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The Effect of Spatio-Temporal Resolution
and Camera Work on the Dance
Appreciation Experience

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時空間解像度とカメラワークがダンスの鑑賞体験に及ぼす影響

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In this paper, the effects of resolution and camera work on the appreciation experience of dance were verified. Specifically, I defined "embodiment in dance" as "what is expressed by the fact that the dancing (external order) appears to move from an internal order such as emotion", and examined whether or not this could be communicated through video by improving resolution and devising camera work. In the method focusing on resolution, the dance works were first shot with an 8K camera. Next, the experiment was conducted to appreciate the dance videos by changing the resolution of the shot videos to 2K, 4K, and 8K. This experiment revealed that material things, such as costumes and the body itself, were well visible. In the method focusing on camera work, the experiment was conducted using a smartphone and a drone. In this experiment, the results showed that dance videos with ingenious camera work were more engaging, novel, and interesting outside of the box. In addition, it was clarified what the dancers were trying to shoot in their dance works and how they were trying to shoot it. Further studies are needed to clarify whether or not "embodiment in dance" can be communicated through videos. However, I found that camera work has the potential to communicate the "embodiment in dance" more than live in this experiment. Moreover, it was found that what is important when appreciating dance is not only "embodiment in dance" but also "whether or not the audience can have a live appreciation experience".

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Chapter 1

Introduction

Dance, called "*buyo*" in Japanese, is a form of human expression. The origin of the word "dance" is the ancient Greek word "*Chara*": joy, or the Greek word "*tenein*": muscle tension, stretching, supporting, sustaining, and the original Sanskrit word "*tanha*": desire for life. These words mean the state of the human body at the time the dance occurs or the state of the human body at that time. Dance is a culture that has existed as a proof of what human beings have sought and how they have lived, and how they are trying to live, while changing according to the times, regions, and lifestyles[1]. In addition, dance is regarded as a "dynamic spatio-temporal art using the body as a medium" among the arts, and dance, theater and music are classified as "*jouen geijutsu*" in Japan because of their commonality in the art of performing with the body. In the past, dance, theater, music, and sports were all fused and coexisted in a playful celebration, and in Japan there is a concept of "*geinou*" that encompasses all of these, but in English the word "performing arts" is applied to both "*geinou*" and "*jouen geijutsu*". In this paper, "dance" means "dance as a performing art" (Figure 1.1).

Since dance is an art form that uses the body as a medium, it is considered better to appreciate it live. The theme, movement, and impression of the work can be clearly communicated by the live appreciation of the work. On the other hand, the recording of dance videos has flourished with the development of video media. Since the 1960s, it has become not only a tool for recording and preserving, but also a "new art form" called "video dance" that pursues effects of dance that cannot be achieved on stage by adding video technology, and has established an area different from dance and video[2]. Therefore, it can be seen that the opportunity to appreciate dance through video is increasing. However, the "embodiment" that can be felt in a live performance is lost when appreciating through video. The paper by Harada et al. (2007) clearly indicated that appreciating in live clearly communicated the themes, movements, and impressions of the work more clearly than appreciating in video[3]. That is, "how to communicate abstract thoughts expressed by the body through video" is currently a difficult question.

1.1 Embodiment

Dance is an art form that depends on the existence of the human body, and cannot be discussed without the body. The fundamental difference between dance and other arts is exactly on this point. Dance is a world of non-verbal communication in which the body

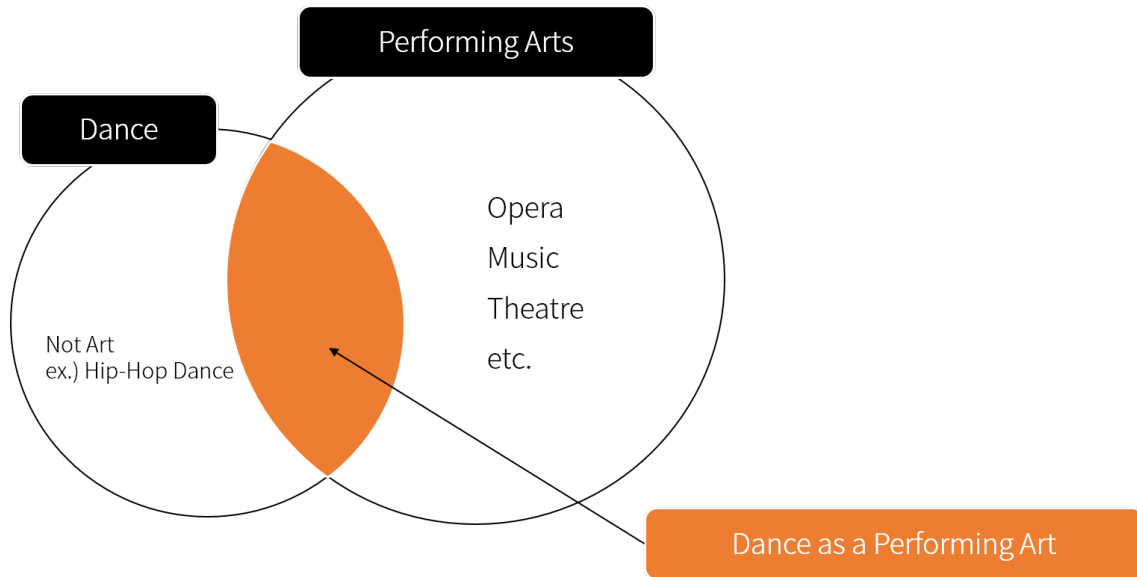


Figure 1.1: Position of dance as a performing art.

speaks, and the basic condition is that there is a "body" there that can be freely sensed[1]. The existence of the human "body" is attracting attention not only from fields such as physical education, dance, and medicine, where the body is the direct object, but also from various other fields, such as philosophy and cultural anthropology. In addition, the body is attracting interest not simply because of the need for health and energy, but also as a great "mystery" that can be used to understand human beings. Of course, the body here does not mean the material body separated from the mind or spirit, but the body as a human existence, that is, the body unified mind and body. Such a property of the body is called "embodiment", called "*shintaisei*" in Japanese. Although there is a similar word "physicality", the definition of this word is "related to someone's body rather than their mind or emotions", so "embodiment" was adopted in this paper.

1.1.1 Investigation of "Embodiment in Dance" through Performance

Since the definition of "embodiment" differs from field to field, I investigated the definition of "embodiment in dance" through my own dancing as a dancer as well as through literature review. The figure 1.2 is a work entitled "*Kentoshi: Seeking Knowledge with the Body*", which was created in cooperation with the University of Tsukuba Dance Club[4]. This work received the Minister of Education Award, the top prize, at the All Japan Dance Festival competition. Besides, this work was performed again in three independent performances by the University of Tsukuba Dance Club, and I participated in the performances myself. Figure 1.3 shows my work "Buried in Ashes"[5]. This work was performed in "Theater 21 Fest. vol.119" at a theater called Kagurazaka Session House. In addition, I performed in "Sarcophagus", the work of Prof. Motoko Hirayama, a professional choreographer and associate professor at the University of Tsukuba (Figure 1.4)[6]. Unlike the aforementioned two works, most of the performers in this work were professional dancers selected by audition, so I was able to investigate the embodiment in dance in a very high-level environment. By investigating the embodiment in dance in the performances described above, it became clear

that dance requires physical strength, or superior technique, to withstand appreciation. I also felt that the most important thing was to express myself with the body and to communicate that to the audience, which might lead to the embodiment in dance. The pleasure when what I was expressing is communicated to the audience is unfathomable.



Figure 1.2: The dance work "*Kentoshi: Seeking Knowledge with the Body*" 『遣唐使一身を以て知を求め—』 (photo by PhotoStudio Yagi).



Figure 1.3: The dance work "*Buried in Ashes*" 『灰に沈む』 .



Figure 1.4: The dance work "Sarcophagus" (photo by Hiroyasu Daido).

1.1.2 Investigation of "Embodiment in Dance" by Literature Review

In addition to the investigation in Section 1.1.1, I reviewed various literature. Amagasaki (2004) describes various aspects of the body in art (Figure 1.5)[7].

First, the issue of the body in art is the layer of expression, and there are two: the expressing body and the expressed body. The expressed body is the impression of the body presented through the body as a medium, and the expressing body is the dancer's own body used as a medium of expression in performing art. This expressing body is often not the object of attention in dance, and a second layer becomes apparent as the expressing body becomes opaque. The second layer is the "plain (unadorned) body" and the "performing body". The plain (unadorned) body is the body of daily life, and the performing body is the body that moves to realize a pre-ordained physical scheme, such as in ballet. The distinction between dance and theater is that the audience's attention is directed to the expressed body in theater, whereas it is directed to the performing body in dance. When the audience's attention is directed to this performing body, the "ordered body" and the "unordered body" become apparent, and this is the third layer.

In these various aspects of the body in art, the "body in dance" appears through two processes: disordering and reordering (Figure 1.6).

Disordering means to focus attention on the plain (unadorned) body and detach from it, so that the performing body should be the focus of attention rather than the expressed body. Reordering is the ordering of two external aspects, temporal and spatial segmentation. Temporal segmentation is to follow the temporal order of music, and spatial segmentation is to follow a sophisticated "form (called *kata* in Japanese)": like the system of classical

dance (ballet, Japanese dance). In other words, the body in dance appears when it looks like it is born from a single inner order of "self-unfolding of the living body: the plain (unadorned) body".

In addition, Dance Education Study Group (1991) noted that "The mysterious charm of dancing is not in the conceptual awareness of what is being expressed, but rather in the body that feels something and concentrates on it and the expression feeling appears from within the body in the dance movements' change of pace"[1].

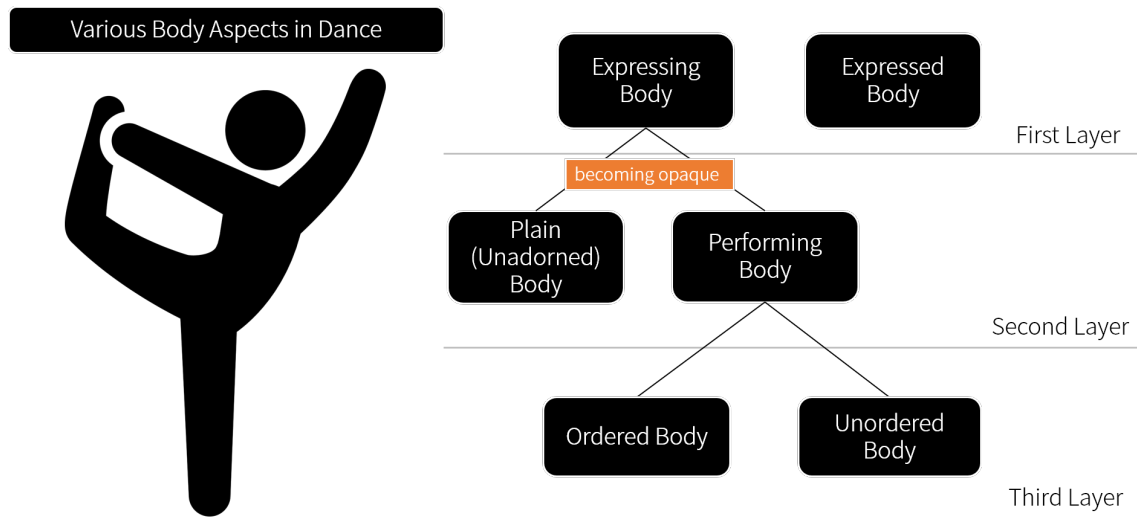


Figure 1.5: Overview of various body aspects in dance.

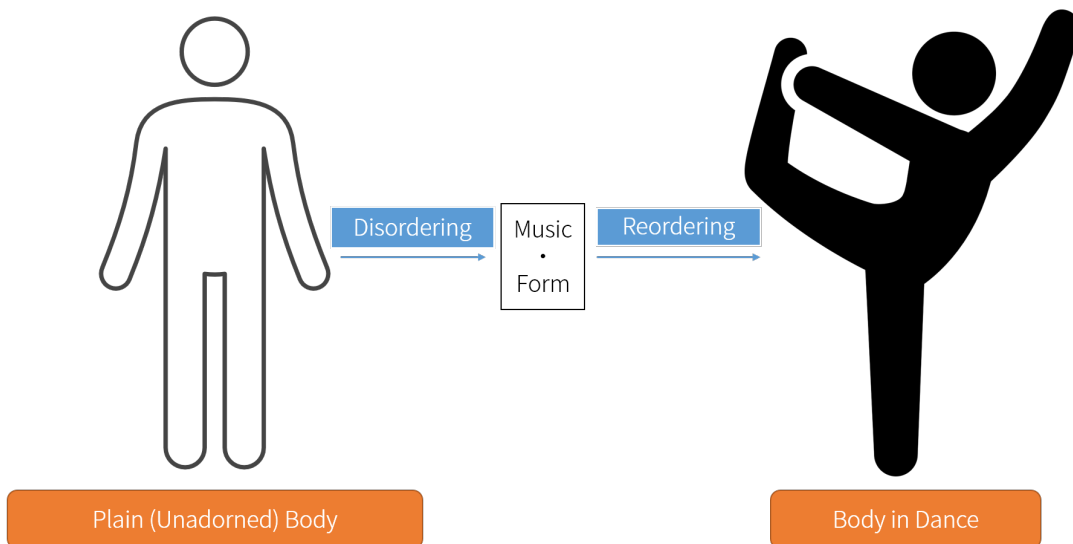


Figure 1.6: Overview of the body in dance.

1.1.3 Embodiment in Dance

From the investigations in Section 1.1.1 and Section 1.1.2, this paper defines embodiment in dance as follows. Embodiment in the art of dance is expressed by the fact that the dancing (external order) appears to move from an internal order such as emotion. The dancer's body is connected to a certain mental activity, and undergoes changes that are different from those of the body of daily life. The dancer expresses to the audience through the visible movement by externalizing the emotions and sentiments that arise inside the dancer directly through the body, and the audience captures the dancer's inner world by receiving the movement visually[1]. The world in the dance is unfolding here that is different from the everyday world.

1.2 "New Digital Nature" in Dance

Digital Nature is a new nature environment that is reconstructed by the affinity between computers and non-computer resources, and a new nature deconstructed and connected with people, objects, nature, computers, and data[8]. Moreover, the recent development of digitization and the Internet has made it possible to integrate various media fields. The recording of dance videos has become popular in the dance field with the development of video technology since the 1960s, and a new form of expression has emerged called "video dance" which combines the techniques of video and dance, but is different from video and dance[2]. There are not only videos, but also an increasing number of other works that fuse various technologies with dance. For example, a dance work using projection mapping, a work dancing in the dark with LED lights all over the dancer's body[9], and a work dancing with a machine that moves autonomously[10]. In these works, it can be said that they are not relying only on the body, but are attempting to further expand the expression of the body by using technology. However, is it possible to appreciate the expression of the human body through video as the expression of the body? Are these technology-based works "the expression of the body"?

First, I would like to consider whether we can accept the expression of the body through videos. Harada et al. (2007) have verified the difference of dance appreciation between live and video[3]. This paper has reported that live appreciation more clearly communicates the theme, movement, and impression of the work. This shows that the "video" itself is an obstacle to the dance appreciation and prevents the expression of the body from being communicated. If the audience appreciates the dance in a live performance, the dancer's movements are clearly visible because they are communicated directly from the dancer's body to the audience body. However, if the audience appreciates the dance in video, the dancer's movements are communicated from the dancer's body to the video and from the video to the audience body, so the video becomes an unnecessary filter. This is because, as a problem of the video medium itself, "how to explain a concrete scene in video with words, and how to communicate an abstract thought with words in video" remains a difficult problem. In the same way, "how to communicate an abstract thought expressed with the body in video" is also a difficult problem. In the first place, shooting a dance work on film is "reproduction" of the work, and the "aura" of the work is lost. "Aura" is a concept proposed by Walter Benjamin, which is a "certain atmosphere" in conventional works of art and a

mental phenomenon that disappears with the mechanical reproduction[11]. Furthermore, the mechanical reproduction wavers the authenticity of the work of art, that is, the authority of the thing and the significance of the thing being handed down. Benjamin noted that "a work of art exists only once, in the place where it exists, but this characteristic of being here and now is lacking in a reproduction"[11]. The loss of these two characteristics through mechanical reproduction makes it difficult to communicate abstract thoughts expressed by the body in videos.

In addition, the body itself does not become an object of appreciation in works that integrate technology and dance, but rather a part of the object of appreciation. For example, the human body is almost never visible in the dance with LED lights that I mentioned above[9]. Moreover, the body and the machine are present at the same time in the work that dances with machines, and the focus is not on the body itself[10]. As a result, the communication of the expression of the body from the dancer to the audience is obstructed. This phenomenon is often referred to as the "materialization of the body". Amagasaki (2004) pointed out that dance has lagged behind while various genres of art and music have been created using editing[7]. This is because the medium of dance is the primitive and inflexible body, or all choreographers come from a dancer background, and the internal sensation of the dancing body and the pleasure of being gazed at by the audience are unforgettable so it is impossible to objectify the body as a mere material. Therefore, treating the body as a material in the dance can no longer be called art. The reason why dance is an art form is that "embodiment in dance" is essential.

That being the case, there is a new Digital Nature in dance at the midpoint between "embodiment in dance" and "materialization". In this paper, the purpose is to communicate the embodiment in dance through video media (Figure 1.7).

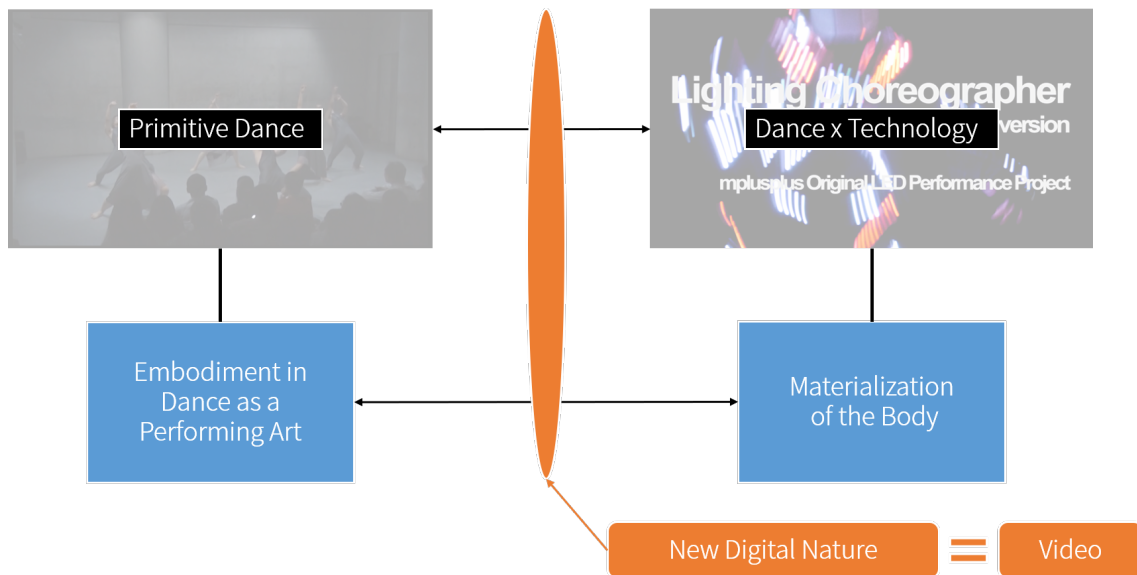


Figure 1.7: Overview of new Digital Nature in dance.

1.3 Effects of COVID-19

Another reason for focusing on video is the effects of COVID-19. The spread of COVID-19 led to the closure of theaters and the cancellation of all dance performances. For this reason, various dance companies uploaded archived videos of their past works to the Internet. New National Theater, Tokyo has released a series of operas and ballets under the title "NNTT at home"[12]. Other performances are increasingly held online and video works are being created. At a theater called Kagurazaka Session House, a session online theater was held[13]. This performance can be watched for free, but there is also a "ticket by giving money" available for those who want to support it and pay for it. Thus, the demand for appreciation of dance through videos is increasing in the age of coexisting with COVID-19, and the redefinition of the relationship between video and human beings is essential.

1.4 Contribution of This Paper

The main contributions of this paper are the following:

- The effect on the appreciation experience of dance was verified by focusing on the resolution and camera work.
- In particular, I defined "embodiment in dance" as "what is expressed by the fact that the dancing (external order) appears to move from an internal order such as emotion" and verified whether this could be communicated better by improving the resolution or devising camera work.

Chapter 2

Related Work

In this paper, I verified whether it is possible to communicate "embodiment in dance" through video media by focusing on two methods. One is to improve the spatio-temporal resolution, and the other is to devise the camera work. In this chapter, related work is reviewed (i) research on the appreciation experience in dance, (ii) changes in dance appreciation with the advent of video technology, and (iii) research related to the development of video technology.

2.1 Dance Appreciation Experience

Studies of the dance appreciation experience have been conducted by various methods. In particular, many studies have been conducted to understand what perspectives are used to appreciate dance. Harada (2004) studied how the audience watched five different dances by analyzing their written impressions of the dances[14]. This study has indicated that most of the participants in the experiment use only "what they can see" as their appreciation perspective. In addition, Harada et al. (2006) have reported what viewers pay attention to and how they perceive dance works by measuring their gaze using an eye camera[15]. From this study, there was a lot of attention to the upper body such as the face and torso for dynamic movements, and to the end parts of the body such as the hands and toes for static movements. Moreover, Uchiyama et al. (2013) created an appreciation measure for the audience, categorized the audience, read the experience characteristics of each group of audiences, and clarified the defining factors of perspectives[16]. The above studies have indicated how to appreciate and approach dance works, that is, how to appreciate not only external movements but also "embodiment in dance". Besides, Ito et al. (2015) have identified what the audience of dance performances enjoys[17]. However, the experimental methods used in the above studies are only for "live" appreciation.

2.2 Changes in Dance Appreciation with the Advent of Video Technology

Live performances have been the standard way to appreciate the stage. On the other hand, the recording and archiving of dance videos has become popular with the development of video technology. Since the 1960s, it has become not only a tool for recording and archiving, but also a "new art form" called "video dance" that pursues effects of dance that cannot

be achieved on stage by adding video technology, establishing a different realm from dance and video[2]. Matsuoka (2012) analyzed the video dance work "Roseland" (1990) by Wim Vandekeybus (1962-) using three analytical perspectives from "Theory of the Film" by Bela Balazs. The three analytical perspectives are (a) the aspect of the body in the frame and the imagination of the body outside the frame, (b) the identification obtained by sharing the dance space, and (c) the choreography reconstructed by video editing.

Thus, the possibility of watching dance on video has led to studies that compare the live appreciation with the video appreciation and clarify how audiences perceive the characteristics and impressions of each work. Harada et al. (2007) verified how audiences appreciate and approach works by watching live and video performances of solo works created by the student and the professional dancer respectively[3]. For both works, it was clear that the theme, movement, and impression of the work were more clearly communicated on live than video. In addition, the study noted that differences in expressive techniques between professionals and students were distinguishable in live appreciation, but were less distinguishable in video appreciation. Therefore, how to communicate abstract thoughts expressed by the body, that is, "embodiment in dance", through video is currently a difficult issue.

2.3 Development of Video Technology

2.3.1 Improving Resolution

It has been considered difficult to communicate something through videos, but in recent years, a possible solution can be found with the further development of video technology. One is the improvement in resolution. While 4K is now the mainstream, further improvement in resolution is expected with 8K and 16K. A study has emerged that examines the effects of resolution differences on physiological and psychological assessment. Sakamoto et al. (2015) experimented with watching different resolutions of 2K and 4K video using a 4K-compatible 65-inch LCD TV and an A3-sized tablet[18]. When watching a 65-inch TV 4K video, there are significant differences and significant trends between the 2K video and the 4K video in many psychological indices including "realism" in the content of natural scenery, and significant differences and significant trends in psychological indices in the content of material and material feeling in the A3 size 4K tablet. However, there have been no experiments with dance video content.

2.3.2 Camera Work Analysis

Furthermore, studies on camera work analysis for video appreciation are in progress. LAUFER (2020) investigated how pre-programming the camera work of a performance using a tool called CuePilot can affect the appreciation experience in a live music broadcast[19]. This study has indicated that pre-programmed camera work, to some extent, provides a more unified experience compared to manual camera work. Although this study deals with live music which is a type of performing arts like dance, there is no analysis of camera work in the dance.

2.3.3 Changes in Videography Technique by Drone

Small flying robot technology, called drones, is attracting attention from society not only in academic fields but also in industrial applications, hobbies, and many other fields. In particular, multicopters, which are flight types with multiple propellers, are the mainstream. In Japan, the term "drone" is often used to refer to multicopters, but the term originally referred to all unmanned aircraft, including a variety of flight types, from small to large aircraft[20]. Drones are robots used in a wide range of fields from military to agriculture, but the drones treated in this paper refer to drones equipped with cameras for shooting.

The increasing popularity of drones is changing videography techniques. In the past, large equipment such as cranes were used to take video from places that were beyond the reach of human hands, and the human and equipment costs were enormous. However, the cost of a drone is only about 100,000 yen, licenses are not required to operate it, and its small size makes it possible to take video from any perspective, making it easy for individuals to prepare and take video. Taking advantage of the above characteristics of drones, Yoshizawa et al. (2018) have clarified the characteristics of videos taken from drones[21].

However, it is difficult for beginners to operate drones, so there are qualifications for drone operation. Therefore, to enable anyone to take videos with drones, studies have been conducted on automatic flight videography[22, 23, 24, 25]. These studies are based on video theory for filming movies, but there is no video theory for dance video, so there is no system for filming dance.

2.4 Position of This Paper

In Figure 2.1, the studies I have reviewed above are summarized. Conventional studies of the appreciation experience of dance have been conducted through experiments of live appreciation. Since video has appeared, studies of video appreciation have been conducted, but they are limited in number, and no study has been conducted focusing on the development of video technology. In addition, as far as I know, there is no study that focuses on "embodiment in dance," and it is not clarified whether it can be communicated through video. Therefore, this paper verified whether the "embodiment in dance" can be communicated through video by focusing on the improvement of resolution and camera work.

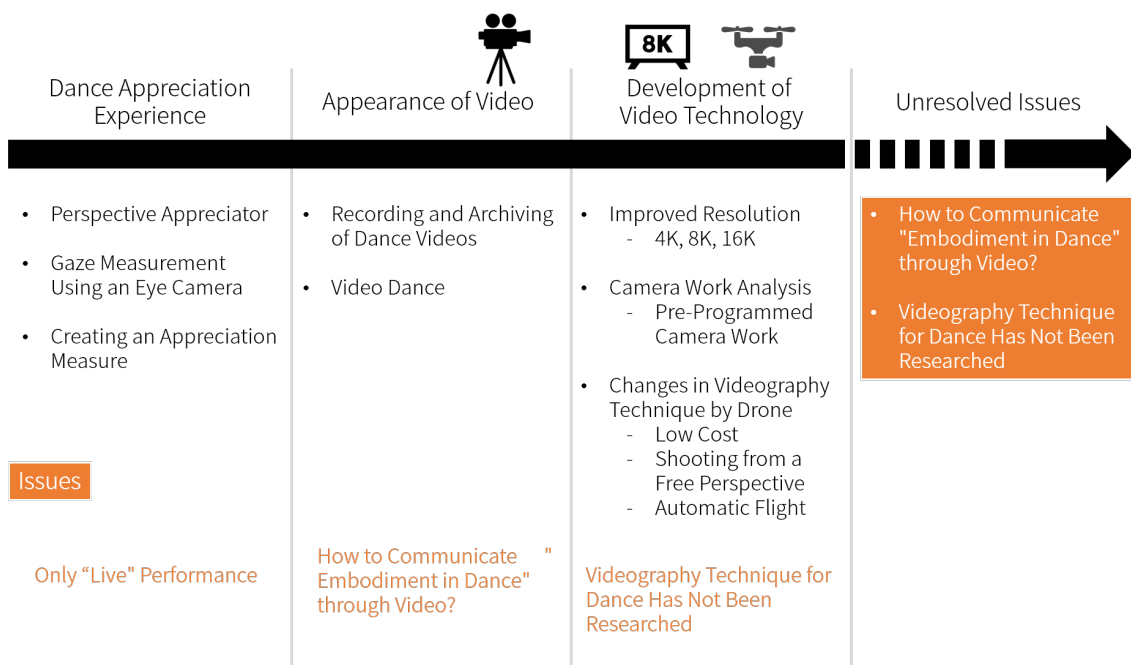


Figure 2.1: Overview of the studies reviewed and issues.

Chapter 3

Method

In this chapter, the experiments focusing on spatio-temporal resolution and camera work to verify whether it is possible to communicate "embodiment in dance" through video are introduced.

3.1 High Resolution

In order to verify whether or not "embodiment in dance" can be communicated through videos by appreciating them in high resolution, the experiment of watching videos in different resolutions will be conducted. First, the two dance works used in the appreciation experiment were filmed using an 8K camera.

3.1.1 Shooting Two Dance Works with 8K Camera

For this shoot, I asked ASTRODESIGN, Inc., 8K video production company, to borrow their 8K camera to shoot two solo dance works: titled "Flash" and "When You Can Be Kind to Others". Each work is about three and a half minutes long. The reason for conducting this experiment with solo works is that the focus is more on the dancer's body in a solo work. Whereas, elements such as composition come into the dance work in a group dance work. In this paper, only solo works were used in order to verify whether embodiment is communicated or not. In addition, because different works may affect the results of the evaluation experiment, two works were shot, one by a male solo and one by a female solo. Both of these works have won awards in competitions and have received a certain level of recognition.

The figure 3.1 and 3.2 show the shooting environment, and the details are as follows.

- Place: University of Tsukuba Central Gymnasium Dance Hall
- Date and time: Thursday, November 19, 19:00 - 21:00
- Stage size: front 8m30cm, back 16m, depth 7m90cm
- Distance from the stage to the camera: 8m60cm
- Lighting: all lights in the dance floor, 4 stage side spotlights, 2 LED lights
- Backdrop: big black curtain

- Floor: black linoleum

The trapezoidal shape of the stage size is due to the fact that the camera has an angle of view that is wider in the back than in the front. In addition, the lighting, backdrop, and flooring were made to resemble an actual theater stage.

The specifications of the 8K camera used for the shooting are as follows.

- Camera: AB-4815
- FPS: 119.88
- Gamma / Color: SDR200 BT.709
- Shutter speed: 1/160s
- Gain: +12dB
- Focus position: 10m
- Focal length: 30mm
- Focal Number: 5.6
- Lens: ZK4.7x19

Shooting was carried out in such an environment. In addition, although the videos shot at 120 fps were used for this paper's experiments, the videos were also shot at 60 fps for comparison.



Figure 3.1: A scene from the shooting of the dance work "Flash".

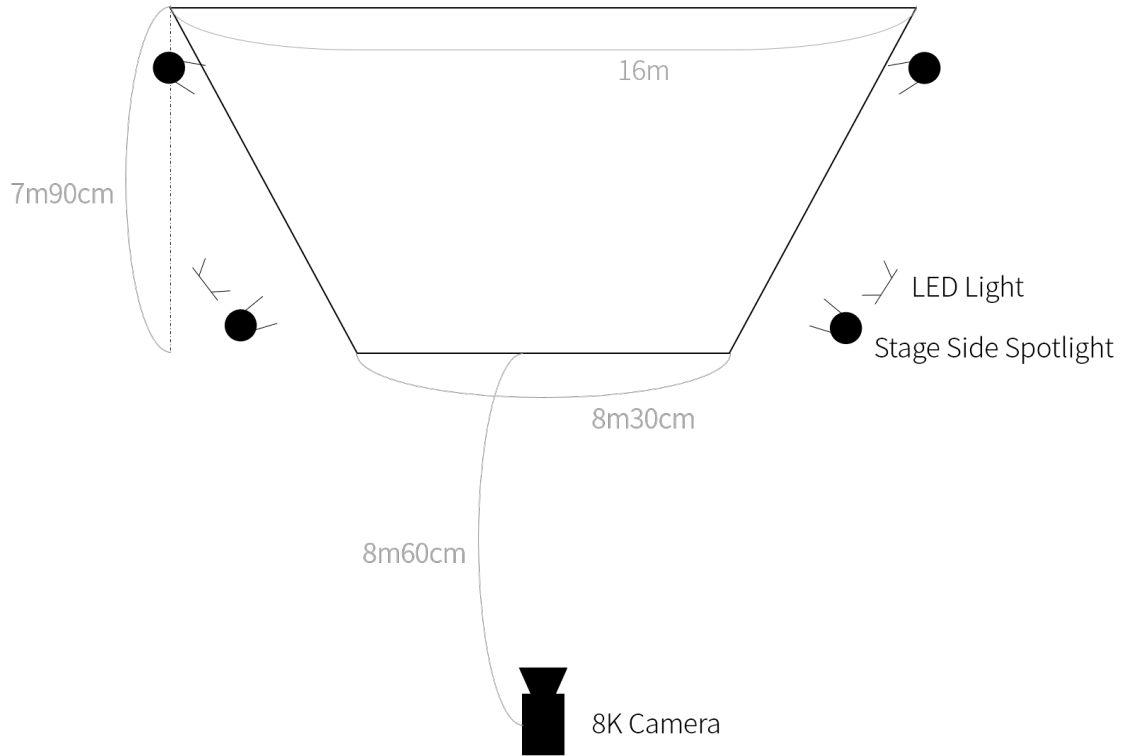


Figure 3.2: The size of the stage and the location of the camera and lighting.

3.1.2 Experiment on Appreciation of Dance works with Different Resolutions

Using the dance video taken in Section 3.1.1, appreciation experiments were conducted to verify whether "embodiment in dance" could be communicated from the high-resolution video.

The experimental task was to watch the videos and answer a questionnaire using Google Form. The videos shot by an 8K camera were down-converted videos from 8K to 2K and 4K in order to compare the different resolutions of the videos.

The content of the questionnaire is as follows:

- First, before starting the appreciation experiment, there are eight questions about the experiment participants themselves, such as "age" and "gender" (Question Group A) (Table 3.1).
- Next, there are two sections (a total of 38 questions) to be answered after watching the video. One is question group B, which focuses on the resolution of the video, and includes questions such as "Did you feel that the resolution was better?" and "Did you feel a sense of realism from the video?" (Table 3.2).
- The other is question group C, which focuses on the dance work, and includes questions such as "Did you feel drawn in?" and "Did you feel any meaning or message from the dancer's movements?" (Table 3.3). Question groups B and C are to be answered on a five-level Likert scale, with the higher the number, the more positive the rating. These questions were selected based on previous studies[3, 18].

- Finally, at the end of the appreciation experiment, there are two questions in free writing format (Question Group D): "Please describe freely what you felt and thought after watching the video" and "Please describe freely your thoughts on the effect of resolution differences on dance" (Table 3.4).

If the higher resolution communicates more "embodiment in dance", significant differences are expected to be found in items such as "Did you feel any meaning or message from the dancer's movements?" and "Did you feel the dancer's inner world (emotions, etc.) through the dancer's movements?".

The participants of this experiment were 11 people (6 males and 5 females) who were still dancing contemporary dance. One of them is a member of the laboratory of this study. The age of the participants ranged from 19 to 29 years (mean 22.73 ± 2.936). Additionally, the participants' dance experience ranged from 4 to 21 years (mean 11.45 ± 5.628) and contemporary dance experience ranged from 1.5 to 22 years (mean 7.591 ± 7.2554).

Figure 3.3 and 3.4 shows the experimental environment, and the details are as follows:

- Place: Theater room on the 2nd floor of ASTRODESIGN, Inc.
- Date and time: Wednesday, December 9, 18:00 - 20:00
- 8K projector model number: INSIGHT LASER 8K Imaging by ASTRO
- Screen size: 170 inches

Moreover, I asked the participants to wear masks and disinfect their hands before entering the experimental area as a countermeasure against infection by COVID-19.

The procedure of this experiment is as follows:

1. I first explained the contents and procedures of this experiment to the participants and asked them to sign the consent form.
2. The consented experimental participants were asked to answer question group A.
3. The participants were divided into two groups of six and five. Since the capacity of the experimental site was about 10 people, it was necessary to take countermeasures against infection by COVID-19 by avoiding "Three Cs".
4. After informing the experimental participants of the title of the work, they watched a three-and-a-half-minute video of the dance work.
5. After the appreciation of the video, participants were asked to answer a total of 38 questions in two sections, groups B and C, on a five-level Likert scale (1 to 5, with higher scores indicating a more positive evaluation). At this time, I asked them if they had any questions that they did not understand.
6. Procedures 4 and 5 were conducted for each resolution (2K, 4K, and 8K) for each work. Note that I did not inform the participants about the resolution of the video being watched in the experiment, as it may greatly affect the results of the evaluation experiment.
7. At the end, participants were asked to write two free questions (Question Group D).

This is the end of the experiment. The experiment took a total of two hours. The above experimental procedure was determined by referring to previous studies[3, 18].

Furthermore, as a statistical analysis, Friedman’s test was used to test whether there was a significant difference in each evaluation item by resolution (2K, 4K, 8K) for each dance work. The significance level was set at $p = 0.05$, but $p < 0.10$ was also taken as a significant trend. For items where significant differences were found, Wilcoxon’s signed-rank test was conducted to see where the significant differences were each and every level. The obtained experimental data were processed using "IBM SPSS Statistics 27.0 for Windows".

Table 3.1: Question Group A.

Number	Question
1	What is your gender?
2	How old are you?
3	How long have you been dancing?
4	How long have you been contemporary dancing?
5	What is your favorite dance genre? (multiple answers possible)
6	What do you think of "embodiment in dance"?
7	How often do you watch dance performances?
8	What do you keep in mind when you dance?

Table 3.2: Question Group B.

Number	Question
1	Did you feel that the resolution was better?
2	Did you feel that the video was detailed?
3	Did you feel the video in detail?
4	Did you feel the video was natural?
5	Did you feel the real thing?
6	Did you feel the video was clear?
7	Did you feel the video had a sense of reality?
8	Did you feel that the video was three-dimensional?
9	Did you feel the texture from the video?
10	Did you feel a sense of realism from the video?
11	Did you feel the video was cool and refreshing?
12	Did you feel uncomfortable with the video?
13	Did you feel that the video was impressive?
14	Did you feel good about the video?
15	Did you feel pleasure from the video?
16	Did you enjoy the video?
17	Did you feel nervous while watching the video?
18	Did you like the video?
19	Did you feel sleepy while watching the video?
20	Did you feel eye fatigue while watching the video?

Table 3.3: Question Group C.

Number	Question
1	Did you feel drawn in?
2	Did you feel that the work had a consistent theme?
3	Did you feel any meaning or message from the dancer's movements?
4	Did you feel something that stirred your imagination?
5	Did you feel that the dancer's movements were refined?
6	Did you feel the novelty of the work?
7	Did you feel the presence or atmosphere of the dancer?
8	Did you feel that the flow of the dancers' movements was beautifully connected?
9	Did you feel that the work was coherent?
10	Did you feel something that was good that left a lasting impression?
11	Did you feel that the work was highly degree of completeness?
12	Did you feel that the work was interesting outside of the box?
13	Did you feel that the dancer's skill was high?
14	Did you find the costumes to be effective?
15	Did you feel that the music was appropriate for the work?
16	Did you feel the depth of the theme?
17	Did you feel the dancer's inner world (emotions, etc.) through the dancer's movements?
18	Did you feel the "embodiment in dance" that you think?

Table 3.4: Question Group D.

Number	Question
1	Please describe freely what you felt and thought after watching the video.
2	Please describe freely your thoughts on the effect of resolution differences on dance.



Figure 3.3: A scene from the video appreciation experiment of the dance work "When You Can Be Kind to Others".

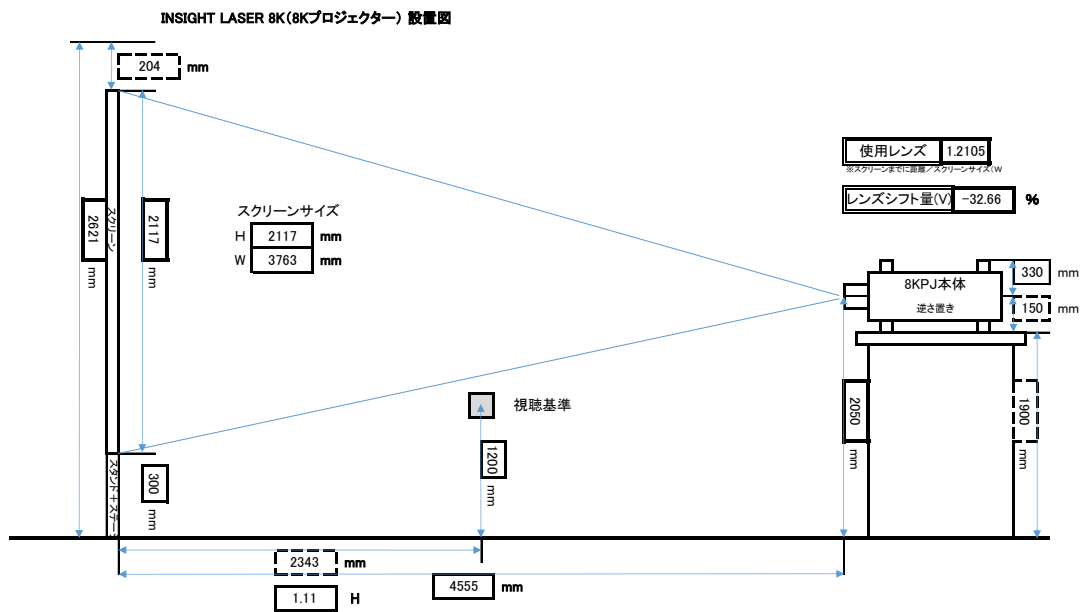


Figure 3.4: Installation diagram of the 8K projector and screen.

3.2 Experiment of Shooting Dance Works Using a Smartphone and a Drone

As another method, I verified whether or not "embodiment in dance" could be conveyed through videos shot from a free perspective using a drone.

The experimental task to be performed is to pair up for this experiment and shoot a one-minute dance for each other using a smartphone and a drone. The participants were asked to take three types of videos: a fixed-point and a non-fixed point video with a smartphone, and a video with a drone. After each of the three sessions, I asked the participants to fill out a questionnaire using Google Forms. Moreover, for this experiment, the participants were asked to prepare their own choreography for the one-minute dance. In addition, they did not wear costumes for the dance work, but experimented with the clothes they usually wear in lessons.

The content of the questionnaire is as follows:

- First, as in the appreciation experiment (Section 3.1.2), there are eight questions about the experiment participants themselves, such as "age" and "gender" (Question Group A) (Table 3.5).
- There are 15 items to be answered after the watching of the video taken, referring to previous studies[3] (Question Group Y). Question groups Y are to be answered on a five-level Likert scale, with the higher the number, the more positive the rating. Questions about costumes and music were also included in the previous studies, but since no costumes were worn in this experiment and the drone did not pick up sound, questions about those two were excluded. In addition, for the non-fixed-point shooting that requires camera work, two free-text questions were prepared: "What were you trying to shoot?" and "How did you try to shoot what you answered above?". Table 3.6 shows the above groups of questions.
- Finally, I asked the participants to answer on a five-level Likert scale whether they felt the "embodiment in dance" that they thought, and I prepared a question in free writing format (Question Group Z) on how they thought the difference in camera work affected the dance (Table 3.7).

If "embodiment in dance" is communicated better in the video with creative camera work, significant differences are expected to be found in items such as "Did you feel any meaning or message from the dancer's movements?" and "Did you feel the dancer's inner world (emotions, etc.) through the dancer's movements?".

Six participants (three males and three females) in this experiment were collected from those who were still dancing contemporary dance. One of them is a member of the laboratory of this study. The age of the participants ranged from 19 to 25 years (mean 21.50 ± 2.074). Additionally, the participants' dance experience ranged from 4 to 20 years (mean 11.50 ± 6.348) and contemporary dance experience ranged from 1.5 to 20 years (mean 6.750 ± 6.6314).

The experiment was conducted in the entire dance hall 1 of the University of Tsukuba's Central Gymnasium, on Wednesday, December 16, 2010, between 10:00 and 17:00. In addition, the devices used for shooting are as follows:

- Smartphone: google pixel 3
 - Resolution and frame rate: 4K30FPS
 - Focal Number: 1.8
 - Number of pixels: 12.2 million pixels
- Drone: DJI mavic 2 zoom
 - Resolution and frame rate: 4K30FPS
 - ISO: 800
 - Shutter speed: 1/160s
 - M.M: -2.3

The procedure of this experiment is as follows:

1. First, I explained the contents and procedures of the experiment to the participants and asked them to sign a consent form.
2. Next, the consented experimental participants were asked to answer the questions in question group X.
3. Each pair was asked to shoot each other's dances, taking turns shooting. Shooting was done in the following order: fixed-point shooting using a smartphone, non-fixed-point shooting using a smartphone, and shooting using a drone.
4. After each shooting, the participants were asked to watch the video and answer a questionnaire (Question Group Y).
5. After all the shooting was finished, the participants were asked if they felt the "embodiment in dance" from the video taken by each of them, and to answer the free description items (Question Group Z).

The time required for each experiment was 90 minutes.

Then, as a statistical analysis, Friedman's test was used to test whether there was a difference in each evaluation item between the captured videos (fixed point with a smartphone, non-fixed point with a smartphone, and drone). The significance level was set at $p = 0.05$, but $p < 0.10$ was also taken as a significant trend. For items where significant differences were found, Wilcoxon's signed-rank test was conducted to see where the significant differences were each and every level. The obtained experimental data were processed using "IBM SPSS Statistics 27.0 for Windows".

Table 3.5: Question Group X.

Number	Question
1	What is your gender?
2	How old are you?
3	How long have you been dancing?
4	How long have you been contemporary dancing?
5	What is your favorite dance genre? (multiple answers possible)
6	What do you think of "embodiment in dance"?
7	How often do you watch dance performances?
8	What do you keep in mind when you dance?

Table 3.6: Question Group Y.

Number	Question
1	Did you feel drawn in?
2	Did you feel that the work had a consistent theme?
3	Did you feel any meaning or message from the dancer's movements?
4	Did you feel something that stirred your imagination?
5	Did you feel that the dancer's movements were refined?
6	Did you feel the novelty of the work?
7	Did you feel the presence or atmosphere of the dancer?
8	Did you feel that the flow of the dancers' movements was beautifully connected?
9	Did you feel that the work was coherent?
10	Did you feel something that was good that left a lasting impression?
11	Did you feel that the work was highly degree of completeness?
12	Did you feel that the work was interesting outside of the box?
13	Did you feel that the dancer's skill was high?
14	Did you feel the depth of the theme?
15	Did you feel the dancer's inner world (emotions, etc.) through the dancer's movements?
16	What were you trying to shoot?
17	How did you try to shoot what you answered above?

Table 3.7: Question Group Z.

Number	Question
1	Did you feel "embodiment in dance" that you think when you watched the video shot by smartphone?
2	Did you feel "embodiment in dance" that you think when you watched the video shot by drone?
3	Please describe freely your thoughts on the effect of the different camera work on dance.



Figure 3.5: A scene from shooting of the dance work.

Chapter 4

Result

In this chapter, the results of the analysis of the data obtained based on the experimental method introduced in Chapter 3 are presented.

4.1 Results of the Dance Appreciation Experiments with Different Resolutions

In this section, the results obtained from the experiments described in Section 3.1.2 are presented. Table 4.1 and 4.2 shows the details of the results of the analysis of each dance work between the resolutions of question group B, which is to be answered by focusing on the resolution of the video, and question group C, which is to be answered by focusing on the dance. In addition, the comments of the free description are shown in Table 4.3 and 4.4. Each item shown in each column of Table 4.1 and 4.2 indicate whether the comparison resolution is significant or not. If there is a significant difference, $p < 0.05$ is assigned. If there is no significant difference, "NS (Not Significant)" is assigned. In this paper, the significance level was set at $p = 0.05$, but $p < 0.10$ was also taken as a significant trend.

In the work "Flash", the evaluation score of 8K was significantly larger than that of 4K in question B-6 "Sharpness" ($p < 0.05$) (Figure 4.1). In question C-14, "Costumes are effective," the evaluation scores for 8K and 4K were significantly greater than those for 2K ($p < 0.05$) (Figure 4.2). In addition, there was a significant trend ($p < 0.10$) in the evaluation scores between resolutions for the items "Was it good?", "Degree of pleasure", and "Degree of tension" in questions B-10, 14, 15, and 17 (Figure 4.3, 4.4, 4.5 and 4.6). No significant differences were found in the other question items.

In the work "When You Can Be Kind to Others," there were no significant differences in most of the items. The only difference was that in question C-5, "The movement was sophisticated," there was a significant trend in the evaluation score of 8K compared to that of 4K (Figure 4.7).

Table 4.1: Results of the dance work A titled "Flash" 『閃光』 (NS: No Significant).

Question Group B		Question Group C	
1	NS	1	NS
2	NS	2	NS
3	NS	3	NS
4	NS	4	NS
5	NS	5	NS
6	$p < 0.05$ (8K > 4K)	6	NS
7	NS	7	NS
8	NS	8	NS
9	NS	9	NS
10	$p < 0.10$ (8K > 2K)	10	NS
11	NS	11	NS
12	NS	12	NS
13	NS	13	NS
14	$p < 0.10$ (8K > 4K)	14	$p < 0.05$ (4K > 2K), (8K > 2K)
15	$p < 0.10$ (4K > 2K), (8K > 2K)	15	NS
16	NS	16	NS
17	$p < 0.10$ (8K > 2K)	17	NS
18	NS	18	NS
19	NS		
20	NS		

Table 4.2: Results of the dance work B titled "When You Can Be Kind to Others" 『ひとに優しくなれるとき』 (NS: No Significant).

Question Group B		Question Group C	
1	NS	1	NS
2	NS	2	NS
3	NS	3	NS
4	NS	4	NS
5	NS	5	$p < 0.10$ (8K > 4K)
6	NS	6	NS
7	NS	7	NS
8	NS	8	NS
9	NS	9	NS
10	NS	10	NS
11	NS	11	NS
12	NS	12	NS
13	NS	13	NS
14	NS	14	NS
15	NS	15	NS
16	NS	16	NS
17	NS	17	NS
18	NS	18	NS
19	NS		
20	NS		

Table 4.3: Comments of Question Group D-1: Please describe freely what you felt and thought after watching the video.

ID	Answer
101	No answer
102	The video was much clearer and more beautiful than what I usually see. Until now, I had thought that the filming of a stage production would, in a sense, degrade the work, but it was more realistic than I had imagined, and I felt that it had potential.
103	I didn't get the sense that I was seeing anything too new in terms of resolution. But I did feel like I was watching something that I wouldn't normally see, because it was on a scale and in a size that I wouldn't normally see. From the perspective of frame rate rather than resolution, the scale of the video also made me feel the physicality of the movement.
104	I didn't feel much of a "live" feeling coming from any of the videos, and I felt that there was no difference. I felt that the subtlety was expressed in the videos, but I wondered if the power was not expressed in the videos.
105	I was reminded that videos are just videos. This does not mean that the videos are bad, but that they are completely different. The video I watched this time had a strong aspect of recording video, and I thought that it could not be called a work of art. I believe that videos have the advantage of being able to shoot and direct in a way that cannot be done live. I felt that simply improving the resolution of the recorded videos would only help in remembering choreography, and that we had already reached the ceiling a few years ago. If I write too much, it will sound like criticism, so I won't... After all, I think that dance should be something that lives only in live performances as a person who still dances. I felt that this might be one of the lines that separates entertainment from art.
106	Overall, the men's work had a more realistic feel than the woman's work. I wondered if the color of the costume or the color of the skin affected the sense of vividness. I got the impression that the men's work showed more of the texture of the body, while the women's work showed more of the facial expressions.
107	The first time I watched it was the most unthinking; after the second time, my mind started to wander. After watching it, I was reminded of an old movie.
108	When the lights were on, it looked very clear and I could tell a little difference, but when they were dancing in the back of the stage, I couldn't tell much difference.
109	I felt like I could see the costumes well when they were dancing and judged the details there. I felt that the clarity of the video varied depending on the distance between the dancers and the camera.
110	It was very interesting to see the different physicality in the two works, and how each used their own body to the fullest.
111	The appreciation of dance is often described in terms of two frameworks: the subjective experience of experiencing it live, and the objective experience of ruminating on it later, relying on memory. In the case of dance appreciation through video works, there is less of a sense of having the first subjective "live experience", and there is a sense that a reflective consciousness is already at work in the stage of watching the video. In other words, it can be said that the subjective experience of the first stage and the objective experience of the second stage are softened. How to catch the dynamism of dance in such a dance appreciation experience without much "living experience" in the first stage is a challenge. In addition, I felt that the bias of the audience is more likely to enter into the dance appreciation that is not reflective.

Table 4.4: Comments of Question Group D-2: Please describe freely your thoughts on the effect of resolution differences on dance.

ID	Answer
101	I felt that the impression was different between the one where I could see the moving tracks and the one where I couldn't.
102	I felt a strong sense of physicality and realism in the video that I perceived as having high resolution.
103	In terms of resolution, I thought it was possible to more clearly capture the facial expressions and the texture of the skin and costume rather than the movement, and to get a better sense of the body as a material.
104	I felt that it does not create a big impact on the stopped pose, and the impact appears in the blurring of the limbs (afterimage) when moving. Personally, I think the difference in resolution affects the dance because I think the blurring of the limbs (afterimage) greatly changes the impression of the movement. However, whether it is good or bad depends on the skill of the dancer and the direction of the work. Sometimes I think it's beautiful to see the trajectory of the movement, and other times I think there are both patterns where something that the dancer doesn't want to show is visible, and the evaluation suffers.
105	As I mentioned a little above, I don't think there is much difference in the format of this recorded video. To be honest, I didn't notice much of a difference. I think there might be a difference if the camera was to get deeper into the dancers. However, the human eye has its limitations, so even if the performance of the machine gets better...
106	To be honest, I didn't notice any difference in resolution. The ones that gave me a good sense of the muscles and unevenness of the skin looked better.
107	I didn't think that the change in resolution would have a noticeable effect on the dance in this case. However, I think the resolution may change what we think at the first viewing.
108	I thought that the brilliance of "the moment" rather than "always", such as a sudden turn of the head or a moment of jumping, would change whether or not it was easy to see depending on the difference in resolution.
109	I felt the beauty and texture of the videos. However, I felt that the power of the videos did not change much. When I could feel the lines of the muscles and the depth of the body, I felt the realism and thought that it was a human body.
110	I didn't really understand the thematic impact of the different resolutions, but I felt that the different ways of seeing the muscles and the textures of the costumes increased the number of elements to look at and drew me in differently.
111	No Answer

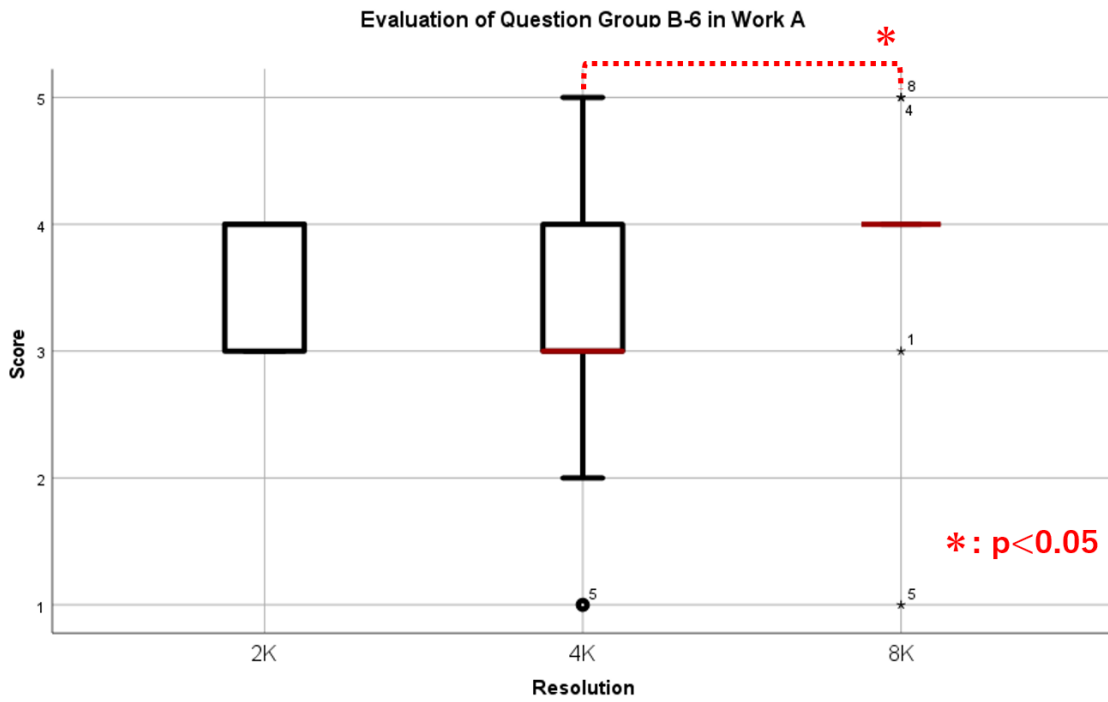


Figure 4.1: Score of question group B-6 in work A, where the x-axis represents the video's resolution, and the y-axis represents the score of answer.

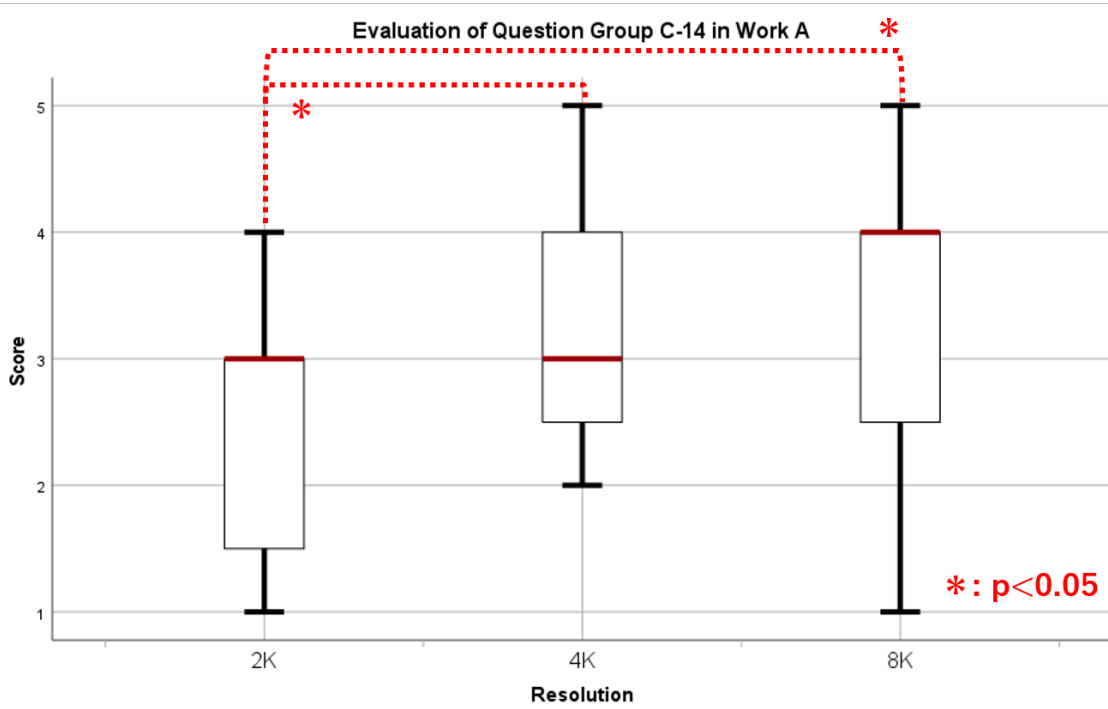


Figure 4.2: Score of question group C-14 in work A, where the x-axis represents the video's resolution, and the y-axis represents the score of answer.

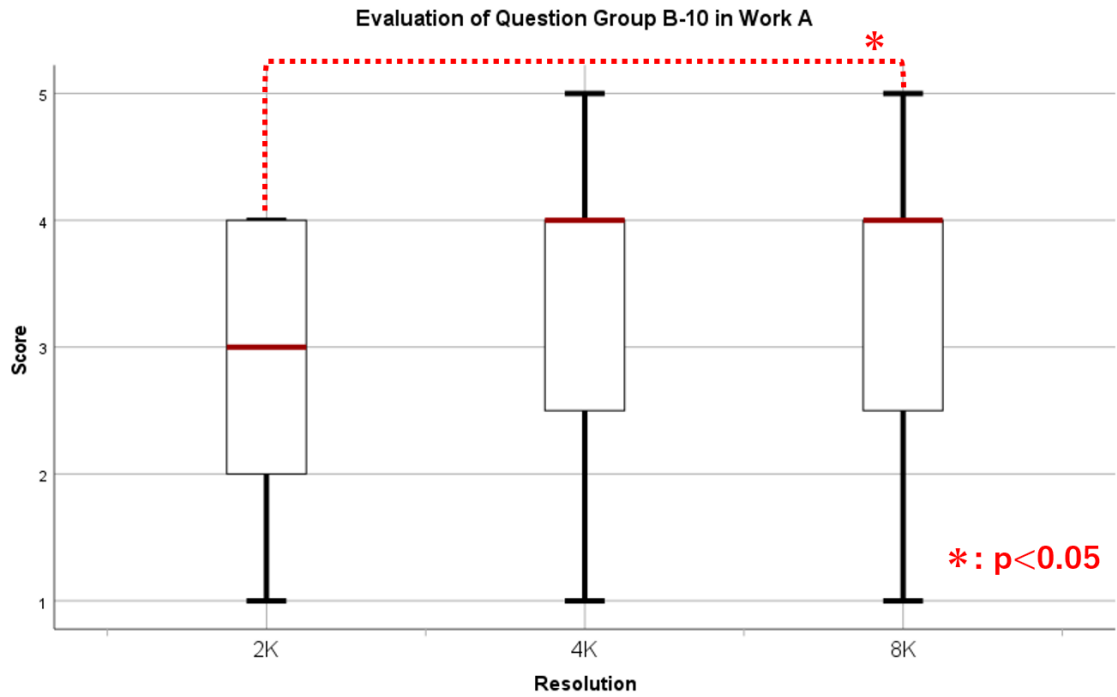


Figure 4.3: Score of question group B-10 in work A, where the x-axis represents the video's resolution, and the y-axis represents the score of answer.

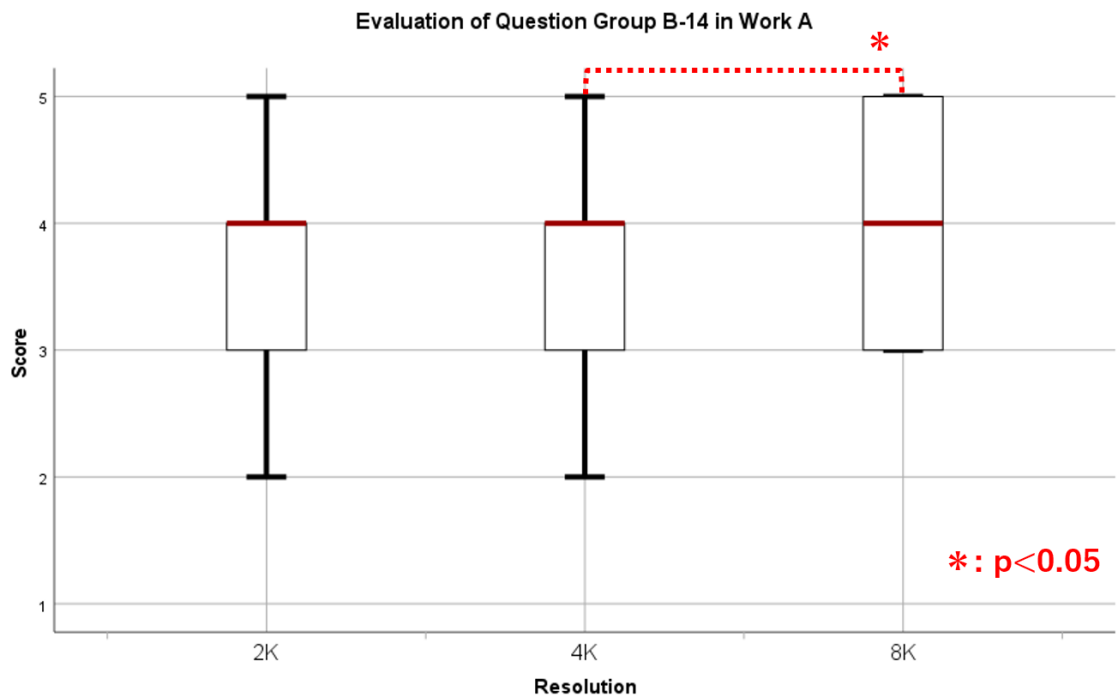


Figure 4.4: Score of question group B-14 in work A, where the x-axis represents the video's resolution, and the y-axis represents the score of answer.

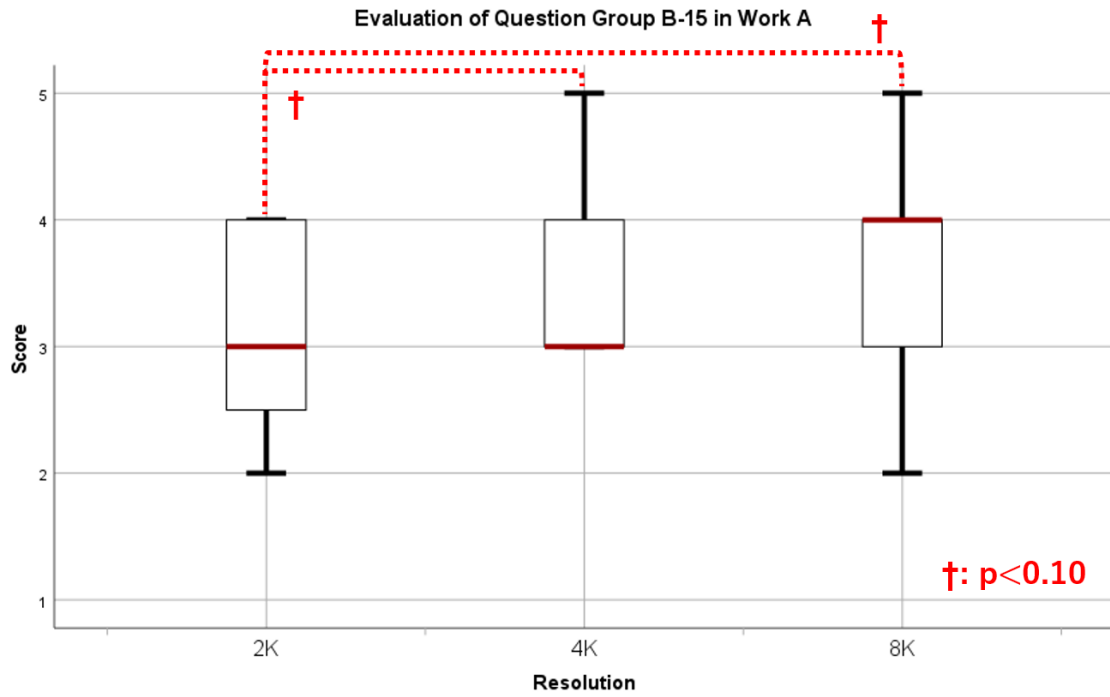


Figure 4.5: Score of question group B-15 in work A, where the x-axis represents the video's resolution, and the y-axis represents the score of answer.

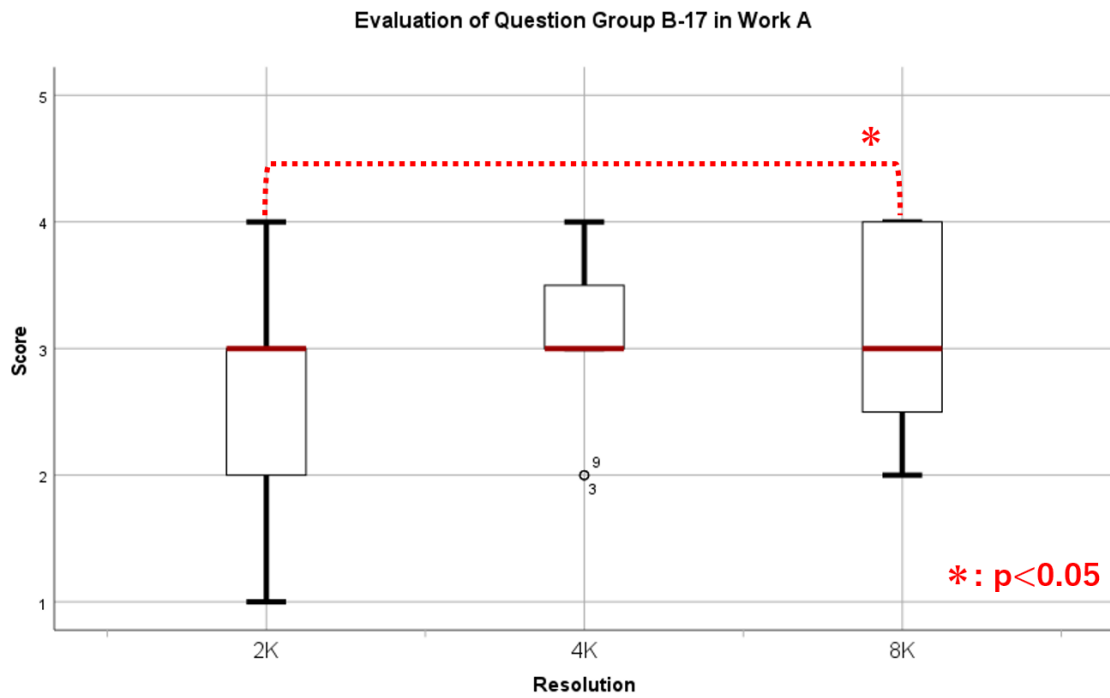


Figure 4.6: Score of question group B-17 in work A, where the x-axis represents the video's resolution, and the y-axis represents the score of answer.

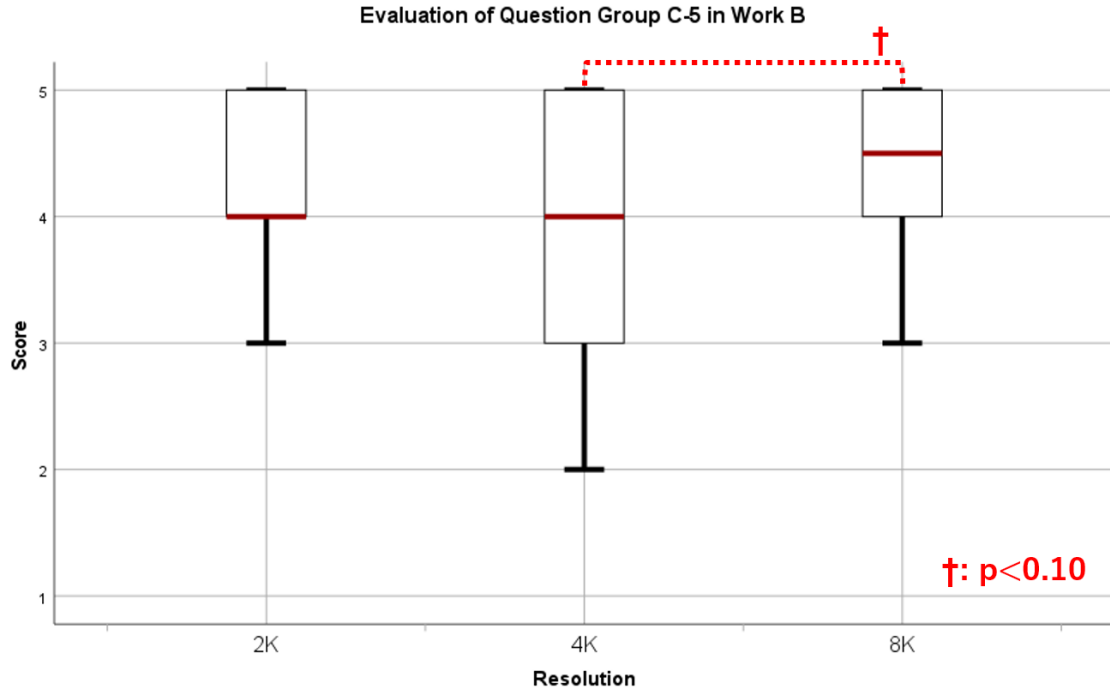


Figure 4.7: Score of question group C-5 in work B, where the x-axis represents the video's resolution, and the y-axis represents the score of answer.

4.2 Results of the Experiment of Shooting Dance Using a Smartphone and a Drone

In this section, the results obtained from the experiments described in Section 3.2 are presented. The details of the results of the analysis of the data from question group Y between the different shooting methods are shown in Table 4.5, and the free description comments are shown in Table 4.6. Similar to the results in Section 4.1, each item shown in each column of Table 4.5 indicates whether the comparison by resolution is significant or not. If there is a significant difference, $p < 0.05$ is assigned. If there is no significant difference, "NS (Not Significant)" is assigned. In this paper, the significance level was set at $p = 0.05$, but $p < 0.10$ was also taken as a significant trend.

For question 1, "Did you feel drawn in?", the evaluation scores for both non-fixed-point shooting with a smartphone and shooting with a drone were significantly larger than those for fixed-point shooting ($p < 0.05$) (Figure 4.8). In addition, in question 6, "Did you feel the novelty of the work?", the evaluation score for shooting using a drone was significantly greater ($p < 0.05$) than the two evaluation scores for fixed-point and non-fixed-point shooting using a smartphone (Figure 4.9). Furthermore, in question 12, "Did you feel that the work was interesting outside of the box?", the evaluation score for shooting with the drone was significantly greater ($p < 0.05$) than that for non-fixed-point with a smartphone ($p < 0.05$) (Figure 4.10).

Table 4.5: Results of shooting dance using a smartphone and a drone (NS: No Significant, F: Fix-Point, N: Non-Fixed-Point, D: Drone).

Question Group Y	
1	$p < 0.05$ (N > F, D > F)
2	NS
3	NS
4	NS
5	NS
6	$p < 0.05$ (D > F, D > N)
7	NS
8	NS
9	NS
10	NS
11	NS
12	$p < 0.05$ (D > F)
13	NS
14	NS
15	NS
16	NS
17	NS
18	NS
19	NS
20	NS

Table 4.6: Comments on the experiment of shooting with a smartphone.

Question Group Y-16: What were you trying to shoot?	
ID	Answer
201	Dancer’s vision. The movement of the dancer from the point of view of another person on the stage.
202	I tried to film something like the heat rising up from the loneliness.
203	I tried to capture the bodies of the dancer well, and to get closer to the symbolic parts so that you can feel the connection.
204	I could sense from the dancer that she was expressing what was in her heart, so I was trying to shoot the expression of her hands and such.
205	Face, presence, dynamic.
206	The shaking of air, the dynamics.
Question Group Y-17: How did you try to shoot what you answered above?	
ID	Answer
201	Moments behind the dancer, moments where the dancer also faces each other.
202	I used an angle that allowed me to shoot from directly in front of the dancer.
203	I didn’t feel much different from the first time. I thought I would dance the piece to the best of my ability.
204	I was conscious of the parts where I had to get really close and the parts where I had to shoot widely. When the dancer was moving, I stopped.
205	Zoom in, out, super close up
206	I shifted the angle of view and tilted my phone to where the dancer was looking.

Table 4.7: Comments on the experiment of shooting with a smartphone.

Question Group Y-16: What were you trying to shoot?	
ID	Answer
201	Difference in height
202	I tried to shoot something like the heat that comes up from the loneliness. I also tried to shoot the situation as if the dancer was moving through the space.
203	I tried not to let the space overwhelm the dancer and to make sure that their bodies were clearly visible.
204	I wanted to use the top and bottom of the camera to get an angle that I couldn't get with a human.
205	Height, three-dimensionality
206	Height difference, speed when moving the screen
Question Group Y-17: How did you try to shoot what you answered above?	
ID	Answer
201	With the active track, I don't have to worry about the angle of the camera, so it's easier to focus on the height difference.
202	I tried to shoot the movement of the dancer with the movement of the drone.
203	I tried to get as close to the subject as possible. I was conscious of distance.
204	I really wanted to go around and shoot.
205	Takeoff, zoom
206	Switching between zooms, operating at different heights, and shooting from positions out of reach of human hands.

Table 4.8: Comments of Question Group Z-3: Please describe freely your thoughts on the effect of camera work on dance.

ID	Answer
201	I was able to see the dance from an angle and perspective that I would not have been able to experience on a regular stage, and the sense of immersion that this provided allowed me to see a different relationship between the dancer and the audience.
202	I felt that the camera work had the potential to help me express this image or theme.
203	I think it's both good and bad for the dancers because the camera can disguise their movements a bit. I felt that the realism was diminished. But I think the new thing is that you can see the movements from so many different angles.
204	I felt that the dancer became more of a main character in both the drone and the smartphone camera. With a smartphone camera, the dancer is the main character, but with a drone, the surrounding scenery and the human senses are combined to create a single image.
205	I felt refreshing, novel, three-dimensional, and trendy. I found it interesting to discover the breadth of ingenuity in the technique, which cannot be achieved at a fixed point.
206	While the stage has the advantages of live performance, I felt that manipulating the camera work could intentionally emphasize important elements of physical expression, such as facial expressions and toes, and could convey expression more than the advantages of live performance.

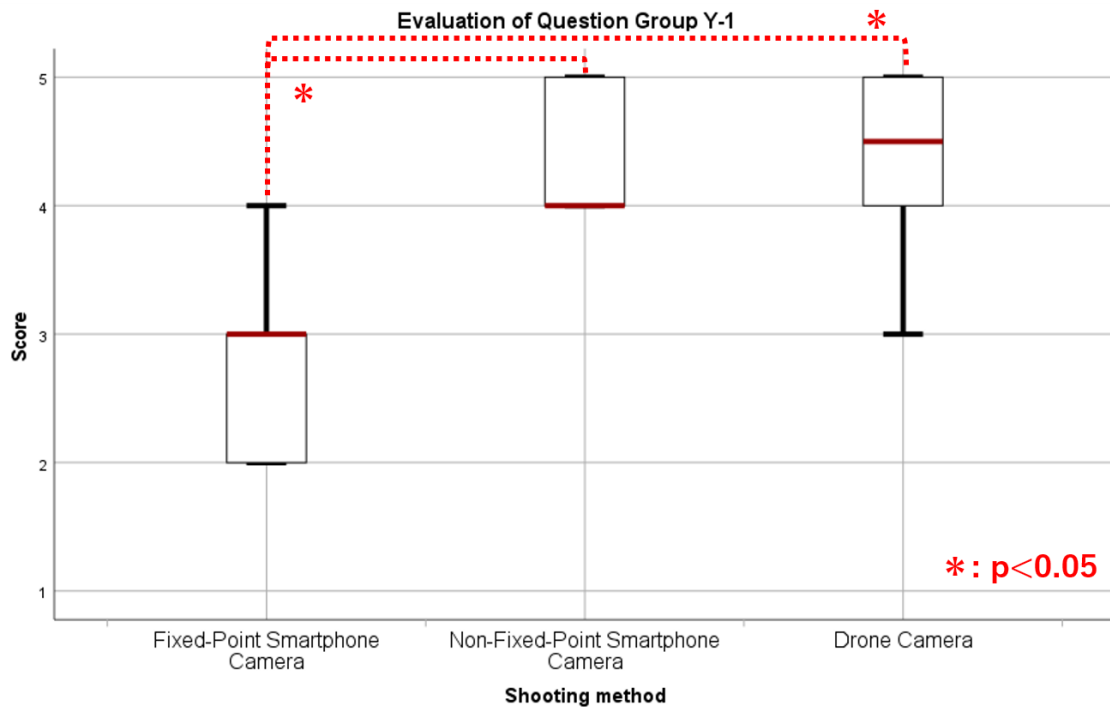


Figure 4.8: Score of question Y-1, where the x-axis represents the shooting method, and the y-axis represents the score of answer.

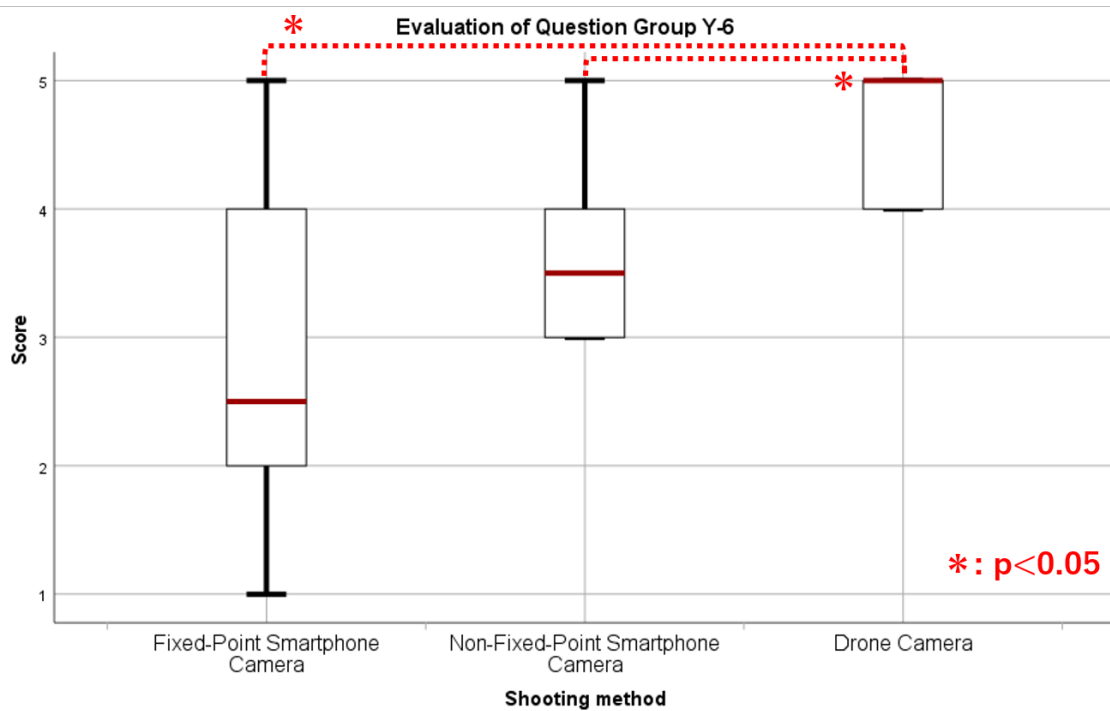


Figure 4.9: Score of question group Y-6, where the x-axis represents the shooting method, and the y-axis represents the score of answer.

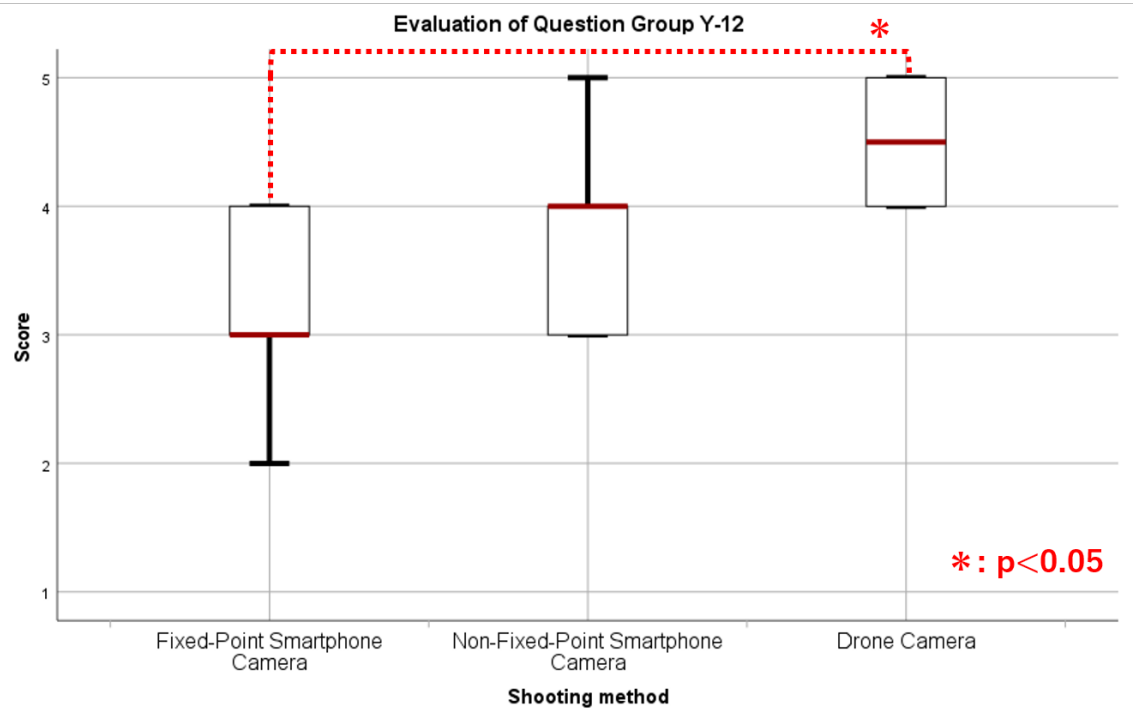


Figure 4.10: Score of question group Y-12, where the x-axis represents the shooting method, and the y-axis represents the score of answer.

Chapter 5

Disucussion

5.1 Effect of Resolution on the Dance Appreciation Experience

The results in Section 4.1 show that there were no significant differences in the rating scores of almost all the question items between resolutions. Since there was no significant difference in items such as "Did you feel any meaning or message from the dancer's movements?" and "Did you feel the dancer's inner world (emotions, etc.) through the dancer's movements?" in both works, it cannot be concluded that "embodiment in dance" is communicated more by improving the resolution in this experiment. The following five points are considered to be the reasons for the lack of significant differences:

- The video quality is better than ordinary 4K and 2K video because it is down-converted from 8K videos.
- The dancers are not always at the focal point of the 8K camera, and there are many blurry moments.
- With an 8K projector, the video quality is lower than that of an 8K monitor (quality degradation was confirmed especially at the edges of the screen).
- During the appreciation experiment, the videos were sometimes disturbed.
- It may be greatly affected by differences in individual interests and preferences, as well as differences in experience of having seen 8K videos or not.

The above points need to be further examined in the future. However, a significant difference was found in the item "the costumes were effective" in work A "Flash" and the following comments suggest that material things such as the costumes and the body itself can be seen clearly:

- (Question Group D-1, ID: 106): I got the impression that the men's work showed more of the texture of the body, while the women's work showed more of the facial expressions.
- (Question Group D-1, ID: 109): I felt like I could see the costumes well when they were dancing and judged the details there.

- (Question Group D-2, ID: 102): I felt a strong sense of physicality and realism in the video that I perceived as having high resolution.
- (Question Group D-2, ID: 103): In terms of resolution, I thought it was possible to more clearly capture the facial expressions and the texture of the skin and costume rather than the movement, and to get a better sense of the body as a material.
- (Question Group D-2, ID: 106): The ones that gave me a good sense of the muscles and unevenness of the skin looked better.

Another commented, "From the perspective of frame rate rather than resolution, the scale of the video also made me feel the physicality of the movement." (Question Group D-1, ID: 103). The frame rate of the video used in this experiment was fixed at 120, but I would like to consider an experiment in which the frame rate is changed instead of the resolution. Furthermore, although this experiment was conducted using images shot with a fixed camera, the following comments suggest that camera work is a necessary element in video works:

- (Question Group D-1, ID: 105): I believe that videos have the advantage of being able to shoot and direct in a way that cannot be done live.
- (Question Group D-1, ID: 105): I think there might be a difference if the camera was to get deeper into the dancers.

Other positive comments included the following:

- (Question Group D-1, ID: 102): Until now, I had thought that the filming of a stage production would, in a sense, degrade the work, but it was more realistic than I had imagined, and I felt that it had potential.
- (Question Group D-2, ID: 109): When I could feel the lines of the muscles and the depth of the body, I felt the realism and thought that it was a human body.

On the other hand, there were some negative comments, such as the following:

- (Question Group D-1, ID: 103): I didn't get the sense that I was seeing anything too new in terms of resolution.
- (Question Group D-2, ID: 107): I didn't think that the change in resolution would have a noticeable effect on the dance in this case.
- (Question Group D-2, ID: 110): I didn't really understand the thematic impact of the different resolutions.

Moreover, the keyword "live" was often found in some comments:

- (Question Group D-1, ID: 104): I didn't feel much of a "live" feeling coming from any of the videos, and I felt that there was no difference.
- (Question Group D-1, ID: 105): After all, I think that dance should be something that lives only in live performances as a person who still dances.

- (Question Group D-1, ID: 111): In the case of dance appreciation through video works, there is less of a sense of having the first subjective "live experience".

This suggests that "live appreciation experience" is also considered important in the appreciation of dance apart from "embodiment in dance". However, appreciation by video does not become a "live appreciation experience". This may happen by wavering the authenticity of the work of art, that is, the authority of the thing and the significance of the thing[11]. By not appreciating the work in a live setting, the characteristic of "being here and now" disappears. Mochizuki (2018) states that "the artistic and aesthetic value of a work of art is not realized without the simultaneous presence of the appreciator confronting the work of art, as Ingarden also states"[26]. In addition, the structure of the audience's appreciation experience is divided into primary and secondary appreciation. Primary appreciation is a pre-reflective sharing of the dance by the audience in the act of "watching". This shifts to a reflective level of perception. Secondary appreciation is to remember the work as a representation of "a dance that does not already exist here". Therefore, appreciation through videos lacks primary appreciation and does not become a "living appreciation experience".

5.2 Effect of Camera Work on the Dance Appreciation Experience

The results of Section 4.2 showed that there were significant differences in the items "Did you feel drawn in?", "Did you feel the novelty of the work?" and "Did you feel that the work was interesting outside of the box?". From this result and the following comments, it is considered that the dance video introducing camera work was novel to the participants of this experiment:

- (Question Group Z-3, ID: 201): I was able to see the dance from an angle and perspective that I would not have been able to experience on a regular stage, and the sense of immersion that this provided allowed me to see a different relationship between the dancer and the audience.
- (Question Group Z-3, ID: 205): I felt refreshing, novel, three-dimensional, and trendy. I found it interesting to discover the breadth of ingenuity in the technique, which cannot be achieved at a fixed point.

In addition, there were some comments such as "I felt that the realism was diminished." (Question Group Z-3, ID: 203), which suggests that the live viewing experience is just as important as in Section 5.1.

However, since there was no significant difference in items such as "Did you feel any meaning or message from the dancer's movements?" and "Did you feel the dancer's inner world (emotions, etc.) through the dancer's movements?" in both works, it cannot be concluded that "embodiment in dance" is communicated more by improving the resolution in this experiment. This experiment may have been affected by the fact that there was no performing arts element such as costumes, music, or lighting. On the other hand, there was a comment: "While the stage has the advantages of live performance, I felt that manipulating the camera work could intentionally emphasize important elements of physical expression, such as facial expressions and toes, and could convey expression more than the advantages

of live performance"(Question Group Z-3, ID: 206). Therefore, it is thought that there is a possibility that "embodiment in dance" can be communicated more emphatically.

The following is a summary of the comments obtained from Question Group Y-16, "What were you trying to shoot?":

- Body Expression
 - (ID: 202): I tried to film something like the heat rising up from the loneliness.
 - (ID: 204): I could sense from the dancer that she was expressing what was in her heart, so I was trying to shoot the expression of her hands and such.
- Awareness of Space
 - (ID: 201): Moments behind the dancer, moments where the dancer also faces each other.
 - (ID: 205): Height, three-dimensionality.
 - (ID: 206): The shaking of air, the dynamics.

Dance is a "dynamic spatio-temporal art," so it may be necessary to emphasize not only the body but also the awareness of space.

The comments obtained from Question Group Y-17 "How did you try to shoot what you answered above?" are summarized below:

- For Body Expression
 - (ID: 202): I used an angle that allowed me to shoot from directly in front of the dancer.
 - (ID: 204): I was conscious of the parts where I had to get really close and the parts where I had to shoot widely. When the dancer was moving, I stopped.
- Shooting From a Dancer's Perspective
 - (ID: 201): Moments behind the dancer, moments where the dancer also faces each other.
- For Space
 - (ID: 205): zoom
 - (ID: 206): I shifted the angle of view and tilted my phone to where the dancer was looking.

There is still a need for more studies on what dancers try to shoot and how they shoot it, as described above. Moreover, I would like to verify what kind of camera work is effective in communicating the "embodiment in dance".

Chapter 6

Future Work

In this paper, I examined the effects of resolution and camera work on the appreciation experience of dance. In the examination of the effect of resolution on the appreciation experience of dance in this paper, it was considered that the resolution of material objects such as costumes and bodies would be better. Further studies are needed in order to clarify whether high-resolution videos can communicate the "embodiment in dance". I believe that it is effective to shoot while maintaining the focal length of the camera and experiment with the videos. Maurice Béjart's choreography "Bolero"[27] may be suitable for shooting with limited focus because the dancers do not move around the stage significantly. In addition, although low resolution videos were prepared by down-converting in this study, it is conceivable that this is not the case and that preparation with low resolution camera shots is necessary. Furthermore, I would like to verify the effect of the frame rate by the appreciation experiments of videos with different frame rates.

In the camera work, it was thought that it was novel for the dancers who participated in this experiment, but further investigation is needed to verify whether "embodiment in dance" is communicated or not. However, the possibility of the camera work communicating "embodiment in dance" more than live could be found. In this experiment, it was a one-minute choreographic work, but I would like to experiment with a work that is a total work of art with costumes, music, lighting, etc. The comments also revealed what kind of things the dancers were trying to shoot and how they shot them. Further studies are needed in this regard. I will interview people who usually shoot dance works to find out what kind of camera work they are conscious of. I also would like to examine what kind of camera work is appropriate for communicating "embodiment in dance" through video. Eventually, I believe it will be easier for dancers to self-promote themselves by using drones to take pictures automatically.

Finally, through the two experiments, it was revealed that a "live appreciation experience" is not possible with video. However, with video, it is possible to create effects that cannot be done live through camera work and editing. In the future, I would like to proceed with studies of performing arts as video works rather than as just recorded videos. Moreover, although the audience was dancers in this experiment, I would like to experiment with people who do not normally dance.

Chapter 7

Conclusion

In this paper, the effects of resolution and camera work on the appreciation experience of dance are verified. In order to verify this, I have clarified that the important thing when appreciating dance is "embodiment" through literature surveys and performances. Moreover, I defined "embodiment in dance" as "what is expressed by the fact that the dancing (external order) appears to move from an internal order such as emotion". There have been many studies on dance appreciation using various methods, but as far as I know, this is the first study that focuses on the improvement of video technology and "embodiment in dance".

In the method focusing on resolution, the dance works were first shot with an 8K camera. Next, the experiment was conducted to appreciate the dance videos by changing the resolution of the shot videos to 2K, 4K, and 8K. This experiment revealed that material things were well visible such as costumes and the body itself. In the method focusing on camera work, the experiment was conducted using a smartphone and a drone. In this experiment, the results showed that dance videos with ingenious camera work were more engaging, novel, and interesting outside of the box. In addition, it was clarified what the dancers were trying to shoot in their dance works and how they were trying to shoot it.

Further studies are needed to clarify whether or not "embodiment in dance" can be communicated through videos. However, I found that camera work had the potential to communicate the "embodiment in dance" more than live in this experiment. Moreover, it was found that what was important when appreciating dance was not only "embodiment in dance" but also "whether or not the audience could have a live appreciation experience". Whereas, it may be difficult to have a "live appreciation experience" with video. In the future, I would like to investigate the performing arts as a video work rather than as a just recording of them, because video can be used to create effects that cannot be done live through camera work and editing. I believe that the issues revealed in this paper will be useful for these studies in the future. Furthermore, I hope that this paper will help to define a new Digital Nature in the art of dance, and help to redefine the relationship between videos and humans in the age of coexisting with COVID-19.

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