Crafting a Crafty Witch: Hybrid Printing Processes for Novel Animation Aesthetics

Laura-Beth Cowley

ABSTRACT

This paper presents strategies for conducting a mixed-method practice-led investigation through the creation of a one-minute micro-short stop-motion animation film that uses 3D printing to represent two distinct design styles. The film combines the 1950s animation style of 'cartoon modern' (Amidi, 2006) with historic woodblock printing found in early documents on witchcraft, reflecting various definitions of 'craft' that combine analogue methods with digital skills and tools. This was documented in a making-of video, showing the various processes and technologies used throughout the film, which uses 3D printing as both a tool and a material in the creation of a novel aesthetic to explore conceptual visual ideas such as post-digital art, glitch art and sloppy craft.

PROJECT OUTLINE

The project was developed to conduct research into the aesthetic potential that 3D printing could offer stop-motion puppet fabrication when developed through the dual lenses of post-digital art (Cramer, 2005), glitch art (Betancourt, 2017) and sloppy craft (Wilson, 2015) as conceptual ideas that emphasized organic imperfections as a purposeful, advantageous feature of a work. The combination of historic art styles was in response to the striking, but often crude, woodcuts of the period, which frequently used simplified shapes and bold facial profiles that parallel the design features found in many iconic 'cartoon modern' characters. The case study used 3D printing as the connecting technology to combine these styles. Fused deposition modeling (FDM) printing, with its noticeable layer lines, was used to create a textured visual profile that approximated the pattern in woodblock printing, as seen in Figure 1. Pre-visualisation elements were developed in collaboration with 2D animator Sam Shaw, then modelled digitally, 3D printed and animated in stop-motion, combining all three primary forms of animation.

'CARTOON MODERN' AS AN APPROPRIATE VISUAL STYLE

The 'cartoon modern' aesthetic is visible in the work of various animators and studios throughout the 1950s; as Amid Amidi (2006) explains, it represented several distinctive art styles that were influenced by modern art, cubism, surrealism and expressionism, embracing animation as a medium and rejecting the circular character designs such as those of Disney for more modern design elements such as hard-edged shapes and lines. These design features were incorporated into the movements of the characters, often distorting them frame by frame before returning them to their original state. Others kept specific body parts still while performing through the limbs or other parts of the character in a method known as limited animation, something that became popular in the industry as a cost-cutting measure. These concepts were also brought into the background design by abstracting the character's environment, relying heavily on flat colours and white space, or using larger, painterly strokes that emphasised the handmade, artistic nature of the work. The energetic and playful nature of the 'cartoon modern' style has had a long-lasting appeal and impact on the language of

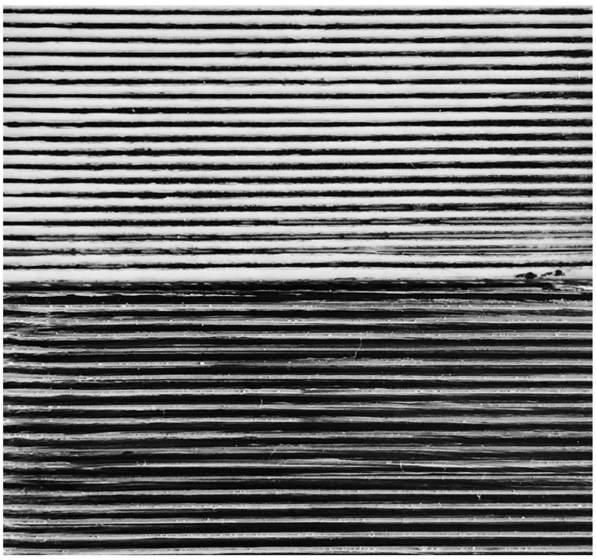

Image 1

Image 1: FDM Layer line texture

animation that often goes unrecognised due to its wide range of design features and short-form format. Thus, it was a perfect design style to recreate with 3D printing.

PROCESS

The style and process were selected in tandem to explore the potential for replacement animation. As with all animated works, it is important to set out working methods or rules to apply a logic to the design principles moving forward. Only puppet elements would be 3D printed, to create replacement parts with varying texture profiles and to differentiate the character from background and foreground elements. Heads and bodies were created using the FDM printing process to allow the organic layer lines created by the process to form a bespoke texture profile, using 3D printing for its organic visual materiality. Stereolithography (SLA) printing was used to create the puppet components that required a detailed, high-quality surface finish. Thinner parts, such as hair, eyelashes, eyebrows, thin mouths, and squinting eyes, were created using a mix of paper and oven-fired polymer clay as they would be unlikely to survive the SLA printing process. The limbs were created with wire and built-up layers of latex-impregnated foam (Murphy, 2008:78–9) to create flexible rods that could be cut to length when required in the sequence. Wire allowed for subtle movement and adaptability on set. Backgrounds, water, symbols, and clouds were created using either paper or digital techniques.

COLLABORATION

Once initial designs, storyboards and a basic animatic were created, I, as researcher/director, contacted collaborator Sam Shaw to develop the final pre-visual materials. Shaw is an animator and director well known for his character design. He regularly incorporates the ‘cartoon modern’ style into his work, making him an ideal collaborator. Shaw developed the pre-visualisation for the film, from which all the components were designed. In our initial meeting, we outlined considerations that needed to be addressed regarding physical construction to avoid issues further down the line. This included the incorporation of interconnecting parts to aid with registration when animating, which was achieved by keeping the bodies of the characters consistent, with minimal changes throughout the film. This, in turn, required that most of the movement be achieved through the heads, hands, and limbs in a performance akin to limited animation. Shaw, through his knowledge of ‘cartoon modern’ movement, performance and timing, produced a highly detailed 2D animatic that could be broken down and rebuilt in three dimensions, allowing for a pragmatic working process with less potential for error.

REPLACEMENT BREAKDOWN AND LAYER HEIGHT

A detailed data log documenting the entire case study was kept. To break down the animation into its component parts, the animatic was rendered into individual frames and put into a table, with each replacement element labelled and cross-referenced for duplication of frames that were then removed. A separate table was created to indicate each replacement part that needed to be created in computer-aided design (CAD). Layer heights and printing parameters were tested using a simplified 3D shape - nozzle sizes, printing settings, and print orientations variation were tested to determine how far the layer height could be increased and remain functional. This was done to improve the visibility of the individual layers without creating holes or other unwanted anomalies in the printing process. There are settings for nozzle height and temperature that are pre-determined to give the best results. Such settings are normally defined as creating a high-quality, strong piece that is fast to print as these are the perceived advantages of using a larger nozzle size in FDM printing. Visual qualities are rarely considered beyond a desire to make it appear 3D printed. However, as I intended to use these naturally formed ridges for their aesthetic potential, it was important to test these parameters to their fullest. An Ender 3 FDM printer with a Hero Me Gen5 upgrade was used to allow a stronger, more heat-resistant hot end that could push more filament at the correct temperature through a larger nozzle. Extensive testing was undertaken to reach a balance between distinctive line-making and print anomalies or failures due to layers not fusing. This meant pragmatically testing various settings in the slicer software (Cura). A final selection of a 1.2mm nozzle with a 1.0-layer height was chosen. By reducing the speed and increasing the temperature, printing at this layer height was achievable with consistent layers and without developing gaps or extensive flaws. When printing with a larger nozzle, the need for internal infill was not necessary. An issue with over-extrusion on the initial layers was noted as it created a noticeable warping which would cause the heads and bodies of the puppets to interlock rather than slide together. By fine-tuning the bed level and increasing the bevel on the base of the digital model, the issue was removed, leaving clean prints that were able to fit together with minimal post-print sanding.

SCULPTING

Once all the potential puppet replacement parts were labelled, each piece was created as a 3D model using a CAD programme. The character designs, with their angular geometry, were well suited to CAD modelling software. Although possible through any computer modelling software, the combination of functionality, angular design and carved aesthetic led me to select CAD software for the creation of all the 3D design elements. The body, as the single element that remained largely unchanged throughout the film, was the starting point for each of the puppets, and from it, all other measurements were taken. Small details such as collars and buttons were recessed into the face of the body to create a valley for paint once printed. Holes for limbs were also added at this point. The heads were designed to fit into the body recess, both to give depth and to aid with registration on set once animating. All the edges of the head were given a slight bevel to create a smooth finish; a more exaggerated bevel at the base reduced the potential for initial print layers over-extruding. Images of the individual replacements were used to trace and plot the initial digital sketch, before extruding and adding additional details. The final shapes were scaled to make sure the proportions were correct across both the puppets and all the replacements.

PRINTING

The prints were printed upright to create uniformity in the line pattern texture. They were largely printed without the need for support except for the few heads of one character for whom the nose was suspended at a 90° angle. Due to the layer testing, the printing was quick, with multiple heads being printed at the same time and only minimal reprints required. The SLA-printed facial components and accessories were printed in standard grey resin. It took six to seven hours for the full beds of objects to be printed. Some parts were reprinted due to small errors in the final prints, partially due to the age of the materials that had been left as sediment, and because of a small internal flaw. This was perceived to be due to something (most likely dust) on the glass of the optical window which caused a single hair-width line to be created in all the prints on a certain part of the bed. Multiple prints were created in case of issues which may have arisen during the post-processing or filming, such as breakages or parts being lost. The prints were soaked in isopropyl alcohol (IPA) before being fully cured in a UV light chamber.

POST-PROCESSING

Once all the prints were completed, various post-processing techniques were applied to the colour, bringing out the texture and/or applying details to the prints. The bodies were painted with acrylic for clothing details such as buttons. Small holes or drooping layers that had occurred during the printing process for the heads, predominantly in areas of extreme angle change such as the mouth and nose, had a small amount of air-drying epoxy putty added to fill the holes. This was done not to hide the anomalies but to stop the spaces from creating dark spots when lit during animation. Each head was then coated in shoe polish before being burnished to highlight the natural grain created by the printing process; the polish sat in the valleys of the print to create contrast. Black acrylic paint was also used on the sides of the heads to add depth and highlight the design features of the puppets. The SLA prints had all supports removed, and then small surface scratches and bits of debris were removed using fine sandpaper and water. They were then cleaned using IPA as water leaves a powdery residue on the prints. These prints were then painted in either black or white acrylic paint, using a sponge to create a textured matt finish. The hands were back-painted to highlight the depth in the design. The teeth and lips were painted to separate them from the back of the SLA-printed mouths, which were left in pure grey resin.

FILMING

A shooting space with a rostrum set-up allowed for shooting flat with the camera position down. As the film is one continuous thirty-second sequence, it was shot over two days. The first day of shooting consisted of just over half the film, leading up to a transition. The second included the transition and the final sequence. The process was straightforward; overlaying the animatic helped keep track of timing and posing for each frame of the animation. There was room to make small creative changes on set to help with the visual clarity of shots or push individual poses to emphasize the ease, bounce, squash and stretch of movement in the film. Small, incremental movements were possible between the head and body due to the overlap and space between the parts. The range of parts created in the pre-production stage allowed for full creative control, largely due to the animator/researcher creating every element.

The duality of the replacement process means that, although it is creatively satisfying to have pre-created parts that offer extreme poses and physical changes in a puppet (without the labour of sculpting each frame or making small gestural changes in various elements of the puppet's face, hands, and/or body), the need to replace multiple elements between each frame or remove the puppet entirely from the shot to make alterations produces a lack of organic 'flow'. Rather than being able to push, pull, or otherwise manipulate the puppet from movement to movement, the replacement process feels more stilted and mechanical. Although a perceivable drawback, no stop-motion—or indeed, any animated technique—is without its less satisfying procedural requirements.

BEHIND-THE-SCENES DOCUMENTATION

A making-of, or behind-the-scenes, video documenting the entire study was created to aid in the dissemination of the project, while also offering an opportunity for reflection. Like all documentaries, decisions must be made before shooting and at the editing stage as to what is—or, perhaps more importantly, what is not—going to be present in the final film. It was decided that the film should have no voices, narration or statements from the researcher or collaborators but, instead, should represent a material-led process, with minimal written notes explaining or describing the various methods and stages of production. Once the film was completed, the various pieces of footage taken during the project were put together to honestly represent the linear process of making the film. Labels were added to differentiate tasks and aid in future dissemination presentations. This was done to showcase the processes to a wider audience and highlight the complexity 3D printing adds to the production of a short, animated film [1].

CONCLUSION

This case study identified the strengths and weaknesses of 3D printing both visually and mechanically, through experiments and practical work, in the development of a novel aesthetic that combined the style of 'cartoon modern' with early woodblock printing. The selected materials, animation techniques and subject matter were blended to create an appealing, clear and entertaining film. The film furthers the consideration for 3D printing as a tool with multiple potential roles in the animation process, beneficial in the creation of novel aesthetic profiles and, particularly, in combining visual styles. There was a focus on the inherent material qualities and textures 3D printing affords, which may be taken forward for further visual, artistic, and narrative synthesis in future. The additional making-of video aids in visually demonstrating and disseminating the process of the film to a broader audience.

NOTES

1. The making-of video can be seen through the following link: www.vimeo.com/551256484

REFERENCES

Amid, A (2006) Cartoon Modern: Style and Design in Fifties Animation. San Francisco: Chronicle Books.

Betancourt, M (2017) Glitch Art in Theory and Practice - Critical Failure and Post-Digital Aesthetics. New York: Routledge.

Cascone, K. (2000) The Aesthetics of Failure: "Post-Digital" Tendencies in Contemporary Computer Music. Computer Music Journal [online]. 24 (4), pp 12-18. [Accessed 5 March 2019]

Cramer, F. (2015) What is 'Post-digital?'. In: Berry, D. M. and Dieter, M., ed. (2015) Postdigital Aesthetics Art, Computation and Design. London: Palgrave Macmillan, pp 12-26.

Furniss, M. (1998) Art in Motion - Animation Aesthetics. Sydney: John Libbey & Company Pty Ltd.

OReilly, D. (2009) Basic animation aesthetics. Available from: davidoreilly.com. [Accessed 24 August 2021]

Pasek, A. (2017) The Pencil of Error: Glitch Aesthetics and Post-Liquid Intelligence. Photography and culture [online]. 10 (1), pp 37-52. [Accessed 5 March 2019]

Ruddell, C. and Ward, P. ed. (2019) The Crafty Animator; Handmade, Craft-based Animation and Cultural Value. Switzerland: Palgrave Macmillan.

Wilson, A. (2015) Forward: Sloppy Craft - Origins of Term, Ann Wilson, School of the Art Institute of Chicago. In: Paterson, E. C. and Surette, S. (2015) Sloppy Craft Postidisciplinarity and the Crafts. London: Bloomsbury Publishing Ltd, pp xxiii-xxvii

AUTHOR

Laura-Beth Cowley

Dr Laura-Beth Cowley completed her PhD at the Centre For Print Research at the University of the West of England, in association with the 3D3 Centre for doctoral training. Her research focused on the use of new technology in the stop-motion animation industry. She is a lecturer, filmmaker and animation writer for various online and print industry publications. She is based in Bristol, UK.

Presented at IMPACT 12 Conference, Bristol, The Printmakers' Voice, 21-25 September 2022 UK September 2022

IMAGE GALLERY

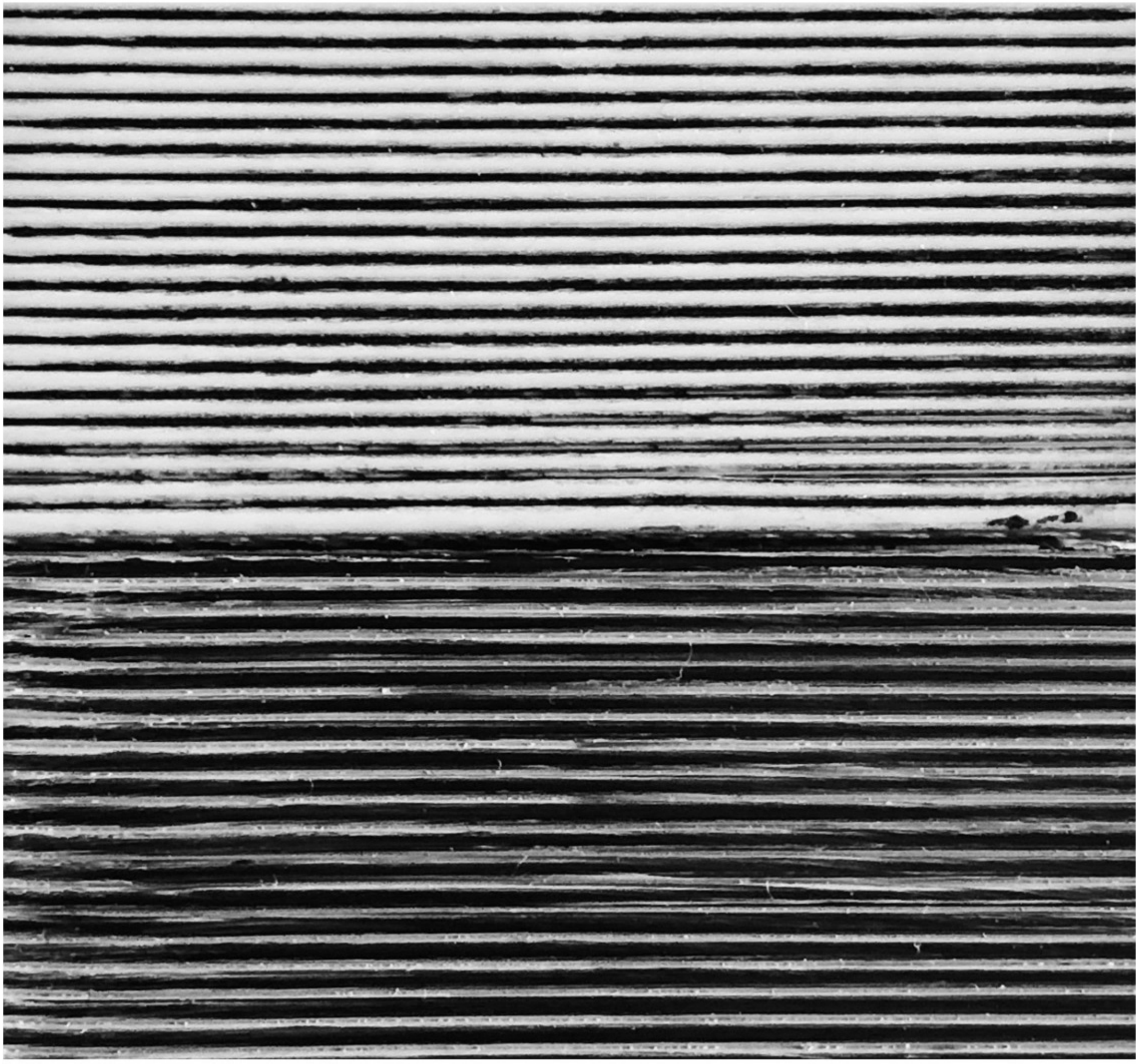

Image 1: FDM Layer line texture