# Animating and Desiging Movements for Turtle Figure in 3D Animated Short Film Entitled "TUKIK"

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**Abstract.** One of the most important elements in an animated film to convey a message to the audience is animating a character. Character movement in a scene is very necessary to show what is happening and what the character is experiencing in a scene that is being witnessed by the audience. This research will raise the animating process of the turtle character in a 3D animated short film entitled "TUKIK". There are two scenes that will be discussed; a scene when the turtle is swimming in the ocean and the movement when the turtle is trapped by the waste at the beach. In the design process, various principles of animation and movement of turtles are applied based on references. The results of this research will be applied to the movements of the turtle characters in the animated awareness film called "TUKIK".

**Keywords.** Animating, movement, character animation, turtle, 3D animated.

## 1. Introduction

In this era of globalization, humans often dispose of waste improperly. Non-decomposed plastic waste is often eaten by animals, especially turtles. The impact of this garbage increases the number of turtle deaths. In National Geographic news, it is stated that every year thousands of turtles die from plastic waste that looks like jellyfish. [1]

According to Kallen, popular animation depends on a great character in an interesting story, however in the making of a believable motion is a long and complicated technical process. [2] Williams also mentioned that body movements must tell a story or the atmosphere of the scene even though the dialogue is limited. [3] In Broken Faith, it is stated that the slight movement of the finger can express the emotion and psychology character. [4] There are three aspects in creating the movement; physiological, sociological and psychological. In order for the characters to appear alive, it is necessary to apply animation principles and use video references.

In animated films, characters that are used to deliver message not always human, but characters in a film can be in the form of animals. Examples of 3D animated films that use animals as their main characters are "Finding Nemo", "A Turtle's Tale: Sammy's Adventures", "Kung Fu Panda", "Penguins of Madagascar" and "Rango. Plants, humans and animals have different movement characteristics, for instance sea turtles are slow on the land and fast in the water.

## 2. Research Purpose

In the animated film titled "TUKIK", the turtle character used is adapted from the hawksbill sea turtle's point of view. "TUKIK" was made as an awareness for the audience to start caring about the environment and the animals. Thus, this film itself is visual storytelling and social empowerment as a sense of an act to persuade children from an early age to create a generation that cares about nature. The aim on focusing in the animating and designing turtle's movement is to apply the designed process on the character to create a believable motion. Animating a swimming cycle of a turtle and trapped action on the turtle is very crucial because it tells a story of how endangered turtle struggled throughout the film. It is also create the intense atmosphere of the scene.

## 3. Method

In this study, the method of data collection and observation are used in animating and designing movement of a turtle. The researchers collect data from literature study such as books that explain about the movement of turtles and observe videos about the movement of turtles such as video in the documentation National Geographic and Daily Picks and Flicks documentary.

## 4. Literature Study

### 4.1 Anatomy of Turtle

According to Gerosa and Aureggi, turtles have a head and neck that cannot be inserted into their shell and two front fins, while on the back, there is a tail with a cloaca and two dorsal. Turtles have flat turtles and consist of strong backbones. [5] The anatomy of turtle is shown in the Figure 1 below.
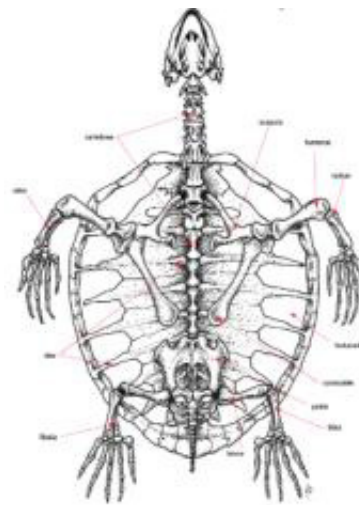


**Figure 1.** Anatomy of Turtle (Source: Gerosa & Aureggi from the book Sea Turtle Handling Guidebook for Fishermen Teaching Book)

### 4.1 Turtle Movements

Liang et al. explained that turtles have two ways of movement which are classified as land movement and water movements. [6] Turtles generally live in water, only to the surface to breathe. However, when laying eggs, turtles will drag themselves to the beach to deposit their eggs in the sand. The function of the turtle's body is slim to minimize dragging, allowing itself to move more efficiently. Therefore, sea turtles can swim at speeds up to six times that of land turtles.

When swimming in a straight direction, sea turtles stretch their limbs simultaneously. When changing the direction to the right and left, the front fins move asynchronously and the beat of the fins becomes faster when turning. The dorsal fin can assist in turning, although the front fin can bend the

body without the aid of the dorsal fin. When turning, the other fin will row less. For example, when a turtle is about to turn left, the turtle has less frequency of its left fin when rowing.

Davenport et al. analyzed two types of swimming in turtles; routine and powerful swimming styles which are illustrated in Figure 2. [7] The routine swimming style is the swimming style that turtle uses most of their time. This style allows one chest wing flaps, leaning their body slightly forward downward at a 10 degree angle and the downward swing is faster. Powerful swimming style is a swimming motion as a reaction to fear in a situation. Compared to the routine swimming style, this style has the upward and downward stroke increasing rapidly which creates an occasional figure-eight when pedaling. There are 3 movements that move simultaneously when a turtle is swimming. Flapping is an upward and downward movement (the distance is around 190 pulses). Fin rotation is a per-turn movement of the turtle's fin (around 90 degrees) and paddling is a forward and backward pedaling motion.
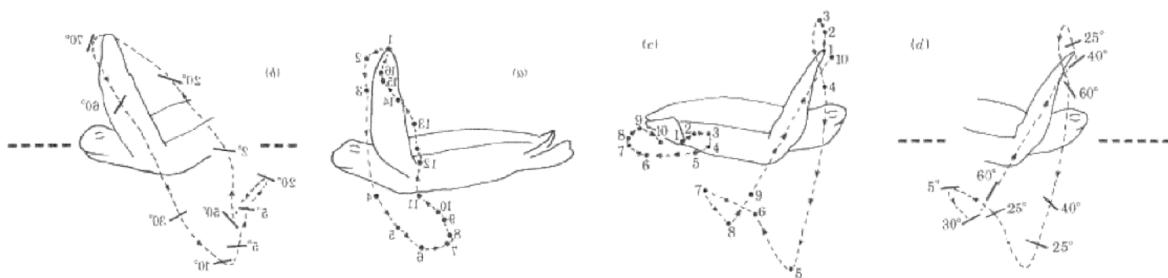


**Figure 2.** Routine swimming style and powerful swimming style (Source: Liang et al. from the book Design of a Flipper Prosthetic For a Kemp's Ridley Sea Turtle, 2016)

Carr explains that when turtles crawl on land, the right and left fins of the front move alternately. [8] Mazouchova et al. mentioned that there are two different types of turtle's crawling movements; non-overlapping crawling movement and overlapping crawling movement. [9] In Figure 3, one crawling motion which is the picture on the left has no overlapping steps, while the other movement on the right is overlapping and forms a circle. When the front fin takes the second step (red), it will interact with the sand surface of the previous movement (yellow), shown in the lower right panel. The force increases as when the large fin penetrates to the surface of the sand. Depending on the depth of penetration of the turtle's fin into the sand surface, it generates the force to propel itself.
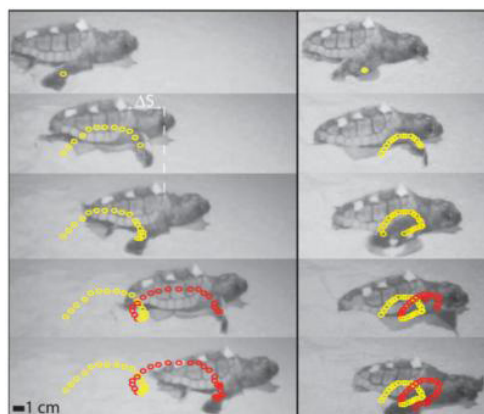


**Figure 3.** Non-overlapping and overlapping crawling movement (Source: Mazouchova et al. from the book Flipper-driven Terrestrial Locomotion of a Sea Turtle-inspired Robot, 2012)

## 5. Video References

The researchers observe a National Geographic documentation shot where a small turtle is swimming in the sea. [10] The movement of the turtle's front fin flaps up, down and pushes itself, as long as the movement takes place the turtle's front fin rotates to push. In frames 8-11 there is acceleration and the turtle's body moves forward faster as it can be seen in Figure 4.
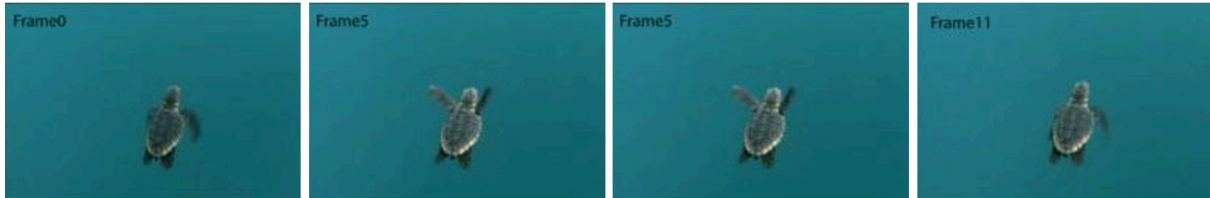


**Figure 4.** Turtle's swimming movement
(Source: Baby Turtle Swimming Frenzy by National Geographic, 2017)

An adult turtle that is trying to free itself from the garbage and is helped by someone is seen in the Daily Picks and Flicks documentary shot. [11] In the incident, the turtle could not move because its right fin was stuck by garbage. The turtle tried to run but the rubbish got stuck on the rocks on the beach, so the turtle could not go. Then, the turtle resigned and did not move much which are shown in Figure 5.



**Figure 5.** Turtle's trapped movement (Source: Two Guys Save Turtle Wrapped in Plastic by Daily Picks and Flicks, 2018)

## 6. Animation Process

The swimming scene (Scene 5 Shot 1-2) is when the small turtle is swimming slowly and advancing towards the front. When swimming, it swims up and down and move slightly to the right and left. The movement of the swimming is slow because it is enjoying the beauty of the underwater and occasionally looking at the coral reefs and passing fish. In Figure 6, it shows the process of animation by starting off with arranging the flipper movement.
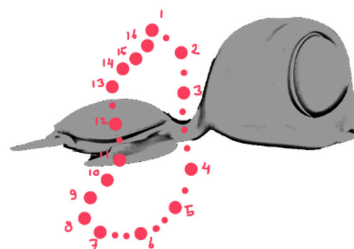


**Figure 6.** Turtle's flipper movement (Source: Documentation of Steven Halim)

In animating and designing process of turtle swimming movement by applying animation principles according to the literatures and video reference, the researches follow the number of key frames which are 12 and the movements. In the reference video, the movement of the right and left flippers has a different pattern which will then be applied in animating the character so that it is not repetitive by adding the principle of exaggeration. The animation process of turtle's swimming movement is shown in the Figure 7 below.
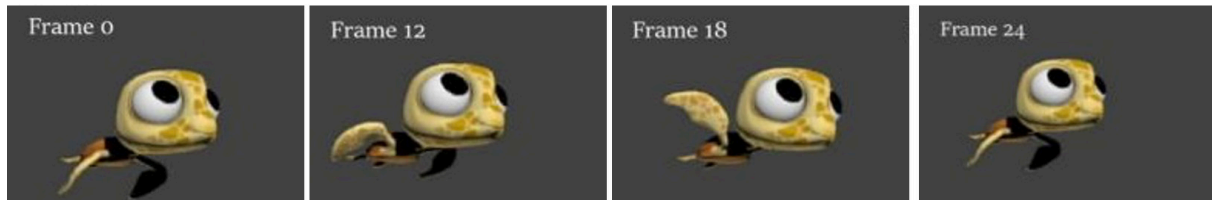


**Figure 7.** Animating and designing swimming movement (Source: Documentation of Steven Halim)

The trapped scene (Scene 5 Shot 11-13) is when the adult turtle is running on the surface of the trash and the body is leaning upwards and moving slowly, then it gets trapped by some rubbish and waste on the sand, thus its movements will be limited. As the turtle tries to move her limbs to move freely but gets stuck, therefore the movement gets weaker and slower gradually. From the two images below (Figure 8), the difference between running on a solid surface and a sandy surface can be seen. A turtle running on a solid surface will lift itself higher when crawling and vice versa on a turtle running on a sandy surface. This is occurred due to the penetration of turtle fins into the sandy surface.
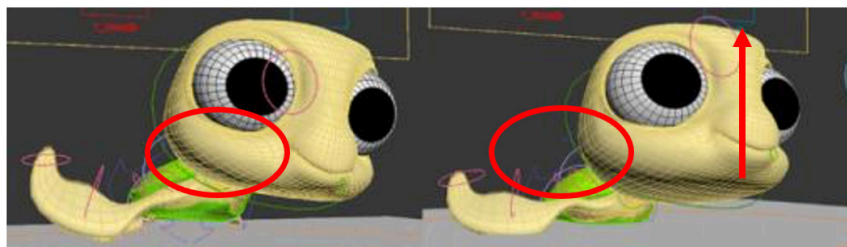


**Figure 8.** The different crawling movement on a solid and sandy surface
(Source: Documentation of Steven Halim)

In designing and animating the process of trapped adult turtle movement, an adult turtle will run on the surface of the wood with a slope of 15 degrees so that the movement of the adult turtle running rate will be drastically reduced. Therefore, the length of animation frames in adult turtle running will be extended so that the adult turtle runs slower. In addition, the adult turtle shell is given a little exaggeration to make the turtle shell look more elastic when moving.

There's a scene when an adult turtle gets trapped, the adult turtle will run and get trapped in the tire litter. At the time of the scene, the adult turtle will try to move its entire body to escape the garbage. By looking at Figure 9 at frames 95 to frames 470, the adult turtle's panicking movement was made by moving the entire limb swiftly and initially slows down. This is to explain that the adult turtle began to burn out after she panicked. From frames 470 onwards, the turtle stay still to show to the audience that she is losing hope. Researchers used a reference as guidance in a scene of an adult turtle trapped seen in Figure 5 that shows the process of how when the turtle moves its entire body when trapped which then adapted to the storyline itself.
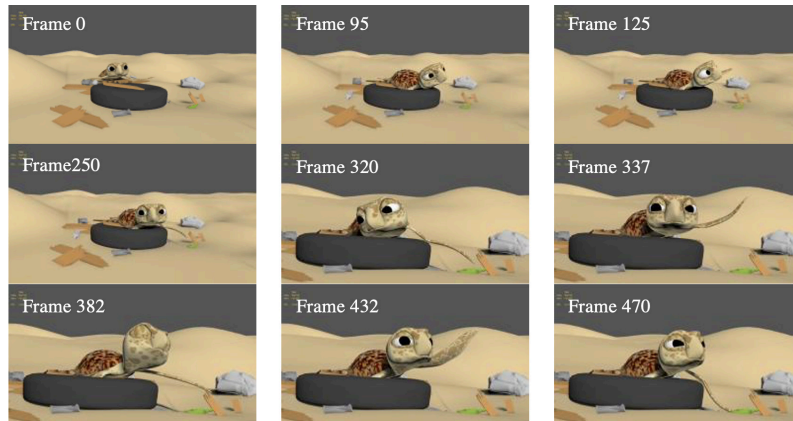
**Figure 9.** Animating and designing trapped movement (Source: Documentation of Steven Halim)

## 7 Results and Discussions

### 7.1 Turtle's Swimming Movement (Scene 5 Shot 1-2)

In the 3D animated short film entitled "TUKIK", scene 5 in shots 1-2 is a scene where the small turtle swims casually and happily seeing the beautiful underwater view. This movement is the default swimming style, it is made to show how the small turtle relaxes in the sea enjoying the beauty of the calm and clean sea.

By using Davenport et al. analyzation, the researchers animate the turtle with the routine swimming style, her body leans forward slightly and the downward swing is faster. During the upward stroke movement, the ends remain curved at the very end. Her front fins movement is moving in an upward flapping motion, it rotates when pedaling and moves downward faster. There is a curve at the tip of the turtle which is illustrated in Figure 10.

The rear fin of a small turtle is designed to float up and down because in this scene the small turtle swim straight from shot 1 to shot 2. Her hind turtle fin has a float motion pattern (vertical upward and downward motion). In this vertical swimming scene, there is occasional diagonal movement, so that the dorsal fin of the small turtle is stretched slightly upright. When she turns, her dorsal fin is stretched upright.
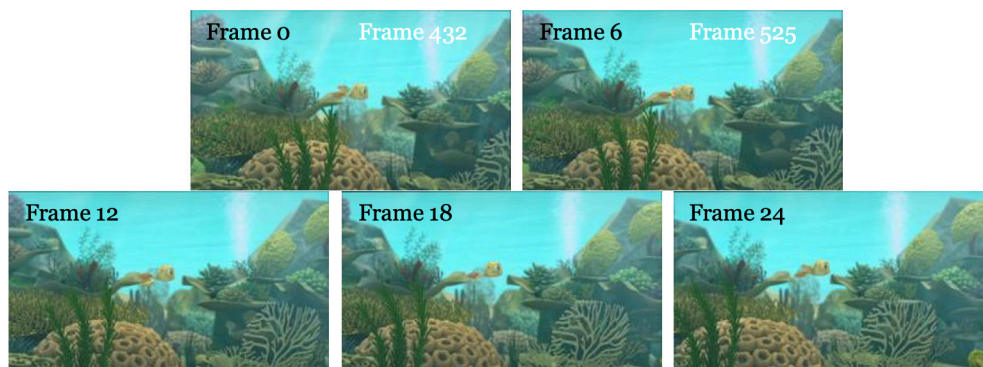


**Figure 10.** Turtle's swimming movement (Source: Documentation of Steven Halim)

### 7.2 Turtle is trapped (Scene 5 Shot 11-13)

In the 3D animated short film entitled "TUKIK", scene 5 in shot 11-13 is a scene where an adult turtle returns to the beach where she was born and spawn, then when she is about to return to the sea, an adult turtle is trapped by garbage and tries to move but does not succeed. This movement was made to show how an adult turtle is helpless with the trash that keeps her trapped.

Her movement starts when she runs on the surface of sand while her right and left front fins move forward alternately (Figure 11). Shen then penetrates into the surface of the sand surface to propel herself. In animating a trapped action, several movement are added such as her fin being punctured, her body turns right and left and then her moves start to slow down due to fatigue. Her movements are adjusted to her surroundings so when she fells down, her confusion is shown by turning her body to the right and left and moving her limbs back and forth quickly to escape. While trying to escape, she gets injured as her left fin gets stabbed with a wood which make her movement get slower as she gets weaker.
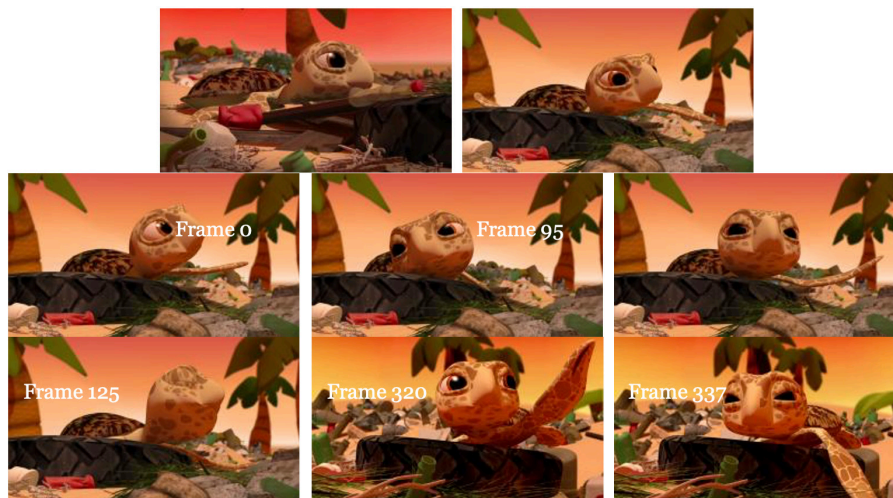


**Figure 11.** Turtle is trapped (Source: Documentation of Steven Halim)

## 8. Conclusions

This study concludes that animating animal characters as its visual storytelling and social empowerment film not only requires reference data form films and literature studies but the researches also need to do a field research to see how these animals move and interact. In animating and designing movement of animal figures, the importance of anthropomorphism elements is needed to be taken into consideration so that these figures will look more alive and have emotions, making the animation is believable to the audience. When animating a turtle character for "TUKIK", anthropomorphism elements was shown in the swimming movement and trapped action by adding details to her flapping, fin rotation and pedalling.

To animate a character, it is important for the animator to study the character's personality, emotions, characteristic movements, and behaviour of the character in order to achieve the best results of the character's movement which is matched to the storyline of the film being made. In developing their characteristic movements, the researchers must use a reference video to make it easier for the animator during the work process. This research on animating a turtle character has been using references as guidance for its movements while following the storyline of the film. The movements of the turtle are adjusted to the story and style of the film. Turtle movements are generally stiff and look choppy. However, eleven animation principles are used to support her movements to achieve a style that is smooth and exaggerated. Although the movement of the turtle is limited by its shell, the principles of animation can be applied to its fins and head. As an inclusion, the elastic effect on the shell gives the impression of a more dynamic and exaggerated movement of the turtle.

The drawback of this research is that it is lacking to show their personality on the film on the swimming movement and very little personality on the trapped movement. This happened because when animating and designing the turtle movement, the researchers were too occupied making detail of the movement on the action of swimming and being trapped itself. However, this research has been very helpful in studying a turtle movement from its head to its tail. "TUKIK" has been successful as

an awareness to persuade and educate children to care more about nature because this film was made with the support of the Ministry of Environment and Forestry and Kepulauan Seribu National Park in Indonesia. The expectation for the future research is to focus on putting character's personality while balancing the animation with the action itself when animating both human character and non-human character.

## 9. References

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