an A.I. tool such as DeepArt.io (or google dream, photoshop, etc) can be seen in other literature and research projects, and has become a common pairing between these types of tools, generative A.I. and image to image translation.

Figure 15. Example of oil painting style transfer via A.I. tool *DeepArt.io* by Abraham Marthinus Spies (*Constrained Creativity: a digital presentation of Mozart's Die Zauberflöte,* Abraham Marinus Spies, 2021), stylistic example is Henri de Toulouse-Lautrec's *La Toilette*.

For this specific use of EbSynth, other researchers have proposed different tools. In particular a group of researchers from Shenzhen and Nanjing (*Face Translation based on Semantic Style Transfer and Rendering from One Single Image,* P Lin, B Liu, L Wang, Z Lei, J Cheng, 2021) have developed their own tool and methodology for stylising and altering faces to appear as other creatures. The researchers compared the results among a few different tools including EbSynth. The tool and workflow used by these researchers gave the most consistent and effective results. Features of the faces were first colour blocked into different segments before being stylised to allow for more consistent tracking and feature retention. This same method could also be used with EbSynth, by making multiple steps/layers during the rotoscoping process.

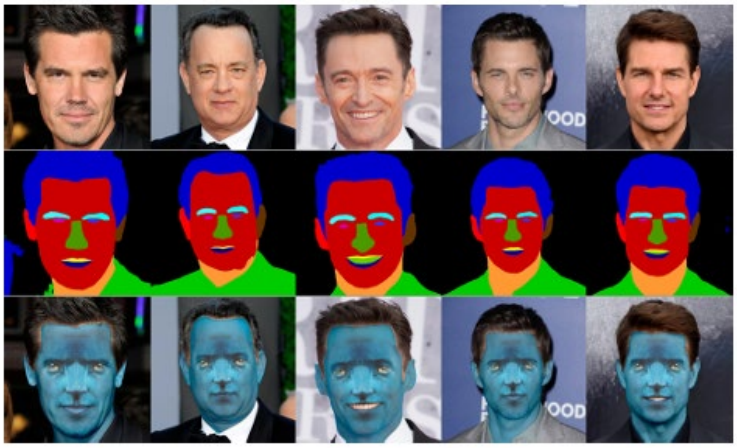

Figure 16. Colour blocking method to segment faces prior to video stylisation by Shenzhen and Nanjing Researchers (*Face Translation based on Semantic Style Transfer and Rendering from One Single Image,* P Lin, B Liu, L Wang, Z Lei, J Cheng, 2021).

For an instance of non-rigid representation, we can look at an EbSynth rotoscoping project that transformed videos of wildfires into oil paintings (*Paradise,* Jay Smerling, 2022). The oil painting style in this differs from the previous example, as the author personally painted the keyframes with an oil paint add-on in Photoshop and a drawing tablet. This choice to video something changing and non-repetitive, in this case fire, is in line with the concept of our project *Experimental Rotoscoping Methods*.

Figure 17. Keyframe of oil painted wildfire (*Paradise,* Jay Smerling, 2022).

Another example of experimental use cases of EbSynth can be seen in some of the different rotoscoping works by Eloïse Fabre (*The Contemporary Image,* Eloïse Fabre, 2022). Fabre used EbSynth in situations of non-repetitive change to take advantage of the inconsistencies or unpredictable artefacts created by EbSynth when used in a non-typical situation. In relation to this

project, the most prominent example being a video of the author dunking their head in a bathtub, with a water colour style keyframe, and intentionally allowing the water movement to distort the process. This is very similar to the thought process in our paper *Experimental Rotoscoping Methodology.*

Figure 18. Images from water distortion rotoscoping, original unedited keyframe (upper left), screenshots from final output (below), (*The Contemporary Image,* Eloïse Fabre, 2022).

In a somewhat opposite approach, a team led by Y.C. Lee created a workflow specifically aimed at creating greater consistency while using such tools. These researcher's methodology is 100% software driven and continues as follow: live action video into image sequence, use of stable diffusion to edit keyframes via text prompts, processing via EbSynth to synthesise video from keyframes (*Shape aware text driven layered video editing*, YC Lee, JZG Jang, YT Chen, E Qiu 2023).

This process is much more similar to the typical use cases of rotoscoping. Subjects within the videos are represented as similar things to themselves, e.g. bear to lion, jeep to car, duck to swan, dog to cat. Results vary in effectiveness. Essentially the process is the same as previous methods, with the added edition of editing via text based prompts in stable diffusion. There are other

additions to the process, including a form of UV mapping, and other processes for masking in the workflow. These UV mapping and masking steps allow for the overall shape or silhouette of the moving object to be slightly altered. Although it is unclear if this workflow is the most efficient, as the outcome could also be closely replicated by regular usage of EbSynth alongside A.I. image editing software.

Figure 19. Examples of pre-edited footage alongside their final outputs, colourisation of bird, truck to train, bear to lion, dog to cat, respectively, (*Shape aware text driven layered video editing*, YC Lee, JZG Jang, YT Chen, E Qiu 2023).

Also utilising text prompt based A.I. image editing software, Shanghai researchers designed a method to create 3D animated heads for use as digital avatars (*Instruct-Video2Avatar: Video-to-Avatar Generation with Instructions*, Shaoxu Li, 2023). The method is as follows: Live action video of a person's face (preferably from the front with plenty of motion in different directions, such as in a public speech), video to image sequence, keyframes edited via A.I. powered text prompts (*instructPix2Pix*), edited images interpolated over video via EbSynth synthesis, animations rigged to 3D avatar. This usage of software to create a 3D neural head certainly shows the potential power these tools possess for the games industry. It would certainly be interesting to expand this method for use in creating full bodied game characters. Rotoscoping has certainly

been present in games before, and this could allow for some new creative approaches.

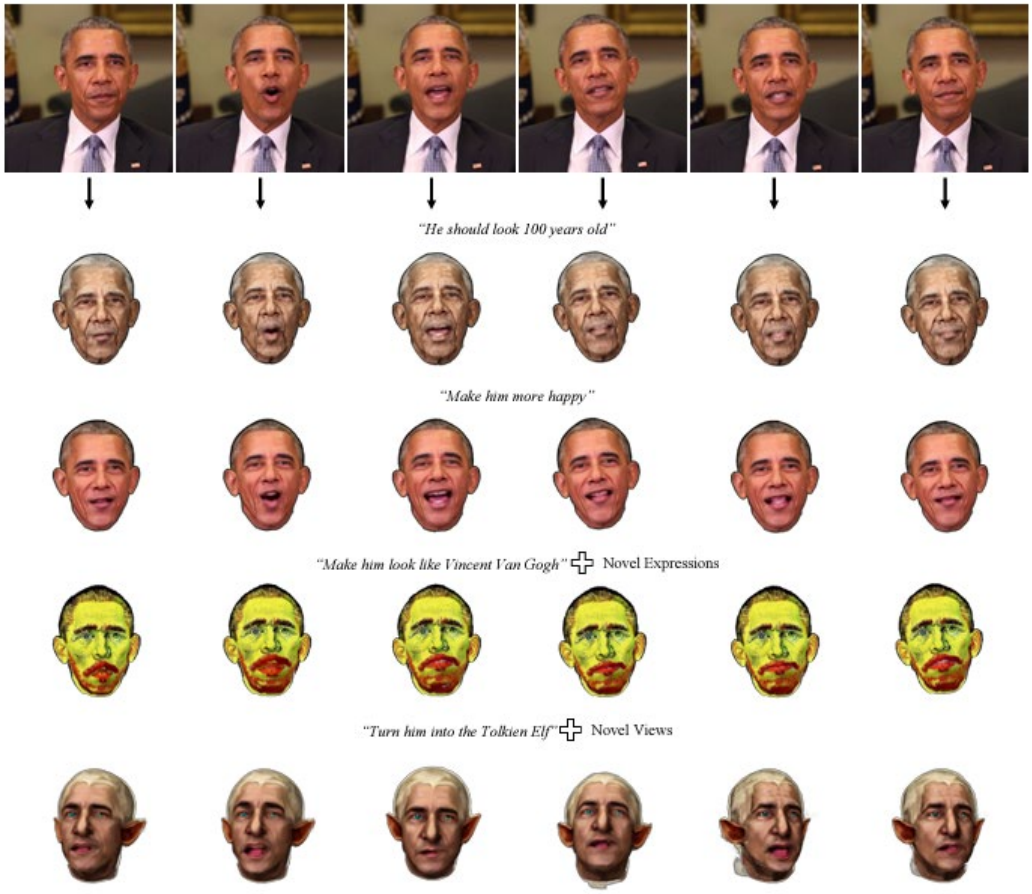

Figure 20. Researchers call their method *"Instruct-Video2Avatar",* a 3D neural head (*Instruct-Video2Avatar: Video-to-Avatar Generation with Instructions*, Shaoxu Li, 2023).

Continuing with the pairing of A.I. powered editing tool and EbSynth, a group of architectural researchers applied similar principles to 3D space (*From concept to space: a new perspective on AIGC-involved attribute translation,* Kaiyu Cheng, 2023). Cheng refers to the aforementioned A.I. powered tools as A.I. Generated Content (AIGC) technology. In this research, firstly footage of a 3D space can be created either via 3D modelling or UAV (drone recording), this is image sequenced, keyframes are edited via AIGC tool, and video footage of 3D space is synthesised with EbSynth. The project in mention is intended for use within architecture but could be applied to many other situations, including but not limited to animation, special effects (TV, cinema), cinematography, video editing, and gaming. The experimental intent of these researchers is

interesting, in that they intend to use the AIGC to postulate new architectural forms rather than relying on past iterations or previously established norms. This is akin to the mindset of *Experimental Rotoscoping Methodology.*

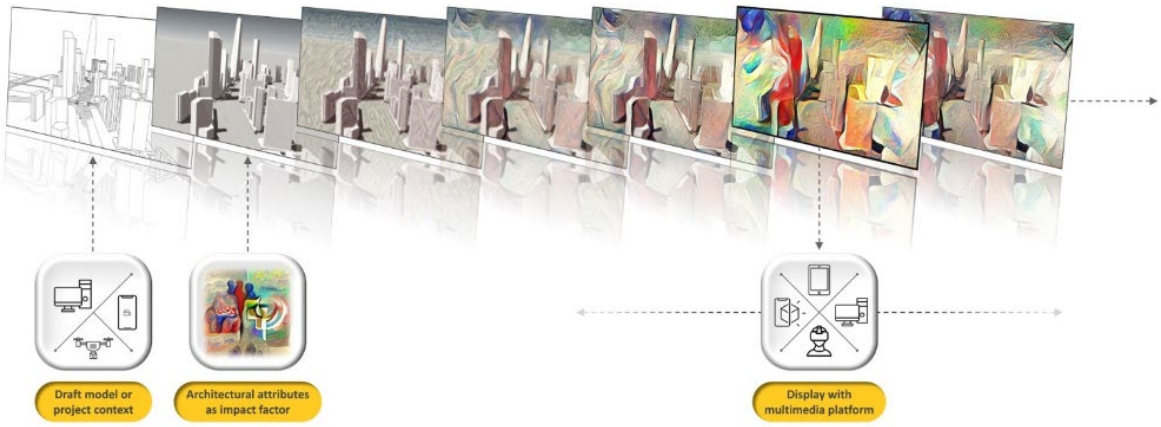

Figure 21. Diagram of virtual spatial translation for architecture (*From concept to space: a new perspective on AIGC-involved attribute translation,* Kaiyu Cheng, 2023).

While Ebsynth is being used in many different projects to synthesise video, there are also other interpolation tools being made by researchers for specialised purposes. Such as a tool that allows for a more consistent and efficient interpolation of rough drawn lines (*Efficient Interpolation of Rough Drawn Lines*, J Chen, X Zhu, M Even, J Basset 2023). The animation step before clean line drawings are created. These researchers have developed their own tool for this specific task, with the aim of the line style of the keyframes being more accurately reproduced and with less warping or artefacts.

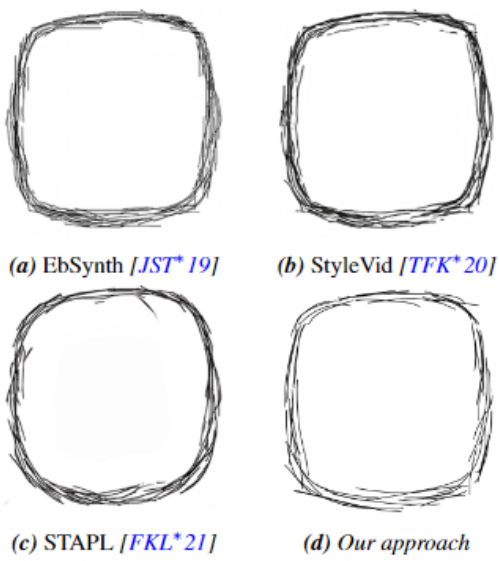

Figure 22. Comparison of interpolated rough line drawings with four different tools, with (d) being the result of the approach in *Efficient Interpolation of Rough Drawn Lines*, J Chen, X Zhu, M Even, J Basset, 2023.

Another approach inspired by EbSynth is Multi Frame Diffusion as proposed within *Highly Detailed and Temporal Consistent Video Stylization via Synchronized Multi-Frame Diffusion (*M Xie, H Liu, C Li, TT Wong, 2023). Xie and their team used a similar method to EbSynth for video synthesis, blending frames, however starting from quite a different point. For this Multi Frame Diffusion, instead of picking specific keyframes, the entirety of the image sequence is stylised via a text to image generator (T2I). The researchers in this case then used their own special approach of overlapping frames to ensure consistency within the T2I edited images. Their method reduced flickering of colour, shape and so on. However with this method one is completely reliant on the T2I tool in question. This method allows for high consistency with the caveat of restricted creativity.

In relation to *Experimental Rotoscoping Methods* the multi frame diffusion model nullifies the ability to experiment and find new forms of movement and non-typical representation/usage. The results achieved are very consistent, although they move in a direction almost opposite to the proposed applications within our project *Experimental Rotoscoping Methods*. Another difficulty with this study, is despite stating being inspired by EbSynth to create this methodology, an example output with EbSynth was not included in their study.

Figure 23. Comparison of results of varying tools. From top to bottom respectively: original video, stable diffusion, ControlNet, Text2Video-Zero, Renderer-A-Video, Multi Frame Diffusion Model from paper (*Highly Detailed and Temporal Consistent Video Stylization via Synchronized Multi-Frame Diffusion,* M Xie, H Liu, C Li, TT Wong, 2023).

Also using a method akin to the aforementioned multi frame diffusion, a group of researchers created a tool they have named *FlowVid* (*FlowVid: Taming Imperfect Optical Flows for Consistent Video-to-Video Synthesis*, F Liang, B Wu, J Wang, L Yu, K Li, Y Zhao, 2023). Liang's paper proposes this tool and similar competitors are being referred to as Video to Video Synthesis (V2V). Results from this study allow for further creativity at the cost of shape consistency compared to the Multi Frame Diffusion method presented by Xie's team. However this method and other V2V processes extinguish the usage of *Experimental Rotoscoping Methods,* in this regard EbSynth is the only apparent tool which allows for absolute creativity. In general it seems there is an inverse correlation between consistency and creative freedom when comparing various V2V syntheses and EbSynth methodologies.

Figure 24. Examples of different prompts and their results when using *FlowVid* (*FlowVid: Taming Imperfect Optical Flows for Consistent Video-to-Video Synthesis*, F Liang, B Wu, J Wang, L Yu, K Li, Y Zhao, 2023).

Similarly to previous pairings of AIGC and EbSynth. One researcher paired the Face App ageing tool paired with EbSynth, to transfer the effect from image to video (*Artificial Intelligence Pada Aplikasi FaceApp Dan* EbSynth, M Asharyanto, 2023). The primary problem with the method used in this project, is that the Face App ageing tool often does not maintain the overall shape of the person's face. Due to this, when synthesised via EbSynth, after movement occurs in the video many unwanted artefacts and inconsistencies will appear. This is because the images are not directly overlaid like they would be if one were to directly edit the keyframe in a program like Photoshop. In saying all of this, the method is very straightforward and requires little effort, if improved upon, it could be an efficient VFX tool.

Figure 25. From top to bottom respectively: original image, Face App aged keyframe, distorted synthesised video frame with artefacts after movement (*Artificial Intelligence Pada Aplikasi FaceApp Dan* EbSynth, M Asharyanto, 2023).

If one can replace certain textures to make someone look older in a more overlaid shape retentive way, we could certainly save time with this VFX. Replacing texture is something detailed alongside models that direct the pose in question in *Appearance and Pose-guided Human Generation: A Survey (*F Liao, X Zou, W Wong, 2024).

Researchers' efforts in the field of A.I. image generation were studied and compiled, particularly the work of Yurui Ren. Whose work allows for a complex control of imagery and textures, specifically what is being showcased would be effective for fashion photography as it allows clothes and appearances to be transformed into different poses based on a simple 3D skeleton and reference image (*Neural texture extraction and distribution for controllable person image synthesis,* Y Ren, X Fan, G Li, S Liu, TH Li , 2022). It could also be used in animation should one decide to use it for a multi frame diffusion variant or paired with EbSynth for video synthesis. In such a situation a character's clothes could be textured or coloured, as well as edited easily in postproduction.

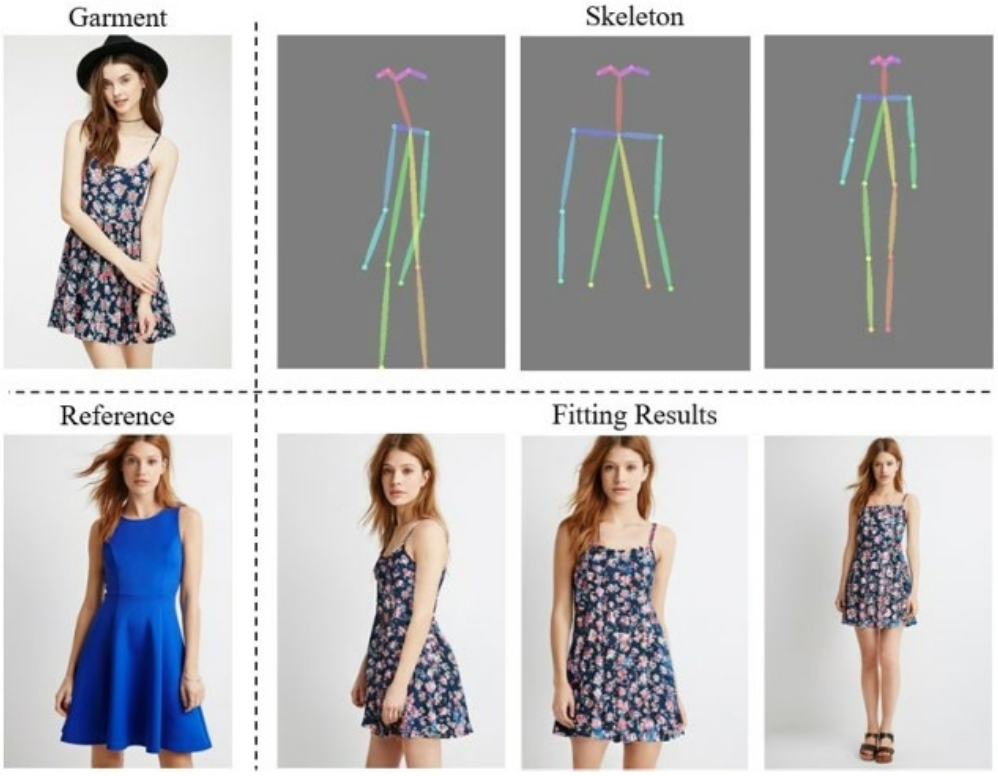

Figure 26. Illustration of the virtual fitting system outlined in *Neural texture extraction and distribution for controllable person image synthesis* (Y Ren, X Fan, G Li, S Liu, TH Li , 2022).

In contrast to a virtual fitting, other studies have been completed with Sophi in Audition (SiA), a movable studio robot. One group of researchers attempted to create different personas with improved realism of Sophia. The pipeline involved recording video of Sophia "acting", image sequencing, using stable diffusion style processing for keyframes, and interpolating via EbSynth(Pipeline diagram (*Sophia in Audition: Virtual Production with a Robot Performer* ,T Zhou, T Xu, D Zhang, Y Jiao, P Xu, Y He, 2024). These same principles could be applied to stop animation for editing in post production, or any video format really.

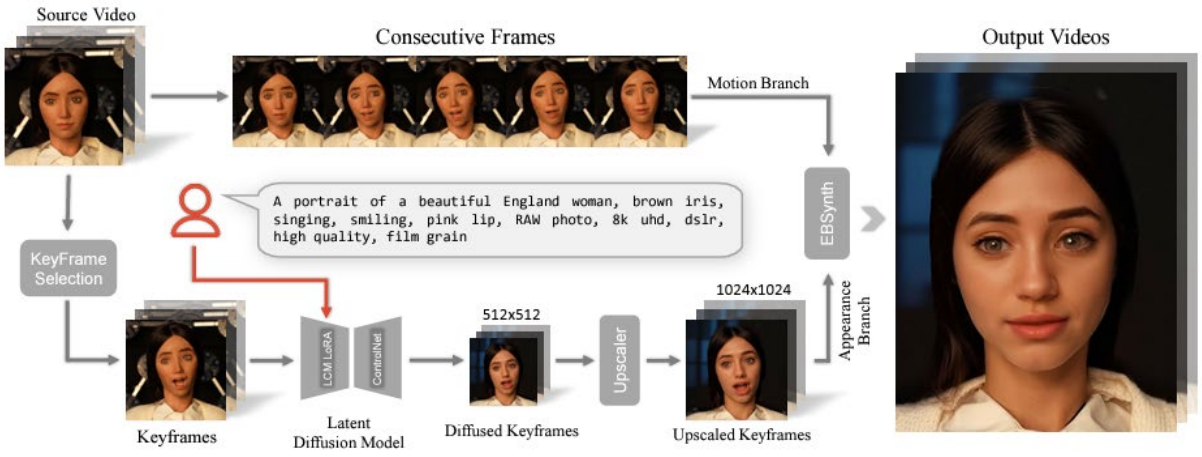

Figure 27. Pipeline diagram (*Sophia in Audition: Virtual Production with a Robot Performer* ,T Zhou, T Xu, D Zhang, Y Jiao, P Xu, Y He, 2024).

To look again at colour blocking strategies, we can see this recent *Prince of Persia* (1989) inspired rotoscoping study *Lester: rotoscope animation through video object segmentation and tracking, (*R Tous, 2024). The author of the study developed their own system for rotoscoping block colour animations. With a specification for rotoscoping figures in this style, somewhat similar to moments of *Waking Life (2001).*

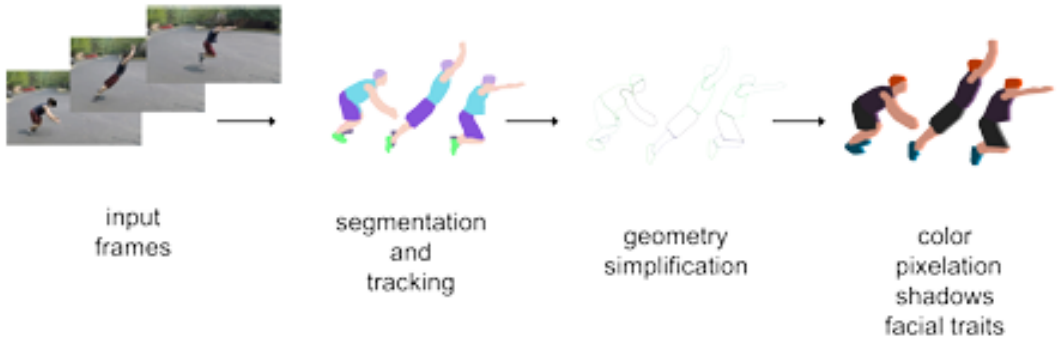

Figure 28. Workflow diagram from *Lester: rotoscope animation through video object segmentation and tracking, (*R. Tous, 2024).

Further research was conducted with EbSynth in the 3D space by the creator/researcher of *Sheepless* (Jan Klicpera, 2020). Klicpera used EbSynth to stylise the elements within his Unity game project. The stylisation employed watercolour paintings as keyframes for the 2D character

animations in the game. The results seem successful but there are no fully hand drawn animations to compare to, so it is difficult to assess. Klicpera decided to use the first and last frames as keyframes as detailed in the diagram below. Though this method does produce successful results, the method could be improved. To be precise, keyframes are required within EbSynth so that all aspects of a scene are covered. If an element of the video is not included in the keyframe, when it appears in the sequence it will be distorted and noncongruent.

If Klicpera had used frame (d, i) as the keyframe, then they would have only needed a single keyframe, instead of two. This sounds like a trivial difference, but when applied to large scale projects, cutting keyframes by half is significant. The chair and figure are both fully visible in (d, i), it is also closer to the starting frame to avoid further distortion, and that is why they are most suitable to choose in order to save time. Though if the figure is often static in the first and final position, perhaps having the extra detail from the keyframes in those locations is worth the extra work throughout the project.

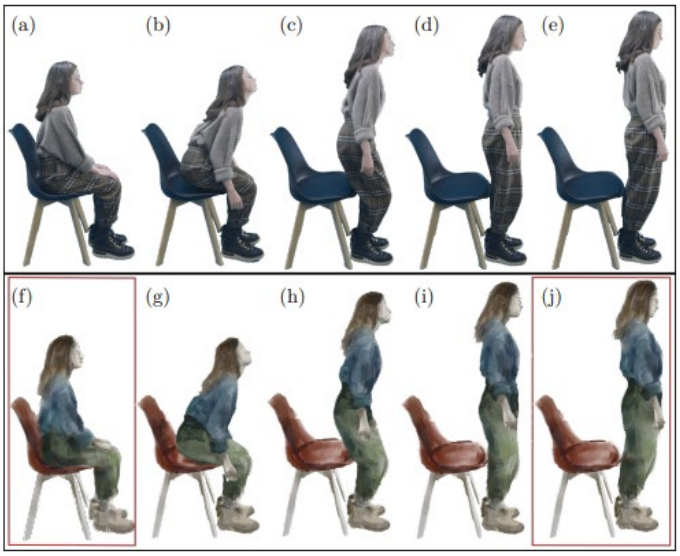

Figure 29. An example of the processed images (a - e) being used to create synthesised images (g ,h, i) based on two exemplar keyframes (f, j). Stylized keyframes courtesy of © Polina Akhmetzhanova. (*Sheepless - an Open Source 2D Adventure Game in Unity,* Jan Klicpera, 2020).

A different research project from Prague used EbSynth as a module within their “Paintbot”. The Paintbot project used drawings done by the artist/researcher in Photoshop on top of image sequences. The brush strokes of the artist were recorded in Photoshop and utilised within the first module of the paintbot program to stylise individual images through an “automatic stroke system”. These individual images were then fed through EbSynth to stylise entire image sequences for video (Lazarek Jan, 2022).

The process involves much more automation in comparison to the previously mentioned research and while undoubtedly saving lots of time, the visual results may not be as diverse or robust. It must also be remembered the huge amount of work involved in creating the Paintbot and the research around it, with EbSynth only being one segment of the project and not the primary focus.

Figure 30. Example synthesised EbSynth frame with the stylised brush stroke method from *Paintbot* as a keyframe *(Photo Stylization Using Painterly Rendering,* Jan Lazarek, 2022).

EbSynth can be used in many different ways and even in different fields. Though the focus of our project is rotoscoping, it is important to take note of other imaginative implementations. Both for learning and to reflect on what is happening with the tool, and how it can be utilised. A thesis project involving data driven deep learning robotic control used EbSynth in a very creative and interesting way. This robotic control project was to train hexapod (six legged, or crab shaped) robots to complete locomotion tasks. There were physical robots, as well as digital spaces in which they were trained. These digital spaces were created by taking videos of real life locations, converting them into point maps, then translating these into heightmaps that could then be used as a digital training space for the robots. Deep learning algorithms require innumerable re-attempts

of the same task, therefore most of the training, particularly at the start must be done digitally and not physically, as the computer can process thousands of digital attempts in an instant.

To create more data for the robot training, the height maps were then processed again through EbSynth as images in sequences (*Robotic Control with Deep-Learned Structured Policies,* Azayev Teymur, 2022). The EbSynth outputs were height maps of places that do not exist in real life and were not designed by a human. This approach could be continued to create as much training data as desired. This is a very creative use of EbSynth and takes advantage of the sometimes unpredictable nature of EbSynth. Utilising the inaccuracy that naturally arises. In our previous paper from Kivisto (2019) the inaccuracy was a problem for the 3D artist, in this robotic control case the inaccuracies are a boon. This type of unconventional use, of utlising EbSynth's limitations and "mistakes", is how artists and researchers could be viewing the very new, and unexplored tools becoming available to us.

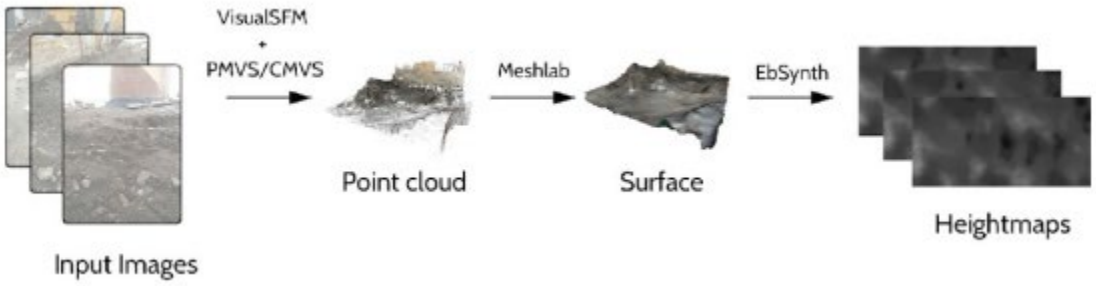

Figure 31. Workflow for synthesising data for robotic testing (*Robotic Control with Deep-Learned Structured Policies,* Azayev Teymur, 2022).

Interviews and Foreword

In accordance with this research into rotoscoping, various creators, studios and developers were contacted for interview. The purpose of contacting these experts in rotoscoping was to gain greater insight as to the most up to date rotoscoping processes, to investigate interpolation software in the professional sector, to see new perspectives on rotoscoping techniques and applications, and to understand the pitfalls of current technology. The questions were tailored for each interview, depending on the individuals. Following the interview section is a conclusion which involves cross examining overlapping information within the interviews.

The people interviewed as part of this project were contacted due to their knowledge and expertise with rotoscoping and EbSynth. There are four interviews, one with cofounder of SCRTWPNS Šárka Sochorová, the team which created EbSynth. This interview is the most different from the others, in the sense that the questions tend to focus on the software. Morgan King of Gorgonaut studio was interviewed as to how he created *The Spine of Night*, a brilliant feature of adult animation building upon the rotoscoping of the past. Artem Sawitski utilised EbSynth heavily while working as a VFX artist for *Algorytmika*, and as a member of the interpolation team for *The Peasants.* Steph Swope and Craig Staggs have a long history of rotoscoping experience in the professional sector, from *A Scanner Darkly*, to more modern features such as *Apollo 10½,* and *Undone.*

Firstly, interviewees were asked about their background in animation, how they began rotoscoping, and their experience with EbSynth. Through the responses we can see that rotoscoping artists can come from various backgrounds, not necessarily animation. Coming from graphic design, concept art, visual art, film production and animation.

With traditional rotoscoping such as Morgan King's *The Spine of Night,* EbSynth was not used. Though King does speak about using the tool, but mostly for tests currently. Minnow Mountain make use of EbSynth, but for more incidental parts. There is still a lot of traditional rotoscoping taking place within their features as well. Which may echo Sawitski's statement that it is a "unpopular soft" in the professional sector currently, but it may gain more popularity in the future, he also speaks about how the tool is quite versatile and has a lot of uses. Similarly, King remarks

how it is likely more often used by hobbyists or for editing 2D animation. However, there is interest expressed in using it, and the reasoning as to why it is hard to include in an animation pipeline in the professional sector, may be because of deadlines and a need for stability and consistency. Also worth noting is how new all these tools are, and they are not yet fully explored or understood.

Discussing the rotoscoping process in regard to these different projects, we can see how time consuming the process is when completed with the traditional method. Currently when rotoscoping or animating, of course frame by frame hand drawn animation/rotoscoping will always give the most control and power to the artist. At the same time, the usage of EbSynth can create opportunities for rotoscoping that would be practically impossible. While *The Spine of Night* took 7 years of hard work to animate by hand, such a process would not be feasible with *The Peasants,* without an army of painters and a very large budget. Sawitski calculates that based on the time it takes to paint one frame of the movie, it would require 27 years of man hours to create *The Peasants* traditionally. In this instance, EbSynth is a fantastic alternative. Highly textured animation seems to be one of the areas that EbSynth shines, King mentions he also has plans to use EbSynth for texturing elements of animation and adding depth. Alongside this, the newest version in development at SCRTWPNS may solve these problems. Especially as it will have close to real time synthesis, which is extremely fast.

Another element which appeared, was the consensus from interviewees that rotoscoping is not just animation, but film. Which may seem apparent, however, rotoscoping is often treated as another form of animation, while people may ignore the role that actors and directors bring to the art. That rotoscoping by its very nature is physical, and often collaborative. Therefore, one could extrapolate that EbSynth is not only an animation tool but a video tool, a film tool.

Šárka Sochorová, *SCRTWPNS,*

- What are the key differences in the new and improved version of EbSynth you are working on currently?

The new version will run in the browser and will have a graphic user interface.

- Does this new EbSynth still primarily use non-parametric texture synthesis algorithms?

Yes, the non-parametric approach has so far outperformed any parametric methods.

- What are your thoughts on incorporating machine learning and neural networks into EbSynth?

We're planning on adding stable diffusion as an option to generate the keyframes. We're generally open to including machine learning techniques if they prove useful.

- What do you consider to be the main rivalry to EbSynth, or does EbSynth have any competition?

Sora from openAI. But I believe that artists and filmmakers will need more visual control over their output so that's where EbSynth might still be useful.

- What EbSynth usage has surprised you most?

We really love what Joel Haver does. He took the output from EbSynth including all the pixel-soup artifacts we were always frowning at, and made it his signature style. He makes great comedy and we're so happy EbSynth plays a part in his creative process.

- What is the probable release date for this newest version? Is it exiting beta?

Hopefully this year :)

- What do you think of A.I. video creation software such as Sora.AI?

This could be a topic for discussion on its own, but I'll keep this answer short. Despite the controversial origin of the image-generating models, I think that this technology is exciting. I love seeing how many people get inspired by it - artists, engineers, and researchers. If Sora.AI turns into a tool that offers control to the user, I can't wait to see what the new generation of filmmakers does with it. But it's still just a tool, and to cite Aaron Hertzmann - Computers Do

Not Make Art, People Do. (https://cacm.acm.org/opinion/computers-do-not-make-art-people-do/)

- In a previous interview, there was a mention of real-time previews with EbSynth, is this still a goal for you?
Yes, we already have a very close-to-real-time preview in the new version.

- Are you making any changes to the EbSynth UI? Such as the previously mentioned interactive timeline?
The new UI is completely different, it's more like a video player than the spreadsheet table from the beta version.

- Do you have any new tips for EbSynth not mentioned previously?
I think the most important tip is still to start from just one keyframe and create additional keyframes by making local fixes to the broken frames. Making as little change as possible is a key to consistency.

- Are you aware of any new, different or experimental uses of EbSynth? Such as creatively utilising the artefact creation sometimes caused by EbSynth, in a way, leaning into the inconsistencies.
A friend recently sent me this video (links to a funny video of Batman emerging from a swamp unexpectedly and being pushed with a stick) and I thought it was hilarious. We also love it when people use EbSynth for trippy videos. For example when you take a video of a swimmer and use a keyframe of a meadow of tulips. The tulips start to move like the swimmer and it's somehow relaxing and weird at the same time. Like here (links to the Nine Perfect Strangers intro) for example.

- What are your hopes for EbSynth going forward?
We want to create a tool that will help people make films at home, on a low budget, without big studios or gear. As kids, we both got fascinated by movies like Star Wars, Jurrasic Park, Matrix... so we tried making our own films from anything we could find at home and it was a

blissful time. When people get inspired, beautiful things can happen. We'd like to turn EbSynth into a tool that would be one of their creative "secret weapons".

Morgan King; *Gorgonaut*

-How did you become an animator?

I wanted to film since I was very young, but I went to a school without a film department. I tried to use the communications and art departments, and I made a couple of short films. But then I got out of college and there was just… well you know, I couldn't really afford to do it, I didn't really have any training or connections to the film industry. So I mostly did graphic design for the next decade. I was working at this one place, I just hated it. I told my wife, "I think I want to do animation, I've wanted to do this for a long time", and I started not rotoscoping, but always loved it. When I was a kid it was peak rotoscope animation. Well I started doing flash animation, that's what everybody was doing.

-What made you start rotoscoping?

There's a shot where I wanted this guy's cape to move as he turned. I experimented with a hundred different ways of animating it in a sort of flash style. Then I was like you know what, I'm just going to film myself in the backyard with a bathrobe and just twirl the bathrobe. Then I started rotoscoping, I knew about it, I went to do it, and thought, oh this is achievable. This is a thing I could learn how to do. It's kind of an addictive process, cause it's fun to design a shot, fun to shoot it and it's fun to animate it.

-How did you make *Exordium* and *The Spine of Night?*

Since I had done graphic design for so long, I was sort of just using the tools I knew how to use. All the animation is done in Photoshop, in frames. Then I drop the frames into Premiere, you know 24fps project and they're each on the twos at 12fps, mostly. I drew Exordium on a Wacom Intuous 4, and I did The Spine of Night on the screen, on the old model Cintiq.

-What is your rotoscoping process?

The actual process is, storyboard it, film the shots I storyboarded, as much as we can now (especially on The Spine of Night) being able to do a full live action edit of your project before you animate anything, cause you don't want to waste a second of animation. It's brutal if you

have to lose six or seven frames cause you wanted to tighten it up a little bit. So we try to get the live action edit as tight as possible. Put in place holders for things that would be illustrated or animated. Export that, 12 frames per second mostly. I made a bunch of custom action sets in photoshop to process them all in to the exact layer format that I want. Then it's kind of just a matter of drawing it.

-Do you have any rotoscoping tips?
The major thing I do, that a lot of people rotoscoping don't do, is I do a lot of work onion skinning with transparency layers in photoshop. Take for example, if someone is moving their arm at the elbow, I'll take the previous frame and advance it to match their pace in the video. I think a lot of people approach rotoscoping like they're going to go in blind and retrace the details, but that gives you a much more jittery, messy aesthetic. Which I was trying to veer away from that as much as I could.

-Do you use any kind of interpolation software to assist in animating, such as EbSynth?
The Spine of Night and previous features were all frame by frame fully by hand. But I am working on a new project I can't speak much about right now, which uses a little bit of EbSynth for textures. It's still all drawn frame by frame, but I'm just using it for the mottling on the skin and textures, the shading is all by hand too.

-The animated gore in your work such as *The Spine of Night* is quite impressive, how did you go about animating that into your rotoscoped work?
Well it's really just, the basic answer is it's just animation. It's always funny when people comment on the movie like "How did you cut that guy in half cause you're rotoscoping?", well it's animation, when you have a thing that you can't do with live action, it's live animation. So everything is infinitely malleable.

It's still going to make hand drawn rotoscope animation stand out from all the automated stuff that's surely coming, you can't tell A.I. to do a subdermal fracture (like how the character in Spine of Night does), you can't film that and if you're going to do the special FX for that to look real then you might as well do it in live action. You can't just tell the A.I. to do that. It's that sort of thing like gore and special FX which is going to be a hard wall for A.I., filters and

automated stuff.

-What is your opinion of EbSynth in the professional sphere and media industry?
*EbSynth is fun to play around with for sure, and I love what it **can** do, but I'm a little worried they (the dev team) have stopped supporting it? I kind of think maybe they're not working on it anymore. I think people **are** using it, I know Minnow Mountain use it a little bit, but they mostly use, what is it, Lockdown? Which is a kind of similar tech. For like surface tracking. I think a lot of hobbyists are using EbSynth. But I think it has uses. When it first came out I was so close to doing what I wanted to with it. But because it's not really A.I., it's kind of pixel tracking, anytime anything goes out of frame and comes back, it doesn't know what to do with it. You can turn your head away, but you can't turn your head back. But I sort of embraced it and that's why I use it for textures now. At least in my workflow, I think it's very good at making interesting live feeling textures that give you some sort of depth all through the image you send through, for the most part. Also when textures come back on screen, you can use the autofill function in photoshop to clean it up pretty easily, as long as the textures are kind of vague. It was a big learning curve though, to figure out how to best use it (EbSynth). It couldn't do exactly what I wanted, I was sort of disappointed at first, especially with linework. Our work is very linework heavy and it garbles the linework immediately. But for textures and stuff I found it to be pretty useful. It certainly does things that you could never do by hand. In terms of others using it, I suspect it has a fair amount of use in frame by frame animation at least. I think a lot of the puppet animation probably doesn't have much use for it.*

-What are the advantages and drawbacks of rotoscoping?
Well the drawbacks, obviously it takes forever, it's very, very slow. If you want to do it in a more traditionally animated way, it's very slow. While out for a coffee I saw this animation book on a shelf. Oh this looks fun, had a look inside and saw the rotoscoping section, and the very first sentence said "If you think you're going to try and make a rotoscope feature film make sure you have a long prison sentence, because that's about how long it's going to take". It took a solid seven years to draw 92 minutes (The Spine of Night). We were always a small studio, we only ever had a team of three. I drew 50% of it myself. The other guys mostly did the background characters and stuff, or any shots that didn't have effects of any sort. Also with live action, the

human body doesn't do the squash and stretch as with standard cartooning, so in action scenes it's hard to get that same impact. But there are some work arounds with cutting and choosing frames at a higher 24fps.

In terms of advantages I really like how collaborative it is, in a traditional film making sense. The stuff that actors bring to the performance. If you're animating it, it's not that your characters aren't performing, but when you have actors they're going to make choices that you would never think of as an animator. They introduce their own creative process so it's just way more collaboration. The ability to shoot the entire project and edit it, and the timing. Having live action for the entire animation process is an amazing advantage, even over animatics or detailed storyboards.

Although another limitation is that some camera moves are really difficult if your background isn't 3D. You want to actively not shoot people's feet, because of the way their feet are planted on the ground, if you have a flat painted background it can't rotate properly. In The Spine of Night we locked the camera down most of the time. Basic pans, maybe zooms. We're trying to be freer with the camera on our new project. More sophisticated camera movements. Traditional animation is really good at that, but if you have a painted background you're going to have a lot of problems. If you look at a lot of older rotoscope stuff it's similar, the few times they move the camera in any complex way in Fire and Ice they basically have to make surrealist backgrounds to make it work.

Artem Sawitski; *BreakThru Films*

-What is your experience with EbSynth?

Basically EbSynth is pretty unpopular soft, it which I did try to play around on my time. I did a test, based on Old Boy movie, and pretty much forget about it. But one Polish director found me and wanted me to be a vfx guy for his film. And it wasn't The Peasants. The movie was called Algorytmica. Low budget movies for upcoming talents. In this environment you basically have to do everything. By the end I knew pretty much all there is to know about EbSynth. Plus I figured my own pipeline for film production. A year later, I found out there is a studio that's doing film "painterly style", they didn't look for anybody to hire, but I called anyway. When producer found

out that I'm the one of the few people who actually did something with EbSynth, he hired me on the spot. And I became part of interpolation team.

-What was the process you used to make *The Peasants* and the role of EbSynth in that?
So technically I can't say much, but in terms of details of pipeline, the Peasants was structured in the way that helps painters make their life easier. Here is some math: if the film is 1h 50m - 79 200 frames (12 fps) And one painting will take 3-5 hours (its actually pretty fast) so it will make 27 years of pure man hours. Pretty insane.

Back to the structure, some scenes were painted in 1\4 1\8 1\16, depends on the movement and importance, and everything in between was basically EbSynth The biggest problem with it, is it very strict with edges. By that I mean, if you paint 1-pixel outside the value of an object, it will smear across the frame with movement. There is no easy solution, or any that I can find implementation. So it better to stick using EbSynth on surfaces, full of visual information, dirt or anything that has a texture. Otherwise EBS doesn't know how to properly stick with the picture and the end results will look wobbly.

-What are the key differences between the animation in *Loving Vincent* and *The Peasants*?
Loving Vincent didn't use interpolation as far as I'm aware?
Yes, Loving Vincent was full on, hardcore painting, plus I wasn't there at that time. So I know only the stories of painters and VFX people who did it.

-What do you see for the future of EbSynth in the professional sector?
I don't know how it would look like in professional sector. Because the professionals need reliable results. EbSynth is a more artistic tool for users that has lots of ways to implement. Plus nobody knows the proper way to use it, including the developers. In my spare time, I do experiments for it. Maybe in the future if The Peasants and our future films will implement more, yes it will create a popularity spike.

Steph Swope & Chris Staggs; *Minnow Mountain*

- How did you become animators and when did you begin rotoscoping?

Craig: *My first animation job was on Richard Linklater's A Scanner Darkly, which came out in 2006, and I've been rotoscoping ever since.*

Steph: *I'm actually not an animator, although I do produce it. I started in live-action independent filmmaking in 1999 and did that until Craig and I formed Minnow Mountain in 2012.*

- What is your rotoscoping process?

We animate by drawing over live action footage using software to supplement our traditional frame-by-frame 2D process.

- When did you start using EbSynth and what triggered the need for EbSynth?

We started using it between seasons 1 and 2 of Undone (2019/2020), and we started using it to reduce the amount of labor we spent tracking incidental parts of the animation.

- What are your thoughts on EbSynth and how do you utilise it?

It's a good tool for getting animation started but does require a human touch to perfect the final piece.

- Do you utilise other rotoscoping software or interpolation software?

Yes, we have a constantly-evolving cocktail of softwares we use depending on the narrative and stylistic requirements of the project.

- What is your opinion of EbSynth in the professional sector? For example, is it commonly used, popular/unknown, effectively used or not well understood.

Neither of us really have enough info to answer this one.

- Do you have any tips for rotoscoping? Related to or not related to EbSynth, both are fine. I understand you have some instructional videos as well.

We do have some videos! Our How To Rotoscope lessons are linked on our site and are a pretty fun and instructional watch.

Our tips: Simplify and focus on emotion.

- What do you see for the future of rotoscoping animation and related software?
Rotoscoping has been around for over 100 years, regardless of how it's made. Neither of us see that going anywhere, although there will undoubtedly be changes in the technology. Our ultimate goal is a film that is a painting--or at least a work of art that lasts forever--but software comes and goes.

- Do you know of any unexpected or experimental uses of rotoscope animation software?
Our company's favorite thing is to use software for unintended purposes. In our pipeline, each project has a unique look and feel so they all end up being experimental in one way or another. One thing we try to avoid is having any one piece of software be obvious in the final result.

- Are you working on any new projects, and if so has your process changed?
We have several projects in development at the moment, and we're always adjusting our process based on the story universe of each project. Every project is unique and gets its own style, pipeline, team, etc.

- What are the advantages of rotoscoping?
Rotoscoping is a hybrid of animation and live action. It allows you the flexibility of animation and the dramatic impact of live action.

Project Case Study

Project Overview

To represent the potential of these Experimental Rotoscoping Methods via EbSynth, a video was created with a loose storyline. This video is watchable at this link here: https://www.youtube.com/watch?v=66JiVwyZT4Y&ab_channel=HumanName
Two characters, a younger usually pink or gold coloured "Human Name", and an older character with a beard we can call "Bluebeard". Human Name is writing in his room, when Bluebeard appears, suddenly turning into a key allowing entrance to a newly appeared door. The pair of characters go through various time periods in rotoscoping history and styles. From *Out of the Inkwell,* to *Waking Life, The Tale of the Fisherman and the Fish, Begone Dull Care, Contract, The Spine of Night,* and *Undone.* These traversals through styles and technological mimicry are not exact copies, but done in the style of reference, homage, or inspiration. Alongside these stylised versions, is the work of the author of this project, in the style of the author. Using famous rotoscoping instances like these as inspiration for these scenes can give an indication of how some of these EbSynth methods compare to their traditional counterparts.

The animation in this video is comprised of mixed media and mixed methodologies. With the aim of attempting as many different approaches to EbSynth usage as possible. Among the media used for video or image sequencing, are live action video, 3D renders, 2D hand drawn sequences, edited and/or layer synthesised video. To create keyframes the primary tool used was Photoshop with a Wacom tablet. Backgrounds when animated were usually rotoscoped from live action footage. Some backgrounds were drawn from imagination, others were edited versions of rotoscoped stills, in places Photoshop A.I. was experimented with to create backgrounds for certain animated sequences. Specifically the photorealistic background in the *Out of the Inkwell* inspired scene.

The script for the video primarily consists of the line "Nothing feels better than falling apart". Whenever this is spoken in a scene, the characters "fall apart" in some literal or metaphorical way before moving onto the next scene.

A key goal for this project is to utilise non-linear representations of subjects via rotoscoping. Video subjects that were explored for this project include, varying types of food; fruit, eggs,

tomatoes, unstable subjects such as water, fire, melting bathbombs, fireworks, and props used non-linearly like folding fans or editing 2D frame by frame with intended distortions.

In the past rotoscoping these things may not have been as practical as it is today, due to the time constraints of traditional rotoscoping. With interpolating software such as EbSynth, experimenting with these subjects is possible. The video artefacts or distortions that can occur under these conditions may be worth exploring. Adding an element of randomness, and allowing for pairings of unlikely texture, movement, and flow.

Scene 1: Human Name Intro

Opening scene, a door slightly ajar, block colours and hard lines with pink backgrounds. Arriving inside the house, a pink rotoscoped figure, *Human Name* sits writing at a desk. Pondering something before *Bluebeard* appears, mutters "nothing feels better than falling apart" and turns into a key. Human Name goes through the newly formed door, climbing a staircase and travelling through some different environment.

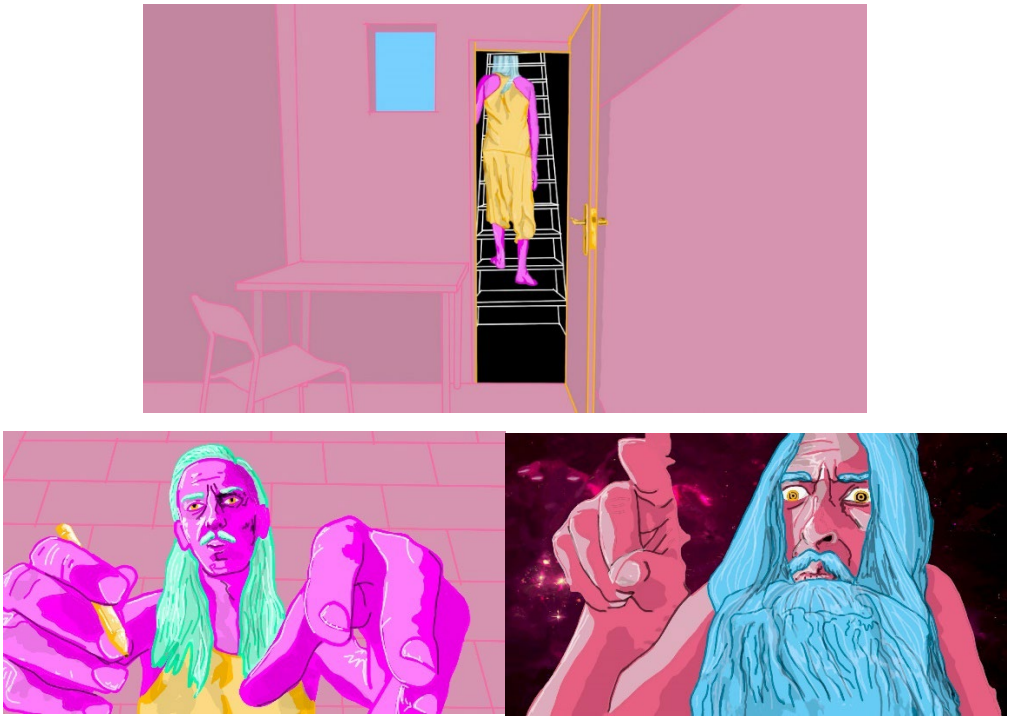

Figure 32. Screenshots from video intro, with authors style and linear rotoscoping. Hand drawn keyframes, synthesised with EbSynth and composited in Premiere Pro. With Human Name character on left and Bluebeard on right.

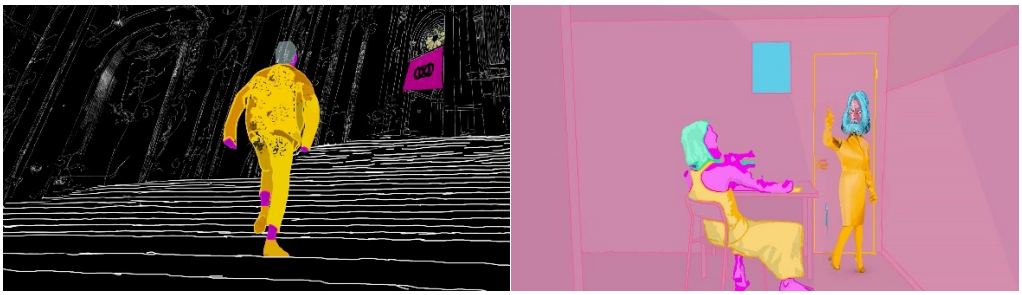

Figure 33. Examples of photoshop expand and autofill functions experiment. Pictured left, Human Name climbing staircase, regular rotoscoping with Photoshop A.I. Expand used to create the top left corner, above the stairs and left of the church. Pictured right, a still of one of the strange frames for bluebeard's flashing montage transformation, random bodies and golden keys were created using autofill and then flashed through frame by frame.

This intro scene is in the style of the author and displays a more typical, non-experimental usage of rotoscoping. Rotoscoping characters but with a pallet change. The backgrounds are also rotoscoped, composed in Premiere Pro. With some hand drawn elements, and some experimentation with Photoshop's generative A.I. expand function and the staircases that Human Name climbs.

One problem that EbSynth can have is when rotoscoping mouths. During these segments many keyframes can be necessary as the mouth can become distorted after closing or opening. In this video the two speaking segments were a composition of rotoscoped characters, with speaking mouths created via *Luma A.I. Dream Machine*. This generative A.I. can be extremely unpredictable with it's output, but if one uses their own artwork to prompt the A.I., and puts in very simple instructions, very effective results can be achieved. In contrast the close up mouth section is frame by frame animation.

To create the golden tentacles that are writhing, live action video of anemones at the aquarium, was rotoscoped via EbSynth and a hand drawn keyframe. These were ultra keyed in Premiere Pro and overlapped.

Figure 34. Top left anemone footage from aquarium, top right golden tentacle keyframe, bottom left pre-rotoscope figure, bottom right rotoscoped and composited final frame from video.

For the strobe like key transformation of Bluebeard, photoshop generative A.I. was used to create individual frames of random keys. These generated portions were put back-to-back in Photoshop timeline to create a somewhat strobe like effect for the key transformation. Regarding the flashing door that appears behind Bluebeard, this transformation was hand drawn frame by frame. The mouth closeup for the speaking part is also 100% hand drawn.

Scene 2: 3D Sequence

Following the 2D rotoscoped intro. A 3D sequence with some rotoscoping was created as the "interdimensional bridge" between the varying styles in the oncoming scenes. This 3D scene was created with Blender.

Figure 35. Screenshot from 3D sequence created in Blender.

In this segment of the video, Human Name is absorbed by the previously 2D writhing tentacles. He then reappears out of a tentacled golden 3D face. This golden giant carries Human Name over to an even more gigantic monster, as they move through the desert. Everything in this sequence was animated in Blender 3D. With the Human Name character also being 3D during this scene, and rotoscoped to look like the 2D character.

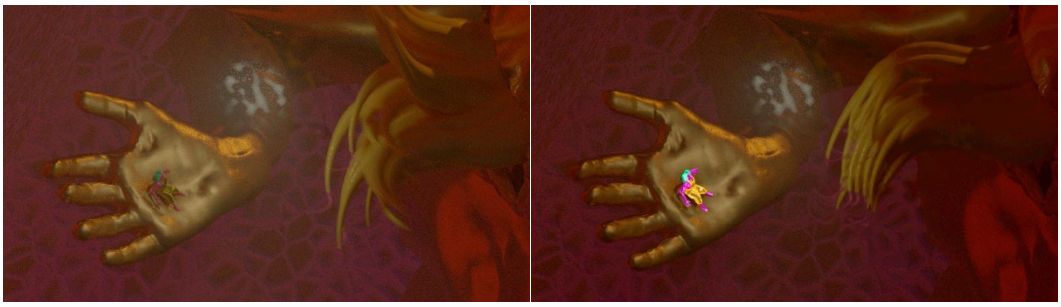

Figure 36. 3D scene with rotoscoped character before and after.

The 3D Human Name character is rotoscoped at the end with the keyframe purposefully placed before the model enters the liquid. With this intentional placement, the 3D liquid "washes away" the 2D stylisation of the character to reveal the 3D model underneath. This is to represent the character changing as they enter the interdimensional space.

Scene 3: *Out of the Inkwell*

In this scene the style is inspired by Max Fleischer's 1919 short, *Out of the Inkwell: The Clown's Pup.* Thus it is in black and white, noise and static filters were used to mimic the original recording.

Figure 37. Screenshot from *Out of the Inkwell* inspired scene. Background created in segments via photoshop autofill function. Clown character rotoscoped via EbSynth and composited via Premiere Pro. Noise, static and lighting edited with Premiere Pro.

The back of an animator can be seen as he draws this Human Name-esque clown "to life". The clown says "Nothing feels better than falling apart". With the animator responding through writing "What do you mean?". Shortly before being shot in the head by the clown.

The title card at the opening of this scene with the cartoon styled Bluebeard was draw in Photoshop, with a first frame and last frame bering drawn by hand, and then interpolating the slight movement via *ToonCrafter* which saved some time. This scene is in a old fashioned style with lots of static, so the low resolution of the *ToonCrafter* generative was not a problem in this instance.

To create this scene, firstly a video was taken of the author sitting at their desk, acting out the necessary movements. Using EbSynth to rotoscope the actor into a greenscreen, the background of the video was then transformed utilising Photoshop. The background in this scene needed to be somewhat photorealistic, as it is supposed to look like an office or art studio from 1919. Due to this requirement, Photoshop generative A.I. was used in segments to alter the background. With the loop tool, gradually transforming the background piece by piece. The desktop going from

IKEA to old wood, the laptop becoming a canvas, transforming the plaster walls into wood and shelves.

Separate videos were taken using props and costume to achieve a clown appearance. As well as a prop gun. The video was rotoscoped in black and white to mimic the style of Koko the Clown, including the face being reduced to more simple lines.

When Human Name the Clown shoots their gun, a flash that reads "BANG" appears, then fades away like a smoke cloud. This was created by taking rotoscoping a video of a firework. In the video a person is walking, the keyframe is at the moment of the flash, and the BANG is written on the person's body. This is an experimental use of EbSynth, in that we are actively trying to utilise the unstable nature of EbSynth under these circumstances. Rapid change in lighting, colour or contrast can create interesting results with EbSynth, that would be much more time consuming to recreate in conventional methods such as with After Effects.

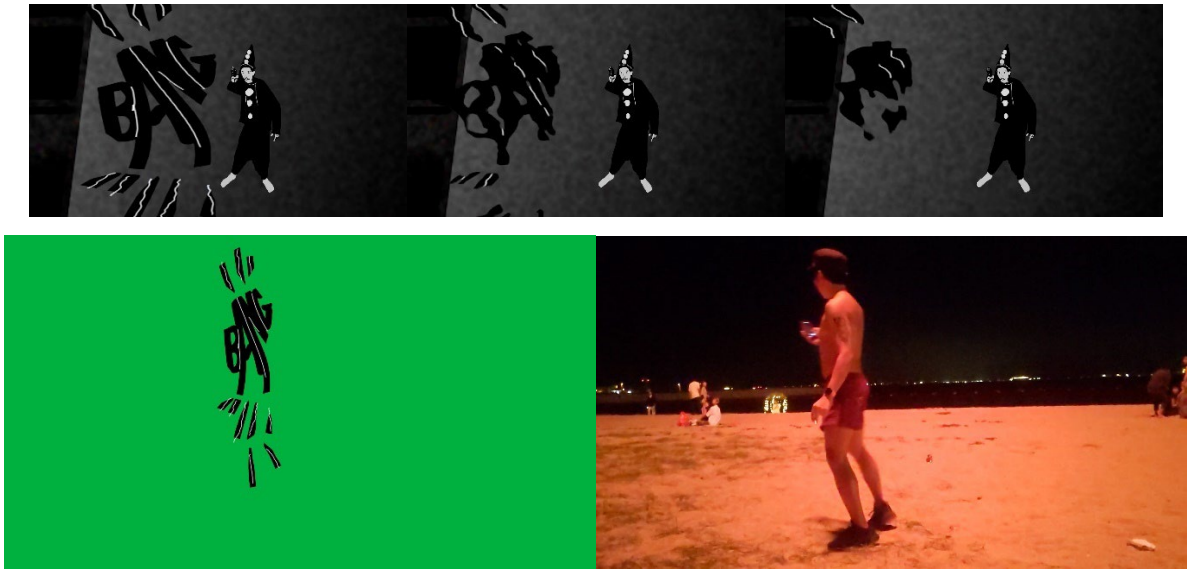

Figure 38. BANG! Animated effected illustrated in top three images. Bottom left is the keyframe for synthesis, bottom right is the corresponding frame from the image sequence. The image sequence is of fireworks on a beach. Due to the movement of the figure, and the change in lighting with the fireworks flashing, the bang morphs and dissipates as intended, with an effective result.

When the artist is shot, their head explodes suddenly. To create this effect, a very simple 3D model of a head was created in Blender 3D. The image of the artist in their final frame before being shot, was imported to Blender 3D as an image on a plane. The 3D head was lined up with the head of

the artist in the image, Blender camera settings were matched to the real life camera footage, and the head was run through a quick explosion simulation.

This render of the pure white 3D head exploding was then image sequenced. The final frame of the artist sitting down, the same one used as the image imported onto the 3D plane, was used as a new keyframe, which was slightly edited in two variations. One without much editing, a second with some editing to make the back of the head look gory. Two videos were synthesised, these were layered, with the gory version slightly after. This allowed for the head explosion to require as little hand drawing as possible, while remaining within our style. This is another experimental usage, intentionally creating distortions by operating EbSynth under specific conditions. The distorted synthesised videos allowed for the exploded pieces to look more fluid and natural, compared to the raw 3D render.

Figure 39. Top left and right are the two keyframes (explosion involved two synthesised videos), Bottom Left 3D model of exploding head in Blender, used for image sequencing in EbSynth. Pictured bottom right, final composite of exploding head effect. This method made good use of distortions and artifacts and was very time efficient.

Scene 4: *Waking Life*

An alarm clock buzzes. The style employed here is inspired by *Waking Life*. The characters and backgrounds are all rotoscoped video, with the keyframes created in Photoshop via Wacom tablet. For various parts of the video separate elements of the keyframes were exported individually and the layered on top of each other with slightly different timings in Premiere Pro. This was to mimic the floating movement of backgrounds and character features in *Waking Life.*

Elements from the keyframes, such as colour from a specific photoshop layer, shading, linework, or other layers of the rotoscope style drawings, were exported and set to different speeds in Premiere Pro. Each export included a green screen layer to allow for ultra keying in Premiere Pro.

The boat that floats down the street is a simple 3D render made in blender, with an image imported as a plane, then rotoscoped via EbSynth to match the style. This was intended to be a reference to *Waking Life.* Returning to the room, the body that floats up is actually a 3D model as well, rotoscoped to the same style.

The rotoscoping of the floating 3D character have some thought-provoking results. Specifically, usually when EbSynth is used to rotoscope and part of the animation comes from out of frame, EbSynth smudges/smears whatever colour is at the edge, and doesn't know what to do. But in this instance, the feet of the 3D model, despite not being in the initial keyframe, are coloured correctly. The same can be said for the pant legs.

Figure 40. Shots from Blender 3D image sequence pictured top row, painted keyframe middle left, synthesised frame middle right; composited final frames bottom row. Notice how the feet, under the shirt, and the pants are mostly correctly coloured despite not being visible in the keyframe.

This may be because the original video of the 3D model consists of bright contrasting colours. When either the image sequence, or the key frame utilise extreme colour blocking and/or simplifications, EbSynth can be capable of "guessing" the texture or colouring for previously unaccounted for assets. Such as the feet in this scene. This method is worth further exploring in future research.

The melting clock and the room that melt away, are the keyframes previously used, now synthesised on top of a video of a melting bathbomb, but at different speeds. This allows for the melting transition animation to be created from a single already created keyframe. This is an

experimental method of rotoscoping. Melting substances, or substances that change state, can lead to novel distortions that might be difficult to create otherwise.

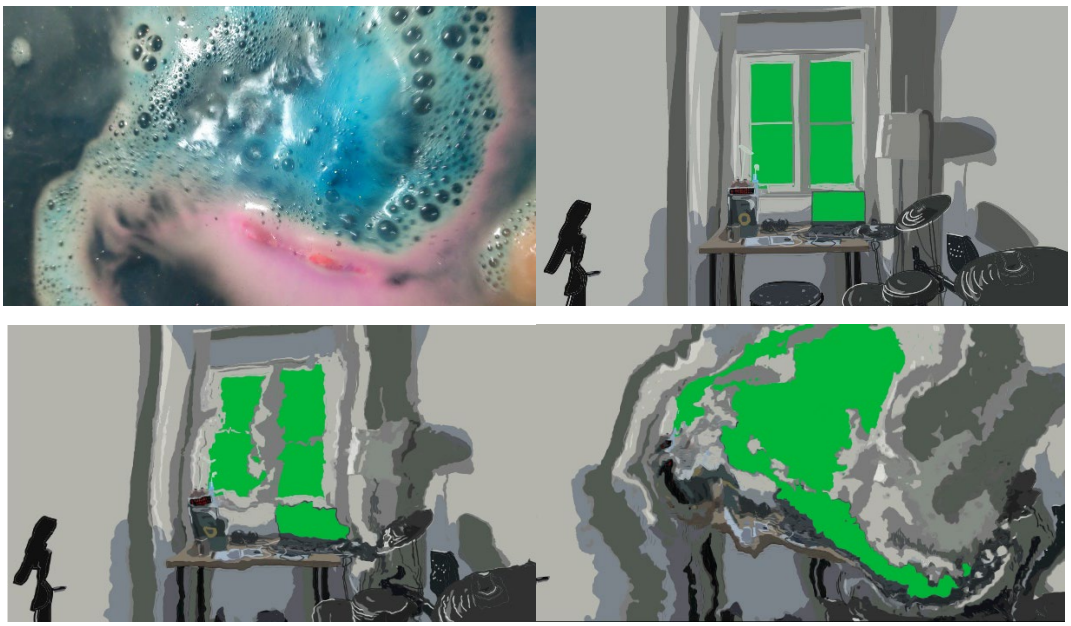

Figure 41. Top left is a bath bomb melting in water from an image sequence, top right is the drawn keyframe, bottom row are example synthesised frames depicting the melting room. This same method and video was used to create the melting clock in the same scene.

The narrative for this scene. Is that after "dying" in *Out of the Inkwell*, Human Name thinks they have woken up to this alarm. When they check the clock, the street and their hand, they start to notice they are dreaming. They float up into the air and the world disappears as they fly above the ocean. Lining us up for our next Scene.

Scene 5: *Tale of the Fisherman and the Fish*

As the ocean sways, we suddenly see a fish flopping on rocks. The fish is ugly. It was made from a quick 3D model, and the author decided to lean into this more humorous character design. In Blender 3D the model was textured with very simple block colours and simple yet rough patterns to better guide the rotoscoping with EbSynth later. Shape Keys were sculpted for the model, a crown and waves were also created for the scenes involving the fish.

The key difference or experimental method in this scene, was using simple shape keys and getting EbSynth to colour, detail and texture the rest of the frames while utilising the morphing nature of the shape keys in an interesting, time efficient way.

Figure 42. Pictured above are five images from the 3D image sequence created in Blender. Below are five rotoscoped images. With only one key frame, the linework and expression of the character changes in humorous ways, this seems to be an amusing way to use the artifacts of EbSynth, and also create consistent relationships in the synthesised frames. The eye whites and linework transform alongside the model, animating the mouth succesfully with little effort.

The fish was rotoscoped to have a funny cartoon appearance. The fisherman in the scene is a bluebeard version of the fisherman from the original Russian animation. This scene is much briefer than the original story and altered. After picking up the fish and returning it to the sea, the fish suddenly appears to be the king of the sea and offers bluebeard a wish, to which he responds "nothing feels better than falling apart".

For this part of the sequence, another basic 3D model was created in Blender, rendered, and then rotoscoped in EbSynth to create linework, colouring and to match the style. The final frame from the 3D render was used to create a lip synced video via Hedra. At first the final rotoscoped frame was uploaded to Hedra, however due to the stylisation Hedra did not recognise any face. This was

solved by using the final frame from the 3D render, and then rotoscoping the output from Hedra with EbSynth. The final result is quite humorous and fits with what was being attempted.

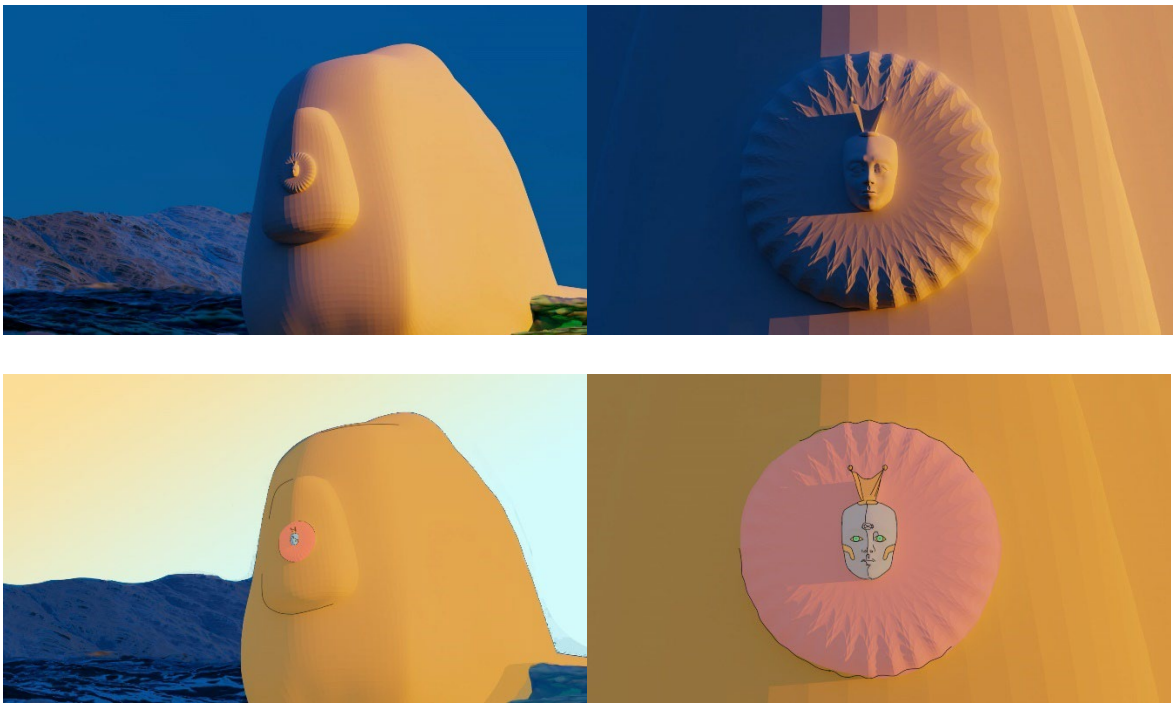

Figure 43. Top left is the first frame of the 3D render for the Sea King, top left is the final frame of the 3D render which was also used as the input for Hedra lip sync generation, bottom left is the first EbSynth keyframe, bottom right is the last EbSynth keyframe which was used to rotoscoped to 3D render as well as the Hedra generated video.

Scene 6: *Begone Dull Care*

In the original animated music piece, *Begone Dull Care*, an oscilloscope was used to measure the wave form in a jazz piece specifically recorded for this artwork. The artists rotoscoped the output of the oscilloscope with real life paintings they later photographed and transformed back into video. The result of which is an early experimental approach to rotoscoping with a fantastic abstract visualisation of music.

A digital oscilloscope alongside music created by the author were used to create a scene inspired by *Begone Dull Care.* The music with this scene triggers a different movement in the oscilloscope. The oscilloscope alongside this music created a more ring like structure that expanded and vibrated, compared to the vertical string in the original *Begone Dull Care*.

Eight keyframes were made at different points in the recording of the oscilloscope. These keyframe segments were aligned with the music in Premiere Pro. With the most animated part of each segment being repeated as new instruments enter.

The animation in this scene was approached from an abstract angle. Inspired by the original, a series of stills from the oscilloscope image sequence were chosen as keyframes and drawn roughly on top of. The drawings for these keyframes were arbitrarily chosen as the first thing to come to mind from the author. The varying attempts have quite different results. Most form some kind of distortion in accordance with the shape of the oscillator. Which was the general aim.

Most interestingly, was the case of a certain keyframe drawn as a mouth. This keyframe had been drawn to match the oscillator more, the mouth being ring shaped and empty in the centre. This keyframe instead of simply distorting, somehow maintained the line work within the mouth to end up becoming a fairly nice animation of a mouth opening and closing. Due to the movement of the oscilloscope, the mouth animation synthesised via EbSynth includes a sense of stretch and pull. Further research into similar rotoscoping experiments could be beneficial. Perhaps modelling that includes a movement that is similar to the movement of the oscilloscope.

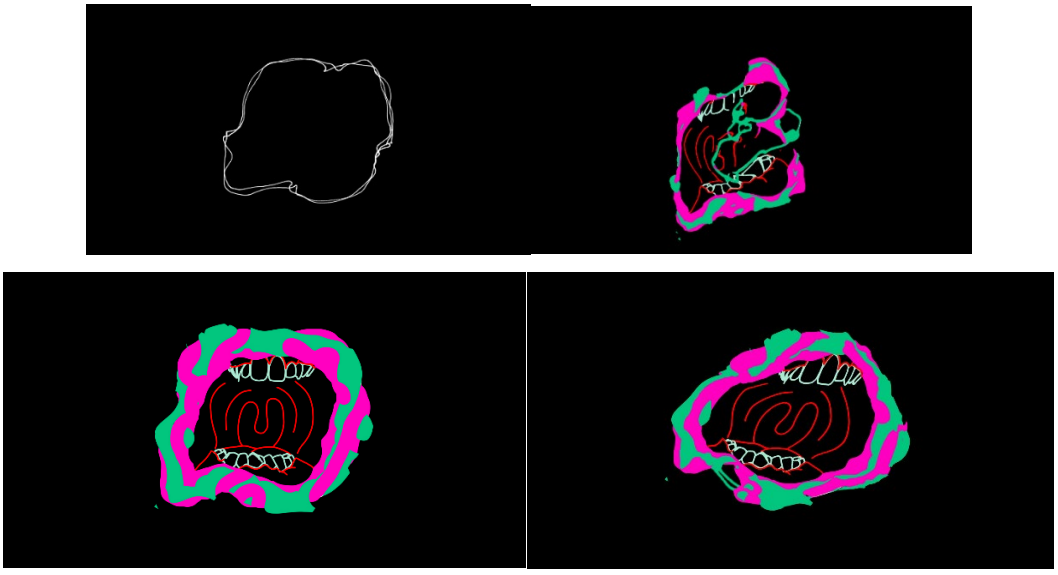

Figure 44. Top left oscilloscope frame from image sequence, bottom left keyframe, top right and bottom right synthesised frames. Animating in this matter with the oscilloscope created a rhythm with the corresponding music as intended. There were unexpected results in how these became animated, in particular the mouth biting animation was unintended and interesting.

Scene 7: *Lucy in the Sky with Diamonds*

Following the rhythmic video of oscilloscope, inspiration was found in the partially rotoscoped sequence during the animated feature *The Yellow Submarine* (1967). Specifically, the portion of the animation backed by the song *Lucy in the Sky with Diamonds.*

This scene within the project is composed of a stylised facial profile with an empty head, the background with blue and pink rectangles, shaped by red barriers. Mostly mimicking the background in the original animation, with some small changes. A larger change being the head being filled with various experimental rotoscoped animations.

The animations in the head have a base key frame similar to the original *Beatles* video, paired with an image sequence invoking unstable EbSynth conditions. Such as tide on sand, and a folding fan.

In Premiere Pro after compositing the different animations, the tint video effect was used with keyframes to create a strobing colour effect to mimic the effect seen in the original. This strobing colour effect was applied at different intervals to the varying frames. All the animations and backgrounds in this scene were drawn in Photoshop on a Wacom tablet.

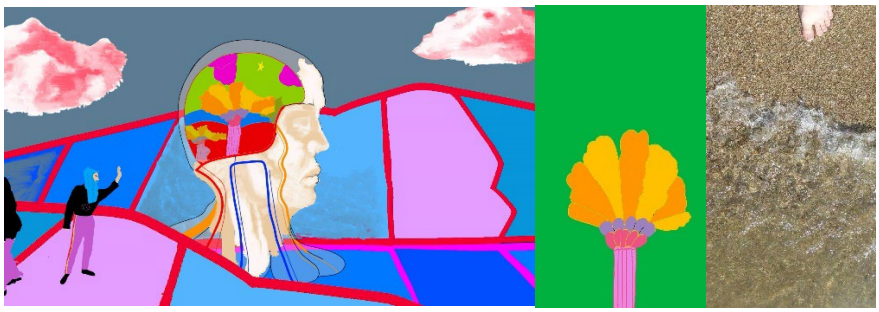

Figure 45. Left final composition from scene, middle painted keyframe, right tide from image sequence.

The flower like animations were synthesised with a video of a wave coming onto sand, filmed close, directly from above. This gave a wavey and fluid movement to the flower like objects. The moving stripey sunset was synthesised on top of a folding fan video, which resulted in some artefacts that lend themselves to this art style. The bluebeard character is rotoscoped and the star wearing “Lucy” character is also rotoscoped, with the strobe effect being applied in Premiere Pro.

Figure 46. Top is a screenshot from final composition, bottom left keyframe, bottom right corresponding image from sequence. Distortion and movement better illustrated in actual video, as with other rotoscoping efforts in this project.

Using different scaling speeds on the different objects in the scene, a multiplanar movement was created for the zoom into the head, seeing the star characters and transitioning into the next scene.

Scene 8: *Contract*

While zooming through the stars in our previous scene, the sky turns to orange and stylised clouds appear. This scene is inspired Vladimir Tarasov's 1985 Russo Soviet animation *Contract*. Tarasov's creative work throughout the 20th century is especially impressive when considering the conditions he was working under. Tarasov employs various techniques while animating, often including one or two rotoscoped characters.

In this homage to *Contract*, the design of the main character is mostly maintained, though slightly adjusted to fit the "Human Name" character. Opening we see this man staring at the sky and

clouds, smoking tobacco. A robot/alien/merchant suddenly flies down, exclaiming for the man to "Purchase Tobacco".

After which the robot opens its large mouth to reveal a pack of cigarettes on its tongue. The man takes this, the pyramid eye from the robot's head flies down, transforms into a lighter, and lights the cigarette. The blue fire in this scene allows for the transition to the next one.

The human character in this scene was created using regular rotoscoping techniques alongside EbSynth. The environment, such as clouds, ground and sky were hand drawn in Photoshop. The robot alien was animated via hand drawn frames and EbSynth. Firstly, the linework for all frames was drawn by hand. Flat colour fills were used for the different areas of the robot alien.

A keyframe that included shading, texturing and further detailed was created. This keyframe was used to synthesise detail, shading and texture across the frame by frame animated robot. This saved lots of time and allowed for different styles/colourings to be tried without requiring much extra effort.

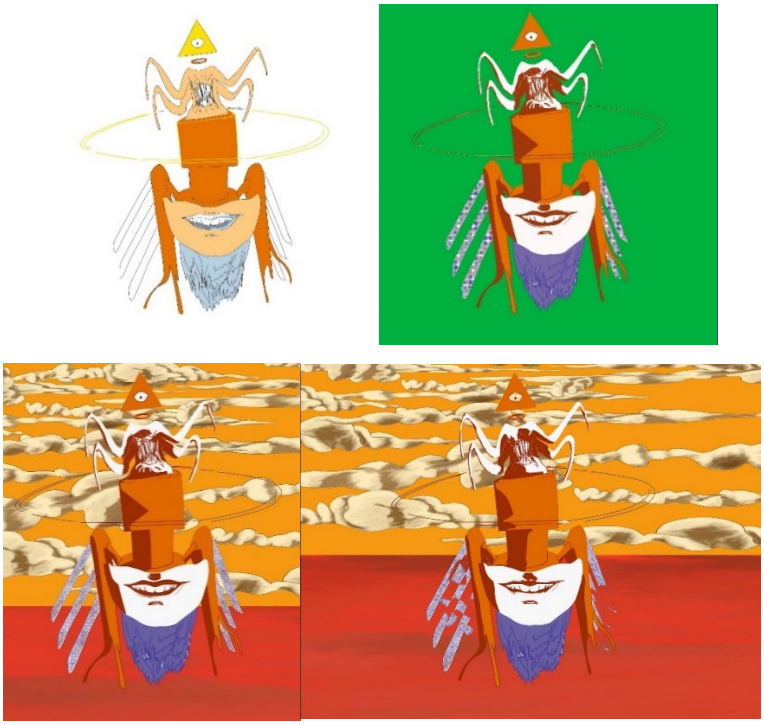

Figure 47. Top left hand drawn image sequence first frame (notice uncoloured wings), top right painted keyframe, bottom left final composition, bottom right synthesised character with intentionally distorted wings. Succesfully created localised or controlled distortion to add animation to the character, perhaps worth exploring in further research.

The wing like extremities of the robot alien were purposefully not colour filled, instead they were left empty and drawn with somewhat erratic movement from frame to frame to capitalise on the artefacts created by EbSynth under these conditions. The keyframe for the wings included screen tones to create a more psychedelic effect alongside the warping and to ensure that the colouring would not mix with the other parts of the animation during the EbSynth process.

Figure 48. Left final composition from scene, centre painting keyframe is a pale white opacity layer on a green screen rgb layer, right corresponding image from sequence of a melting bathbomb. This is illustrating how the smoke animation was created for the cigarettes and the background mist.

Regarding experimental applications, the animated smoke was made with minimal effort successfully mimicking the style of the smoke in the original. This animated smoke was created with a single keyframe of a flat white opaque "smoky" shape (with green background layer for keying in Premiere Pro), synthesised with EbSynth on top of a video of a bathbomb dissolving in water. This smoke animation was very simple to create compared to traditional methods. Using positions and scale keyframes in Premiere Pro allowed for the smoke to be adjusted for different shots and purposes. The smoke animation was primarily used for the smoke coming from the cigarette, but also used to create the mist on the planet.

Scene 9: *The Spine of Night*

Emerging from the blue flame of the lighter in the previous scene, the blue flame gets larger and starts to resemble the magical blue flame in *The Spine of Night*. Zooming out this flame illuminates the following two characters based on the style in *The Spine of Night*. The face of one outlined by the blue, the other character's back facing us. The original character designs are inspired by the designs and styles in *The Spine of Night*. With the bluebeard character appearing as a sort of barbarian, and the Human Name character a simple swordsman.

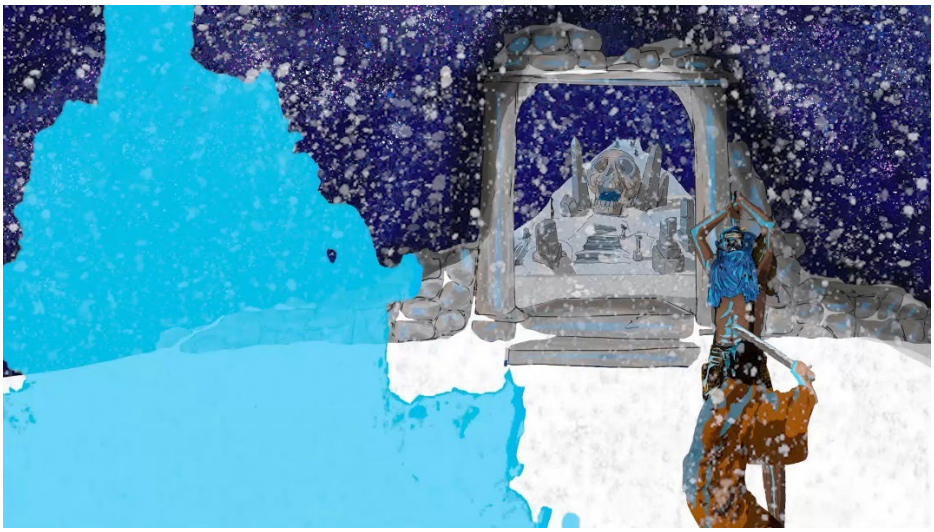

Figure 49. Scene is set in the world of *The Spine of Night* and includes several animated layers for the shot. EbSynth Rotoscoped fire, animated snow created with simple opacity layer keyframes and *ToonCrafter*, rotoscoped characters via EbSynth, and multiplanar movement via Premiere Pro compositing.

The other character is smaller and vulnerable looking. As his head is then split in half by the barbarian character wielding a sword. The characters are products of regular rotoscoping techniques like the previous scenes in this project. Editing keyframes in photoshop and synthesising via EbSynth.

The blue flame was animated by creating a single keyframe on top of a video of a fireplace, synthesised via EbSynth. The result is decent and very low effort, but it is missing the charming movement from the flames in the movie.

The snow falling effect was created very quickly with ToonCrafter (*ToonCrafter: Generative Cartoon Interpolation,* J Xing, H Liu, M Xia, Y Zhang, 2024). With two keyframes as is necessary

with this software, a beginning frame, and an ending frame. The keyframes were very simple white splotches on a green screen layer, painted with the splatter brush at different sizes in Photoshop. After using ToonCrafter to generate the in between frames, the resulting snowfall effect was quite pleasing. However, the movement of the snow was backwards, meaning the snow was floating upwards. This was easily remedied via vertical transform in Premiere Pro, although it was interesting to see this kind of misinterpretation by the ToonCrafter A.I. generator.

These generated animations tend to be very short, in the realm of one or two seconds, perhaps an experienced user would be capable of lenghtening this. To circumvent this and create a seamless loop of the snowfall, the short clip was crossfaded in layers to stop it popping in the animation upon loop.

It is also important to bear in mind that all of these uses of ToonCrafter were done through *Hugging Face Demo*, the open-source browser based shell that allows to run such software. Alternatively, and likely for more control, one could run this natively on their own hardware via Python.

One disadvantage encountered with ToonCrafter, is that the generated animations are very low resolution. Due to this it is not advisable to use when requiring fine detail or medium to large resolutions. For example, if a ToonCrafter generated video is scaled up to 1920x1080 pixels, it will look very pixelated and low res. Perhaps this is only a problem with the demo version, in comparison to running it personally.

For the moment, this low resolution is not a problem when animating things that would naturally have some kind of extreme motion blur like water, or subjects that would normally be out of focus like snowfall or atmospheric effects.

The head splitting segment of the scene was achieved with some experimental rotoscoping techniques. In this instance the options that came to mind regarding simulating this were mostly food based. Deciding on a roasted tomato being cut with a kitchen knife. Doing this with impact to simulate a sort of blood splatter of gore.

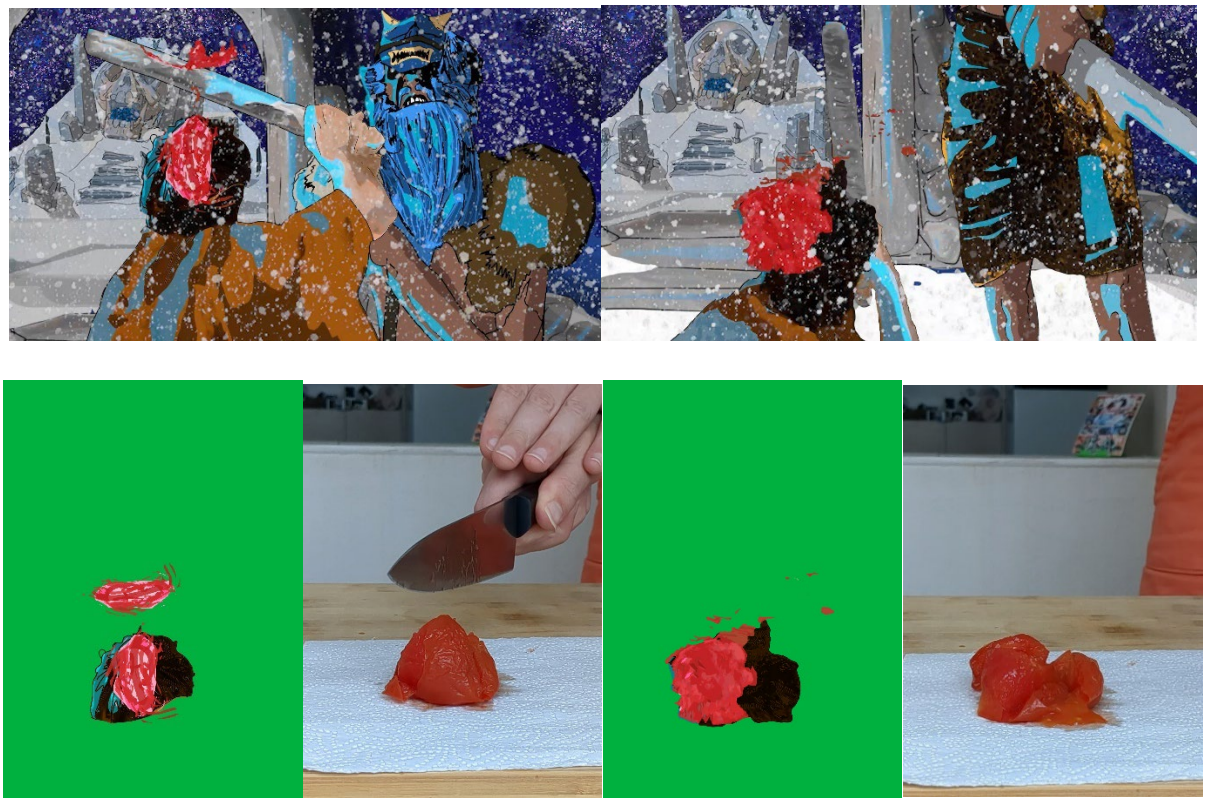

Figure 50. Top row are frames from the final composition of this scene, bottom first left is the painted keyframe, second is the corresponding image from the video, followed by a synthesised frame and its corresponding image.

The split tomato synthesised video was sped up and using position keyframes in Premiere Pro composited with the rest of the video. This allowed for a fairly effective animated gore effect that was very quick and easy to produce, though it is of course not nearly as effective or impactful as the animated gore in the actual feature. Further research into this field of experimental rotoscoping could garner interesting results.

The Spine of Night contains many examples of very well animated gore and is seamlessly blended with the art style in the feature. Inspired by this, the primary goal of this scene was to explore experimental methods for gore.

Scene 10: *Undone*

Awakening in a bed in a wooded meadow, the composition and style of this scene was based on a moment in the mind-bending animated TV series *Undone*. Some parts of the composition were changed to accommodate the limitations of the author of this project. Mainly the bed in the centre of the meadow had its direction and angle changed. This was because of the limited amount of space when recording the rotoscoping for the character in the bed, a wide-angle shot was not possible. Due to this the angle of the lighting also had to be changed. Aside from this the overall composition was mostly the same. The background for this scene was created with a Wacom tablet in photoshop, focusing on oil blend brushes, as were all the painted keyframes in this scene.

The main character is rotoscoped in a regular manner with EbSynth. With the pillow behind their head purposefully drawn into the keyframe in such a way to allow a distortion that looks like the pillow is moving, when in reality, the original video does not contain pillows at all. Usually when rotoscoping a character it is better to greenscreen them and keep them separate to their environment.

Figure 51. Distortion caused by EbSynth on the pillow adds animation and natural quality, while requiring almost no time to implement.

However, in this instance, the regular rotoscoping techniques are combined with the experimental techniques. Saving time and adding a fluidity to the movement of the animated pillow. Alongside

the high level of detail and filled composition, animating the background became a challenge that looked very time consuming. Primarily the river in the foreground needed to be animated.

The initial idea was to use a video containing a sort of fluidity and keyframing the top layer of the river (opacity lines on water surface). Instead as a glance into an alternative method that may be better suited for this specific situation, the recently released A.I. based software *ToonCrafter* was used (*ToonCrafter: Generative Cartoon Interpolation,* J Xing, H Liu, M Xia, Y Zhang, 2024).

ToonCrafter has a similar process to EbSynth in some ways, in that it is also keyframe based, and interpolates from the keyframes created by its user. The primary difference being that ToonCrafter is not a rotoscoping tool and does not require video. Instead ToonCrafter requires the user to insert the starting and ending keyframes of the animation they wish to create. ToonCrafter then generates frames between these starting and end frames.

Figure 52. River animation generated with *Tooncrafter* by using these two images as first and last key frames. Images drawn in Photoshop with a Wacom tablet.

One of the key disadvantages of ToonCrafter listed by its creators in their failure cases, is that elements not included in the initial keyframe can cause strange artefacts and distortions. This intrigued me and I saw that this could potentially be utilised similar to the experimental rotoscoping methods. Although, due to the generative nature of the ToonCrafter, the distortions and applications are not as wide reaching as EbSynth. With EbSynth capable of a huge array of applications, both conventional and experimental.

The animation for the river generated by Tooncrafter from the hand drawn key frames was very effective. Though the generated video can be quite low resolution. This river animation was composited and masked in Premiere Pro, so that it followed the lighting in the rest of the scene, and could be used alongside the other animations in the scene.

After this success with Tooncrafter, another scene animation was attempted. Inspired by a scene in *Undone* where the time passes very quickly and flashes between night and day, three keyframes were created and then interpolated in rotation with one another. Tooncrafter requires a start and end frame, so daytime keyframe plus sunset keyframe, sunset plus nightsky, nightsky plus daytime. Creating a total of three videos which could be looped for the desired effect. The three keyframes are the same base image already hand drawn, with the lighting, shadows and sky changed via layers in the Photoshop file. These keyframes go from day to sunset to night to day. The resulting animation required some tweaking and experimentation with varying the seed, but overall was quite effective and achieved what had been set out to do.

Figure 53. Top left hand drawn keyframe no.1, top right synthesised frame via Tooncrafter, centre left keyframe no.2, centre right synthesised frame, bottom left keyframe no.3, bottom right synthesised frame. Using these three keyframes, three videos were created, then joined into a loop in Premiere Pro.

As the loop increases in speed flashing between night and day, we can see a rotoscoped bluebeard and human name on the right side of the screen, between flashes they can be seen briefly. Suddenly the flashing stops, and the two seem to float off into the air, human name disappearing as bluebeard

is left, implying that human name has aged, and was always going to become bluebeard. This bluebeard animation was created by using various powerful tools in combination. First a regular video was taken for the desired action. This video was image sequenced in Premiere Pro. A keyframe was chosen, then edited with Photoshop aging neural filter, to make the person look older. This aged keyframe was then processed with *Luma Dream Machine.* to create a consistent video of the old man moving, unfortunately with EbSynth in this scenario there were too many artefacts and Luma Dream Machine turned out to be the better option for interpolating the aged character keyframe, this was primarily due to the beard in the keyframe not being present in the original video. Using Luma led to some very stable results, of course with less control over the output however. This video generated with Luma, was then image sequenced with Premiere Pro, the same keyframe as before was chosen, now edited with photoshop and a Wacom tablet to paint the character in the desired rotoscope style to match with the scene. EbSynth was then used to rotoscope the video interpolated by Luma.

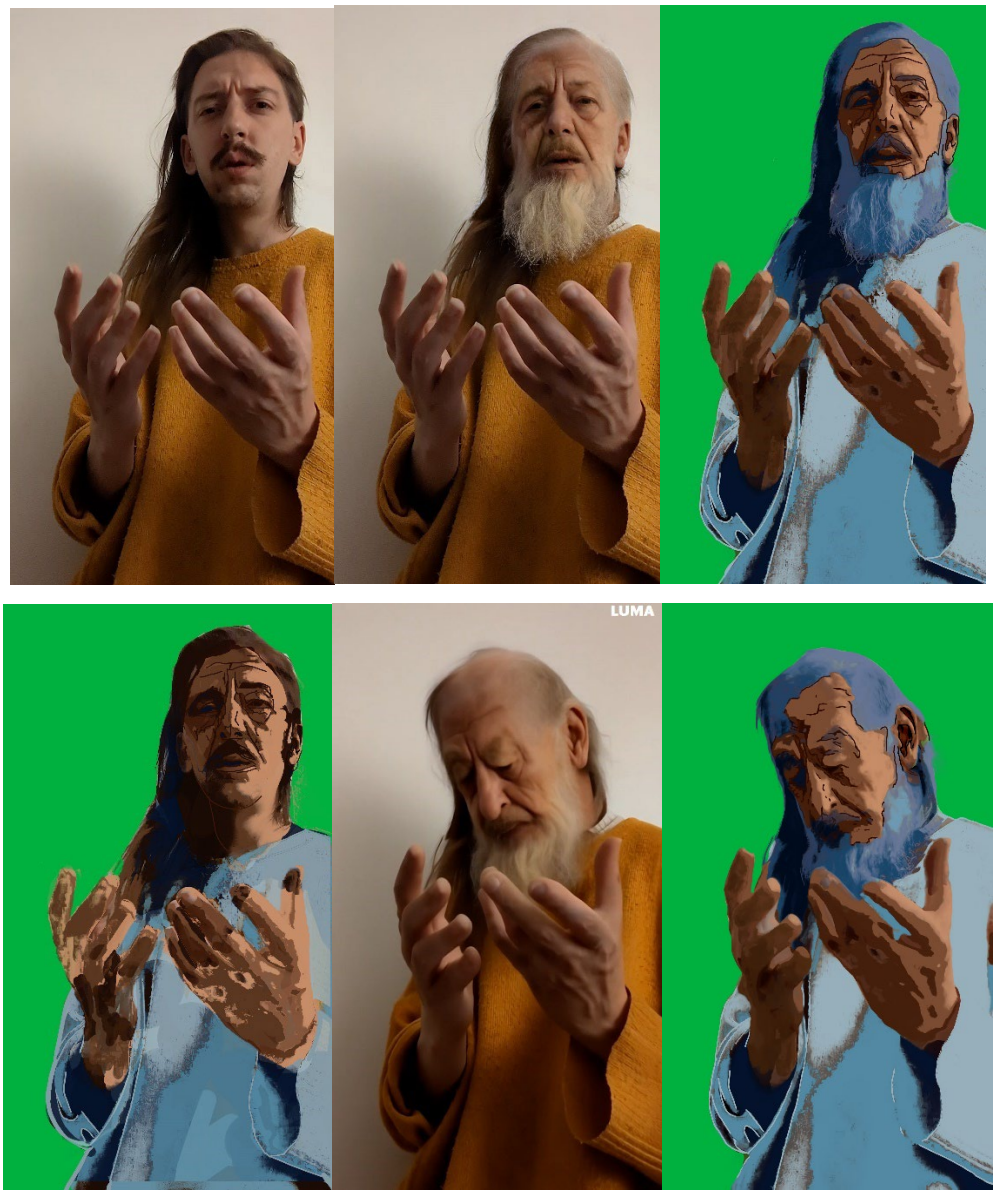

Figure 54. Top left image from original video, top centre image created with Photoshop aging neural filter and used as the keyframe for Luma Dream Machine video, top right keyframe painted by hand in photoshop for use with EbSynth, bottom left keyframe painted in photoshop for use with EbSynth, bottom centre is an image synthesised by Luma Dream Machine, bottom right is a frame synthesised with EbSynth.

The rising background effect as they float out of the meadow was created with Luma Dream Machine by inserting the same background keyframe painted earlier. The human name and bluebeard characters were then composited into the scene with Premiere Pro. The final frame of this rising sequence was then used with *Hedra* to create a lip synced animation of the character based on audio already recorded for the project. Hedra is a free to use A.I. powered animation

and lip syncing tool. Simply take any character or person's image, add an audio file or type in a description, then the app will perfectly animate and lip sync the corresponding files. After one use, the ability of Hedra is already extremely impressive. This could prove to be a valuable pairing between EbSynth and Hedra, as one of EbSynth's primary difficulties is when dealing with speaking mouths.

Figure 55. Top row are images from the final composition with the characters previously described in front and the background animation interpolated via Luma Dream Machine, top right image was also used as the keyframe for the Hedra animated lip sync. Bottom row are three images synthesised with Hedra, they are scaled up to match the aspect ratio of the video.

Scene 11: Outro

As the truth of their identity is revealed, Bluebeard is simply the aged version of the other character, after travelling on the journey they started for themselves. The camera zooms out to reveal the 3D beast again, which fires up a single shot into the sky. Bluebeard/Human Name is shooting through space, and a montage of experimental rotoscoping methods fills this scene. With lots of different visuals adding to the character's psychedelic space journey. Including some scenes that were created by giving keyframes from this project to *Luma A.I.,* which the A.I. then interpolated.

Specifically, after the laser is fired from the top of the beast's head, that final frame was used as a prompt for Luma Dream Machine, and given vague instructions like "journey through a psychedelic tunnel", which ended up creating a very random but amusing and visually interesting sequence interpolated from the initial keyframe. This keyframe being a screenshot from a Blender composition created for the project.

Luma Dream Machine was used in conjunction with EbSynth for the eyeball cutting scene. First a video was taken of a poached egg being cut with a knife. From this video, a keyframe was chosen, edited with photoshop in a collage/painting approach, synthesised via EbSynth, and then to create a run up to the eyeball being cut, the same drawn keyframe was used with Luma to create a short zoom effect. These videos were then composited together in Premiere Pro, with the Luma zoom starting this segment, and the EbSynth egg ending the segment.

Figure 56. Left is Luma Dream Machine synthesised frame at beginning of video, centre is the keyframe created via collage and painting in Photoshop, right is the cut eyeball synthesised with EbSynth, and above is the corresponding frame from the original image sequence of a poached egg being cut.

After travelling on this hyperdimensional journey, bluebeard arrives exactly at the beginning. Standing in front of the door in the pink house, he utters the line which first began his journey, "Nothing feels better than falling apart". His shape turns into a key and the video ends with the key falling into Human Name's hand.

Conclusion

This video project was partially created as a proof of concept for the Experimental Rotoscoping Methods described in this paper, and the open ended functionality of new software like EbSynth. The experimental animations presented in this project aimed to be time efficient replacements or novel creations. To this end, there has been success to greater and lesser extents within the different experimental applications. In this section, these instances and their further implications are discussed, in order of their appearance in the project video.

In the opening sequence, the golden tentacles rotoscoped on the anemone footage was an application of EbSynth to do what is expected of it really, but instead of people, to tightly rotoscope these tentacles. The result allowed for animated tentacles to be blended with the stylised animation. The creation was novel and would be very time consuming to create with traditional methods. But it is hard to imagine further expansion on this specific subject, or similar use cases. The takeaway from this segment might simply be that animals and living things are usually interesting to rotoscope or record.

In the *Out of the Inkwell* inspired scene, the smoke and animated "BANG" from the gun was created by rotoscoping that on a person lit up by a firework flash. This was perhaps an un-conventional approach to creating this animated effect. However the resulting animation was effective and fits with the scene. This animation was quick and easy to create. The primary influencing factor in this instance being lighting. It could be interesting to test EbSynth in varying types of lighting, and changes in lighting. Whether that be quick flashes, slow fades, strobing colours, high contrasts or so on. Lighting is a powerful tool in any form of visual art, and may extend here as well.

In the same scene, the exploding head animation fulfilled its purpose and the results were satisfactory. Created with a minimal amount of effort in 3D and relying on the power of keyframing in EbSynth, the resulting distortions added a fluidity and texture to the special effect, which in the raw 3D render looked more like porcelain shattering. Processing 3D renders through EbSynth is not a new idea. However in this project purposefully utilising the differences between these softwares to create something novel. Further research could be in testing how EbSynth handles other fluid simulations or changes of state uniquely suited to 3D rendering.

Following this the *Waking Life* inspired scene involved some interesting implications. Primarily with the 3D model floating figure. This floating figure rendered with very simple block colours, had a keyframe which was drawn in photoshop which did not include certain details such as the feet or under the shirt. However, after synthesising this sequence via EbSynth, these same details were coloured in accordance with their counterparts and shaded accordingly with some minor artifacts. This is one of the most intriguing results of the project. For further research, one could try testing the boundaries of this, perhaps layering multiple instances of simplified layerwork. Block colours in one export, linework in another export, shading in a different export. Using different forms of pattern or stroke on top of the keyframe, stacks of lettering or wording. These are just some possible avenues to follow.

Also in this scene, the background dissipates suddenly in a flowing motion. This trippy transition was achieved by rotoscoping the scene background onto a video of a melting bathbomb. The result is satisfactory for its purpose and similar methods are used throughout the video in different spots to add to the animation. Such as the melting clock. This is a time efficient way of creating melting or flowing animations when needed, though it is unclear if there what else there is to explore with this. Although, it would certainly be very difficult and time consuming to create such animated effects by hand or with traditional methods. On the other hand, melting or fluid like effects in traditional or hand drawn methods may look better depending on a range of factors. As with all forms of animation.

In the next scene inspired by *The Tale of the Fisherman and the Fish,* in another instance of 3D being rotoscoped with EbSynth, the shape key transforming fish created in Blender 3D took well to the simple animation. The synthesised linework was messy but surprisingly maintained. The resulting animations fit for a humorous style and work for this scene. It may be worth looking further into this area. Specifically for linework on transforming 3D shapes.

Following this the oscilloscope rotoscoped scene allowed for some interesting animations to be created. Particularly the movement and unintended biting of the mouth animation. The interaction of the oscilloscope and the images did not turn out as expected. In fact the results were more interesting than projected. One could imagine the oscilloscope would simply wipe away any image there, though in rhythm to the movement. Instead, the images morphed with the many frantically

vibrating threads of the oscilloscope. Further research in this area could certainly be interesting, however what that research would be or where to start is unclear.

For the *Lucy in the Sky with Diamonds* inspired scene, the two non-linear rotoscoped assets were created very time efficiently and the following distortions were in line with the style of video. The results had satisfactory movement, though uninspiring in regard to further iteration or implication from these specific moments. The flower rotoscoped to the tide extends and folds as necessary, the stripey sunset rotoscoped to the folding fan also fulfils its role in such a manner.

Once again rotoscoping the bathbomb melting video, the smoke and mist in the *Contract* inspired scene was very easily created in this manner. This animated smoke works well in this instance, however it is because the smoke in this style is in general flat and non-descript. If the smoke was detailed or stylised differently this method may not have worked as well as it did.

The robot alien creature selling tobacco was successfully rotoscoped with the localised distortions. As to what further research could be conducted under these conditions, or what other approaches it could be used for, these things are unclear at the time of writing. But there may be unexpected uses.

Going from the martian-esque landscape to a snowy mountain, *The Spine of Night* was a big inspiration when contemplating experimental rotoscoping methods. The attempt to create interesting gore via these methods was partially successfully. In the sense that novel movement was created for the cutting by rotoscoping the tomato, however, of course the animation created by rotoscoping this tomato does not compare to the animation achieved by the traditional frame by frame methods in the original feature. It would be interesting to do further tests though, with closer detail on the subject being cut, both in the keyframe, and in the footage. Also to experiment with different materials.

There were many other scenes planned for this project, inspired by other exemplars of rotoscoping animation including but not limited to *Heavy Metal, Fire & Ice¸ Aku no Hana, Tarasov's The Return, Wizards, Superman, Betty Boop, FAITH: An Unholy Trinity, Prince of Persia,* but to name only a few. We look forward to creating these and other particular scenes in the near future.

In terms of future applications, the methods shown in this project should be seen as time efficient workarounds for various forms of animation. It is the intention of this project and the different

experimental applications to inspire others to think open mindedly about the tools we are being presented currently. Whether that be the tools outlined and discussed in this project, or the new wave of creative software on the horizon.

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*Hedra (*https://www.hedra.com/)

*Luma Dream Machine (*https://lumalabs.ai/dream-machine)

*ToonCrafter (*https://doubiiu.github.io/projects/ToonCrafter/)

Annex of Interviews in Full

Šárka Sochorová, *SCRTWPNS,*

- What are the key differences in the new and improved version of EbSynth you are working on currently?

The new version will run in the browser and will have a graphic user interface.

- Does this new EbSynth still primarily use non-parametric texture synthesis algorithms?

Yes, the non-parametric approach has so far outperformed any parametric methods.

- What are your thoughts on incorporating machine learning and neural networks into EbSynth?

We're planning on adding stable diffusion as an option to generate the keyframes. We're generally open to including machine learning techniques if they prove useful.

- What do you consider to be the main rivalry to EbSynth, or does EbSynth have any competition?

Sora from openAI. But I believe that artists and filmmakers will need more visual control over their output so that's where EbSynth might still be useful.

- What EbSynth usage has surprised you most?

We really love what Joel Haver does. He took the output from EbSynth including all the pixel-soup artifacts we were always frowning at, and made it his signature style. He makes great comedy and we're so happy EbSynth plays a part in his creative process.

- What is the probable release date for this newest version? Is it exiting beta?

Hopefully this year :)

- What do you think of A.I. video creation software such as Sora.AI?

This could be a topic for discussion on its own, but I'll keep this answer short. Despite the controversial origin of the image-generating models, I think that this technology is exciting. I love seeing how many people get inspired by it - artists, engineers, and researchers. If Sora.AI turns into a tool that offers control to the user, I can't wait to see what the new generation of

filmmakers does with it. But it's still just a tool, and to cite Aaron Hertzmann - Computers Do Not Make Art, People Do.

- In a previous interview, there was a mention of real-time previews with EbSynth, is this still a goal for you?
Yes, we already have a very close-to-real-time preview in the new version.

- Are you making any changes to the EbSynth UI? Such as the previously mentioned interactive timeline?
The new UI is completely different, it's more like a video player than the spreadsheet table from the beta version.

- Do you have any new tips for EbSynth not mentioned previously?
I think the most important tip is still to start from just one keyframe and create additional keyframes by making local fixes to the broken frames. Making as little change as possible is a key to consistency.

- Are you aware of any new, different or experimental uses of EbSynth? Such as creatively utilising the artefact creation sometimes caused by EbSynth, in a way, leaning into the inconsistencies.
A friend recently sent me this video and I thought it was hilarious. We also love it when people use EbSynth for trippy videos. For example when you take a video of a swimmer and use a keyframe of a meadow of tulips. The tulips start to move like the swimmer and it's somehow relaxing and weird at the same time. Like here for example.

- What are your hopes for EbSynth going forward?
We want to create a tool that will help people make films at home, on a low budget, without big studios or gear. As kids, we both got fascinated by movies like Star Wars, Jurrasic Park, Matrix... so we tried making our own films from anything we could find at home and it was a blissful time. When people get inspired, beautiful things can happen. We'd like to turn EbSynth into a tool that would be one of their creative "secret weapons".

Morgan King; *Gorgonaut*

-How did you become an animator?

I wanted to film since I was very young, but I went to a school without a film department. I tried to use the communications and art departments, and I made a couple of short films. But then I got out of college and there was just… well you know, I couldn't really afford to do it, I didn't really have any training or connections to the film industry. So I mostly did graphic design for the next decade. I was working at this one place, I just hated it. I told my wife, "I think I want to do animation, I've wanted to do this for a long time", and I started not rotoscoping, but always loved it. When I was a kid it was peak rotoscope animation. Well I started doing flash animation, that's what everybody was doing.

-What made you start rotoscoping?

There's a shot where I wanted this guy's cape to move as he turned. I experimented with a hundred different ways of animating it in a sort of flash style. Then I was like you know what, I'm just going to film myself in the backyard with a bathrobe and just twirl the bathrobe. Then I started rotoscoping, I knew about it, I went to do it, and thought, oh this is achievable. This is a thing I could learn how to do. It's kind of an addictive process, cause it's fun to design a shot, fun to shoot it and it's fun to animate it.

-How did you make *Exordium* and *The Spine of Night?*

Since I had done graphic design for so long, I was sort of just using the tools I knew how to use. All the animation is done in Photoshop, in frames. Then I drop the frames into Premiere, you know 24fps project and they're each on the twos at 12fps, mostly. I drew Exordium on a Wacom Intuous 4, and I did The Spine of Night on the screen, on the old model Cintiq.

-What is your rotoscoping process?

The actual process is, storyboard it, film the shots I storyboarded, as much as we can now (especially on The Spine of Night) being able to do a full live action edit of your project before you animate anything, cause you don't want to waste a second of animation. It's brutal if you have to lose six or seven frames cause you wanted to tighten it up a little bit. So we try to get the live action edit as tight as possible. Put in place holders for things that would be illustrated or animated. Export that, 12 frames per second mostly. I made a bunch of custom action sets in

photoshop to process them all in to the exact layer format that I want. Then it's kind of just a matter of drawing it.

-Do you have any rotoscoping tips?
The major thing I do, that a lot of people rotoscoping don't do, is I do a lot of work onion skinning with transparency layers in photoshop. Take for example, if someone is moving their arm at the elbow, I'll take the previous frame and advance it to match their pace in the video. I think a lot of people approach rotoscoping like they're going to go in blind and retrace the details, but that gives you a much more jittery, messy aesthetic. Which I was trying to veer away from that as much as I could.

-Do you use any kind of interpolation software to assist in animating, such as EbSynth?
The Spine of Night and previous features were all frame by frame fully by hand. But I am working on a new project I can't speak much about right now, which uses a little bit of EbSynth for textures. It's still all drawn frame by frame, but I'm just using it for the mottling on the skin and textures, the shading is all by hand too.

-The animated gore in your work such as *The Spine of Night* is quite impressive, how did you go about animating that into your rotoscoped work?
Well it's really just, the basic answer is it's just animation. It's always funny when people comment on the movie like "How did you cut that guy in half cause you're rotoscoping?", well it's animation, when you have a thing that you can't do with live action, it's live animation. So everything is infinitely malleable.

It's still going to make hand drawn rotoscope animation stand out from all the automated stuff that's surely coming, you can't tell A.I. to do a subdermal fracture (like how the character in Spine of Night does), you can't film that and if you're going to do the special FX for that to look real then you might as well do it in live action. You can't just tell the A.I. to do that. It's that sort of thing like gore and special FX which is going to be a hard wall for A.I., filters and automated stuff.

-What is your opinion of EbSynth in the professional sphere and media industry?
EbSynth is fun to play around with for sure, and I love what it ***can*** *do, but I'm a little worried they (the dev team) have stopped supporting it? I kind of think maybe they're not working on it*

*anymore. I think people **are** using it, I know Minnow Mountain use it a little bit, but they mostly use, what is it, Lockdown? Which is a kind of similar tech. For like surface tracking. I think a lot of hobbyists are using EbSynth. But I think it has uses. When it first came out I was so close to doing what I wanted to with it. But because it's not really A.I., it's kind of pixel tracking, anytime anything goes out of frame and comes back, it doesn't know what to do with it. You can turn your head away, but you can't turn your head back. But I sort of embraced it and that's why I use it for textures now. At least in my workflow, I think it's very good at making interesting live feeling textures that give you some sort of depth all through the image you send through, for the most part. Also when textures come back on screen, you can use the autofill function in photoshop to clean it up pretty easily, as long as the textures are kind of vague. It was a big learning curve though, to figure out how to best use it (EbSynth). It couldn't do exactly what I wanted, I was sort of disappointed at first, especially with linework. Our work is very linework heavy and it garbles the linework immediately. But for textures and stuff I found it to be pretty useful. It certainly does things that you could never do by hand. In terms of others using it, I suspect it has a fair amount of use in frame by frame animation at least. I think a lot of the puppet animation probably doesn't have much use for it.*

-What are the advantages and drawbacks of rotoscoping?

Well the drawbacks, obviously it takes forever, it's very, very slow. If you want to do it in a more traditionally animated way, it's very slow. While out for a coffee I saw this animation book on a shelf. Oh this looks fun, had a look inside and saw the rotoscoping section, and the very first sentence said "If you think you're going to try and make a rotoscope feature film make sure you have a long prison sentence, because that's about how long it's going to take". It took a solid seven years to draw 92 minutes (The Spine of Night). We were always a small studio, we only ever had a team of three. I drew 50% of it myself. The other guys mostly did the background characters and stuff, or any shots that didn't have effects of any sort. Also with live action, the human body doesn't do the squash and stretch as with standard cartooning, so in action scenes it's hard to get that same impact. But there are some work arounds with cutting and choosing frames at a higher 24fps.

In terms of advantages I really like how collaborative it is, in a traditional film making sense. The stuff that actors bring to the performance. If you're animating it, it's not that your

characters aren't performing, but when you have actors they're going to make choices that you would never think of as an animator. They introduce their own creative process so it's just way more collaboration. The ability to shoot the entire project and edit it, and the timing. Having live action for the entire animation process is an amazing advantage, even over animatics or detailed storyboards.

Although another limitation is that some camera moves are really difficult if your background isn't 3D. You want to actively not shoot people's feet, because of the way their feet are planted on the ground, if you have a flat painted background it can't rotate properly. In The Spine of Night we locked the camera down most of the time. Basic pans, maybe zooms. We're trying to be freer with the camera on our new project. More sophisticated camera movements. Traditional animation is really good at that, but if you have a painted background you're going to have a lot of problems. If you look at a lot of older rotoscope stuff it's similar, the few times they move the camera in a any complex way in Fire and Ice they basically have to make surrealist backgrounds to make it work.

Artem Sawitski; *BreakThru Films*

-What is your experience with EbSynth?

Basically EbSynth is pretty unpopular soft, it which I did try to play around on my time. I did a test, based on Old Boy movie, and pretty much forget about it. But one Polish director found me and wanted me to be a vfx guy for his film. And it wasn't The Peasants. The movie was called Algorytmica. Low budget movies for upcoming talents. In this environment you basically have to do everything. By the end I knew pretty much all there is to know about EbSynth. Plus I figured my own pipeline for film production. A year later, I found out there is a studio that's doing film "painterly style", they didn't look for anybody to hire, but I called anyway. When producer found out that I'm the one of the few people who actually did something with EbSynth, he hired me on the spot. And I became part of interpolation team.

-What was the process you used to make *The Peasants* and the role of EbSynth in that?

So technically I can't say much, but in terms of details of pipeline, the Peasants was structured in the way that helps painters make their life easier. Here is some math: if the film is 1h 50m - 79

200 frames (12 fps) And one painting will take 3-5 hours (its actually pretty fast) so it will make 27 years of pure man hours. Pretty insane.

Back to the structure, some scenes were painted in 1\4 1\8 1\16, depends on the movement and importance, and everything in between was basically EbSynth The biggest problem with it, is it very strict with edges. By that I mean, if you paint 1-pixel outside the value of an object, it will smear across the frame with movement. There is no easy solution, or any that I can find implementation. So it better to stick using EbSynth on surfaces, full of visual information, dirt or anything that has a texture. Otherwise EBS doesn't know how to properly stick with the picture and the end results will look wobbly.

-What are the key differences between the animation in *Loving Vincent* and *The Peasants*?
Loving Vincent didn't use interpolation as far as I'm aware?
Yes, Loving Vincent was full on, hardcore painting, plus I wasn't there at that time. So I know only the stories of painters and VFX people who did it.

-What do you see for the future of EbSynth in the professional sector?
I don't know how it would look like in professional sector. Because the professionals need reliable results. EbSynth is a more artistic tool for users that has lots of ways to implement. Plus nobody knows the proper way to use it, including the developers. In my spare time, I do experiments for it. Maybe in the future if The Peasants and our future films will implement more, yes it will create a popularity spike.

Steph Swope & Chris Staggs; *Minnow Mountain*

- How did you become animators and when did you begin rotoscoping?
Craig: *My first animation job was on Richard Linklater's A Scanner Darkly, which came out in 2006, and I've been rotoscoping ever since.*

Steph: *I'm actually not an animator, although I do produce it. I started in live-action*

independent filmmaking in 1999 and did that until Craig and I formed Minnow Mountain in 2012.

- What is your rotoscoping process?
We animate by drawing over live action footage using software to supplement our traditional frame-by-frame 2D process.

- When did you start using EbSynth and what triggered the need for EbSynth?
We started using it between seasons 1 and 2 of Undone (2019/2020), and we started using it to reduce the amount of labor we spent tracking incidental parts of the animation.

- What are your thoughts on EbSynth and how do you utilise it?
It's a good tool for getting animation started but does require a human touch to perfect the final piece.

- Do you utilise other rotoscoping software or interpolation software?
Yes, we have a constantly-evolving cocktail of softwares we use depending on the narrative and stylistic requirements of the project.

- What is your opinion of EbSynth in the professional sector? For example, is it commonly used, popular/unknown, effectively used or not well understood.
Neither of us really have enough info to answer this one.

- Do you have any tips for rotoscoping? Related to or not related to EbSynth, both are fine. I understand you have some instructional videos as well.
We do have some videos! Our How To Rotoscope lessons are linked on our site and are a pretty fun and instructional watch.

Our tips: Simplify and focus on emotion.

- What do you see for the future of rotoscoping animation and related software?

Rotoscoping has been around for over 100 years, regardless of how it's made. Neither of us see that going anywhere, although there will undoubtedly be changes in the technology. Our ultimate goal is a film that is a painting--or at least a work of art that lasts forever--but software comes and goes.

- Do you know of any unexpected or experimental uses of rotoscope animation software?
Our company's favorite thing is to use software for unintended purposes. In our pipeline, each project has a unique look and feel so they all end up being experimental in one way or another. One thing we try to avoid is having any one piece of software be obvious in the final result.

- Are you working on any new projects, and if so has your process changed?
We have several projects in development at the moment, and we're always adjusting our process based on the story universe of each project. Every project is unique and gets its own style, pipeline, team, etc.

- What are the advantages of rotoscoping?
Rotoscoping is a hybrid of animation and live action. It allows you the flexibility of animation and the dramatic impact of live action.