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THE INFLUENCE OF CULTURAL DIFFERENCES IN MOTION FOR ENHANCING NONVERBAL COMMUNICATION

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ABSTRACT
Nonverbal communication is an important and helpful way to deliver messages. Motion is one element of nonverbal communication that can enhance the clarity of messages between the sender and receiver. However, the perception of motion varies based on the diverse backgrounds of participants, with the difference in cultural background being one thing that affects interpretation. Nevertheless, there is a lack of research on how people from different backgrounds perceive motion. This study aims to verify the factors influencing the perception of vitality and understand how individuals in various locations perceive motion. The experiment employed motion graphics, utilising angle, acceleration, and fluctuation as tools to investigate their influence on the evaluation. This research implements an experiment with participants from Japan and Thailand, utilising Head-Mounted Displays (HMDs). These 10 questions are categorised as positive mood states, which correlate with the feeling of vitality. The results reveal differences in the evaluation of motion perception between Thai and Japanese participants. Specifically, Thai participants significantly rated attributes such as lively, vigorous, cheerful, active, alert, energetic, helpful, and efficient higher compared to Japanese participants ($p < .01$). Understanding cultural influences on perception leads to enhancing nonverbal communication and guiding diverse product development for varied target audiences. In terms of education, the use of learning materials designed to evoke positive emotions enhances comprehension. Researching methods to elicit positive emotions is essential for the future.

Keywords: Cultural differences, motion, emotional evaluation

1 INTRODUCTION
Nonverbal communication has evolved significantly since its inception with static images in prehistoric times, such as the cave paintings found in the Altamira cave in Spain or the Lascaux cave in France. These images were used to depict personal experiences and tell stories [1]. This evolution can be observed in various forms, such as sculptures like Michelangelo's Pieta, which tell stories about the Christian religion. The progression has continued into modern times with the development of animated graphics and motion. Animation, defined as giving life to the inanimate, creates a sense of movement and vitality [2]. This ongoing evolution aims to enhance the receiver's perception of messages and sensations through visual media [3]. In today's world, the transition from print to digital media has reshaped the way we communicate and access information, with screens now serving as the primary medium. This evolution highlights the significance of motion graphics, which utilise elements like colours, symbols, and physical movements to convey messages [4]. Motion, a component of nonverbal communication, involves the change in an object's position, leading to various perceptions [5]. Understanding how motion conveys messages is crucial, significantly enhancing communication between senders and receivers [6]. Furthermore, studies indicate that motion can deeply affect our emotions and cognitive processes. For instance, rapid, flipping text can convey playfulness and urgency, while a slow, gentle appearance of text against a black background can create a sense of peace and mystery [7]. Moreover, motion elicits emotional reactions in viewers [8], influencing cortical arousal and attention [9]. Although studies have investigated motion's emotional effects, much remains unknown about its impact on particular emotional responses, like vitality. Understanding this sensation is vital for enhancing medium realism and narrative clarity.

In addition to examining how motion affects emotions, it's imperative to consider participants' backgrounds to gain a deeper understanding of how motion graphics influence evaluation. Cho [10] explored the impact of design experience on interpreting motion attributes like moving speed, aggressiveness, and pleasure. When studying participants' backgrounds, one crucial factor to consider is cultural differences. Culture profoundly shapes individuals' behaviours, thoughts, and emotions, encompassing linguistic, symbolic, and aesthetic aspects such as languages, symbols, colours, and images. Moreover, cultural disparities extend to distinct ways of thinking, emotions, personalities, and perceptions [11]. Colours hold different symbolic meanings in various cultures. For example, in Asia, orange represents positivity, whereas in Western cultures like the United States, orange is associated with road warning signs and hazards [12]. Cultural distinctions in nonverbal communication are globally apparent. For example, in America and Europe, greetings often involve handshakes and smiles, while in East Asia, bowing with hands at the sides is customary [13]. This research emphasises the importance of understanding participants' cultural differences, particularly in assessing motion factors, to enhance nonverbal communication. It aims to develop emotionally impactful content suited to diverse audience groups in the future. The Bauhaus, a pioneering institution in art and design education, has had its principles integrated into art colleges and design schools [14]. Bauhaus methodology utilises three core design elements - line, dot, and graphic elements - arranged in different ways to create new compositions [15 and 16]. These compositions aim to evoke diverse emotional effects like noise and quietness through form and composition [17]. In this study, the Profile of Mood State was utilised as a tool for assessing emotional states [18]. The insights gained from this study can lead to various applications, such as in the education field. Using materials that evoke positive emotions enhances comprehension, as several studies have demonstrated the expedited learning associated with positive academic emotions such as enjoyment and pride [19, 20, 21, and 22]. The objective of this research is to clarify how individuals evaluate stimuli related to their perception of vitality and how cultural backgrounds affect this evaluation through motion graphics. The result leads to the development of emotionally impactful content that is suitable for diverse audiences from different cultural backgrounds.

2 METHOD

2.1 Participants and motion stimuli

This study involved two groups of participants: 39 Japanese and 20 Thai. There were nine motion stimuli, each characterised by three different motion variables with three levels each: displacement (linear), sine curve, and fluctuation, with corresponding angle levels of 60°, 90°, and 120°, acceleration levels of without acceleration (WA), slow to fast (STF), and fast to slow (FTS), and fluctuation levels of without fluctuation (WF), low fluctuation (LF), and high fluctuation (HF). These three factors were developed according to a previous experiment to verify the factors that can evoke a sense of vitality [23]. The stimuli were the display of an animated white sphere for around 15 seconds. Participants evaluated the questionnaire by using the Head-Mounted Display (HMD) to view the animation. Following each stimulus, they removed the HMD and provided their evaluation. Using the HMD ensured consistent setup, minimising distractions, and enabling natural interactions in an immersive virtual environment because of its high resolution of 1832x1920 pixels per eye.

2.2 Questionnaire Design

In this study, the affective words from the Profile of Mood States 2nd edition (POMS 2) were used as evaluation phrases. POMS 2 is employed as a psychological assessment tool to measure an individual's mood state [24]. It comprises 65 phrases representing various moods, such as Tension-Anxiety (TA), Depression-Dejection (DD), Anger-Hostility (AH), Vigor-Activity (VA), Figure-Inertia (FI), Confusion-Bewilderment (CB), and Friendliness (FR) [25].To select the best phrases that express the sense of vitality, 65 phrases from POMS were evaluated by 63 university students (37 males and 26 females, mean age: 19.2, SD: 1.18) using a 5-point Likert scale (ranging from 1 = "Not at all" to 5 = "Extremely").

The evaluation results were derived using cluster analysis methodology. Among the 65 evaluation phrases, they were categorised into two groups: Group A, mainly comprising phrases associated with positive mood states, encompassed phrases from the Vigor-Activity (VA) and Friendliness (FR) sub-scales. Group B, primarily composed of phrases linked to negative mood states, consisted of phrases from the Depression-Dejection (DD), Confusion-Bewilderment (CB), Tension-Anxiety (TA), Anger-Hostility (AH), and Figure-Inertia (FI) sub-scales. Notably, the mean evaluation score in Group A

surpassed that of Group B (Group A = 2.18, and Group B = 1.53). Based on these findings, ten evaluation phrases were chosen, predominantly originating from the Vigor-Activity sub-scale. These included lively, vigorous, cheerful, energetic, useful, uneasy, active, alert, full of life, and efficient. These ten phrases were then assessed using a 5-point Likert scale, ranging from 0 = "Not at all" to 4 = "Extremely."

3 RESULTS

The two-way ANOVA was performed to evaluate how the factors (angle, acceleration, and fluctuation) influenced the perception of vitality among two distinct participant groups (Japanese and Thai participants). The results indicated that the ratings of the three factors by Thai participants were significantly higher than those by Japanese participants in the evaluation of lively ($p < .01$), vigorous ($p < .01$), cheerful ($p < .01$), active ($p < .01$), alert ($p < .01$), energetic ($p < .01$), helpful ($p < .01$) and efficient ($p < .01$).

In the evaluation of angle (Figure 1, i), For Japanese participants, 60° had a significantly higher rating than 120° in the evaluation of lively ($p < .01$), vigorous ($p < .05$), cheerful ($p < .05$), uneasy ($p < .05$), energetic ($p < .05$) and full of life ($p < .01$). Furthermore, 60° had a significantly higher rating than 90° in the evaluation of lively ($p < .05$). In the evaluation of acceleration (Figure 1, ii), For Japanese participants, FTS received significantly higher ratings than STF in the evaluation of lively ($p < .01$), vigorous ($p < .05$), cheerful ($p < .05$), active ($p < .05$), energetic ($p < .05$), full of life ($p < .05$). Moreover, FTS received significantly higher ratings than WA in the evaluation of uneasy ($p < .05$) and full of life ($p < .01$). In the evaluation of fluctuation (Figure 1, iii), Japanese participants significantly rated WF higher than HF in the evaluation of helpful ($p < .05$) and efficient ($p < .05$).

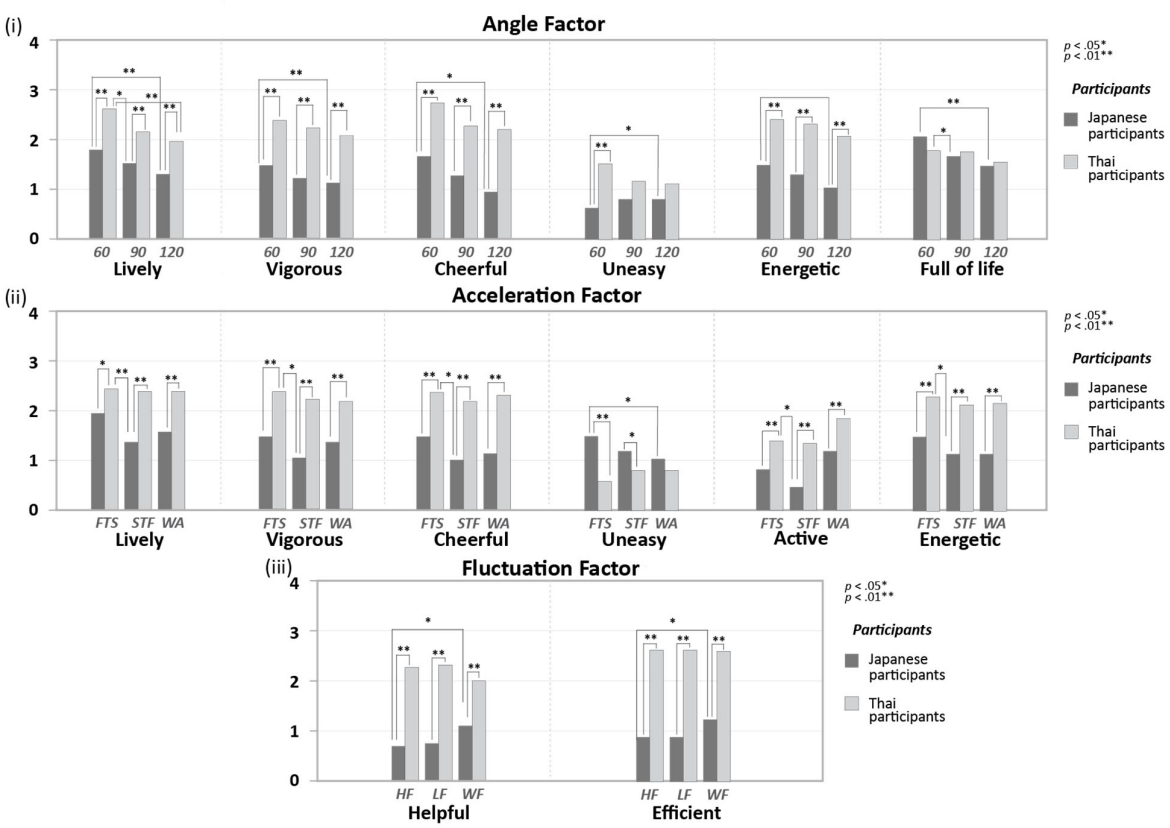

*Figure 1. Results of evaluation. A significant difference was found as *p < .05 and **p < .01*

4 DISSCUSSION AND CONCLUDING REMARKS

The research aims to clarify how participants evaluate stimuli related to their perception of vitality and how participants' cultural backgrounds affect the evaluation through motion graphics.

The findings revealed disparities in the evaluation of motion perception between Thai and Japanese participants, indicating that individuals from diverse cultural backgrounds will demonstrate varying perceptions and evaluations of motion graphics. Thai participants significantly rated the three factors (angle, acceleration, fluctuation) and the three levels higher compared to Japanese participants ($p < .01$) in attributes such as lively, vigorous, cheerful, active, alert, energetic, helpful, and efficient. These findings indicate that cultural factors may impact the evaluation process. Individuals from different cultural backgrounds exhibit varied responses to colour perception and optical illusions, demonstrating the influence of culture on various psychological processes, including fundamental perception [26]. Each culture transmits, shares, and shapes various aspects such as behaviours, languages, values, music, art, and shared beliefs, thereby distinguishing one culture from another. As a result, individuals from different cultures interpret visual images differently, influenced by their unique experiences and learned behaviours [27]. For example, a study contrasting Japanese and American viewers' responses to an underwater video show differing visual interpretation. Americans focus on size, colour, and movement details, while the Japanese emphasise broader context and object relationships [28]. Differences in evaluation between Japanese and Thai participants may be influenced by the physical environment, which shapes their experiences. In Japan, where media and technology are ubiquitous in daily life, individuals are likely more accustomed to encountering dynamic and visually engaging content, potentially shaping their perception and evaluation of motion graphics. In contrast, in Thailand, where the media landscape may be less pervasive, individuals may have different perceptions of motion graphics.

The results indicated the influence of three simulation factors (angle, acceleration, and fluctuation) on the perception of vitality. At the Angle factor: According to Japanese participants, 60° received higher evaluation than 120° in the evaluation of lively ($p < .01$), vigorous ($p < .05$), cheerful ($p < .05$), uneasy ($p < .05$), energetic ($p < .05$), and full of life ($p < .01$). Furthermore, 60° had a higher evaluation than 90° in the evaluation of full of life ($p < .05$). For Thai participants, 60° is better in providing the sense of lively compared to 90° ($p < .05$) and 120° ($p < .01$). The assessment revealed that Japanese participants attributed importance to angles of a narrow degree, with 60° receiving higher ratings compared to other angles (90° and 120°), thus providing a stronger sense of vitality. For Thai participants exhibited a preference for 60° over 90° and 120° in their evaluations of lively. This underscores the importance of the narrow-degree angle of 60° in the evaluation of motion perception, especially in eliciting feelings of liveliness among both participant groups. Stimuli moving at 60° may mimic the natural movements and rhythms found in living organisms, while those at 120° might appear less rhythmic and less associated with vitality. Motion characterised by more pronounced rhythms may evoke sensations of frequency similar to biological vibrations seen in physiological processes like breathing and heartbeats [29].

At the Acceleration factor: Differences among acceleration factors were observed in the evaluation by Japanese participants, while no significant differences were reported among Thai participants. For Japanese participants, FTS compared to STF. FTS received higher evaluations than STF in the evaluation of lively ($p < .01$), vigorous ($p < .05$), cheerful ($p < .05$), active ($p < .05$), energetic ($p < .05$), and full of life ($p < .05$). It appears that the changing of acceleration factors influences the evaluation of motion graphic stimuli by Japanese participants. Furthermore, cultural differences may play a role in shaping participants' perceptions of the Acceleration factor. For example, Ichio's study [30] investigated the differing perceptions of speed and duration between Thai and Japanese children. It discovered that Thai children, influenced by language differences, prioritise temporal order less than Japanese children. Additionally, language differences affect colour perception, such as the absence of separate words for red and orange in languages like Shona in Zimbabwe [12].

At the fluctuation factor: There were significant differences were reported in the evaluation by Japanese participants. They perceived WF as providing a higher sense of helpfulness and efficiency compared to HF ($p < .05$). Previous research on the interaction effect between angle and fluctuation suggested that participants can feel a sense of vitality even without a fluctuation factor [3]. However, no significant differences were reported among Thai participants.

This study explores how cultural differences influence participants' evaluations of motion factors and their impact on vitality perception. It examines how variations in motion attributes affect assessments, highlighting both similarities and differences across backgrounds. These insights improve our understanding of specific motion factors shaping vitality perception. The findings can enhance nonverbal communication, guiding tailored content creation for diverse populations and specific

emotional effects. For instance, in education, adapting materials and strategies to diverse student needs can enhance communication and learning outcomes. Utilising VR aligns with constructivist principles, promoting active engagement and deeper understanding. It enriches edutainment experiences by emotionally engaging learners through motion graphics.

5 LIMITATION AND FUTURE STUDY

1) In future studies, we intend to utilise the Two-Dimensional Mood Scale (TDMS) to assess Thai and Japanese participants both before and after the evaluation. TDMS was employed to measure mood states in the moment [31]. By employing the TDMS, researchers can effectively measure the emotional experiences of participants before and after exposure to the stimuli, facilitating an accurate comparison of emotional responses among Thai and Japanese participants. 2) To gain a deeper understanding of how participants' backgrounds affect the evaluation, future studies aim to include participants from diverse cultural backgrounds. Additionally, the study intends to explore individual factors such as age ranges, gender differences, and varying levels of design experience. 3) For a more comprehensive understanding of participants' evaluations, future studies could investigate physiological responses alongside evaluation, potentially enriching our insight into participants mechanisms. The documented linkage between emotion evaluation and physiological responses [8] emphasises the importance of further exploration of this connection. 4) For study on how cultural differences impact evaluation, an experiment involving scientific content will be conducted using virtual reality. This will enable students to explore and learn in an interactive environment. The study will compare the learning outcomes of Thai and Japanese students to assess the effectiveness of this technology across different cultural contexts.

REFERENCES

[1] Carroll F. (2009). The Spatial Development of the Visual-Narrative from Prehistoric Cave Paintings to Computer Games. In P. Turner, S. Turner, & E. Davenport (Eds.), *Exploration of Space, Technology, and Spatiality: Interdisciplinary Perspectives* (pp. 141-154). Hershey, PA: Information Science Reference.

[2] Crafton D. (2011). The Veiled Genealogies of Animation and Cinema. *Animation, 6*(2), 93-110. https://doi.org/10.1177/1746847711404979

[3] Ongon W. and Cho Y. (2023). A Study on the Sense of Being Alive Expressed in Motion. In *Proceedings of the 10th Congress of the International Association of Societies of Design Research (IASDR 2023)*, Milan, 9th to 13th October. Retrieved from https://doi.org/10.21606/iasdr.2023.463.

[4] Ezaka S. and Emechebe N. C. (2018). Nonverbal and Subliminal Communications in Media Convergence: A Perspective. *IOSR Journal of Humanities and Social Science (IOSR-JHSS), 23*(7), 09-16. doi:10.9790/0837-2307010916

[5] Dewi A. K. and Dwinaya L. (2023). Exploring Motion Concepts to Images as Multimodal Factors in Nonverbal Language. *iRecall Journal: An Indonesian Journal for Language Learning and Teaching, 1*(2), July–December.

[6] Heller S. (2005). *The Education of a Graphic Designer* (2nd ed.). Allworth Press.

[7] Krasner J. (2008). *Motion Graphic Design: Applied History and Aesthetics*. Burlington, MA: Focal Press.

[8] Detenber B. H., Simons R. A. and Bennett G. F. (1998). *Roll 'em!: The effects of picture motion on emotional responses. Journal of Broadcasting & Electronic Media, 42*(1), 113–127. doi: 10.1080/08838159809364437.

[9] Reeves B. E., Thorson E., Rothschild M., McDonald D., Hirsch J. and Goldstein R. (1985). Attention to television: Intrastimulus effects of movement and scene changes on alpha variation over time. *International Journal of Neuroscience, 25*, 241-255.

[10] [In Japanese] Cho Y. (2011). *Characteristics of Kansei Evaluation of the Elements and Experience of Motion Graphics in Visual Communication*. Doctoral dissertation. University of Tsukuba, Japan.

[11] Komin S. (1991). *Psychology of the Thai People: Values and Behavioral Patterns*. Magenta, Bangkok, Thailand.

[12] De Bortoli M. and Maroto J. (2001). Translating colours in website localisation. In *Proceedings of the European Languages and the Implementation of Communication and Information Technologies (ELICIT) conference* (pp. 1-10). University of Paisley. ISBN: 0-9541774-0-1.

[13] Matsumoto D. an Hwang H. C. (2016). *The cultural bases of nonverbal communication.* In American Psychological Association eBooks (pp. 77–101). https://doi.org/10.1037/14669-004.
[14] Johnson R. (2020). *Incorporating Bauhaus Principles in Design Education. Design Education Review, 27*(3), 251-265.
[15] Williams S. (2017). Deconstruction and Reconstruction in Bauhaus Methodology. *Design Theory, 42*(3), 315-330.
[16] Davis P. (2019). The Evolution of Composition Theory in Graphic Design. *Graphic Design Quarterly, 25*(2), 123-138.
[17] Bhammar A. (2021, February 8). *51262 Project 2: Form & Composition. Communication Design Fundamentals - Spring 2021.* Retrieved from https://medium.com/communication-design-fundamentals-spring-2021/51262-project-2-form-composition-c8bf1d242773
[18] [In German] Biehl B. and Landauer A. (1975). *The Profile of Mood States (POMS)*. Mannheim.
[19] Um E. R., Plass J. L., Hayward E. O. and Homer B. D. (2012). Emotional design in multimedia learning. *Journal of Educational Psychology, 104*, 485-498. https://doi.org/10.1037/a0026609.
[20] Mayer R. E. and Estrella G. (2014). Benefits of emotional design in multimedia instruction. *Learning and Instruction, 33*, 12-18. https://doi.org/10.1016/j.learninstruc.2014.02.004.
[21] Plass J. L., Heidig S., Hayward E. O., Homer B. D. and Um E. (2014). Emotional design in multimedia learning: Effects of shape and colour on affect and learning. *Learning and Instruction*, 29, 128-140. https://doi.org/10.1016/j.learninstruc.2013.02.006.
[22] Tan J., Mao J., Jiang Y. and Gao M. (2021). The influence of academic emotions on learning effects: A systematic review. *International Journal of Environmental Research and Public Health, 18*(18), 9678. https://doi.org/10.3390/ijerph18189678
[23] Ongon W., Koichi N. and Youngil C. (2022). A study on the evaluation of a sense of being alive by motion graphic. *In the International Conference of Kansei Engineering and Emotion Research*, Barcelona, Spain. 5th to 8th September, 2022.
[24] Bourgeois A., LeUnes A. and Meyers M. (2010). Full-scale and short-form of the Profile of Mood States: A factor analytic comparison. *Journal of Sport Behaviour, 33*(4), 355–376.
[25] Lin S., Hsiao Y. Y. and Wang M. (2014). Test review: The Profile of Mood States 2nd Edition. *Journal of Psychoeducational Assessment, 32*(3), 273-277. DOI number: 10.1177/0734282913505995.
[26] Segall M., Campbell D. and Herskovitz M. (1966). *The Influence of Culture on Visual Perception*. Indianapolis: Bobbs-Merrill.
[27] Segall M. H., Dasen P. R., Berry J. W. and Poortinga Y. H. (1999). *Human Behaviour in Global Perspective: An Introduction to Cross-Cultural Psychology* (2nd ed.). Simon & Schuster, MA.
[28] Masuda T. and Nisbett R. E. (2001). Attending holistically versus analytically: Comparing the context sensitivity of Japanese and Americans. *Journal of Personality and Social Psychology, 81*(5), 922–934. https://doi.org/10.1037/0022-3514.81.5.922
[29] Muehsam D. and Ventura C. (2014). Life Rhythm as a Symphony of Oscillatory Patterns: Electromagnetic Energy and Sound Vibration Modulates Gene Expression for Biological Signalling and Healing. *Global Advances in Health and Medicine, 3*(2), 40-55. doi: 10.7453/gahmj.2014.008.
[30] Ichio. (1976). *Japanese Psychological Research 1976, 18*(3), 105-112.
[31] Sakairi Y., Nakatsuka K. and Shimizu T. (2013). Development of the Two-Dimensional Mood Scale for self-monitoring and self-regulation of momentary mood states. *Japanese Psychological Research, 55*(4). DOI: 10.1111/jpr.12021.