Developing a Framework to Preserve the Intangible Culture and Heritage in the Endemic Era Using Motion Capture as Capturing Tools

Zaini Kamarol Zaman(✉)

Multimedia University, Cyberjaya, Malaysia
zaini.kamarolzaman@mmu.edu.my

Abstract. In this paper, the researcher addresses on developing the framework of preserving the intangible cultural movement that designed as digital preservation. It draws importance of the process of pre production, ethic reviews, and preparation before the cultural movement recording process. The researcher signifies the needs of the framework to differ the capturing cultural movement comparing the normal capturing process using motion capture suite.

Keywords: Intangible cultural heritage · preservation · motion capture · framework

1 Introduction

1.1 Intangible Cultural Heritage (ICH)

Cultural heritage in general consists of the products and processes of a culture that are preserved and passed on through the generations. (Matsuura, 2001) Some of that heritage takes the form of cultural property, formed by tangible artifacts such as buildings or works of arts. Many parts of culture, however, are intangible, including song, music, dance, drama, skills, cuisine, crafts and martial arts practices. They are forms of culture that can be recorded but can not be touched or stored in physical form, like in a museum, but only experienced through a vehicle giving expressions to it. These cultural vehicles are called "Human Treasures" by the United Nation (UN).

Hicks (2017) suggested that to safeguard intangible cultural heritage, there need to be different measures from the ones used for conserving monuments, sites, and natural spaces. For ICH to be kept alive, it must remain relevant to a culture and be regularly practiced and learned within communities and between generations. Therefore, the way of safeguarding this needs to evolve, aligning with modern technologies where preservation will be accurate and secure.

F. Mustaffa et al. (Eds.): ICCM 2022, ASSEHR 706, pp. 34–40, 2023.
https://doi.org/10.2991/978-2-494069-57-2_5

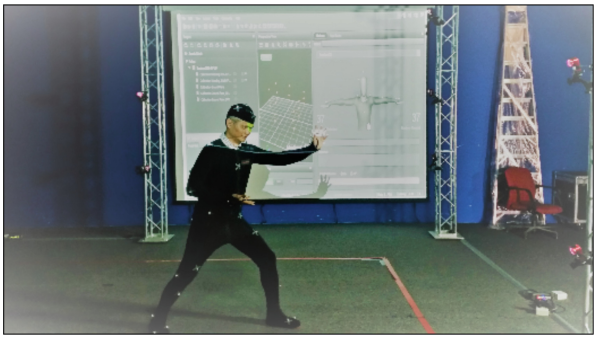

Fig. 1. A practitioner performing the Silat Gayong movement wearing the motion capture suit.

1.2 Motion Capture (Mocap)

Using an 'omniscient frame' generated by the capacity of a Mocap system's camera array to 'see within a volume, to capture not just the height and width of the 2D frame, but to capture depth (via movement) as well' (Delbridge 2015). It is an ideal solution for recording cultural practice due to its nature to record unbiasedly and accurately.

Whilst motion capture documents the 'geometry' of the dance, it is unable to capture the 'nuance/tone' – the emotion, intention or interaction with the environment by the performer (Aristidou et al. 2014). Thus Mocap needs to be augmented to store cultural practice (Fig. 1).

1.3 Conceptual Framework

This research develops and presents a new framework that provides a new perspective on preserving cultural practice using mocap. This contributes to knowledge by providing a linked structure through which to examine each of the specific stages in this framework. These stages consist of specific roles namely activities, objects, and concepts.

The activities stage that focuses on the analysis of the cultural movement will contributing to the fidelity or closeness between the performing and the recording session.

The objects stage solely focusing on the metadata of the capturing stage. Metadata should be affixed with the necessary elements that aligning with the principles of preservation.

The concepts stage will look closely at the integrity of the captured movement.This stage will determine the success rate of the whole framework development before proceeding into storage for preservation. The individual stages themselves (i.e. pre-production, production, and post-production) also each provide a further contribution to knowledge.

This framework also holds potential to be applied post hoc to other projects that used mocap, that require integrity checking after the capture process.

2 Problem of Statement

Using motion capture as tools of preserving cultural movement is relevant as the motion capture capabilities to record movement in 3D environment is flawless. However, there is a need of a thorough screening process to differentiate between an usual recording to a preserving recording with semantic value and the necessary metadata as storage and archive purposes. This is important as archiving for preservation need to have credibility and endorsement to add value to the preservation.

2.1 Semantic Gap

The semantic gap can be defined as "the difference in meaning between construct form within different representation systems" (Hein 2010), therefore in the aspect of recording cultural movement, there is a need to study the organisational context in which recording cultural movement operates, rather than just its technical aspects. Moreover, Mujoo-Munshi, U. (2011) in this effort to preserve cultural heritage image, stated that the gap between low-level visual features and semantic concepts mediated by an image is still a big problem. Munshi (2011) claims that "the gap between low-level features and text annotations has been identified as the semantic gap…it is widely recognised that the family of image retrieval techniques should become an integration of both low-level visual features addressing the more detail perceptual aspect and high-level semantic features represented in metadata standards". Based on Munshi statement, the semantic gap implies that by recording cultural movement in a high-quality recording device such as motion capture, there will be a gap of semantic understanding features when the cultural movement is translated into metadata standards even at a highest digital preservation state.

3 Framework Development

To facilitate the design of preparation before proceeding into recording cultural movement, it is essential to examine the factors that may influence the attributes of needs to be implanted into the framework. Policy on "garbage in – garbage out" is vital in the framework to maintain the integrity of the data captured. This study is critical because of a well-designed framework will be able to contribute positively to preserving cultural movement to the most exceptional data with integrity intact. This study will add to the corpus of knowledge related to intangible cultural and heritage preservation. In addition to adding to the literature and enriching the body of knowledge on the preserving cultural movement, the research contributes to the formulation of the chain of custody towards the recorded data. The work will verify that the captured data is aligned with the cultural movement source. Other sectors can benefit from the results of a study to develop a comprehensive way of recording tools in preserving intangible culture and heritage. Also, the governing body may implement an effective way to keep one's culture based on this research with the addition of integrity, and practical digital preservation with the chain of custody.

In this research, two broad areas of intangible cultural heritage and digital preservation are explored. The study uses the conceptual framework for recording (in this case

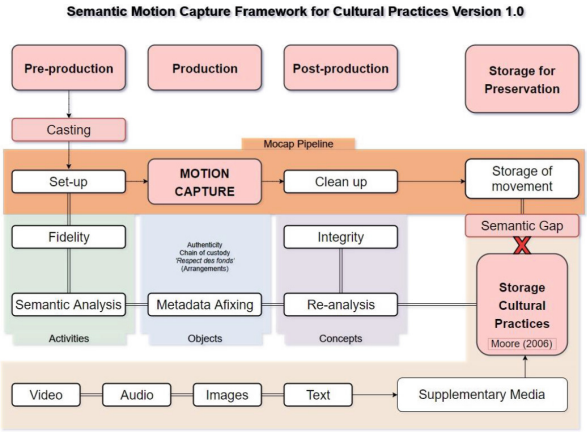

Fig. 2. The development of Semantic Motion Capture for cultural practice version 1.0

motion capture) cultural movement. Therefore, in this study, there will be an implementation of the necessary procedure for capturing cultural change, using a conceptual framework. The objective of this thesis is to explore and analyse the effectiveness of the theoretical framework to gather semantic metadata of cultural movement. This study aims to gain a better understanding of the necessary procedure for preserving cultural movement recording data. It also seeks to provide insights into the captured metadata chain of custody cycle and how to validate those data. Based on these inputs, this study intends to generate an initiative to promote integrity (Fig. 2).

The research also aims to identify the factors that contribute to the effectiveness of the screening/casting process before capturing. The outcomes of the study include recommendations and guidance to recording cultural movement based on the finalise conceptual framework to promote integrity and associations, in their effort to develop effective and efficient preservation.

Research Contributions

In general, this research contributes to a deeper understanding of preserving intangible culture and heritage by implementing a semantic capture framework. Changes in developing the framework are needed when the post-evaluation review indicates the evolvement from theoretical stage to the revised stage. This procedure is important in line with the Research through design procedure to ensure the semantic capture framework remains relevant to users and the technology, now and in the future.

This research also fills the knowledge gap in understanding preserving the paradata with the semantic meanings. By implementing the preproduction stage namely, the casting stage, the semantic gap with the cultural movement recording with the semantic meaning can be reduced. Some empirical academic research has used methods that produce strong evidence of capturing using motion capture technology to gain semantic meaning with limited success.

This research contributes to the understanding of elements of chain of custody to trackback all the cultural movement data that have been recorded. This research has

confirmed that chain of custody by gaining recognition and acknowledgement of the paradata from the source of origin are important factors contributing to the effectiveness of semantic capture.

This study will develop understanding about preserving cultural movement in a workplace by implementing the semantic framework by preparing the study protocol to assimilate the cultural movement by case to case study basis. This research also strengthens theories related to studies of movement analysis.

Bigger organization such as UNESCO, have implemented digital preservation systems for the intangible culture and heritage. However, some might still find it difficult to achieve recording data with semantic meanings. This inability to achieve captured cultural movement with semantic meaning with chain of custody to track back to it source can be considered as a key factor contributing to shortfalls between capturing cultural movement and digital preservation. In this study it was found that by creating a study protocol implemented before proceeding to recording process, it is proven that all the necessary paradata can be 'stamped' in to the metadata for references thus making the chain of custody more effective.

This research has also found that the limitation of technology of recording making the casting stage more relevant than ever. The limitation of logistic too play a role in enforcing the casting stage more prominently. Thus, the casting stage contributes to the micro- level of choosing the right sources for the right subject.

This research added additional technology which is the punch tracker. Data from the punch tracker added more semantic value and may be more reliable to read one semantic movement. With the approval from the source of origin, the punch tracker will not also calculate the velocity and thrust of a movement but also the personality of the practitioner and identity from it are also possible. This research focuses more heavily on the entire recording cultural movement management process and all of the elements within the framework applied specifically to the semantic meaning and how this semantic paradata can be managed.

Finally, this research confirms the finalize model framework is an appropriate model in measuring semantic meaning form the recorded cultural movement. The findings reveal that reverting the chain of custody of the captured paradata to the original source and having it recognize/acknowledge have the potential to validate the capture data with credibility and have significant pull and push factors. However, this are heavily relying on case to case basis and technical arrangements are first required which is the casting stage. It is hoped that the semantic motion capture framework initiatives in preserving intangible culture and heritage will continue to be high profile effort as the culture preserving sector becomes a more challenging in the future. Therefore, more deep research in preserving cultural movement semantic meaning is essential.

Expected Outcomes

The next stage in the research process is to implement the design and development framework to guide the application of the necessary information in digital preservation work.

The outcome of the metadata should reflect the digital preservation principles that derive from the framework. With the action taken in mind, it is suggested that this

framework will be able to ascent the the integrity of the metadata files and minimize the semantic gap.

Conclusion

The relevance of using an efficient motion capture framework to capture the intangible cultural movement remains a crucial aspect of digital preservation. Considering the metadata structure that contains semantic information. It maintains the intangible cultural heritage for digital archiving for future reference. However, the pre-production stage is suggested as important before proceeding to capture the necessary cultural movement. The casting decision would reflect the whole preservation effort. From deciding the right individual for performing the movement to authenticate the captured metadata requires a thorough framework that is not just transparent but well-structured. However, the outcome of this ICH metadata still depends on to the final user experience in using the preserved data.

Bibliography

Burri, M. (2014). The UNESCO Convention on Cultural Diversity: An Appraisal Five Years after Its Entry into Force. International Journal of Cultural Property, 20(4), 357-380. doi: https://doi.org/10.1017/S0940739113000209

Kwasnicka, H., Jain, L. C., & SpringerLink (Online service). (2018). Bridging the Semantic Gap in Image and Video Analysis (pp. 1 online resource). Retrieved from http://HZ9PJ6FE4T.search.serialssolutions.com/?V=1.0&L=HZ9PJ6FE4T&S=JCs&C=TC0001986265&T=marc&tab=BOOKS Available only to UIC users

Bonn, M., Kendall, L., & McDonough, J. (2016). Preserving intangible heritage: Defining a research agenda. Proceedings of the Association for Information Science and Technology, 53(1), 1-5. doi: https://doi.org/10.1002/pra2.2016.14505301009

Delbridge, M. (2015). Motion capture in performance: an introduction: Springer.

Lenzerini, F. (2011). Intangible Cultural Heritage: The Living Culture of Peoples. European Journal of International Law, 22(1), 101-120. doi: https://doi.org/10.1093/ejil/chr006

Hein, A., Goldberg, D., & Michelfelder, D. (2010). Identification and bridging of semantic gaps in the context of multi-domain engineering. Paper presented at the Forum on Philosophy, Engineering & Technology.

Jabareen, Y. (2009). Building a conceptual framework: philosophy, definitions, and procedure. International journal of qualitative methods, 8(4), 49-62.

Sullivan, A. M. (2016). Cultural Heritage & New Media: A Future for the Past, 15 J. Marshall Rev. Intell. Prop. L. 604 (2016). The John Marshall Review of Intellectual Property Law, 15(3), 11.

Roders, A. P. (2015). Cultural heritage management: power, values and identity - Christina Luke & Morag Kersel. US cultural diplomacy and archaeology. Soft power, hard heritage. xi+169 pages, 5 tables. 2013. Abingdon: Routledge; 978-0-415-64549-2 hardback £80. - Robert J. Shepherd & Larry Yu. Heritage management, tourism, and governance in China. xii+90 pages, 21 colour illustrations, 3 tables. 2013. New York: Springer, 978-1-4614-6917-0 paperback $49.95. - Sophia Labadi. UNESCO, cultural heritage and Outstanding Universal Value. Value-based analyses of the World Heritage and Intangible Cultural Heritage Conventions. xi+191 pages, 10 b&w illustrations. 2013. Lanham (MD): Altamira; 978-0-7591-2256-7 hardback £51.95. Antiquity, 88(340), 663-666. doi: https://doi.org/10.1017/S0003598X00101310

Ireland, T., & Schofield, J. (2015). The ethics of cultural heritage The ethics of cultural heritage (pp. 1-10): Springer.

Matsuura, Koïchiro. Address by Mr Koïchiro Matsuura, Director-General of UNESCO, on the occasion of the information meeting on the Convention on the Protection of the Underwater Cultural Heritage (Paris, 2001) UNESCO, 21 November 2006, https://unesdoc.unesco.org/ark:/48223/pf0000148431_eng. Accessed 30 April 2022.

Van der Kruk, E., & Reijne, M. M. (2018). Accuracy of human motion capture systems for sport applications; state-of-the-art review. European journal of sport science, 18(6), 806-819.

Furtado, J. S., Liu, H. H., Lai, G., Lacheray, H., & Desouza-Coelho, J. (2019). Comparative analysis of optitrack motion capture systems. In Advances in Motion Sensing and Control for Robotic Applications (pp. 15-31). Springer, Cham.

Wang, Y., Xu, F., Pun, C. M., Xiao, W., Nie, J., Xiong, J., ... & Xu, F. (2020). New multi-view human motion capture framework. IET Image Processing, 14(12), 2668-2674.

Huang, B., Pan, L., Yang, Y., Ju, J., & Wang, Y. (2022). Neural MoCon: Neural Motion Control for Physically Plausible Human Motion Capture. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition* (pp. 6417-6426).

Aristidou, A., & Chrysanthou, Y. (2014). Feature extraction for human motion indexing of acted dance performances. Paper presented at the 2014 International Conference on Computer Graphics Theory and Applications (GRAPP).

Munshi, U. M., & Chaudhuri, B. B. (2011). Multimedia information extraction and digital heritage preservation Statistical science and interdisciplinary research : Platinum jubilee series v 10 (pp. 1 online resource (xiii, 396 p.)).