

Sustainable Animation Production: Movement Effectiveness and Durability of Stop-Motion Puppet Using Alternative Materials for Animation Production

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The IAFOR International Conference on Arts & Humanities in Hawaii 2023
Official Conference Proceedings

Abstract

The stop-motion technique for making animated films is one of the oldest techniques with distinctive visual uniqueness that has a lot of enthusiasts, but the number of stop-motion filmmakers are pale in comparison. One of the expected reasons for the small number of filmmakers, especially on a movie production scale, is that it requires a higher cost and complexity. The characters and sets must be physically made in advance with relatively expensive materials. However, by recycling alternative materials from used objects around us, like inorganic household waste and other reusable materials, the cost and complexity can be minimized. At the same time contributes to the effort of reducing waste from the animation sector. In the previous research, author explored the potential of making stop-motion puppets using alternative materials, resulting in 2 puppets and an entire set for stop-motion animation production. In this paper, author will study the performance of the puppets in the production of stop-motion animation regarding their effectiveness and durability during animation process. This research is qualitative research with the method of collecting data from observations and experiments, guided with checklist forms to maintain objectiveness. The results are gathered from the author's first-hand experience in producing a short stop-motion animated film titled "Junk Food". Finally, the author provides insights on what has worked well with the alternative materials, challenges faced, comparisons with conventional materials, and lessons learned during the process.

Keywords: Stop-Motion Animation, Puppets, Alternative Materials, Recycling, Movement Effectiveness, Durability, Junk Food Movie

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Introduction

Every year, approximately 12.7 million tons of garbage enter the sea (Mambra, 2020). In various industrial sectors such as fashion, handicrafts, construction, and so on, many efforts have been made to reduce waste that enters the sea through material recycling. However, these efforts are still very minimal in the animation industry. This inspired author to make a short animated film titled “Junk Food”, which raises the issue of environmental pollution through stories and the use of alternative materials in the production process.

When talking about marine waste, the most suitable animation technique to convey the message is through animation techniques that involve physical materials as well, namely stop-motion animation techniques using 3D puppets (Purwaningsih & Yekti, 2020). This will be applied in the use of materials for puppets and sets. The explored alternative materials utilize unused items (used goods), waste, and other reusable items while still paying attention to aesthetics and function.

The stop-motion animation technique is less desirable than other animation techniques that are done entirely digitally because it seems impractical and requires more costs, materials, and tools. Thus, the author hopes to open insight for the public that stop-motion animation can be made by anyone at home and does not always require expensive materials.

The research is divided into 2 stages. The first stage focuses on exploring the making of puppets and sets for stop-motion animation production with these alternative materials, while the second stage focuses on making animated films where the research will discuss the performance of the puppets during production. The first stage of the research was completed last year and this year will enter the second stage.

This research aims to test the effectiveness of the movement and durability of puppets using alternative materials made in the previous year for the production of stop-motion animation. The alternative materials include used goods, waste, and other reusable materials. The benefit of this research for the development of animation knowledge is to provide a perspective that making stop-motion animation does not always have to be expensive with materials that are difficult to find so that it can increase the number of enthusiasts/actors of this technique. Indirectly, it also raises awareness about recycling existing materials. In addition, the application of the results of this research plays a significant role in the production of environmental-themed stop-motion animated films by the author titled “Junk Food.”

Research Method

This research uses qualitative methods with data collection methods in the form of observational studies and experiments. Observational studies were conducted by observing stop-motion animated films and behind-the-scenes videos regarding the production process of stop-motion animation. After obtaining these data, author will conduct an experiment by carrying out the puppet animation process for the production of the Junk Food film.

Junk Food film will be 2-3 minutes long in comedy genre. Junk Food tells the story of a cat who dives into the sea in search of fish for lunch. However, the cat several times mistook fish for garbage due to the dirty sea water because it was polluted with waste. After a while, the cat finally caught the fish. While boarding his fishing boat, he was unexpectedly awaited by a

shark wearing a helmet filled with water. The shark snatched the cat's catch. But the victory was not on anyone's side because the fish that was contested turned out to be full of garbage.

There are two main characters in this film; Scubacat and Sharkuza. Sharkuza puppet is made entirely with recycled materials, while Scubacat is mainly made with store-bought conventional stop-motion puppet materials. In this experiment, Scubacat which uses conventional materials will act as a control variable to be compared with Sharkuza which uses recycled materials. A control variable is a variable that is deliberately kept constant and controlled by the researcher to enhance the internal validity of a study (Bhandari, 2021).

These are the phases in this second stage of research:

1. Research Preparation

The preparation stage begins with reviewing the background by looking at the problems and phenomena that exist through news articles, then conducting a literature study on similar research that has been done.

2. Preproduction Stage

This research applies the results in a short animated film, so the preproduction stage of the film is crucial to be the basis. This stage includes making story ideas, scripts, storyboards, character designs, and set designs.

3. Data Collection

At this stage, based on the character designs and sets that have been made, the authors collect alternative materials and then make the puppets and sets.

4. Research Implementation

This stage is carried out by carrying out the puppet animation process for the cat and shark figures for the production of Junk Food stop-motion animation. Because there are two puppets, the author makes one puppet as a control object where the puppet uses conventional materials while the other puppet uses completely alternative materials. This is done in order to obtain a comparison.

5. Data Analysis

At this stage, the author analyzes the performance of puppets using alternative materials in terms of ease and effectiveness when moved (animated). In addition, whether the puppet has suffered significant damage until the production period is finished will be seen.

6. Evaluation of Results

The results of the analysis are evaluated by looking at the advantages and disadvantages. The success indicator is achieved by these alternative materials' ability to function optimally as puppets and stop-motion animated film sets.

Literature Review

Stop-motion Animation Production

Stop-motion is an animation technique in which objects are physically manipulated and photographed image by image so that it looks like it is moving on its own when the photos are sorted at a certain speed (Harryhausen & Dalton, 2008). Stop-motion itself is divided into several types based on the main material used. For example, claymation is a term for stop-motion that uses clay (plasticine/wax). The type of stop-motion that is most widely known by the public and has penetrated the international market is the stop-motion puppet which uses puppets and miniatures as its sets because it has a more complex mechanism so that it can convey stories and visuals more elaborately.

Puppets

Puppets in stop motion animated films are actors who move the story. Despite having a variety of shapes and materials, a puppet will not be able to replicate the movements of live-action film actors or the visual perfection of animated film characters who use CGI. However, puppets can still convey emotions and stories with simple physical materials such as cloth, wire, wood and so on. This is the attraction of puppetry. Puppets are dolls that have a movable frame commonly referred to as armature (Purves, 2010).

Sets

The set is a world where film characters live and tell stories. The set should be designed in such a way as the set is not just a setting for the film but must be considered for its composition in the camera frame and how the set affects the moving characters. Especially in stop-motion animations that use 3D puppets, sets must not only be designed according to the concept and staging of the scene but must also consider the access of animators when animating puppets (Purves, 2008).

Design Process

Scubacat Puppet

The cat character nicknamed Scubacat, is a male cat in his 20s (human age) who lives alone in a small house by the sea. His daily job was not fishing, but he owned a small boat inherited from his grandfather. His nature is nosy and he does not give up easily, but he is a little cowardly. The following is a character design for the Scuba Cat figure. Scuba Cat has a plumage of white and yellow colour with a long tail. When diving, he wears diving equipment such as oxygen cylinders, scuba diving shoes, and "helmets" connected to oxygen cylinders. Considering the production aspect, author made his limbs long to make it easier in animation process.

As mentioned before, Scubacat will act as control variable where the materials that are used in the making process are mostly conventional materials that are usually used in making stop-motion animation puppets, including the armature.

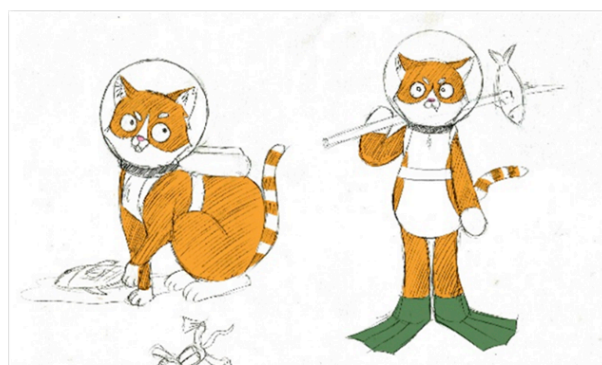


Figure 1: Character Design of Scubacat
(Source: author)

Puppet Body Part	Material
Armature (skeleton)	Store-bought wire and joints
Body	Sponge/ latex
Outer layer	Yelvo Cloth for Doll Making
Eyes (white part) & nose	Plastic eyes and nose (for doll making)
Helmet	Acrylic Ball & magnet
Belt & Oxygen Strap	Synthetic Leather
Scuba diving shoes	Silicone
Oxygen Tank	Metal Pipe
Harpoon	Stick and Epoxy

Table 1: Scubacat Puppet's Materials
(Source: author)

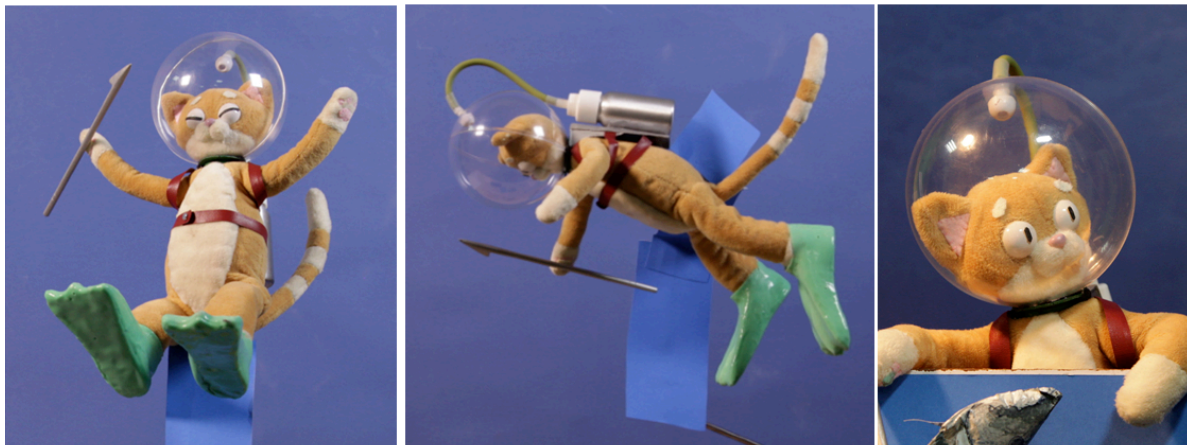


Figure 2: Finished Puppet of Scubacat Made Using Mostly Conventional Materials
(Source: author)

Sharkuza Puppet

The shark character who has the nickname Sharkuza is a shark that lives in the sea near the place where Scuba Cat lives. Sharkuza, like sharks in general, prefers to hunt solitarily. His body has many scars from fighting for food with other sharks. This aggressive sharkuza has a large body and a creepy face with intelligence above the average of other sharks. The sea where he lives is polluted by waste from the mainland, making it difficult for him to get food. When climbing ashore, Sharkuza wears a "helmet" filled with water so that he can breathe longer out of water. The author is looking for references to the anatomy of the Great White Shark that many people are familiar.

The materials that are used in making Sharkuza puppet are all recycled materials from used items, garbage, and other inorganic daily waste (trash). There are some changes in the final puppet result compared to the design due to materials availability and further creative development during the process. Significant change happens in the weapon. Instead of using a harpoon (similar to Scubacat), the team decided to make a sci-fi styled gun to make it appear more intimidating and superior to Scubacat's weapon. The water animation inside Sharkuza's helmet will be done in postproduction.

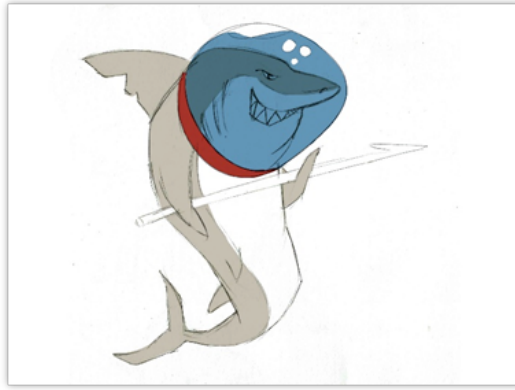


Figure 3: Character Design of Sharkuza
(Source: author)

Puppet Body Part	Material
Armature (skeleton)	Wire from broken clothing hanger & toilet paper cardboard (for rib cage)
Body	Sofa sponge
Outer layer	Used polo shirt (grey) & white plastic bag
Eyes	Shirt buttons (half circle)
Helmet	Take-away food bowl packaging, used belt, & magnet
Body Scar	Instant noodle packaging
Teeth	Plastic bowl packaging (yoghurt)
Weapon (gun)	Used water tap, parts from broken electric tooth brush, cable parts from broken dynamo, tooth paste cap, ring (pull tab) of soda can, drill tap packaging

Table 2: Sharkuza Puppet's Materials
(Source: author)



Figure 4: Finished Puppet of Sharkuza Made Using Entirely Recycled materials
(Source: author)

Research Implementation

Research implementation is done by using both puppets in an actual stop-motion animation production titled “Junk Food” to test their performance regarding movement effectiveness and durability. The production (puppet animation) takes around two months to complete, excluding the postproduction stage. It uses standard bluescreen & greenscreen backdrops, SWIT LED Lightings, DSLR Canon 5D Mark II, customized rigs to hold the puppets, and Dragonframe as the main stop-motion animation software.



Figure 5: Production and Animation Set-up in Research Implementation
(Source: author)

Movement effectiveness means how easy it is to move the armature and joints and pose the puppet to be animated. Animator has to be able to make slight changes in the pose to play with timing and produce well-animated character. And the puppet also has to be able to hold the pose to be photographed. A puppet's durability refers to the puppet's overall condition at the end of the production compared to before it enters the production stage (broken, loose, etc.).

To help measure these variables, checklist forms are made for each puppet. These forms were marked during and after the production. The results for Scubacat puppet, which uses conventional stop-motion puppet materials, can be seen on Table 3 below. Overall performance for Scubacat puppet is good as expected. It might not work at full range (facial expressions, body joints, etc.) like puppets for feature film, but still, from the beginning of the preproduction stage, the mechanism is adjusted with the needs of the movements according to the storyboard.

Title: JUNK FOOD

Character: Scubacat

Frames taken: 523

*1 is lowest, 5 is highest

MOVEMENT EFFECTIVENESS					
Variations of facial expressions*	1	2	3	4	5
Accessibility to change facial expressions (for animator)*	1	2	3	4	5
Flexibility in changing the pose*	1	2	3	4	5
Movement accuracy*	1	2	3	4	5
How well the pose hold*	1	2	3	4	5
Does it need additional rig to hold body part/ property?	yes	no			
Can it perform all movements required by the storyboard?	yes	no			

DURABILITY		
Any changes in color?	yes	no
Any changes in shape?	yes	no
Does it need to be repaired mid production?	yes	no
Any broken part at the end of production?	yes	no
Can it be used again for next production? (if any)	yes	no

Figure 6: Checklist Form Results for Scubacat
(Source: author)

The results for Sharkuza puppet which uses recycled materials can be seen in Table 4 below. Although it's a bit lacking in movement effectiveness compared to Scubacat, Sharkuza holds its part well in terms of durability. When animating Sharkuza, animators find it hard to animate the facial expressions, especially the mouth because the helmet limits the lower jaw's range of movements, and sometimes it's difficult to open the helmet because it's stuck on the gun. Sharkuza also needs an additional rig to hold the gun and upper body position when animating a bending pose.

Title: JUNK FOOD

Character: Sharkuza

Frames taken: 221

*1 is lowest, 5 is highest

MOVEMENT EFFECTIVENESS					
Variations of facial expressions*	1	2	3	4	5
Accessibility to change facial expressions (for animator)*	1	2	3	4	5
Flexibility in changing the pose*	1	2	3	4	5
Movement accuracy*	1	2	3	4	5
How well the pose hold*	1	2	3	4	5
Does it need additional rig to hold body part/ property?	yes	no			
Can it perform all movements required by the storyboard?	yes	no			

DURABILITY		
Any changes in color?	yes	no
Any changes in shape?	yes	no
Does it need to be repaired mid production?	yes	no
Any broken part at the end of production?	yes	no
Can it be used again for next production? (if any)	yes	no

Figure 7: Checklist Form Results for Sharkuza
(Source: author)

Conclusion

Making short stop-motion animation “Junk Food” took around one year from start to finish, with a total duration of 2 minutes. The process included were story and creative development, character design, storyboarding, animatic, rig building, set & puppet building, materials exploration & experiment, shooting (animating), compositing, editing, and sound. Most of the time was spent on materials explorations and experiments for Sharkuza puppet because there were so many trial and error. For example, the material used for the outer layer was a grey raincoat before. The characteristics of a raincoat were deemed suitable for a shark’s skin because it gave an impression of something slippery/ glossy. But it turned out the material was really tough to stitch together to cover the shark’s body without rips in many parts of the outer layer (skin).

That didn’t mean the process of building the puppet using conventional materials for Scubacat was smooth without any obstacles. The most expensive and time-consuming part was the making of its diving shoes using casting method and silicone material. It took several weeks to find the perfect technique and ratio for the silicone part.

There’s also an issue with the limited choice of materials because in the production author could only use trash and other used items that were found around where author lives. Thus, the end result of the puppet might be a little bit different from the initial design because of materials adjustment. In a rare case like the weapon (gun), it turned out to be a happy accident because it’s better than the initial design.

According to the checklist form results, performance of the puppet that is using recycled materials (Sharkuza) still can compete with the performance of the puppet that is using conventional materials (Scubacat) during animation process. Sharkuza lacks in movement effectiveness but has a slight advantage in terms of durability. There might be several factors that are causing this result:

1. Knowledge and choice of materials
2. Time spent on experimenting with the materials during puppet building. The longer the better because filmmaker can explore many options.
3. Difference of movement needs according to storyboard between Scubacat and Sharkuza. Sharkuza’s movement is very minimal.
4. Difference of shot length between Scubacat and Sharkuza. Scubacat’s screen time is almost twice as long.

Finally, it can be concluded that it’s possible to make a small-scale stop-motion animation project by recycling trash, inorganic waste, and other used materials around us for the sets & puppets. It’s more accessible and cheaper. But the filmmaker must have basic knowledge of stop-motion animation first to be able to find substitute for conventional materials. Using alternative materials also requires higher craftsmanship skills because sometimes the materials must be processed before they can be used to make puppets and sets.

Acknowledgements

Author would like to thank PT. Multimedia Digital Nusantara (MDN) for sponsoring and supporting this project.

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