

A Study on the Properties of the Relation between Digital Computer Games and Media Performance with a Focus on the Kinect Device

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Abstract

The development of digital media has ended the conceptual and technical division between the gaming industry and the performing arts. Digital games based on computers provide the experience of enhanced immersion in the game as one enters a virtual environment and leads the story by selecting and manipulating independently. In the case of media performance in which the digital media functions as an important element, a new visual expression of the arts and the opportunity to go beyond the limits of expression are provided through the interactivity between the performer and the media. In this sense, these two fields have common properties, and they interact and allow the story to unfold within the frame of the virtual environment through the independent actions of the actors. Therefore, it can be said that actors' gestures and media interactivity are the most important properties of digital media, and these play the important role of connecting the notions of digital games and the performing arts. Moreover, as the body of the player or performer works as an interface and manifests the most basic interactivity, this becomes an important notion in understanding the similarities of the two fields. Accordingly, through cases of digital game contents and media performances that utilize Kinect, a popular piece of technical equipment that recognizes gestures, this paper aims to examine the possibility of a connection between the two fields and to explore the possibility of development through a mutual interchange.

Keywords: Digital Game, Media Performance, Kinect, Interactivity, Interface

1. Introduction

Before the emergence of the digital era, gaming technology, aimed at sheer pleasure, and the performing arts were two distinct areas. It was uncommon to think of the integration of the two areas or of a direct influence of one on the other. The modern age of digitalization, however, resulted in a change of the revolutionary paradigm in many different fields of study as consistent improvements in computer interfaces and user communication were made by the exchange, application, and development of such technologies through the integrated research of applied fields. Since the emergence of the digital era, machines and computers have been put in charge of the accurate and expeditious management of data processing, which is very logical and computational. Thus, it has become the job of humans to engage in artistic expression (e.g., that of ideas, knowledge, and creativity), and this has resulted in increased attention to highly sentimental individuals rather than very rational or logical individuals. Sensitive people have thus begun to pursue touching impressions and pleasure in the arts,

culture, and leisure as well as in every aspect of daily life, as this has been assisted by digital technology [1]. The appearance of integration in digital media, which, as seen above, embraced a variety of the characteristics and the functions of media, allowed digital games and the performing arts to possess mutually similar properties and develop. As Kyoum Sup Kim puts it, computer games are “an act enclosed within a frame” that is characterized by the segregation of time and space under certain play rules and at the same time “a procedural narrative” where each of a series of unique narratives is accomplished consecutively through continuous rehearsals and repeated play. Kim also says the primary element of seeing computer games as one of the most significant performance acts of the modern era lies in the participation of audience. The participation of the audience in computer games refers to the “interconnectivity” produced by the mutual actions of the audience. In the sense that this notion of interconnectivity highlights the presence of entities, changes in minds, and even the conversion of minds into entities, a gaming study from the perspective of performance studies is likely to be a very attractive element to compliment gaming research made of, up to the present day, an entirely different dimension [2]. In other words, games that base themselves on digital media and the concept of performance arts possess similar characteristics and connote positive and manifold possibilities for communication between societies. In particular, the field of games is one where interface technology development, from joystick games to movement-based indirect interface technology, is commercially utilized well. As technologies and hardware for the application of movement recognition-based interaction are developed, in the field of performing arts where the piece is completed by the performer, a new form of performance, where interactivity is emphasized, is created by applying the form or technology of the game in different ways. After 2010, as Microsoft’s Kinect based on movement recognition was commercialized in the game market, those in the performing arts field made an interactive stage space by following the movements of performers using a Kinect due to its portability and convenience. The expression effect (done without a separate controller by tracking human movement and interacting with a video) applied a gesture gaming factor to the performing arts to increase absorption and fun (similar to the gaming environment) as well as artistic expression. In the gaming field, to support convenient and intuitive interaction between game contents and users, research on a user interface based on movement recognition using the user’s movement is being actively conducted. Research like this will play a positive role in creating dance/performing art that exists with body gestures as a basic surface medium, and research on the possibility of linking these two fields will be essential [3].

The present study examines the positive role of computer games involving the interconnectivity of participants founded in digital properties and the extended notion of performing arts in the artificial world of digital games and in the creation of performing arts that exists with the structural body of the performance stage as its basic medium of expression. Focused on the fact that the body of a performer functions as an interface, the study also analyzes the possibility of a connection between the two areas and their common traits. It is also our goal to analyze the various game contents of Kinect, a movement-sensitive game device that utilizes the human body, and actual cases where such contents have been applied. Finally, we aim to propose a new possibility in the integration of the gaming industry and the performing arts industry.

2. Relationship between Gaming and Performing Arts

Interconnectivity, a typical trait of digital media, is referred to as the interaction between users and the media, and it often appears in games that use the context of an artificial reality, such as computer games. In the interconnectivity found in games, a

user becomes the protagonist of the story embedded in the game, chooses what is going to happen next, and causes the story to follow a different path. For that reason, the experience of making one's own story has been made possible in computer games. Such experiences have altered the environment in which audiences had to watch plays in a passive manner into something where they are capable of getting on stage themselves and performing with the performers; this space inside a computer possesses the same meaning as that given to a theater.

A quick glance at the short history of gaming research implies that the attempts to explain gaming from a performing arts perspective are of significance to the formation of the study of games [2]. Janet Murray in particular regards playing computer games as a dramatic experience grounded on the interconnectivity of computers and proposes a new concept of "cyberdrama," focusing on the capability of computer games to carry out dramatic storytelling. By putting the text, video, and travel space together in one place and by creating the personalities and the actions of the characters, computer games were able to produce an imaginary world constituted with dynamic events. Murray's view on the subject tells us that it is possible for a player of a computer game to bring his own view on the world and desires onto the stage with the help of a background called "artificial reality" and of an actor or an avatar who progresses such events inside the game [4]. The artificial space provided inside computer games can have the same meaning as the imaginary space above a stage, and these two spaces do share some common features, as they both invalidate the border between reality and imagination and effectively provoke the immersion of audiences.

3. Interactivity

Among all the properties that commonly appear in computer games and media performances based on digital media, the most representative is that of interactivity. This refers to a phenomenon influencing individuals through mutual exchange between a digital media and a user, a user and a user, or a media and a media. Depending on the approach, there are slight differences in defining interactivity, but when it comes to games, it is considered the most significant property games possess. Since computer games are played in a virtual environment, interactivity is necessary. The play cannot be accomplished without interactivity, because the play is comprised of the acts of interactivity of the players. Without players, the game remains in a latent form, and it is the active participation of the players that gives meaning to the game [5]. Games are not just unilaterally seen or listened to by the player; rather, the player himself solves the game by deciding on the character and the story. In other words, with the development of digital technology, interactivity works in more varied ways to allow players to enjoy the game by creating new stories and selecting and deciding on the story. In the cyberspace inside computer games, the player unfolds his actions by directly entering the space where the game is unfolding. This space creates an illusion in which the player recognizes it as being the same as real life. The player continuously interacts in a space within the game and creates and leads the game. In normal media performances, interactivity creates a new performance space as the stage space responds to the movements of the performer in real time. In an interactive media performance, the role of the performer is not limited to the simple expression of the beauty of the choreographed movements of the body. Rather, the performer himself becomes a user controlling the multimedia and limits the digital media used in the performance through the instant beauty of the body in a real space [6]. Being the subject of an act, both a player of a computer game and a performer of a performance experience immersion by interacting with the space and taking the lead with the choices they have.

4. Body Interface

Generally, an interface can be defined as a boundary between two different worlds or as an access point where machines and human users exchange information with each other. As a device that enables the communication of two independent entities between computers and users, the boundary of art creation and acceptance process of interactive artistic actions as an interface as a medium will loosen and tend to combine. Work that designs interaction itself to be the kinetic artwork can be esthetically experienced while creating a new art world where interaction between performers and space is possible [6].

The most famous gesture-interactive game hardware, Kinect, is played by moving one's body. In the case of Kinect, Jae-Young Kim, the most famous controller of movement-recognition sensors, plays a role as a performer in a gesture-interactive game, and this interface develops a strong gaming experience, as it acts as a direct medium in the actions and movements of a user [7]. Therefore, the utilization of Kinect, which can express artistic work of experience in the game using the body of the user without a controller, shows the most fundamental aspect of interaction that is possible in the new digital environment while the body is being projected on the work or actively leading the game environment.



Figure 1. Seventh Sense by Anarchy Dance Theater

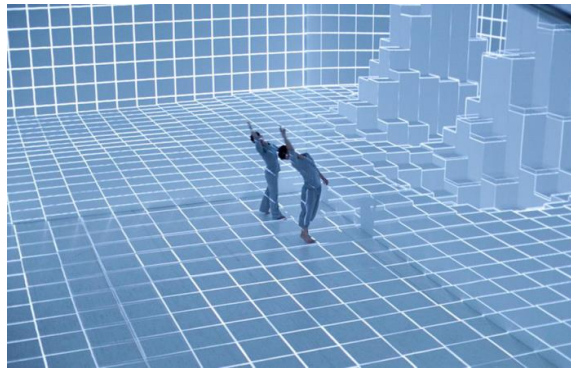


Figure 2. Soccer Game

In *Seventh Sense* (Figure 1), a media performance work, many lines arranged in a pattern on the stage space react to the location that dancers pass and change dimensionally in real time, and the audience members feel as if they are experiencing a computer game graphic on the stage [8]. In the soccer game in Figure 2, the player exists in the virtual world as the virtual body of an avatar, and when the player kicks a ball, Kinect recognizes it and then makes their avatar in the virtual world do the same thing. The players enjoy the game by controlling their own body movement in the virtual world and experiencing themselves in the virtual world. For the media performance, competition as one of the game elements is not included, but the type, engrossment, and visual effects of the experiences in the virtual world are similar to those of other games.

In other words, the body manipulates the digital environment as the dancer's movements are reflected, as in the performance, and it also interacts with the digitalized stage. Manipulating what happens in the game directly and experiencing the virtual world through expressions of various images of real-time image graphics on the stage could mean that strengths of games are included in interactive media performances. Therefore, the similarities of games and interactive performances can be found in their provision of greater absorption and entertainment through the performer's body becoming the interface [3].

5. Use of Kinect Device in Games and Media Performances

Among the game technologies, Kinect is a game device in which the interactivity of the game space due to the recognition of player actions is effectively expressed. Hence, examples of games that use Kinect and media performances that create a new stage space by recognizing the movements of the performer are analyzed.

5.1. Kinect

Microsoft's Kinect is a machine installed with a camera module and infrared sensor, so it recognizes the body frame and movement of the user using motion capture and recognizes voice with the mic module. It revolutionized gaming by providing a new method of experiencing entertainment and games using the user's body without a controller. After that, Kinect for Windows was opened to the public, and as various software developments using Kinect became accessible to everyone, different fields in industries outside the gaming industry started using it [9, 10]. Microsoft Kinect for Windows includes an RGB camera that captures three basic color components and thus enables its human recognition ability. A depth sensor, an infrared projector combined with a monochrome CMOS sensor, enables 3D space recording in any light condition. It also contains a multi-directional microphone that is able to identify voices according to sounds and to distinguish noise from the surroundings. Furthermore, the Kinect device includes a three-axis motor that can tilt the Kinect sensor accordingly [11].

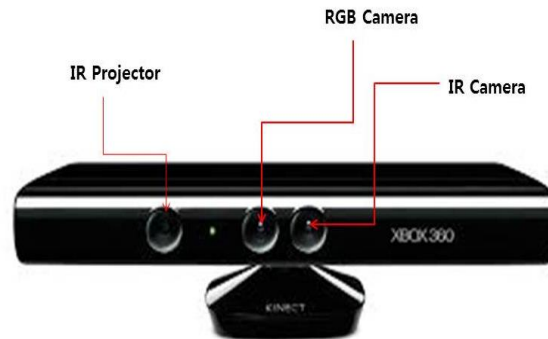


Figure 3. Microsoft Kinect

At present, there are two kinds of movement-recognition libraries that use Kinect, namely, the Kinect SDK and OpenNI. For the OpenNI, which is most commonly used, the method of inputting the color camera is not used. Rather, the method of extracting frames using the depth video data is used. Conversely, the Kinect SDK often uses the input of the color camera for recognition, and it is used by synthesizing the facial recognition and vocal recognition. Following the popularization of Kinect, a library in which OpenNI could be connected to Kinect was created, and the developers support the free use of OpenNI and Kinect [12]. Due to these merits, research on applying contents technology capable of interaction through user gesture recognition has progressed briskly, as it has been applied not only in the gaming industry but also in the field of performing arts.

5.2. Kinect Games

Among the various types of gesture-interactive game hardware, Kinect is the most famous indirect movement-recognition technology that materializes the interaction with the virtual space through a person's movement, and it is often used in gaming contents where gaming and entertainment are combined, like exercising games and educational games for kids. Anyone can enjoy games using their body easily and quickly if they have the required space for the camera built in Kinect to recognize their body, and no other particular equipment is necessary.

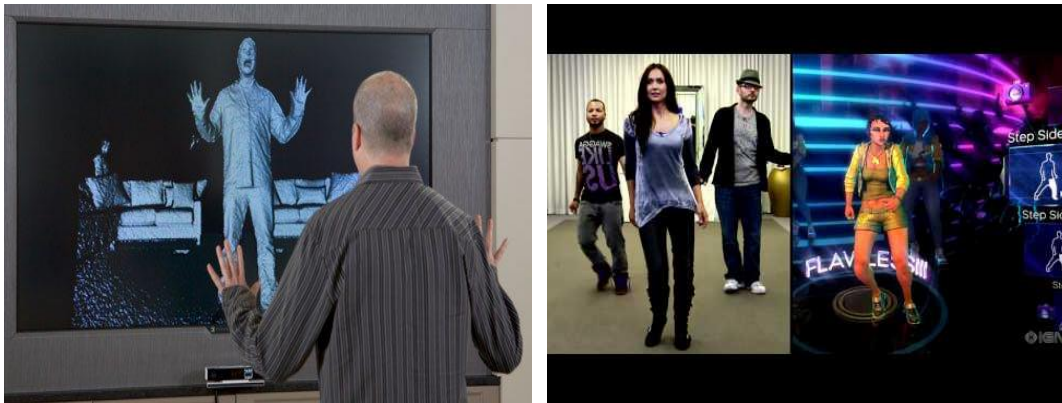


Figure 4. Games that Utilize Kinect

Chanjira notes that in interactive games, motion can be captured and used to drive game characters to give the game player a new experience of participation, such as Kinect for Xbox 360. Motion capture is very useful in gesture training, as it brings traditional training based only on experience into the digital era. The Microsoft Kinect brought these capabilities to a new level, eliminating the need for a hand-held controller and allowing precise position detection of the user in 3D space [13].

5.3. Kinect in Media Performances

Motion-capture technology that inputs by sensing the movements of a person was used for dance performances back in the 1990s where it was used for expressing movements visually with sensors attached to the "body" of a performer. This technology, as the most used technology in interactive performances, recognizes the sensor that is attached to the performer or the artist, and a marker analyzes the screen input to the camera to capture particular movements. A body movement like this is output through the monitor by combining it with a prepared animation.

Choreographer Bill T. Jones, along with many developers and Merce Cunningham in *Ghostcatching* (1999), programmed it separately. This was to show only the movements that react to the sensors and not the bones and muscles when a person moves with a sensor, the equipment that reflects the extracted points, lines, curves, and pillars to the motion capture, by attaching sensors on his body [6]. Dixon states that by using reflective markers on the joints and body parts of the dancers, cameras around the studio relayed the images to computers, which calculated and rendered their kinetic shapes in relation to 3D space. This data was then manipulated in the character studio to create complex and beautiful hand-drawn figure animations performing the same dances [14] (Figure 5). The motion-capturing devices used by both Merce Cunningham and

Kinect have the same principle that extracts the value of the movement by recognizing the movement of the body parts of users. The motion-capturing device directly attaches the marker to the performer's body while the Kinect device shoots countless infrared rays to each part of the body and recognizes what is reflected by the body through the infrared camera.

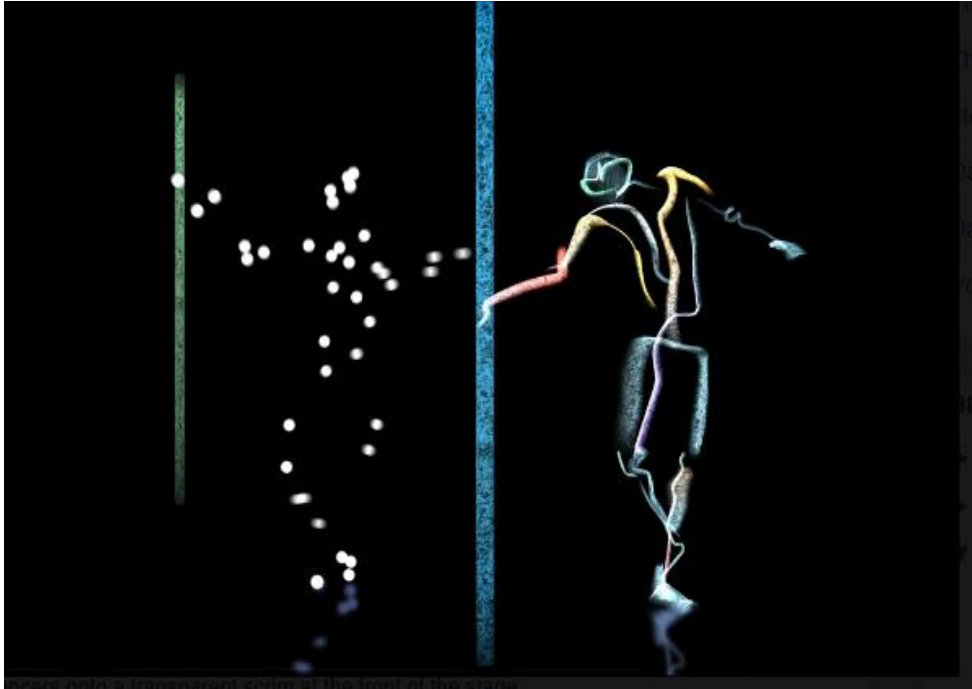


Figure 5. Merce Cunningham's BIPED

However, as Kinect was commercialized, the expensive motion-capture equipment that only professionals could use was replaced with convenient and efficient technology, and the easy and simple artistic expression of pieces became possible in the gaming and dance markets.

In the Midas space of the MIDAS projects in Figure 6, a 3D stage space is created through a projector in real time by capturing the extemporaneous movements of dancers using Kinect. According to the director of the team, Derek, "The Kinect was set up at the front of the stage to track the performer using skeleton tracking and then interface with Synapse. This controlled the particle visuals in Quartz Composer during the performance. Elsewhere, the Kinect was used as a depth sensor to affect other visual aspects of the performance" [15]. The video of the dimensional pattern changes according to the body movements and the immediate presentation of the visual effect create an absorption environment. It is as if one is playing a game, and it expands the senses of the audiences as if the movements of the dancer and space are temporarily linked. The relatively simple hardware installment of a computer, Kinect, projector, and software program for image work creates an environment that can create performances based on computer technology. The interaction of a dancer and space newly reconstructs the gesture stage area and creatively expresses it with only the movements of the dancer; it plays a big role in utilizing the gesture stage space creatively. In other words, because the virtual space and performer, which cannot interact on a traditional

stage set, can be expressed easily and quickly in real time, the utilization of Kinect is being effectively applied to dance work in the area of the performing arts.



Figure 6. Interactions between the Performer and Stage of Midas Space

Table 1. Midas Space Technical Spaces

Software	Hardware
OpenFrameworks	Four iMacs (three for visuals, one for audio)
Syphon	Three projectors (1 x 8000 Lumen Sanyo, 1 x 3500 Lumen NEC, and 1 x 5000 Lumen NEC)
MadMapper	Microsoft Kinect
Quartz Composer	PlayStation 3 Eye (modified to an IR camera)
VDMX	RME Fireface 800
Ableton Live	Network Switch
Synapse	Stage Lights
After Effects	
Google SketchUp	

The *Slipping out of Consciousness* performance by Hyun Yi Jung (Figure 7) also uses Kinect to change its image and sound based on the dancer's movements. When a dancer stands up without movement, it projects images that overlap her body, giving an effect that implies that her soul is leaving her body. When the dancer begins to move her body intensely to get her soul back, the sound turns on and the lighting becomes brighter. As in Figure 8, the simple installation of Kinect with body-action recognition and the use of computer programming can effectively express consciousness (reality) and sub-consciousness (virtual world). Extending the existing GUI (Graphic User Interface) to the NUI (Natural User Interface) enables the application of Kinect NUI concepts to the performing arts.



Figure 7. Slipping Out of Consciousness

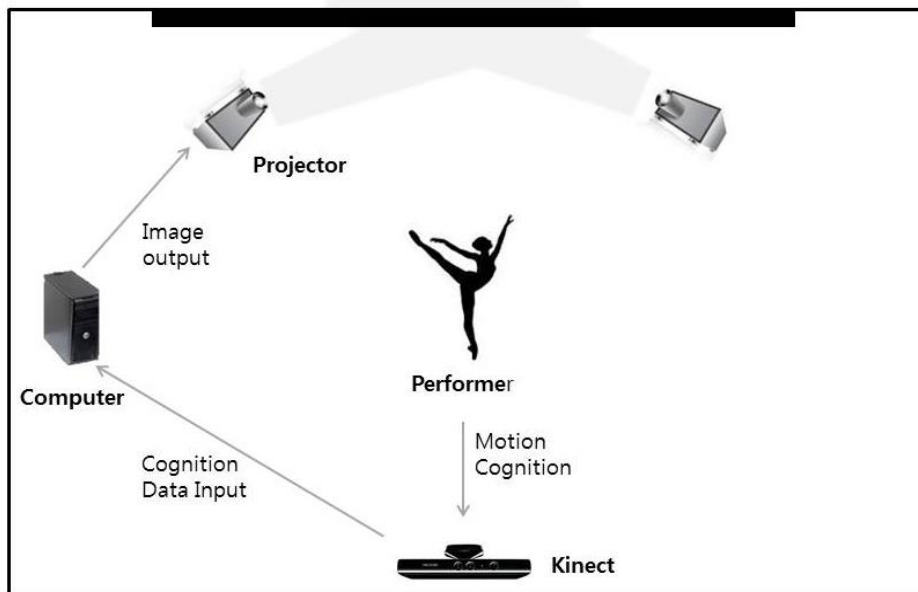


Figure 8. Technical setup using Kinect hardware

Sun-Myung Hwang proposed an NUI using voice and motion recognition. Instead of a keyboard and mouse, this method provides an easy-to-control user interface. Tedious manual work is unnecessary using this method. If a keyboard and mouse occupied the space, a flat surface would have to be installed. In addition, a large screen that cannot be seen in its entirety from a short distance would be inconvenient. However, at a relatively long-range distance, if motion and voice can be operated, it would improve the existing user-friendly interface [16].

6. Conclusion

The digital media technology is continuously developed in various fields. In the field of games (in which developments are the most popular and commercial) and the performing arts (in which new aesthetic experiences are pursued), the relationship is developing and expanding through the exchange of technology. The interactivity of computer games and media performances that appears with the application of digital media and gesture properties as an interface transforms the actor into an active participator and provides an improved feeling of immersion. Janet Murray stated that the game, in which we can experience the perspective of the director, actor, and audience member, is a space for thrilling play, not traditional play, while cyberspace, where the actions of the player unfold, is a space formulated with the navigation of interactive players. In other words, the space where games proceed and the space where performance occur have common properties. That is, these are carried out within the frame, and these two fields display interactivity and expanded gesture properties by the application of digital media.

In the gaming field that is quickly developing due to the focus on the gesture-interactive game industry, the user interface based on easy and direct movement recognition will further develop. This will result in active commercialization of movement-recognition technology and increase the opportunities to adopt and apply game technology for various expression methods using movements even in the area of dance/performance art where the performer's body itself becomes the expressing medium. The utilization of Kinect has its limitations, such as lighting interference and recognition distance limits. In addition, because it is more convenient, portable, and efficient compared to previous motion-capture devices, many media performance works that utilize the strengths of Kinect are being made, and opportunities to express various ideas will increase by applying Kinect and other gesture technologies to performances.

If interactive media performance works that need to create a new movement expression method by applying digital technology in the performance art field use gesture-interactive gaming technology, the beneficial combination of the two fields can play a role in providing future visions for each field [3].

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