

Bone Mother: The challenges of making an indie 3d printed film

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ABSTRACT

After almost 5 years with a small crew, Bone Mother is the first National Film Board of Canada film to explore 3d printing. The filmmakers used 3d printing to achieve a wide range of expressions and dialogue, but also to help build the puppets, sets and rigs. While developing new production pipelines that incorporated this technology into stop-motion, the team found that as one solution was solved, a new challenge surfaced.

CCS CONCEPTS

• Computing methodologies → Animation.

KEYWORDS

Stop motion, animation, 3d printing, rapid prototype, indie film production

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1 INTRODUCTION

Almost 5 years in the making, the award winning short film Bone Mother was adapted from a short story by Maura McHugh. The story's lush details and texture felt natural to be told in stop-motion animation. A common limitation in stop-motion is the facial range of the characters. Since the story was very dialogue based, the film needed to have a large range of expressions and 3d printing could achieve that. The NFB were excited to explore the new frontier of 3d printing in film production and invested in the development of new pipelines that allowed the small team to achieve a big budget feel.

The film may be stop-motion, but it could never have been made without the help of computer graphic technologies. These very accessible technologies have allowed indie stop-motion filmmakers and small studios to carve out a niche of their own in the big studio landscape.

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Figure 1: Co-Director Dale Hayward animates the 3D printed House of Bones, 2017 .



Figure 2: Co-Director Sylvie Trouve on the set of Bone Mother, 2017.

2 EXPOSITION

Typical of an auteur stop-motion production, the filmmakers wear many hats and work solitary, but at certain times during the production of Bone Mother, it was necessary to have the aid of a few crucial team members. With the help of the NFB's technical director, Eloi Champagne, the team expanded to include the expertise of Andre Michaud. The team utilized 3D printing extensively in order to create the sets, puppets and over 1500 replaceable faces for the two characters. The fascinating part about 3d printing is that it

may create a solution, but it almost always creates a new challenge. For example, the type of filament used for the faces was an early challenge. 3d printing filaments are primarily plastic based and audiences could have a hard time feeling for a character with a plastic face covered in acrylic paint. The discovery of a pine wood/PLA filament was momentous as the texture was more organic and could be painted with watercolor. This of course meant that each of the 1500 faces had to be individually hand painted.



Figure 3: 3d printed hands made in the same wood/PLA filament as the faces ensured a consistent skin texture.

Additionally, in order to keep the skin of the hands consistent with the faces, they too had to be 3d printed in the same wood filament. Unfortunately, once printed, this filament was hard and stiff. This is not ideal for hands, which usually have wires in the fingers to allow for nuanced animation. The solution came with the realization that if the plastic was originally melted with heat, then it could be softened again. So with the use of a small heat-gun, the temperature of the plastic could be raised just high enough to pose the fingers, and it would cool very quickly afterwards allowing the animator to create fluid movement out of a hard object.

The NFB is Canada's public film and digital media producer; they have produced over 3,000 productions since 1939 and pride themselves on the innovation and contribution they have made to the film community. Bone Mother is their first endeavor into 3d printing, which meant many of the production processes had to be recreated. One of the most important tools that were developed was a Python script for Maya by Chris Lesage, which automated many technical tasks needed for the faces. Among many others, this script helped to create consistent head registration, identified face duplicates, and organized the faces needed for each shot into an exposure sheet.

As with all productions, especially independent films, the budget is always a concern. Even with government funding, the NFB can't invest half a million dollars into Voxel / Polyjet printers that studios like Laika use. But an immediate advantage to using 3d printing in a film production is that a small team can have the output of a large team even with low-cost printers. These low-cost, Fused Filament Fabrication (FFF) printers do have a detail restriction though, which made the team turn a limitation into intention. During the testing stage in pre-production it was discovered that instead of trying to reduce all the layer stepping, the resolution could be decreased, creating larger stepping that looked like deep wrinkles across the face. This discovery worked out perfectly as the main character, Baba Yaga is an ancient witch. It would be impossible to achieve



Figure 4: The wrinkles of Baba Yaga enhanced by low-cost 3d printers.

this level of detail consistently on hand sculpted faces, making 3d printing essential.

Having a small crew meant for a cohesive vision, but that also made for a much longer production time, enough time for Dale and Sylvie to have a second child. The arrival of Remi resulted in the relocation of the animation shooting into the filmmaker's basement studio, mixing life and work even further.

3 CONCLUSIONS

The journey to make a film, even if it is only 8 minutes, is a life-altering event. Today's technologies have made it possible for a small family to make a big film. The film will be screened in parts throughout the presentation in addition to these production stories.

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