Patunhay: A Software to Generate Motion Capture Animated 3D Models of Philippine Folk Dances for Digital Archiving

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Abstract. Folk dance is crucial to a country's intangible cultural heritage and has been overshadowed by modern forms of entertainment in recent decades. Digital archives are a way to preserve cultural heritage by virtually storing different artifacts, making them more accessible. In addition, motion capture technologies and 3D modeling techniques open creative avenues for application development. This research generates motion capture animated 3D models that accurately represent Philippine folk dances. The motion capture data were gathered from a dancer wearing a motion capture suit. A software, Patunhay, was then created using Unity, which incorporates the motion capture data into a 3D model. The generated models are then added to a digital archive of different Philippine folk dances containing motion capture animated 3D models, offering a method to preserve dances digitally.

Keywords: digital archive, motion capture, 3D models, Philippine folk dance, cultural preservation

1 INTRODUCTION

Culture is the beliefs, values, behavior, and material objects that constitute a people's way of life [1]. Each country has its own culture, shown through various manifestations such as architecture, music, art, clothing, and dancing. These manifestations are tangible (physical artifacts) or intangible cultural heritage (ICH) (non-physical artifacts). Without heritage, historical proof of the existence of previous generations would vanish.

ICH is typically passed down through oral means and knowledge transfer from one generation to another [2]. Digital archives have become valuable tools in preserving cultural heritages, including dances. Creating a digital archive of animated 3D models of Philippine folk dances offers more accurate preservation of movements and enables wider accessibility for learning. Digital archives can also be a foundation for developing Augmented Reality (AR) and Virtual Reality (VR) applications that can further improve the dance learning experience. Some

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use web-based digital archives to preserve ICH. However, more studies must focus on safeguarding Philippine cultural heritage through digitization. This calls for the need to create a digital archive of Philippine folk dances.

The main objective of this research is to generate motion capture animated 3D models that accurately represent Philippine folk dances, which will be stored in a digital archive. The motion capture animated 3D models will be generated through the software Patunhay, which will incorporate motion capture data into a pre-rigged 3D model. This paper focuses on the evaluation of the generated 3D models by experts, notably coaches and dancers. The dance archive includes Jota Gumaqueña, Pattong, Pangalay, Kinugsik-kugsik, and Lapay Bantigue, all chosen because they do not require excessive use of props, have minimal finger movements, and are solo dances. The Rokoko Smartsuit Pro II was chosen because of its accuracy compared to other commercially available devices, and it can collect data from the entire body, excluding the hands and the face. For the selection of the computer graphics application, the following factors were considered: (1) it must be capable of creating software that can generate the animated 3D model, (2) the application must be free of charge, (3) the application must be easy to use, meaning the interface must be simple and beginner-friendly, and (4) it must be compatible with the hardware specifications of the machines that will be used for this research. Based on the stated considerations, Unity was chosen as the computer graphics application to create the software.

The digital archive containing the generated motion capture animated 3D models can benefit education, technology, dance, and cultural preservation. It can be used as a visual aid for teaching Philippine folk dance in formal and informal settings. The several viewing capabilities in the software allow users to see the details of the dance figures not visible in 2D videos through the animated 3D models. In addition, users may gain basic background information about the dance and what emotion it is trying to convey, allowing the users to understand the motions and figures behind the dance.

Aside from education, the digital archive can be used for future studies involving dance emotion detection and analysis, AR and VR studies for providing immersive experiences, and other studies that use patterns and gestures to gain insights into the cultural nuances and variations within the dances. Lastly, the archive can pave the way for the digitization of other cultural heritage, such as traditional costumes and geographical location. It will raise awareness and appreciation for cultural heritage, making them more accessible, sustainable, and interactive.

The paper is organized as follows: Section 2 introduces research in the field of cultural preservation and digitization. This is followed by Section 3, which outlines the methods and procedures employed for data preparation in this study. In Section 4, the software, Patunhay, is discussed in detail. Section 5 presents the results and conducts a thorough analysis of the findings. Finally, Section 6 offers conclusions from the study's outcomes and recommendations for future work.

2 REVIEW OF RELATED WORK

This section presents work that has been done in relation to cultural preservation and digitization methods applied to the field.

Many researchers have recognized the need to preserve ICH. Thus, several studies recently used current technologies to digitize ICH, mainly folk dances. In [3], a prototype of a publicly accessible virtual dance museum documenting Greek and Cypriot folk dance heritage was developed using interactive technologies. The museum used data from an already available dance motion capture repository and stored it in a database along with its descriptive metadata. An optical motion capture system called PhaseSpace Impulse X2 captured the data in the repository. However, this study was unable to capture finger movement and facial expressions. In [4], a web platform named "i-Treasures" and a novel methodology for ICH education were created. This project focused on capturing and analyzing ICH performances using multi-sensing technologies by supporting various sensors for motion, emotion, and sound capture, analysis, and recognition. An expert may use the system to capture dance performances, store them in the database, and create educational courses. At the same time, a researcher or learner can access the provided content and information and use its interactive learning features.

The study of [5] focused on creating a methodology for capturing the movements of the Lazgi dance through 3D silhouette data, 3D detailed hand data, and angles for selected parts of the body to preserve the Lazgi dance, an ancient dance performed by inhabitants of the Amu-Daria River from Uzbekistan. The movement of the dancers performing Lazgi was captured using an optical motion capture system, which was then rendered to create a 3D model depicting the dance [5]. In [6], a markerless motion capture system called the Rokoko Smartsuit Pro was used to record motion capture data of Aeta dance. After that, locomotion and other data filters were applied to clean the data and remove the drift. The study of [6] was conducted to introduce a new way to digitize folk dances and to analyze the drift pattern that came with the output of the markerless motion capture system.

In terms of developing AR and VR technology to further improve the dance learning experience, a mobile application was created that allows users to watch and learn the dance through AR [7]. The user can either watch the dance through the avatar on the application or learn the dance through footsteps and hand visualizers, which are automated in the application. At the Chios Island of Greece, virtual humans and 3D models of the old Mastic Factory were used in the Chios Mastic Museum exhibit [8]. The virtual humans gave visitors a tour of the exhibit. At the same time, the 3D-generated models showed the visitors an image of the machines and objects used in the old Mastic Factory, which produced cost-effective virtual humans that did not require a professional motion-capturing studio and heavy resources in 3D animation and design. The researches of [7] and [8] show the capabilities of AR and VR to improve the dance learning experience and, simultaneously, be a foundation for preserving ICH.

3 METHODOLOGY

This section discusses the methodology implemented to accomplish the study. The methodology consists of collecting data using a Rokoko Smartsuit Pro II, cleaning the data using Rokoko Studio and Blender, and validating the data by interviewing dancers and experts.

3.1 Data Collection

Before motion capture, the dancers' body measurements were taken to ensure precise predictions by Rokoko Studio. The dancer wore the suit (see Fig. 1a), then wirelessly connected to a laptop meeting specific requirements. Calibration involved standing straight for ten to fifteen seconds (see Fig. 1b) to compute marker positions [9]. If necessary, sensor re-positioning and calibration repetition were done for accuracy.

After calibration, each dancer performed the Philippine folk dance thrice under the trainer's guidance, as seen in Fig. 1c. The data was then reviewed and saved in Rokoko Studio. Ethical measures, including consent forms and orientations, were implemented to safeguard the dancers' data throughout the research.

(a) Wearing of Suit (b) Calibration (c) Data Recording

Fig. 1: Data Collection Process

3.2 Data Cleaning

After collecting the motion capture data, it was carefully reviewed for accuracy and completeness. Data cleaning was conducted using two software tools: Rokoko Studio [10] and Blender [11]. However, one notable drawback of using an inertial motion capture system is its susceptibility to drift. Drift refers to minor errors in calculating angular velocity and acceleration, which can impact the positioning of body movements in the motion capture data [6].

Each movement in the generated motion capture data was thoroughly checked for inaccuracies. The locomotion filter in Rokoko Studio was utilized in data cleaning, where values could be adjusted to enhance data quality. This filter detected instances when the dancer's feet were lifted or touching the ground. The issues caused by drift were addressed by ensuring the steps made by the dancer accurately showed proper points of contact with the ground. Corrections were made for errors in calculation, especially when the software failed to accurately record points of ground contact, resulting in the model appearing to float. Steps that were not detected had to be added manually, and instances where the software misidentified foot positions, were also manually adjusted to ensure accurate step detection.

Blender was employed to clean the intricate figures and motions of the data due to its extensive features, allowing easy manipulation and correction of each bone in the rig. The data cleaning process began by retargeting the motion capture data to the same 3D model used in the software Patunhay, enhancing visualization for more straightforward bone manipulation. Next, a track was created in the nonlinear animation (NLA) editor, facilitating changes in the folk dance animations with relative ease [12]. Action blending was set to "Combine" to integrate the modifications with the original motion capture data seamlessly. Basic transformation tools and keyframes were then utilized to address errors in the data, including extremities passing through the body, undetected movements from sensors (e.g., tilting of the head and twisting of the wrists), and other inaccuracies. Only the armature was exported to complete the data cleaning process after fixing all errors.

3.3 Data Validation

Data validation focused on the accuracy and recognizability of the motion capture animated 3D models. Based on convenience sampling, two-phased interviews were conducted from dance trainers, directors, or teachers with at least 2 years experience in the field of Philippine Folk Dances, and members of the La Salle Dance Company - Folk who have been members for at least a year, and are at least 18 years old.

The first phase focused on validating the initially cleaned data, while the second phase verified whether the comments regarding the inaccuracies pointed out in the initial phase were properly addressed. The interviews followed a mixed methods approach, wherein the quantitative results were used to accompany the qualitative analysis derived from the participants' answers. Before the data validation, participants were requested to sign a consent form indicating their agreement to the interview's terms, conditions, and procedures. The interviews were conducted using Zoom. A total of 13 participants, comprising three experts and ten dancers, were interviewed to validate the dances, including the dance trainer who oversaw the data collection for the study.

After the interviews, the standard deviation was then computed for each dance to identify the variation in the participants' ratings. The higher standard deviation meant that the ratings of the participants varied more from each other. On the other hand, a lower value means that the participants' ratings are closer to the average and have a more concentrated deviation. The coefficient of variation was used to determine whether the standard deviation has a relatively high or low value. When the value of the coefficient of variation is one or greater than one, it means that the standard deviation is relatively high.

4 PATUNHAY: A DIGITAL ARCHIVE OF FILIPINO DANCES

This section presents Patunhay, a digital archive of Filipino indigenous dances.

4.1 System Overview

The main objective of Patunhay is to preserve Philippine folk dances by generating a motion capture 3D animated model of a Philippine folk dance. The software is named "Patunhay," a Cebuano term that means to immortalize or preserve. The software applies motion capture data to a pre-rigged 3D model, which results in an animated 3D model.

Users can view motion capture animated 3D models of Philippine folk dances in the software. Users can also contribute to the digital archive of Philippine folk dances by uploading the necessary files, such as the motion capture data and music of the dance, to the online repository. The software also allows users to download its output on their local computer.

4.2 System Functions

The software's functions are indicated through the various pages found below. This section gives an idea of what the software is intended to look like and what the users see once they use the software.

The **home page** is where all users are redirected upon opening the software. A short description of the software can be seen on this page. It also gives users several options: start viewing an animated 3D model, view the instructions page, and exit the software.

The **instructions page** guides users on implementing the different features in viewing the animated 3D model on the view page. The features on the view page can be accessed using various keyboard and mouse controls, as stated on the instructions page.

The **dance information page** shows the dance information page of the software. On this page, users are asked to select a dance from the list of dances in the drop-down menu.

After the software generates the animated 3D model, users are redirected to the **success page** based on the user's selection on the dance information page.

The page signifies that the animated 3D model has been successfully created and is already available for the user. Users may view the animated 3D model or download the files that make up the animated 3D model to their local computer.

The **view page** is where users can view the animated 3D model. Various controls would also allow users to customize their viewing experience, such as the pause or play function and camera controls that allow users to view the generated animated 3D model in a 360-degree view. Like any other viewing platform, there is a progress bar where users may jump specific timestamps and re-watch certain parts of the recording. Users can also view information related to the dance on the upper-left part of the page, such as the dance name, dance suite, place of origin, and general emotion of the dance. An instructions button at the lower right guides users through the different keyboard and mouse controls for viewing the animated 3D model. Lastly, segmentation of the dance figures can be seen in the progress bar and dance figure panel, where users can proceed to the start time of a dance figure, repeatedly play a dance figure on a loop, or see notes on the dance figure. Each dance figure comes with a name that can be seen on the lower-left part of the page, on top of the pause or play button.

5 RESULTS

This section discusses the results obtained during the data validation of this study. Since achieving accuracy and recognizability of the generated motion capture animated 3D models were the objectives of the data validation, the results of this section focuses on the dance identification and explains the inaccuracies in the animation.

5.1 Results of the First Phase of Data Validation

The results of the participants' rating of the difficulty in identifying the dances in the first phase of the data validation can be seen in Table 1, which presents the data about the average rating each dance received regarding the difficulty in identifying the dance, the standard deviation, the coefficient of variation, along with the identification percentage of each dance. Fig. 2 shows a visual comparison of the average ratings that each dance had received. The average rating in Table 1 and Fig. 2 follows the Likert scale: five is very easy, four is easy, three is fair, two is difficult, and one is very difficult.

Based on Table 1 and Fig. 2, the following can be observed through the results of the data validation's first phase:

- Pangalay is the easiest dance to identify with 100% identification percentage and has the lowest standard deviation of 0.718, showing the high similarity of ratings given by the participants.
- Pattong is the most challenging dance to identify, given its low identification percentage of 33.33% and high standard deviation of 1.850, meaning that the given ratings are highly sparse.

– Jota Gumaqueña has a low sparsity despite its similar standard deviation with Pattong, given its coefficient of variation of 0.51. However, it has a much higher identification percentage of 83.33%, meaning it is relatively easy to identify.
– Kinugsik-kugsik and Lapay Bantigue have the same high average of 4.417 and the same identification percentage of 91.67%, but with relatively low standard deviations of 1.443 and 1.505, respectively, meaning almost all of the participants agree that both dances are easily identifiable.

Table 1: Participants' Self-reported Level of Difficulty in Identifying the Dances

Name of Dance	Average (out of 5)	Standard Deviation	Coefficient of Variation	Identification Percentage (%)
Kinugsik-kugsik	4.417	1.443	0.327	91.67
Pangalay	4.167	0.718	0.172	100
Lapay Bantigue	4.417	1.505	0.341	91.67
Jota Gumaqueña	3.625	1.848	0.51	83.33
Pattong	1.167	1.850	1.586	33.33

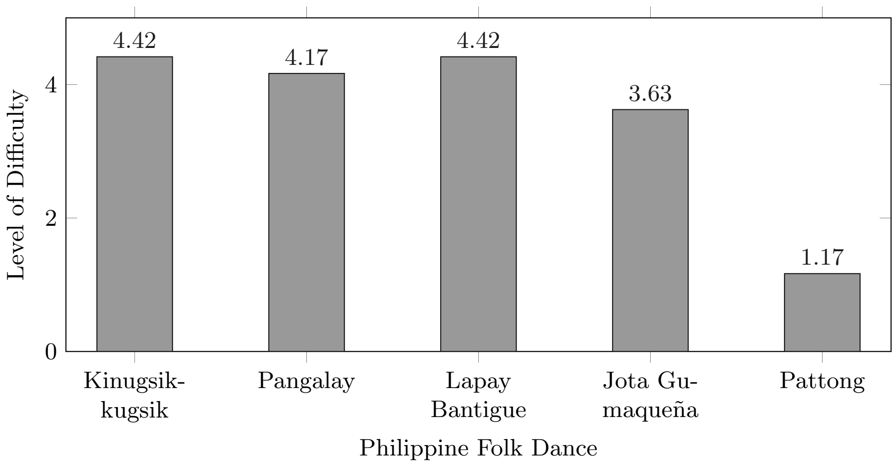
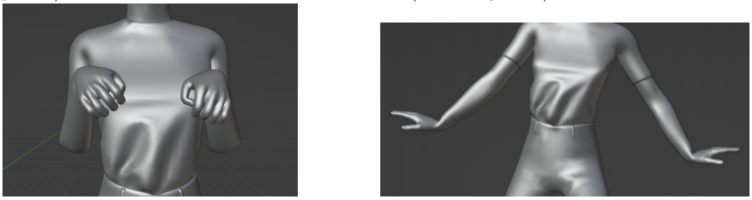


Fig. 2: Bar Graph Representing the Participants' Self-reported Level of Difficulty in Identifying the Dances

Kinugsik-kugsik. Regarding the 3D model's animation, one participant noted a robotic appearance and squirming at the beginning of the dance. Fixing the robotic movement is challenging, particularly with the dance's continuous arm motion on every count. Due to hardware constraints, the Kugsik arm movement could not accurately translate into motion capture data, leaving this inaccuracy to be addressed. Furthermore, half of the participants highlighted the absence of hand and finger movements in the animated 3D model, despite being informed of the study's limitations. Two default hand postures were added to the model to address the mentioned comments: loosely clenched fists or "Kugsik position" (see Fig. 3a), and a neutral hand posture (see Fig. 3b).

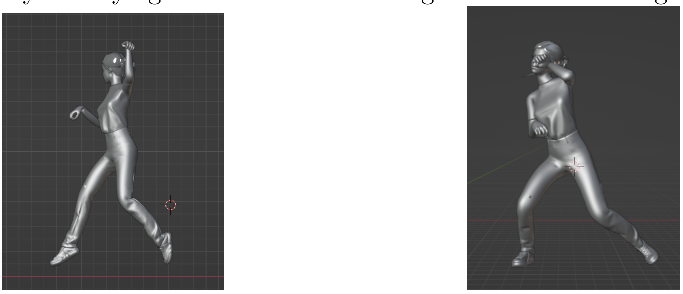


(a) Loosely Clenched Fists or Kugsik Position

(b) Neutral Hand Posture

Fig. 3: Default Hand Postures (Kinugsik-kugsik)

Regarding the dance's figures, participants noted a distinct jump called the "Kugsik jump" lacking sufficient height, which was essential given the dance's context of a squirrel evading an intruder. To address this, the Y value of the model's "Hips" bone was increased at the jump's peak, rectifying the issue (see Fig. 4a). One participant highlighted the necessity for the back of the hand to touch the cheek during a specific figure (see Fig. 4b), whereas the dancer originally positioned their arm and fist above their head. The issue was successfully addressed by modifying the arm motion to align with the desired gesture.

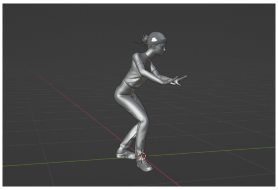


(a) High Jump

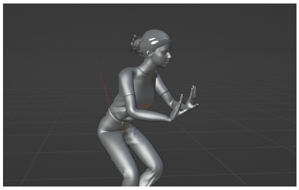
(b) Fist Touching Cheek

Fig. 4: Cleaned Inaccuracies (Kinugsik-kugsik)

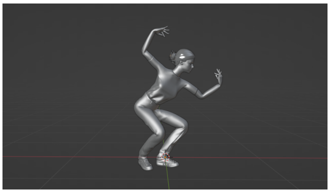
Pangalay. Many comments about the motion capture data inaccuracies were addressed, but not all. Animation-related feedback pointed out jittery movements, which contradicted the dance's intention to mimic the flow of water or breathing. The issue was resolved by correcting the frequent twisting of joints during different parts of the dance, enabling smoother execution (see Fig. 5a). To improve accuracy, the "L" hand posture (see Fig. 5b) and pinching hand posture (see Fig. 5c) were integrated into the animation. In terms of figures, corrections were made to the final kneeling pose and other figures, ensuring both knees touched the ground (see Fig. 5d) and the head faced the correct directions (see Fig. 5c). However, an incorrect figure involving the model's leg and arm positioning was not fixed due to a performance error during data collection. In this figure, the left arm should be raised when the right leg is forward, or vice versa—addressing this required re-collection, which is impossible through data cleaning methods. Similarly, the comment about the women dancing Pangalay sitting or squatting very low was not cleaned since the dance trainer had confirmed this figure to the pupil who directly learned the dance from its original cultural researcher.



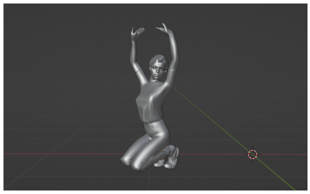
(a) Fixed Joints



(b) "L" Hand Posture



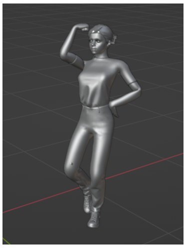
(c) Correct Head Orientation and Hand Posture



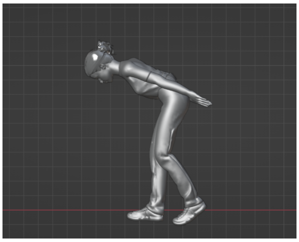
(d) Correct Kneeling Position

Fig. 5: Cleaned Inaccuracies (Pangalay)

Lapay Bantigue. Regarding the animation of the dance, participants commented on the need for a more graceful wing-flapping motion. However, due to the subtlety and complexity of the motion, it could not be addressed during the data cleaning. Regarding the figures, the *kumintang* movement garnered two comments, with one being addressed based on the participant's description. Initially, the fist was positioned in front of the face, which was fixed by aligning it at the shoulder and placing it on the side of the forehead, as suggested by a participant (see Fig. 6a). The second comment arose from an expert's different interpretation, where the *kumintang* was perceived to be done in reverse or outwards when the wrist should twist inwards. However, the notations consider both correct *kumintang* interpretations as correct. In addition, a participant noted that the back angle should be parallel to the ground in a specific figure. The dance trainer explained that this interpretation might vary, as Lapay Bantigue's notations do not specify the exact degree of back bending. However, the dance trainer also suggested that a lower back bend would better mimic a bird's posture. As a result, the model was adjusted to maintain a straight back while bending the trunk lower (see Fig. 6b).



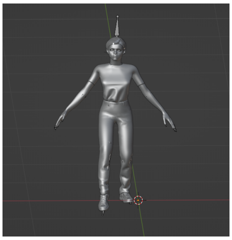
(a) Fist Beside Forehead



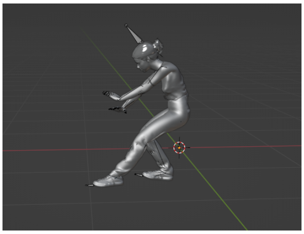
(b) Lower Bent Trunk

Fig. 6: Cleaned Inaccuracies (Lapay Bantigue)

Jota Gumaqueña. In terms of the figures, participants pointed out that the model's arms were bent in the first figure, detracting from the elegance expected in Jota Gumaqueña, a dance from the Spanish-influenced suite. To address this, the model's arms were repositioned straight at its side, portraying a woman holding a skirt more accurately (see Fig. 7a). Additionally, a participant mentioned posture issues where the arms had a wide gap, were misaligned, the knee was bent, and the toe was not pointed. These concerns were rectified by adjusting the body posture to the proper form, as seen in Fig. 7b. Regarding the animation, participants noted that the model floated above the ground in the dance's final segments. This issue was resolved by grounding the model's feet during those segments.



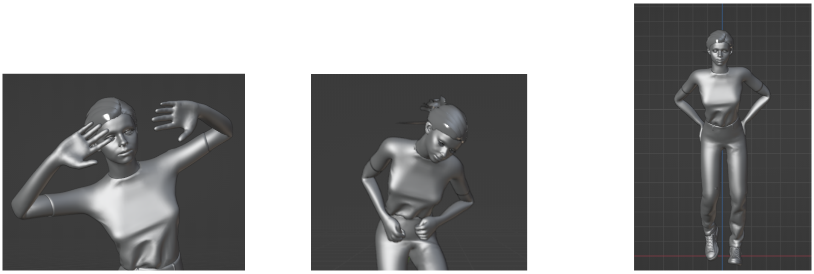
(a) Straight Arms



(b) Corrected Posture

Fig. 7: Cleaned Inaccuracies (Jota Gumaqueña)

Pattong. Regarding the animation, some participants noted that the model's feet were too far apart, and its body staggered and tilted during jumps. These issues were addressed by rotating the model and its body parts to appear straight (see Fig. 8c). While some comments about inaccurate hand gestures could not be completely fixed due to hardware limitations, the dance trainer's suggestion was applied, incorporating two default hand postures: neutral (see Fig. 8a) and clenched fists (see Fig. 8b). These postures improved the representation of different figures in the dance. Another inaccuracy mentioned by a participant involved the model's movement while traveling, specifically using only the right foot stepping forward and the left foot sliding backward. After consulting the dance trainer who supervised data collection, it was confirmed that the original traveling step shown by the model was correct as it was consistent with dance performances in Baguio City, Cordillera Administrative Region (CAR), Philippines. As no published notations state otherwise, this movement was not modified.



(a) Neutral Hand Posture (b) Clenched Fist (c) Straightened Body

Fig. 8: Cleaned Inaccuracies (Pattong)

5.2 Results of the Second Phase of Data Validation

Based on the second phase of data validation, participants noted improvements in the dances. In Kinugsik-kugsik, clenched fists and adjusted arm posture enhanced the dance's distinctiveness, while higher jumps enhanced realism and dance context. In Pangalay, corrections to foot movement, head orientation, and hand postures resulted in more graceful movements. Lapay Bantigue displayed more fluidity in lowered back movement.

In Jota Gumaqueña, corrected arm and body posture improved the animation, and the *bale* posture added elegance. When holding the skirt, the model's hand posture was recommended to mimic Pangalay's pinching hand pose. In Pattong, controlled jumps, fixed body tilt, and fluid movements were achieved. A minor adjustment noted by the participants in Pattong is the awkward position of the model's left hand at the end of the dance.

The comments made in Jota Gumaqueña and Pattong were identified as nuances since not fixing those comments still shows accurate dance movements of the specified dances. However, to address these comments, notes on the commented dance figures will be inserted in the software to guide users when viewing the dances.

5.3 Analysis of Results

This section examines the motion capture device's effects on the data quality by analyzing the data validation results. Moreover, the effects of the participants' familiarity and expertise with the dances on the identification difficulty ratings are also summarized.

Effects of the Motion Capture Device on the Quality of Data
The Rokoko Smartsuit Pro II, used for data collection, suffers from drift, a slight

error in calculating the angular velocity and acceleration, resulting in inaccurate data recording. Drift appeared in recordings of body movements that involved the model's unstretched arms, frequent jumps, and incorrect body posture.

In Kinugsik-kugsik, Pangalay, and Lapay Bantigue, the model's arms were unstretched when it was supposed to be hyperextended. In Kinugsik-kugsik and Pattong, the dancer's frequent jumps resulted in the model's feet going below ground. In Jota Gumaqueña and Lapay Bantigue, there were instances that the body posture of the dancer was positioned with an arched back, but the recorded data only shows a straight back.

Another limitation of the suit is the insufficient data on the movements of the hands, fingers, shoulders, and head movements. As such, hand and finger movements were corrected in Kinugsik-kugsik, Pangalay, and Pattong. In Pangalay, the model's head orientation was corrected since the suit's lack of sensors on the head and neck resulted in the suit not giving accurate recordings of the neck and head. While minor shoulder movements were fixed in Kinugsik-kugsik to make the chest pumping movement more noticeable.

Lastly, the suit did not perfectly capture the dancer's fluidity of movements, resulting in the model's jittery and stiff movements. All the mentioned inaccuracies that were caused by drift were fixed in Rokoko Studio and Blender.

Effects of the Participants' Familiarity and Expertise with the Dances on the Identification Difficulty Ratings

Based on the data validation, participants' familiarity and expertise significantly impacted dance identification's difficulty ratings. High ratings resulted from participants' knowledge and prior performance of the dances. Conversely, low ratings were due to difficulty recalling names, similarity to other dances in the suite, different interpretations, and overall unfamiliarity. Varied interpretations of specific dance figures did not impact ratings.

Kinugsik-kugsik and Lapay Bantigue both received a high average rating of 4.417, attributed to their distinctive animal-inspired figures. Most participants identified these dances from the initial stance of the model. However, some outliers could not recognize the dances, notably affecting the average. Those who could not identify the dance either forgot the name or had yet to encounter it. One participant rated Lapay Bantigue poorly due to its similarity to other bird-mimicking dances. However, most participants quickly recognized Pangalay and Jota Gumaqueña from the initial figures. Pangalay's distinctive slow-paced fluid motions led to a higher average rating of 4.167. In comparison, Jota Gumaqueña received a slightly lower rating of 3.625 due to the shared elegance in many Spanish-influenced dances, making it harder to differentiate. Two participants could not recognize Jota Gumaqueña due to the participants' unfamiliarity with the dance. Despite Pangalay's high average and 100% identification rate, some participants confused it with other Muslim dances.

In the case of Pattong, most participants were unfamiliar with the dance, leading to low identification and ratings. The dance had the lowest average, likely due to its lack of published notations, so there is a heavy reliance on experts and in-depth research from its origin. The lack of published notations means there was not enough written documentation on Pattong that is available to the public, which was likely the cause of its low quantitative results. This resulted in some participants remembering a different interpretation or not knowing the dance. In contrast, others had only recognized the dance suite, the Cordillera suite, due to its common step of stomping feet or *padyak*. Furthermore, only the experts mentioned names of other dances from the same suite when identifying Pattong, such as Balliwes, Tarektek, Uya-uy, and Dalichok.

6 CONCLUSION AND RECOMMENDATIONS

This section discusses the conclusion of the study. In addition, recommendations for future researchers who plan to continue this study or work on a similar project are discussed.

6.1 Conclusion

Patunhay is a software that can generate motion capture animated 3D models to preserve Philippine folk dances. The software offers an improved dance learning experience for users who want to learn Philippine folk dances since it showcases the dance in a 3D setting with a 360-degree view.

Rokoko Smartsuit Pro II was used to record the dancers' body movements during the data collection. The suit contains 19 "9 degrees of freedom" inertial sensors embedded into the suit's different sections, which calculate the movement of each body part. Dancers from a dance group that performs Philippine folk dances participated in the data collection. They performed the dances while wearing the suit with the supervision of their dance trainer.

Unity was used to create Patunhay, with C# as the scripting language. Unity is a well-established multi-platform 3D game engine capable of rendering, world-building, modeling, animation, gameplay and storytelling, cinematic studio, engineering, scripting, mobile game development, motion tracking, AR, VR, and MR design [13].

Lastly, Patunhay and the motion capture data files of the dances were stored in a GitHub repository that serves as the digital archive of Philippine folk dances. Five Philippine folk dances were added to the repository: Jota Gumaqueña, Pattong, Pangalay, Kinugsik-kugsik, and Lapay Bantigue.

Upon completion of this research, a prototype for the Patunhay software was created, where users can view animated 3D models of Philippine folk dances, which can be populated in the future by uploading the necessary files to the online repository to preserve Philippine folk dances digitally.

6.2 Recommendations

Despite the completion of the project, future researchers should consider these recommendations. First, in the data validation, assess the participants' familiarity with the dance beforehand and ask about their confidence in identifying it. Second, enhance data quality by accurately capturing finger movements and facial expressions and fixing the drift issue. Third, improve the software's output by incorporating additional dance elements like prop movements, customizable costumes, and varied backgrounds per dance. Fourth, expand the software features, including speed adjustment, mirror mode, and group or pair dance support. Fifth, enhance data accessibility by creating a mobile and web application of Patunhay that promotes wider use and awareness of Philippine folk dances. Sixth, prioritize user experience by performing functional and usability testing on the software. Since Patunhay is simply a prototype, the study mainly focused on the accuracy and recognizability of the motion capture animated 3D models that can be used in showcasing Philippine folk dances, rather than the software's usability. Lastly, continue adding motion capture data to the online repository, building a foundation for preserving all Philippine folk dances, with Patunhay as a cornerstone.

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