PERFORMANCE CAPTURING PENCHAK SILAT MOVEMENT AS A REFERENCE STUDY FOR CONTENT CREATORS

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ABSTRACT

Content creators like filmmakers, comic artists, designers or animators, are always wanted to be inspired. Some researched have found that a theme that will never be dried out to explore is the theme about culture. The beauty but deadly characteristic of Penchak Silat could be one of Indonesian unique cultural wealth with great potential as a source for any creative content. But animating or mimicking the movement of Penchak Silat is not an easy task for animators or any content creators, it requires deeper on both pieces of knowledge of motion and self-defense itself, which sometimes can only be understood by someone who spent their life trained in this martial art. This paper method is a documented experiment of using motion capture as a quantitative tool which complements the often qualitative approaches of user observations to study captured movements of Penchak Silat in the form of digital data. In this research a real Penchak Silat practitioner were set of tasks to performed jurus or Penchak Silat codified movements. The motions of the research subjects were captured by a set of simple motion capture device with four PlayStation cameras. The data recorded through the motion capture system were translated into a rigged 3D model. Conclusions were drawn on the potential use of motion capture tool that can gain benefit to any content creator, based on the accuracy of the body mechanics and complexity of Penchak Silat movements that's been recorded. Another goal is to provide a ready to use reference for animators, enabling them to bring easier and more effective workflows in animation production.

Keywords: *martial arts, character design, poses, animation, motion capture, performance capture*

INTRODUCTION

The industry of creative and content has grown rapidly over the past several years around the world. Content creators like filmmakers, comic artists, designers or animators, are constantly looking for something that can spark their imagination and make them inspired; they always need new ideas or new perspectives.

"Definition of Creative Industry as it has been noted "*Creative Industries as those industries which have their origin in individual creativity, skill & talent, and which have a potential for wealth and job creation through the generation and exploitation of intellectual property and content* (Nurjanah, 2013)" (Alexandri et al., 2019)

The same thing is also expressed by the Ministry of Trade of Indonesia in "stated that the creative industry is an industry derived from the utilization of creativity, skills and individual talents to create a benefit that gives a positive impact for the creation of jobs in the surrounding environment (Kurniawan, 2016)"(Alexandri et al., 2019).

Also has been noted in "stated that there are 16 creative industry subsectors, they are: culinary, architecture, music, interior design, visual communication design, fashion, film, product design, animation and video, photography, apps and game developers, advertising, publishing, performing arts, as well as television and radio,

fine arts (Presidential Regulation No. 72 of 2014)".(Alexandri et al., 2019)

"Definition of content is defined as "content", is the structure and design of information contained on a site page or information that is available through media or electronic products. Submission of content can be done through various mediums such as the internet, print media, television, audio CDs, even direct events such as conferences and stage shows. This term is used to identify and quantify various formats and genres of information as a component of media value added".(Irawan, 2009)

In their research (Adnyana Yasa, Gede Pasek Putra, Adhi Santosa, 2018) have found that a theme that will never be dried out to explore is the theme about culture. Countries around the world have quite a lot of unique and different cultures. Therefore, cultural themes that are packaged or made into themes in animated films are still very promising. It is proven that cultural themes animated films are quite popular among the audience.

"Some animated films that deal with cultural themes are proven to be successful in the film market and some have reached the 10 highest grossing film of all time. One of them is the Kung Fu Panda animated film. Although this film does not directly tell the culture of a region in its entirety, but the animated Kung Fu Panda film takes the theme of Kungfu culture from China".(Adnyana Yasa, Gede Pasek Putra, Adhi Santosa, 2018)

"Besides that, animated films with cultural themes can introduce regional culture or culture of a country to the world community. The world community can get to know the regional culture and other countries through a film. The animated film at the same time can also provide education to the world community. Especially education about cultures in the world. The use of animated films as a form of intermediary in the form of audio-visual plays a role in conveying the message and ideas to be conveyed to the wider community. Not to mention if we talk about the success of Kung Fu Panda animated film that had dominated the Box Office in several countries including America, which successfully offered stories of martial arts life to the world community into a stunning display of animation. It should be remembered, if in the past few periods we are certainly more familiar with the actor Bruce Lee's if we talk about martial arts, but in the present era with such technological advances in making animation, Kungfu martial arts can be more global and increase the scope of its target audience that was once only leading to an adult audience, but now it can also be enjoyed by children to parents. This proves the role of animation in presenting culture, be it an area or country is a very promising business opportunity in the future".(Adnyana Yasa, Gede Pasek Putra, Adhi Santosa, 2018)

The human instinct to survive is the most powerful drive. A human can survive from any danger and threat by the use of logical thinking and reasoning to create tools and methods of defending themselves, they create a system of defending themselves we call it now as martial arts. Each nation has a codified system of self-defense that has root deep in their traditional way of life. throughout the history, the martial arts systems has always been closely related to natural and social conditions and even politics so that it has become a tradition that is passed down through generations and has a close relationship with the value of life. So they place their philosophy of life and art in their self-defense methods.

"Cultural action is guidelines for the lives of citizens in living life. Silat can be one of the symbols of life that is reflected in every movement. The action serves as a reference for the interpretations of the environment that we face, which have pushed and produced significant actions in the face of the environment. A significant action on silat is a combination of philosophical studies between cultural heritage, identity, mental and physical training. Argues that pencak silat can be clarified in the form of culture in the form of martial arts that have certain patterns and have customary behavioral rules individual. Pencak silat is that human activities in society are of a concrete nature, which can be observed". (Mardotillah & Zein, 2017)

Penchak silat is martial arts widely known from the geo cultural area of Southeast Asia like Indonesia, Malaysia, Brunei, Singapore, southern Philippines and Thailand. Penchak silat comes from two words namely penchak and silat. Penchak means the basic movements of martial arts which are bound to rules.

As it has been noted "Many things related to the issue of identity. Silat is one of the characteristics of identity culture, a related identity issue with martial arts. Indonesian ancestors have a way of self-defense intended for protect and sustain his life or her group from natural challenges (Gilang, 2007)".(Mardotillah & Zein, 2017).

Also it has been noted "Self-defense is created by imitating animal movements on the surrounding environment, such as the ape movement, tiger, snake or bird. Other than that, the development of the silat identity as cultural heritage adopts techniques others not only contained from Nusantara, but the assimilation process occurred from other foreign techniques like from China and other European martial arts. The origin of silat martial arts is from the archipelago this might also developed from the skills of the indigenous Indonesian tribes in hunting and fighting with using machetes, shields and spears or by using objects around (Alexander., etc., 1972)". (Mardotillah & Zein, 2017)

Self-defense is serves as a defense especially attacks from wild animals and another groups of attack fighting

for the food supply. Silat is estimated to spread in archipelago since the 7th century, but it hasn't started yet can be determined exactly. Big kingdom, like Sriwijaya and Majapahit is said to have great fighters who master martial arts and self-defense and can gather reliable soldiers who's also proficient in martial arts and self-defense. Donald F. Research Draeger proved the existence of martial arts can be seen from various weapons artifacts found from the Hindu-Buddhist period as well as on relief sculptures contains the horse stances and movements of the martial arts in Prambanan and Borobudur temples. Indonesian people at that time were integral with weapons and martial arts, not only in the body conditioning, but also in relationships spiritual that is closely related to Indonesian cultures. In addition, trade relations and cooperation between Indonesia and other countries giving the influence of martial arts from China and India in silat. This happened since the beginning of Malay culture has been influenced from that culture brought by traders and nomads from India, China and Europe, so the archipelago silat technique is very developed and much influenced by various adjusted migrant country with the conditions of the Indonesian people at that time".(Mardotillah & Zein, 2017)

"Many things or content can be derived from the four basic elements of Pencak silat it's not only beautiful, hard, strong, tough, and deadly. But Penchak silat was born as a martial art that combines outward and inward aspects. Have a lot of philosophical meanings in life as well as more emphasizes its teachings by reinforcing transcendental relationships to Almighty God".(Ramadhan, Ahmad, & Mansoor, 2017)

Watching movies with fighting scenes creates a thrilling sensation for the audience, today the audience has evolved and become more sophisticated so that an action scene must not only have to be realistic but also beautiful to look at. We can see a lot of high action fight scenes in many creative contents including animation.

As cited "Martial arts films, perhaps unlike any other sub-genre of film, maintain a unique relationship with their spectators. Martial arts, when exhibited in film, signify a mode of conflict resolution that is at once brutal and elegant. The complex choreography characteristic of martial arts films led early analysts to the association between them and the musical genre (Kaminsky, 1974)"(Schehr, 2000),

"Especially musicals punctuated with complex choreography of the kind associated with Fred Astair, Ginger Rogers, Gene Kelley, Mitzey Gainer, and Donald O'Conner. While I will not pursue an analysis of martial arts films from the perspective of spectators, I do wish to emphasize the extent to which fans of martial arts films actively participate in the completion of the filmic experience".(Schehr, 2000)

"Hero expresses its local cultural identity through its adherence to many of the genre conventions of the Chinese martial arts film and especially through its display of genuine martial arts virtuosity – precisely the things that Hollywood martial arts films tend to ignore. The scene of Jet Li and Donnie Yen's encounter is one of the strongest in the entire film, as the film's pace slows down and the camera pulls back to allow the viewer to linger in the visual pleasures of their highly-skilled combat".(Klein, 2004)

To borrowed from "The unique properties of the martial arts film make it particularly amenable to global appropriation. It is both a strong genre with deep roots in many forms of East Asian culture and a flexible one whose many subgenres enable it to blend well with other kinds of films. (Clifford, 1997)" (Klein, 2004)

"The martial arts film partakes of both roots and routes: its origins lie deep within particular cultural traditions and it also travels well. It is a form of local culture that is thriving under globalization, adapting to new conditions and taking on new meanings without losing all connection to its origins". (Klein, 2004)

Animation works requires animators to be able to animate anything, martial arts, and fighting is a major part in many animation film projects especially games where a fighting game is also one of a video game genre, it's a genre based around combat and martial arts, games like Street Fighter, Tekken, Mortal Kombat are just a few examples of many fighting game genre. High action fight scenes also scattered in blockbuster films like Avenger, the Matrix, Iron Man and the like, which also uses 3D animation to replace many of the action scenes.

"The animating process is one of the important processes in the production of a 3D animated film, in this case the final result of an animating process in the form of a series of animated motion. The role of the animator who works behind this process is to create animated motion that is believable because the quality of an animated motion greatly influences the process of delivering stories contained in a 3D animated film. In other words, 3D animated films with animated movements that are not convincing and stiff will be considered not attractive and uninteresting, so that the stories and scenes displayed cannot be captured properly by the audience. To be able to produce good quality motion animation an animator need to understand the basic principles and methods used in the animating process".(Waeo et al., 2016)

Animating any type of action fighting and martial arts can be a very difficult and demanding task for animators; it's a good example of the human body in motion. The movement of a skilled martial artist is not an easy thing to imitate because it requires skills that are the result of years of practice.

"As Kerlow concludes that in order for the final results to be achieved, all parts of the workflow must

be interrelated, the flow is known as the pipeline which is divided into three stages, namely pre-production, production, and post-production" (Waeo et al., 2016)
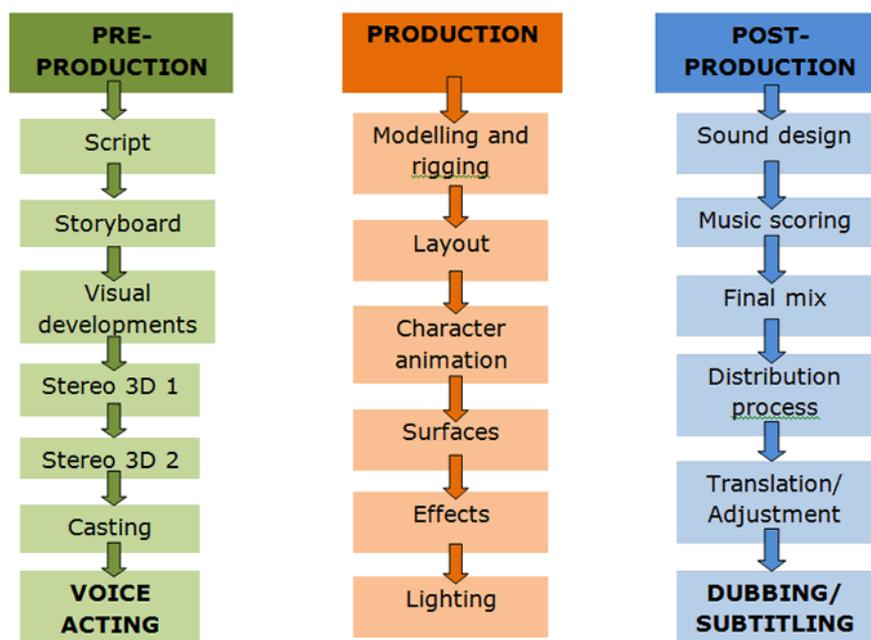

Figure 1. Stages in the creation and distribution of an animated film (freely adapted from Dreamworks Animation)
(Sofía Sánchez Mompeán, 2012)

METHODS

This research is not about giving a lesson of martial arts to animators, but rather as a pre-production method in facilitating reference material before making martial arts scenes for animation which often can be very difficult to animate. The outcome is a character poses inspired by traditional Indonesian martial arts styles Penchak Silat used as an arsenal of inspiration and reference that can be studied in the development of martial art based character designs or animations.

"A character is considered a success when it is believable to the audience even though it does not exist. The character must be new, unique and fresh. A stereotyped character or a weak identity usually fails to attract the audience".(Khalis, Mustaffa, Nor, & Ali, 2016)

The method used is trying to record movements from martial arts Penchak Silat digitally, and then the results can be saved to be studied or applied to create content like games, films or illustrations. Where a lot of creator content can get easy access to martial arts Penchak Silat. With the movements being recorded and captured they can see the movements from any angle and learn the timing and the speed of the movement both in slow motion and real-time. Pencak Silat was chosen as a research object because it has a strong association as Indonesian local culture. Pencak Silat as a martial arts identity has special and distinctive characteristics that are different from other types of martial arts that are not from Indonesia such as Kungfu from China, Taekwondo from Korea, Karate from Okinawa and others.

"In the concept of visual storytelling, it can be understood that there are three points the principal that becomes the essence of pencak silat can be delivered through three ways, namely through narration, gesture, and symbols".(Ramadhan et al., 2017)

"In the mission to convey the essence of pencak silat in animated films, gesture or body language is has the largest portion used in conveying messages and storylines. Because in totality motion in animated films is designed as convincing as possible to display gestures by strengthening the character's gesture to be understood by the audience. In an effort to present the action of martial arts, the audience must be able to distinguish between pencak silat and silat from other regions in the archipelago. By utilizing a typical gesture at the time of the

position of pencak silat distinctive horse stances, quickly the audience will be able to identify which regions the characteristics of pencak silat traditions from. The overall attractive martial arts show can also be shown from gesture. Here gesture, dynamic aspects, and continuity in visual storytelling will look integrated with one another. Motion gesture on characters can be designed dynamically, agile, fast, and firmly".(Ramadhan et al., 2017)

As mentioned in "The use of MOCAP can not only record fluent motions but also save production time. Films like The Lord of Rings, Spiderman, and Avatar all take advantage of MOCAP's features of direct recording of motions. Nevertheless, the use of technology tools does not mean to replace the traditional key frame process. Instead, to incorporate MOCAP in animation pipeline can create more believable and appealing motions, as the 12 principles of animation raised by Disney's animators Ollie Johnston and Frank Thomas mentioned in their book" (Johnston & Thomas, 1995).(Mou, 2018)

The goal of this study is to find out that recording the Pencak silat movement digitally can help support content creators such as filmmakers, comic artists, designers or animators to study the movement of a traditional penchak silat in creative discovery. Following is the sequence of the research process:

Literature research / research, here the research team looks for initial references from various sources of readings and watching's. The research team then conducted a literature study, and then proceeded to make direct observations to penchak silat movement exhibited by real silat fighter performance, using qualitative methods that use a descriptive approach.

Observing direct visual reference, by recording martial arts demonstrations performed by real silat fighter. The team conducted a study by calling a martial arts expert to demonstrate the movements of the penchak silat in a studio recorded with a motion capture device, using several cameras and computer supported by motion capture software.

The calibration process of motion displays in animated characters directly to the computer to obtain accurate results, by first using the calibration procedure and motion capture software. The experimental results are in the form of digital motion data recorded in three-dimensional animated characters that can be seen from all angles and speeds.

Applications are carried out using various types of three-dimensional characters in several different shapes and proportions Finalize visuals in the form of smoothing motion poses manually to be more adapted to the proportions and design of animated characters.

To capture the subtle movements of penchak silat, our traditional Indonesian martial arts the research team uses motion capture tools with the use of four PlayStation cameras (PS3 eye). This camera is quite capable of capturing standard video with a frame rate of 60 hertz at a resolution of 640 × 480 pixels, and 120 hertz at 320 × 240 pixels, which is „four times the resolution" and „twice the frame-rate" of the Eye Toy, according to Sony cameras.

The research team using IPi Motion Capture, a software tool to captures motion without a tread that can be scaled. Provided by iPi Soft LLC for tracking an actor's motion by analyzing multi camera recordings
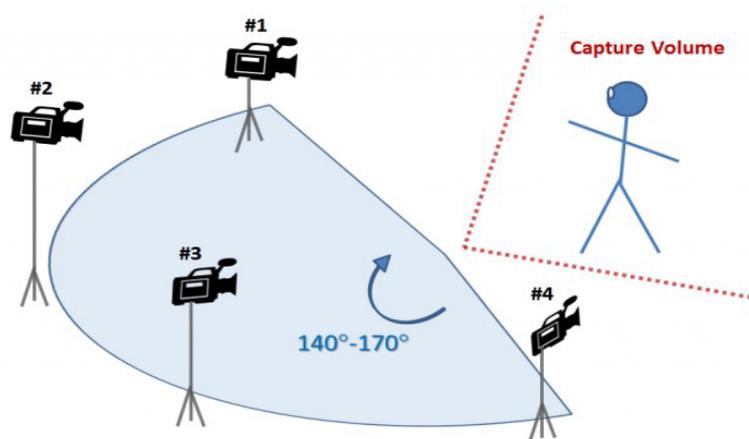

Figure 2. We use four-camera setup to capture the movement

The four camera setup is expected to convey wider range of movements, the more camera is the more detail the software could calculate.

RESULT AND DISCUSSION

The fundamental problem of movement recording is how to generate a credible and convincing human movement while retaining the desired characteristics. When you capture the full motion of the human body, the problem is quite difficult and capturing the movement of the martial art is even more difficult. The faster the movement, the harder it is for the camera to capture it. In these experiments, we filmed the same movements several times at different speeds to ensure that the camera captures all the details and subtleties of the movements.

Following are photos of the recording process:

Figure 3. Recording martial arts with the PS3 eye

Figure 4. Recording of martial arts with PS3 eye

Figure 5. Recorded motion translated into 3D characters

Figure 6. Recorded of motion translated into 3D characters

The camera must first be calibrated according to the world of the software to obtain a result as accurate as possible. Once the desired result is achieved, the actor must stay in the position for a few minutes to perform the initial alignment of the actor model in iPi Mocap Studio. Later, this will require more manual actions to adjust to the proportion of the object with the 3d digital character model.
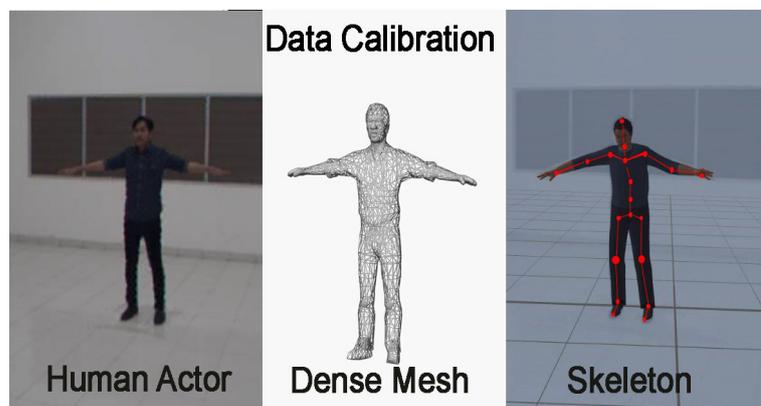

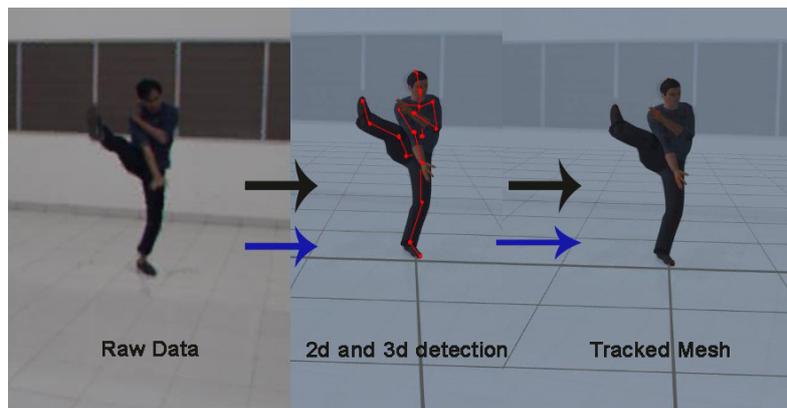**Figure 7.** Calibrating the 3D rig with real human actor

Figure 8. Reconstructing the actor motion into a tracked mesh

In the example of the following poses obtained from the style of penchak silat based on the reference of the silat practitioner, the process of recording motion / pose and smoothing / editing pose characters manually in Maya software. The model that is posed is the free rig character of the software.The author needs to emphasize, not all motion capture results succeed perfectly, in the end still need a manual calibration touch on these poses. This is needed so that the pose looks natural and matches the pose of the martial arts / martial arts style. From figure 8 we could see clearly that the translated movement in the tracked mesh is not 100% accurate, the leg is not as straight as the raw data, this could happen due to several factors.

Incomplete motion capture results due to several factors first differences in proportions between visuals and animated characters (inaccurate calibration), second is the software capability in recording subtle movements is not perfect, third is the limitation of the rig of the animated character receives the original motion from the display

The animator's conclusions made the motion capture results only as references rather than direct results, or the starting point where the animator had to make adjustments again to the animated character, so that the results were perfect, but the insight gained from motion capture would greatly help the animator as a reference seen from one side of the camera but from various angles. The implemented method shows promising results in providing an easier approach to quickly build motions for martial arts character animation.

Differences in design styles and the proportion of character rigs in this study indicate that the results of motion recording can be used quite well, but adjustments also need to be made so that the poses and movements applied are more suitable. in the end, the animator's artistic ability and understanding of the 12 principles of animation remain the most important skill, all these principles of animation are mention and discussed in the book by Disney,(Thomas & Johnston, 1981) because the results of this research were not intended to solve all problems where an animator's abilities were not anymore needed, but this research was intended to enable the animator to start the work quickly on the basis of existing motion, nut then it must be developed again so that it becomes a convincing and entertaining animation.

The following pictures are the result of the implementation of motion capture data results that can be transferred to various types of characters with different proportions, but manual adjustments and tweaking and the ability to adjust are still very much needed, raw data in the form of original actor video footage from many angles used in this research it is also very helpful, so that the animator or designer can study it as a complete reference.

Figure 9. Pose Pencak Silat from free rig, which have been posed through Maya Software
(www.highend3d.com, n.d.)

Figure 10. Pose Pencak Silat from free rig, which have been posed through Maya Software
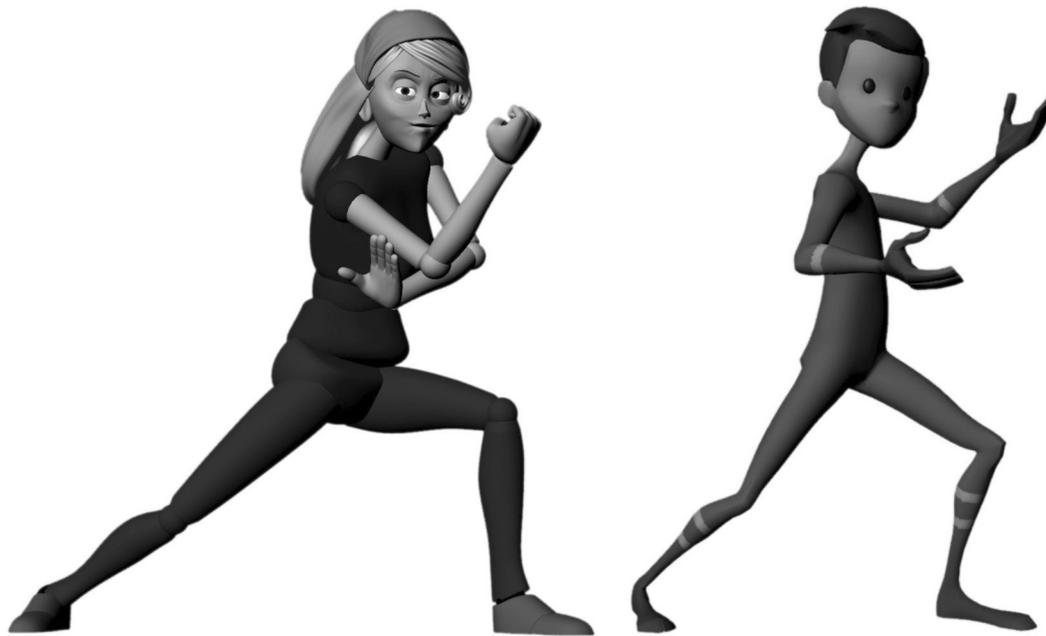(www.highend3d.com, n.d.)

Figure 11. Pose Penchak Silat from free rig, which have been posed through Maya Software (nelsonhurst, n.d.) (animationmentor, n.d.)

CONCLUSION

The results of the research show that the use of performance capture or motion capture can almost replace the manual process of quickly performing Penchak Silat motion animation. However, data transferred in 3D characters is often problematic due to differences in proportions or the software's ability to record fast motion details. but in terms of the speed and completeness of the references in the study of the motion, the results of this study were quite conclusive, because the animator or creator content can immediately get a 3D character that has already moved or posed, making it a good starting point to the next creative process, especially in the process of creating an animation film. Facilitators can get simple and easy-to-follow references

Raw video data from four camera angles is also a valuable source of inspiration. Generally, the videos of Penchak Silat that we can see on the Internet only present an angle of view. With four camera angles allows for a quick overview so content creators can start with a simple and easy-to-follow reference, they can study the movement immediately by watching the video or simply transfer the motion into a 3D character with any proportion and see the result pretty immediately.

Following this brief class experiment, the pencak silat movement, as a beautiful but deadly movement, which constitutes a cultural heritage of the Indonesian nation, will be more easily accessible if the process of recording Penchak Silat with motion capture movement is performed and used as a Penchak Silat movement library, that can be applied right away to various types of characters design. This will greatly facilitate the process of seeking ideas and brain storming for content creators interested in Penchak Silat as their content materials.

As previously discussed, the limitation of this research is the inability of the camera and software to capture fast movements, where the subject must reduce the speed of his movement up to the camera will be able to capture the movement. However, the conclusions of this study also become limited because there may be movements that should be performed at high speed but forced to be slowed down, so that the authenticity of the recorded movements of the martial arts Penchak Silat could be a bit reduced, another further in-depth study will still needed if content creator wanted more complete insight.

Another important limitation of this study is the translations to many different character proportions, it can creates damage that should need more adjustments, which sometimes doing it manually can be a faster and more efficient method, so the results of this study is not the "be-all and end-all" that would solve all the problems to accelerate the production process, rather as an alternative route that can be tried and taken benefits from.

The limitations of this research point towards topics to be addressed in the future. Technology in camera and software will continue to evolve and the exploration of traditional art especially Penchak Silat still have long way ahead, the following are a few areas for future research, using more advanced system to capture the movement of Indonesian traditional dances or exploration in the martial art cinematography.

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