

A STUDY ON THE EXPANSION OF THE AUDIENCES' AESTHETIC EXPERIENCE BY APPLYING THE PUNCTUM IN INTERACTIVE INSTALLATIONS

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ABSTRACT

This study suggests ways to expand aesthetic experience through Roland Barthes' concept the punctum found while creating the interactive artwork *deBallution* based on the audiences' throwing activities. Roland Barthes defined the punctum in his book *Camera Lucida* as applying not a studium or thematic element but the elements of personal experience and memory to an aesthetic element in the photograph. This study develops a methodology for applying the punctum to interactive artwork based on the five symbolic elements of the punctum mentioned by Roland Barthes: String, Speck, Cut, Little hole, and Cast of the dice. It also confirms whether audiences actually experienced the five elements of the punctum and the studium through user testing conducted after making a new test version of the interactive artwork *deBallution: Randomized Trip*.

Keywords: Interactive artwork; Studium; Punctum; *deBallution*; Camera Lucida.

1. INTRODUCTION

The purpose of this study is to discover what the artist did not intend through the direct participation of audiences in the interactive artwork, with Roland Barthes's studium and punctum features (Barthes 1981), based on the concept "Unintended" in the interactive artwork, along with observations in the *deBallution*¹.

Creating and researching the interactive artwork *deBallution* using the throwing activity of audiences, based on the cultural heritage, from 2015 to 2019, we found that audiences acted differently than expected (Oh, Kim, Nam, and Shi, 2017; Oh and Shi, 2021).



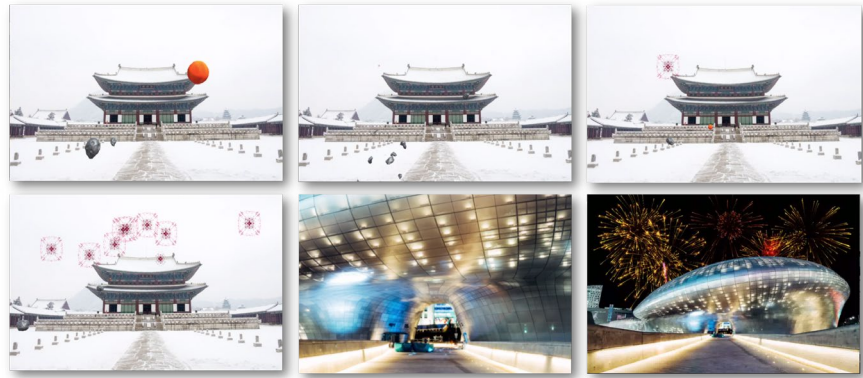
Figures 1–4. Exhibition processes according to the version of the *deBallution* project © Author. (Upper Left: Prototype version

- 1 — Generating circles by virtual throwing activities / Upper Right: Prototype version
- 2 — Throwing the virtual orange and changing background images / Down Left: Prototype version
- 3 — Throwing the virtual balls and hitting targets for changing traditional image / Down Right: Prototype version
- 4 — Throwing the virtual orange and hitting targets for changing environment image).

deBallution projects, a series of interactive artworks using audience throwing activities based on Korean heritage, refers to a “revolution to be performed digitally.” (Oh, Kim, Nam, and Shi, 2017) A new version of *deBallution: Randomized Trip* was produced based on the concept that the fun of traveling beyond time and space and the fusion of two cultures are the main points for embodying the cultural convergence of Korean modernity. This study conducted prototyping of *deBallution: Randomized Trip* based on the fusion of a “throw play” in the Korean Stone War² and the Italian Battle of Oranges through digital interactions. Indeed, in the past, South Koreans were so passionate about democracy that they took out sidewalk blocks for street protests. Thus, this action originated from the cultural heritage game of throwing stones, similar to the Italian Battle of Oranges, the Tomato War Festival, La Tomatina, in Spain, and the Songkran Festival in Thailand (Oh, Kim, Nam, and Shi, 2017). Lower figures showed the basic narrative. The background image changed from a 2D photograph of Gyeongbokgung Palace, as the symbol of Eastern culture, to the final background of a 2D DDP (Dongdaemun Design Plaza), an image that is the symbol of Western culture through the participants’ direct activity (Oh and Shi, 2021).

¹ This study is based on the author's Ph.D. dissertation [Oh, J. H. (2022)].

² The Korean Stone War was a traditional Korean game in the festival. Two communities separated and began throwing stones each other. The game enhanced a group relationship through competition in each community (Oh, Kim, Nam, and Shi, 2017).



Figures 5-10. Scenario still shots of the *deBallution: Randomized Trip* © Author. (Upper left: Throwing the virtual orange / Upper center: At the moment hitting the target / Upper right: Generating kaleidoscope images / Down left: When the sky was filled with kaleidoscope images / Down center: Changing background image to DDP / Down right: Playing fireworks for the ending).

The project was not for audiences to simply act according to the artist's main purpose but to do something else in the artwork while bringing about emotional changes. It reminded audiences of images or objects other than the throwing action, which concerned certain memories or historical places (Melo and Carvalhais, 2016). So, it deviated from the artist's intention that emotional changes would occur through the changed content of objects on the screen, by audiences throwing a virtual ball at it.

Roland Barthes's concepts of studium and punctum are applicable here because the idea of intended thematic consciousness and unintended details coexisting in a photograph are also valid for the interactive artwork. Moreover, these concepts provide a methodology still used to analyze intention in various media.

Therefore, the aims of this study were as follows.

First, it identified various studies that dealt with punctum and interactive artworks which contributed to subjective, intentional, and affective states, applying a new approach.

Second, this study tried to define the punctum in the interactive artwork based on previous studies, proposing a new five-feature model for applying to interactive artwork.

Third, this study examined the *deBallution: Randomized Trip* prototype to gain insight in transformative experiences with subjective and unintended dimensions by participating in an interactive artwork. The aim here was to applicability of the studium and punctum.

Fourth, this study analyzed and discussed the results regarding expanding artistic values to elicit and support change in artists and audience members.

2. LITERATURE REVIEW

This paper reviewed four categories of studies on interactive artwork that applied the concept of punctum — 1) basic theories for punctum and studium, 2) applications of the punctum, 3) basic structure of interactive artworks, and 4) subjectivity in the art experience.

The concept of punctum by Roland Barthes was studied through theories of post-structuralism (Iversen, 1989; Stam, Burgoyne, and Flitterman-Lewis, 1992). Burgin reinterpreted the concept of punctum as the “language of photography” through the analysis of Barthes’ book (Burgin, 1986). Haverkamp compared and studied the memorability of photographs with Walter Benjamin’s concept of *aura* (Haverkamp 1993). From the viewpoint of post-structuralism, intermediality considers the spectator as affected and moved by the punctum; Barthes’ punctum is an experience of the singular, escaping the studious meditation on the image, and *studium* is adopted as the impossible experience of the breaks between two media (Oosterling, 2003). The concept of the punctum provides insight into how the photograph arouses the intangible quality and charitable instincts of compassion, driven by two main but contradictory impulses—science and pleasure—in a movement known as post-structuralism (Davison, 2011). Through these studies, Barthes’s analysis of the photograph was categorized with two features based on the cultural code as studium, the other private and uncoded as punctum.

Various studies dealt with the subjectivity of the punctum in contrast to the studium. Nickel (2000) analyzed the connection between Roland Barthes’s punctum and the snapshot as the coexistence of private and public areas. Fried (2005) analyzed and criticized the meaning of an individual’s private thoughts, contrary to the artist’s intentions, invoking the concept of “art and objecthood” regarding the interpretation of the punctum in photographs. The unintended punctum is where the object tries to interrupt and write the subject, a curious and monstrous process that reverses the subject’s intention. It is where the object eats the subject (Kargupta, 2015). Greco redefined the subversiveness of the correlation between observers and observed while analyzing the poem with the punctum (Greco, 2016). Based on these studies, audience members’ subjective experience was derived contrary to the artist’s intentions and objective.

2.2. APPLICATIONS OF THE PUNCTUM

Studium and punctum apply not only to photographs but also to various arts and some daily activities.

Various studies dealt with applying punctum to various art genres. Duffy (1994) analyzed a Pierre Bonnard painting with punctum. Jay (2001) analyzed tricks of experience with the punctum. Higgin (2009) applied the punctum to analyze games. Badmington (2012) used the punctum to analyze films and photographs. Jenkins (2013) applied the punctum to animations, defining it as “detail and of death”. These studies applied the punctum to analyze the participation of audience members in the artistic experience.

Punctum was applied to understand the user’s emotions while participating in events. McLennan (2016) analyzed hashtags considering

punctum. Lange (2013) analyzed YouTube videos with the concept of the “detached form of sympathy and immediate emotional wound” based on the punctum. Wilson (2017) used the punctum to analyze theatrical performances. Phillips and Ryan (2017) used the punctum to analyze feminist elements. McHendry Jr. (2017) analyzed risk factors by applying the punctum to Instagram posts of the Transport Security Administration in the US. Duarte (2019) analyzed Roland Barthes’ punctum in relation to the meaning of time and death while comparing the concepts of writings that Barthes, Blanchot, and Proust had defined. McLennan (2020) reinterpreted the philosophical meaning of the body in modern photographs with the concept of “aesthetics of the flash” based on the punctum. In arts and other fields, various realms have applied punctum to analyze the audience members’ emotions and experiences. However, no studies applied the concept of punctum to interactive or digital media art.

2.3. BASIC STRUCTURE ON INTERACTIVE ARTWORKS

Most papers on the development of interactive artwork have focused only on the thematic consciousness of the work and the discovery of new technology (Fels, 2000; Heitlinger and Bryan-Kinns, 2013; Machado et al., 2016). These studies viewed audiences as tools that had to perform predetermined actions. While technology derived quantified values of all data on audiences, it could not measure the audiences’ unintended behaviors and emotions (Costello, 2005; Edmonds, 2010; Ahmedien, 2017). Research on unintentional characteristics in interactive artwork is ongoing. Interactive artwork is created with various content influenced by the actions of audiences based on increasingly evolving digital technology (Xiaobo and Yuelin, 2014). The activity of audiences was a major topic in interactive artwork research (Castro, 2017).

Various studies dealt with a new approach: the analyzing meaning in interactive artworks. However, the punctum has not been applied to interactive artwork to analyze audience subjectivity and intentions in participating in interactive artwork. Through these studies about interactive artwork, this paper made the basic structure for applying punctum based on the audience participation.

2.4. SUBJECTIVITY IN THE ART EXPERIENCE

Subjectivity is a primary issue in Western aesthetics, which differs in culture, art, and philosophy (Zehou, 1999; Gaikis, 2020). For example, Man conducted a comparative study of artist objectives and non-objectives based on Dewey’s notion of aesthetics and Taoist and Confucian philosophies (Man, 2017), while Vaillancourt studied artistic values of intention and unintention per Neo-Confucian perspectives (Vaillancourt, 2008). Based on these studies, the current study examines the same from the perspective of audience participation in interactive artwork. Rosa, Morais, and Borges (2022) studied the aesthetics of glitch art, which takes on visual shapes through defective computational

algorithms, tampering with cameras, incompatible software, or any other process intended by the artist.

In the analysis of art and aesthetics, the following studies dealt with the subjectivities involved in the public–work–artist relationship. Parente (2004) studied an institutional mode of representation producing new and heterogeneous subjectivities, which had a decisive impact on recent film theory. Then, Parente (2008) analyzed transformative networks—socio-technical mediations that alter the conditions of the experience and produce new forms of subjectivity—from three different perspectives on networks in contemporary French philosophy. Bellour (2022) proposed a subject “lost in thought” or “daydreaming”; however, in the context of this article, the expression “the spectator-engaged-in-thought” may be a more useful and equally valid translation, suggesting a clear association with the idea of thinking (Radner, 2018). de Freitas (2015) reveals an oscillation feature in these works, which are mediated by a subjective and plural rhythm that brings out the existing gaps and breaks in these dialogues, where the audience can interfere with the artwork. Martins et al. (2019) proposed a new model for analyzing dynamic visual identities based on the differences between variation mechanisms used to attain dynamism and other features for the subjectivation of experiences. Maciel (2021) examined methods for creating interactive and immersive works considering how these methods have fostered practice-based research that approaches subjects as active participants in the creative process. Rebelo (2022) analyzed subjectivation through people’s experiences of the Emotion-driven Audiovisual Installation regarding its diversity, expressiveness, and possible application in commercial and social scenarios. The subjective of audience members influenced dynamic activities and emotional experiences. Additionally, the audience’s direct participation reinforced the immersive experience. Through these studies, this paper proposes subjectivities involved in the public–work–artist relationship by audience experience.

Livingstone (2008) studied the unintentional activities of multi-users in a virtual environment and their consequences. Edmund (2010) researched the same in interactive artwork that changes unexpectedly. Bilda (2011) studied the unintentional participation of audiences in interactive artwork. Edmund (2014) researched the expansion of an “unintended action mode” in public art. Della-Bosca (2018) examined unintentional endings in public art. Kang et al. (2018) studied the production process of unintentional improvised sound artwork and its effects. Liu et al. (2020) examined the functions of wearable sensors through unintentional vibrations. Gruchy (2020) used AI to categorize unintentional computer art. The unintended action and experience were important features in the interactive artwork. However, these studies did not yet reflect on an unintended structure model or framework.

Based on this literature, this study applies various unintentional activities of interactive artwork participants and develops a novel approach for analyzing the activities of participants that diverge from the reaction the artist intends to elicit.

In *Camera Lucida*, Barthes (1981) defines the studium and punctum of photographs as follows:

It is studium, which doesn't mean, at least not immediately, "study," but application to a thing, taste for someone, a kind of general, enthusiastic commitment, of course, but without special acuity. It is by studium that I am interested in so many photographs, whether I receive them as political testimony or enjoy them as good historical scenes: for it is culturally (this connotation is present in studium) that I participate in the figures, the faces, the gestures, the settings, the actions. The second element will break (or punctuate) the studium. This time it is not I who seek it out (as I invest the field of the studium with my sovereign consciousness), it is this element which rises from the scene, shoots out of it like an arrow, and pierces me. This second element which will disturb the studium I shall therefore call punctum; for punctum is also: sting, speck, cut, little hole — and also a cast of the dice. A photograph's punctum is that accident which pricks me (but also bruises me, is poignant to me) (1981, p. 26–27).

Barthes (1981) did not directly define the features of the punctum. However, he presented the five features that generate the punctum from a semiotic point of view as examples.

1. Sting — the audience experiences a change in their senses as if the photo's content pierces their emotions.
2. Speck — an effect as if the audience's emotions are stained by the photo content.
3. Cut — an effect as if the audience's emotions are cut by the photo content.
4. Little hole — the experience in which the photo content reveals a little hole in the audience's emotions or causes them to fall into that hole.
5. Cast of the dice — situations that require convincing oneself after making a crucial decision that one can never turn back. Such situations make participants feel a certain fateful force.

Individuals can act and experience strong emotional changes from participating in interactive artwork, not intentional messages or customary cultural codes expressed by the artist. These works allow individuals to create unique experiences rather than relaying a predetermined collective experience and cultural code. Even in interactive artworks, synaesthetic experiences, such as visual appreciation and audio experiences, offer audiences reflective experiences through changes in their senses.

Defining immersion is critical to understanding the relationship between the user and the virtual environment because it addresses the very notion of *being* in the context of such simulated environments (Grimshaw, Tan, and Lipscomb, 2013). Immersion appears to be less

of a psychological process and more of a physical process where our bodies and senses are tricked into behaving and reacting like the virtual environment is real (Kitson, Prpa, and Riecke 2018). Immersion could influence participation in interactive artwork through continuous activities and sensitive emotions elicited by aesthetic experiences (Oh and Shi, 2021). Immersion, interactivity, and narrativity help to make virtual reality a fully artistic medium of expression (Taborda-Hernández, Rubio-Tamayo, and Fernández, 2022).

The most important point is that the punctum of interactive artworks reflects the direct actions of participants. The five features of the punctum mentioned above apply to interactive artwork as follows.

1. “Sting” arouses an aesthetic experience in audiences by providing a feeling of being pierced in their emotions as they interact with the artwork.
2. “Speck” arouses an aesthetic experience in audiences by providing a feeling of being stained in their emotions as they interact with the artwork.
3. “Cut” arouses an aesthetic experience in audiences by providing a feeling of being cut in their emotions as they interact with the artwork.
4. “Little Hole” arouses an aesthetic experience in audiences by providing a feeling of finding a little hole in their emotions or falling into that hole as they interact with the artwork.
5. “Cast of the dice” refers to audiences being reminded of an event that is irreversible and consequential as they interact with the artwork, engendering perceptions of a fateful force.

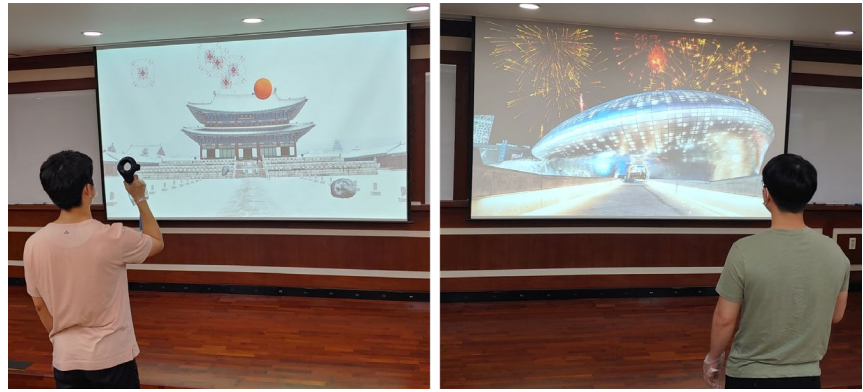
These five features were used to analyze participants’ aesthetic experiences in the interactive artwork prototype to predict the experiences elicited by the actual interactive artwork.

4. PROTOTYPING AND EVALUATION OF INTERACTIVE ARTWORK *DEBALLUTION: RANDOMIZED TRIP*

This paper conducted the prototyping with *deBallution: Randomized Trip* based on the aesthetic experience of Korean cultural heritage throwing activities. This study first changed the prototype to clarify our intention and thematic perspective to find the features of the punctum. A dynamic rather than static background image was used to reinforce the topic of *deBallution: Randomized Trip*.

The background image was changed to a 2D photo of Gyeongbokgung Palace. The ending background was set as a 2D DDP image. Audiences could experience the content change more through their direct actions, focusing on the content change caused by throwing activities. The object to be thrown was set as a concrete image so that audiences could see what they were throwing. Thus, audience members experienced ending scenes caused by their own activities.

This paper exposed 20 subjects to the interactive artwork *deBallution: Randomized Trip* over two days from September 5 to 6, 2020.



Figures 11–12. Conducting the *deBallution: Randomized Trip* test © Author. (Left: Throwing the virtual orange and hitting targets / Right: Changing background image to DDP and watching fireworks).

Since the personal experiences and subjective content of the punctum are of significant importance, this study found the features and then derived the aesthetic value through detailed interviews and questionnaires. Subjects experienced the artwork for approximately 15 minutes, completed questionnaires, and participated in detailed interviews. The average age of the participants, which consisted of 15 males and 5 females, was 23.3 years old.

The questions in the questionnaires are as follows.

Q1) Discovery of the studium — What was your aesthetic experience of *deBallution: Randomized Trip*?

1. I had fun through the throwing game.
2. I produced content for changes in the cultural heritage scenes by throwing.
3. I felt the changes in Korean modernity and history along with the coexistence of Eastern and Western cultures.
4. I enjoyed a festive play based on the cultural heritages of the East and the West.

Q2) Discovery of the punctum — Which sensations do you think you felt while engaging with the artwork?

1. “Sting” — arouses an aesthetic experience by providing a feeling of being pierced in your emotions
2. “Speck” — arouses an aesthetic experience by providing a feeling of being stained in your emotions
3. “Cut” — arouses an aesthetic experience by providing a feeling of being cut in your emotions as your actions
4. “Little Hole” — arouses an aesthetic experience by providing a feeling of finding a little hole in your emotions or falling into that hole
5. “Cast of the dice” — an event that is irreversible and bound to happen given your actions, which arouses an aesthetic experience that makes you feel a certain fateful force.
6. None - you did not feel anything while engaging with the artwork

Q3) Please describe in detail the punctum you have discovered.

The following is a table that summarizes the results.

FACTORS	Q1	Q2	Q3
P1 (Male, 22 years old)	1	2	I felt the creation of a red background that indicated taking damage every time I hit the ball on the screen during the game. So, I felt like the game was over when the background was all dirty from being stained.
P2 (Male, 21 years old)	1	5	When I threw the ball, I could determine if it would hit the target in advance. While I felt like I was throwing the dice, I did not take it to the extreme degree because I could throw the ball again. However, I could feel the emotion often due to the lack of time before the next target that appeared immediately after throwing the ball. At first, it left something to be desired for me because I could hardly hit the target, but I could feel a sense of accomplishment as the hitting accuracy gradually increased over three times. The most memorable place for me was the one where the firecrackers that appeared after the end of training were growing because I could see them comfortably while taking a break. The scene that looked like COEX in Seoul and the firecrackers grew bigger reminded me of the good experience I had with my ex-girlfriend at COEX.
P3 (Male, 22 years old)	4	5	I felt a kind of transition through the contrast between historical and modern buildings. However, I am not sure of the connection to throwing stones or oranges. It would be nice if the change of specks on the building was more interactive. I felt like I was playing the classic games Galaga or Breaking Bricks in terms of throwing something to hit the target.
P4 (Female, 20 years old)	4	2	Especially when I first experienced hitting oranges with stones, I imagined that fresh juice was coming out of oranges, and at the same time, it was visually stained while looking at the background in which the red patterns were displayed.
P5 (Male, 21 years old)	4	2	After seeing specks that looked like red blood, I felt that if I could not hit the stone, it would be damaged due to the increase in the specks. Since the background was a cultural place, I felt the irreversible history of the past as I recalled historical dramas and revolutions, which strengthened my willingness to hit the stones.
P6 (Male, 26 years old)	1	2	I was immersed in the change when I hit an orange object with a rock to make me feel the emotion of a speck. As I was immersed in the fragments or specks, not physical specks, generated when hitting the target with thrown objects, I focused on the speck sensation.
P7 (Female, 20 years old)	4	5	I felt the dice thrown the most when I realized that the stone was thrown in the wrong direction. When I did not hit the object with a stone just before the game ended, I felt that emotion more strongly. I have hated being unable to hit the target when playing that kind of game for a long time. I think the idea that I must get the right answer when solving questions for so many years may affect how I play games.
P8 (Male, 25 years old)	2	3	The experience of seeing the crumbling stones reminded me of the experience of cutting something. In addition, I thought that getting injured by flying stones seemed to do damage to me as well. The color of blood in the background made me feel like I was being punished by death from a king, as if in a historical drama. I felt that everything would be over when I was punished.
P9 (Male, 29 years old)	3	3	I felt the same emotion as when I cut zucchini or fruit. This feeling made me think of the game <i>Fruit Ninja</i> .

P10 (Female, 21 years old)	1	5	First of all, I felt as if I was encountering the final boss with tension from the music played when I cut objects approaching me in the game. Perhaps that was why I thought that not breaking all the objects approaching me would cause big problems for me. I felt like I had to play the game as successfully as possible in the irreversible situation as the game started with the dice already thrown. In addition, the creation of a red pattern each time objects were hit in the artwork's background created an atmosphere of dark hues in the sky that was a little bit cloudy, making an even more negative atmosphere. It made me feel pressure, tension, immersion, and other negative emotions that seemed irreversible already. This experience was similar to that of having to follow through with a test day or interview day for entry to college. At that time, I felt nervous and hopeless.
P11 (Male, 28 years old)	1	5	I felt emotions about the irrevocable past like a dice was cast while seeing Gyeongbokgung Palace surrounded by an image of a kaleidoscope and objects being broken by objects I threw.
P12 (Female, 25 years old)	1	3	When a stone was crushed by a ball, I felt like I was cutting the stone, and I felt like I was cutting something with a knife in kendo or martial arts when I was throwing a ball with a controller. I felt like it was a hole as I looked at the gap the stone had made as it broke into pieces, which also gave me the impression that the look between the stones was like a cave or basalt with many holes. As there was nothing I could do until the ball I threw hit the stone, I felt the point of no return. It made me expect the results after doing something like clay shooting or a board game.
P13 (Male, 21 years old)	1	5	I wanted it to hit the target because of the trajectory that was determined when the ball was thrown. It was out of my control, just like a dice throw. Also, I had the same feeling when the game started. I got the feeling that I could not cancel or revert to the previous condition anymore, which made me focus on the game. The reason why I threw the ball after it was all done was because I could throw it better as I got used to the sensation of throwing.
P14 (Male, 20 years old)	1	5	I could not control the ball. I had difficulty throwing the ball precisely, so each throw felt like a dice roll. Although the ball flew in an arc according to the laws of physics, it disappeared into the background without bouncing off the wall or floor, intensifying my feeling.
P15 (Male, 21 years old)	1	2	When throwing a stone, I felt like throwing a basketball, and at the same time, I felt a connection to what I should do to throw the ball in a fixed position. I focused on hitting the target because of the urgency of the flying stones and the stress caused by a stone that was not flying as I predicted.
P16 (Male, 22 years old)	3	2	I felt the speck sensation when the speck was created on the picture of Gyeongbokgung Palace. In particular, when I looked at the picture of the speck on another speck, I got the feeling that our cultural property or history was being damaged, and it was like the first time when I saw a picture of the Japanese flag hanging at Gyeongbokgung Palace during the Japanese colonial era.
P17 (Female, 27 years old)	1	3	I recalled the experience of cutting fruit while cutting orange-like balls. In addition, splashing red specks on the background immediately after cutting the balls reminded me of squeezed juice. It also reminded me of when I was into the game <i>Fruit Ninja</i> .
P18 (Male, 27 years old)	1	5	I mainly felt that my actions were no longer irreversible because I could do nothing after the stone or ball was thrown. In fact, I had to throw a new one again before it reached its final destination for that reason.

P19 (Male, 27 years old)	1	5	I felt that way when I thought I could not hit the target because I threw the ball in the wrong direction. I actually had a feeling similar to when I played other games and could not hit the target. I felt like when I could not complete a mission in an RPG game and when I missed an enemy in StarCraft. In addition, I felt the same way when I tried but failed to catch a bug at home.
P20 (Male, 20 years old)	1	2	I thought I felt the speck sensation the most from the images created by throwing something and hitting a target. I remembered what I had learned about the dynastic revolution of the Joseon Dynasty in a history book through my experience with the artwork because the effect generated looked like blood spatter on the screen.

Table 1. Test results of 20 audiences © Author.

This study found the following features and connections between the punctum and the studium.

First, the direct experience of audiences with the interactive artwork may have nothing to do with the studium. The audiences discovered the punctum, various personal aesthetic experiences, and the studium intended in the prototype. Among the features of the punctum, the case of the dice appeared the most (10 times), where participants recalled irreversible actions from hitting targets (P2, P3, P7, P11, P13, P15, P18, and P19). In addition, they recalled the urgency of taking a test (P7 and P10) or the desperation of playing a game (P3, P10, and P19). Mention of the speck sensation appeared twice, and the participants recalled looking at the kaleidoscope image created by hitting the target (P1, P4, P6, and P17). They also recalled memories of historical events or dramas due to the connection to the background (P5, P16, and P20) and even mentioned the past revolutions of the palace (P5 and P20). Cut appeared four times, and people who had experienced the game also thought of the game *Fruit Ninja*, a fruit-cutting game, from an orange being cut (P9 and P17). If the participants had had similar experiences, the same punctum appeared. A test was conducted on participants of similar age in their twenties. They recalled memories through the throwing activity, including those they had seen in historical books and dramas through the background of Gyeongbokgung Palace. Similar fruit-cutting games were a common memory, though very private experiences were also mentioned (P2 and P7).

Second, technology-based immersion may evoke the punctum. It was confirmed that the immersive activity of audiences on a mission in the interactive artwork is also a major trigger of the punctum (P6, P7, P10, P12, and P15). A characteristic of interactive artwork is that the content of the artwork changes in response to the audience's activity. Regarding immersion, some participants said that they felt the punctum better. The sound and gamification features reminded the participants of specific experiences, where many characteristics of the punctum were discovered.

Third, several features of the punctum appeared simultaneously to individual participants. Among the features, the case of the dice was the most common, followed by the speck and the cut. Some participants felt two or more features of the punctum in this test (P4, P5, P8, P12, and P17). P4 and P17 felt the punctum features of the cut and the speck

simultaneously; P5 the speck and the cast of the dice; P8 the cut and the cast of the dice. Furthermore, P12 reported three punctum features: the cut, the cast of the dice, and the little hole.

5. CONCLUSION

In summary, Roland Barthes defined the punctum, in contrast to the studium, as the area of uncoded personal experience. It is not conceptualized by theory. Categorizing the punctum into features can be dangerous. However, suggesting new values by discovering new aesthetic domains from audiences participating in interactive artwork can be facilitated through such categorization. This study was the first to apply Barthes' punctum to interactive artworks considering the audience's subjectivity in contrast to the artist's objective.

In conclusion, it is possible to discover the experiential elements of audiences' interactions with artwork that differ from the studium intended by the artist. No matter the artist's intended meaning, interactive artworks allow audiences to enjoy other detailed features of the punctum through their own experiences and personal memories. This also allows participants to expand their aesthetic experiences of the interactive artwork. These findings will apply to other interactive content like video games and exhibitions and in terms of the subjective participation of audience members. From the viewpoint of intertextuality, the concept of punctum based on interactions with artwork will expand artistic experience through the activities of the audience members beyond the artist's intentions and objectives.

Future work should analyze the relationship between studium and punctum and the correlation between punctum and the audience's direct activities in an interactive artwork. Analyzing this relationship could provide insight into making interactive artwork that considers audience objectives, allowing audience members to participate in interactive artwork according to their own intentions.

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