

# DraWiing Together: Exploring Collaborative User Engagement in Art Exhibitions

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**Abstract.** There is growing interest in user experience studies in Human Computer Interaction (HCI) and Interaction Design. Many researchers focus on designing technology to enhance user experience, specifically for engagement, joy, and collaboration. In order to explore user engagement, we developed three different WiiArts applications: *Illumination*, *RippleCast*, and *ChromaFlow*. We performed data analysis based on the video data collected from three different art exhibitions in three different countries: the USA, Germany, and South Korea. In this paper, we present the results of our observations that identified users' engagement time, the number of people in a drawing collaboration session, and their drawing patterns. Then, we discuss the design implications for user engagement in terms of interactivity, collaboration, and creation. We conclude that both situated interaction and collaborative creation should be considered for designing technology for enhancing user engagement.

**Keywords:** Art Installation, User Engagement, Experience Design, Collaborative Interaction, Situated Interaction, Drawing Application, Media Arts, Interactive, Tangible Interaction, Wii Remote-based Physical Interaction.

## 1 Introduction

We live in a world in which technology is seamlessly embedded in our everyday lives. Automatic lighting systems in hallways, self-checkout systems in grocery stores, and wireless Internet connections throughout cities are good illustrations as to how our lives are deeply interconnected to technology. The notion of who are technology consumers has also changed. Besides tech-savvy and gadget-loving consumers, everyday people with no technical background are buying and using technology. Without knowing the logic behind the development, people enjoy using the technologies if they give them fun and joyful experiences. Furthermore, this notion pushes Human Computer Interaction (HCI) researchers to explore user experience and engagement with technology [1, 2]. Traditionally, HCI research focuses on the usability and accessibility of design technology in terms of efficiency

and effectiveness [1]. Usability is the most important factor to consider during the system evaluation stage because technology is usually designed to perform certain specific tasks [3, 4]. For example, HCI researchers usually focus their attentions to issues such as whether the system was designed well enough for users to be able to create documents, websites, and photo albums as they wish, or whether the button was visible and in the right location for the tasks. These are all important matters for research. However, with the extended needs and use of technology in our everyday lives, it is also important to consider user experience factors in designing technology. The question is then, how can we design technology to enhance user experience? In another word, when designing technology, how can we encourage users to actively engage in the experience? Greenburg and Buxton stated the importance of user engagement in their paper. They criticized the current practice of HCI and argued that usability evaluation could be harmful in many instances [5].

In this paper, we explored the design factors for enhancing user engagement. For research purposes, we first developed three different WiiArts applications: *Illumination*, *ChromaFlow*, and *RippleCast* to explore user engagement. Then in order to collect real-life use data, we conducted observations in actual gallery art exhibitions in three different countries: the United States of America, Germany, and South Korea. Based on direct in situ and videotaped observations, we analyzed the data and decided on the factors for enhancing user engagement.

## 2 Interactive Arts

In *Art as Experience* (1984), John Dewey says that a work of art is an individualized participating experience [6]. A work of art is recreated every time it is aesthetically experienced by the viewer. Each viewer creates an imaginative relationship with the self through his/her experience with artwork, and this kind of process can be referred to as “interactive engagement.” In this sense, all artwork is interactive. If we could agree that to a certain degree, all artwork is open to participation and multiple interpretations by viewers, depending on their own experiences with the artwork. Why then, do we call some types of artwork interactive art, and how does this kind of interactive art differ from the other art forms that involve interactive experience?

The goal of interactive art is to involve the spectator in some way.<sup>1</sup> Interactive art is a type of art that involves a viewer’s active participation. Unlike the traditional art piece, such as a painting or sculpture, interactive art encourages viewers to create their own narratives [7]. Interactive artists often claim that their work is open to the audience’s participation [8]. Therefore, their work has an open-ended structure that allows or even encourages the audience to “complete” their creations. In this sense, with respect to interactive artwork, the relationship between the creator and the audience becomes blurred, sometimes to the extent that some may even say that the

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<sup>1</sup> Itsuo Sakane, the Japanese journalist and curator, suggests that interactive art is simply art that involves the participation of the viewer. However, he goes on to remark, “All arts can be called interactive in a deep sense if we consider viewing and interpreting a work of art as a kind of participation” (1989, 3).

audience becomes a co-creator of the work [9].<sup>2</sup> Therefore, user engagement is a critical component in designing an interactive art system [7].

As for its system, new media art or interactive art not only utilizes new media (computer-based media) as its medium for artwork creation, but also exploits the interaction between humans and computers for a new way to experience art. Since most interactive artwork uses the computing system as a communicative means, the interactive artwork often focuses on how to make a reliable input system that can sense the participant's interaction and present a complicated output that can provide new experiences, which are possible only with computer-based creation. Although this kind of interactive artwork does not explicitly aim for functionality and usability in its interaction with the system (in the sense that the system requires an interactive and communicative process between humans and computers), sometimes the focus is still not very much different from that of the HCI type of computing system design. Despite the fact that there are shared interests between HCI research and interactive art, this interactive art as new media art must have its own interests and directions as a genre of art that distinguishes it from commercially applied scientific and technological research.

If the interactive experience is intended as artwork, it can have different goals. We can imagine that there will be some differences with regard to the subjective reading in such experiences. Although some works encourage this more, whereas other works encourage this less, artists may want to explore, question, and challenge the relationship between the viewer and the interactive system. They may want to elicit diverse and flexible dialogues between the work and the viewer in order to expand the scope of the experience to evoke a dialogue between the self and the world beyond. In "The Construction of Experience: Interface as Content (1998)",<sup>3</sup> interactive artist David Rokeby mentions that in interactive art, responsibility is at the heart of interactivity as the system's ability to respond to its interactors' interaction. Therefore, the process of designing an interaction should also, in and of itself, be interactive. In designing the interface, interactive artists need to pay "close attention to the user's responses and make modifications as a result of our observations [10]." In this way, interactive artists need to "expand the terms of this interactive feedback loop from simply measuring functionality and effectiveness, to include an awareness of the impressions an interaction leaves on the user and the ways these impressions

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<sup>2</sup> The Antennae Of The Race by Nina Colosi, Producer/Curator, evol  
<http://www.evol.org/essays.html>

"Audience: The networked, digital environment is by nature polyvocal and favors a plurality of discourses. Interactive art involves reciprocity and collaboration between the creator or creators, the audience and a project. Audiences collaborate in the process of remapping textual, visual, kinetic and aural components of the artwork—the public and audience becomes a participant.

Artist: Rather than being the creator of a work of art, the artist often becomes a mediatory agent and facilitator for audiences' interaction with and contribution to the artwork."

<sup>3</sup> David Rokeby., "The Construction of Experience: Interface as Content"

<http://homepage.mac.com/davidrokeby/experience.html>. This article appears in the book: "Digital Illusion: Entertaining the Future with High Technology," Clark Dodsworth, Jr., Contributing Editor 1998 by the ACM Press, a division of the Association for Computing Machinery, Inc. (ACM) published by Addison-Wesley Publishing Company.

change the user's experience of the world [10]." As a result, he emphasizes that the interface can be a content of interactive works. Interactive artists need to seek profound and subtle ways that the interface itself shapes our experience of that content by defining how we perceive and navigate content.

We also think that in this participation and interaction paradigm, the most important thing is not only interacting with the self, but also engaging in collaboration through interaction. The viewer may himself/herself find different meanings in the piece on different days, at different hours, or at different stages of his/her own development. Furthermore, it is important for artists to well understand how users interact with their work because audience engagement is the one of the most critical factors in public galleries [11]. In fact, the setting where interactive artwork is exhibited in the gallery and appreciated by the viewers affects the interactive experience of the work. The dilemma of an interactive work is how to guide its interaction without specifically or visibly noting so next to the work. Sometimes without a note, there is hardly any guidance to the audience in terms of how to interact with the work. With a note, however, it can delimit the audience's free and voluntary response to the work. In this situation, in the gallery, other audience members' actions and reactions bring about a tremendous effect to others' interactions with the work since people's curiosity about a piece of work is affected by observing other people's interactions and reactions. They get clues from others about how to interact with the work. Thus in interactive artwork, unlike other non-interactive artwork, audience engagement brings into the exhibition arena certain kinds of collaboration with other viewers.

### 3 The WiiArts Applications

The purpose of the WiiArts applications is to let users, or viewers create experimental video, audio, and image processing art projects through collaborative and expressive experience. The applications are developed in Max/MSP/Jitter and Java using pre-existing sensing technologies, such as Nintendo's Wii Remotes and a wireless sensor bar [12]. To explore user engagement through interactive art systems, we chose the Wii Remote as the interaction method for several reasons. First, the Wii Remote can provide an environment where multiple users can play together in front of a large projection screen. Second, it can allow users to interact with and manipulate items on a screen via movement or pointing, due to its motion-sensing capability through accelerometers and infrared detection. In this section, we will describe the three applications respectively: *Illumination*, *RippleCast*, and *ChromaFlow*.

#### 3.1 Illumination

*Illumination* lets participants draw anything with real-time fluid candlelight traces. The projection screen becomes a shared drawing canvas, and up to three audience members can draw simultaneously each with their own Wii Remotes. The candlelight source imagery of the three burning candles is captured by three cameras in real-time. Thus, the three different candlelight traces drawn by three participants can be

composed together to create a dynamic drawing. The goal of the interactivity is to give participants contemplative aesthetic experiences by drawing with candlelight in a dark space. Figure 1 shows six different drawings created in the exhibitions.



**Fig. 1.** Illumination

The drawing located at the top right corner of Figure 1 shows a creation of the word “WiiArt” created by two participants. Since candlelight drawing does not continue more than 5-seconds, after several trial-and-error attempts, the two participants have to work collaboratively to complete the word together within the time constraint. After succeeding in the first collaborative writing, the participants continued to create other objects, such as a house (Figure 1 center right screen), and a heart shape (Figure 1 bottom right screen).

### **3.2 RippleCast and RippleCast 2009**

*RippleCast* attempts to provide a calm engagement and a chance to encounter nature in an interactive media art experience. As if the participants were standing on the shore of a lake, the projected image of a still pond on a big gallery wall lies waiting for the viewers. A viewer may take hold of one of the controllers and start to move it around as players do in Wii games and watch the ripples magically appear on the tranquil lake scene in front of them (Figure 2).

In *RippleCast*, interaction with the Wii Remote is designed to mimic the movement of stone skipping like we do with our hands. Similar to the way we grip a real stone with our fingers, stretch our arms and release the stone from our fingers at the last moment, the participant can trace a curved line in the air while holding the Wii Remote and pressing the big button on the bottom with his/her index finger, and finally release the button to release a virtual stone. As a result, ripples form on the surface of the still pond, depending on where the participant throws the stone. Based on the strength and degree of the throwing motion, the stone skips, making one or more hops. Certain movements, directions, and speeds are programmed to get better results. Tracking of the movement and speed of the Wii Remote are measured with its embedded accelerometer, and the data are wirelessly transmitted to a computer in a separate room via Bluetooth technology.



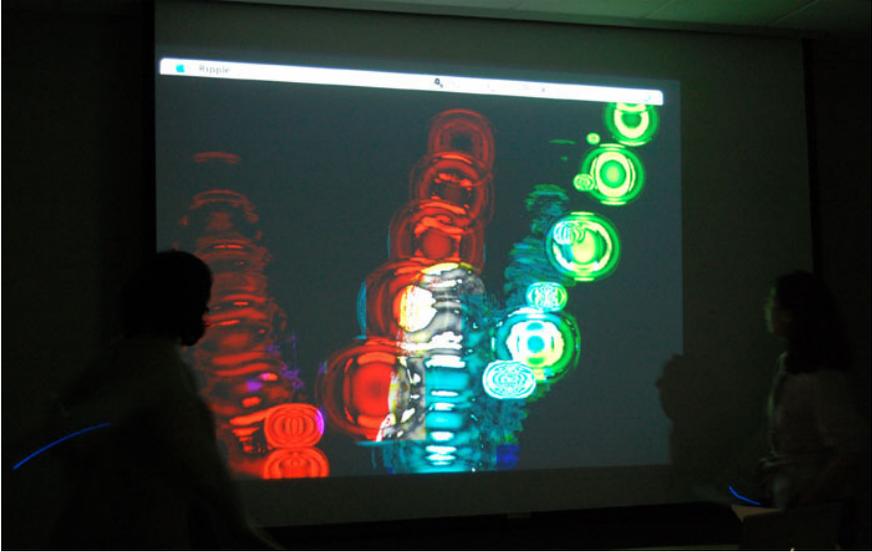
**Fig. 2.** RippleCast 2009

After the success with *RippleCast*, we developed *RippleCast 2009* to include wavering water in a pond rather than a still image. *RippleCast 2009* was implemented with a real-time video of lightly wavering water pond to create a more engaging experience. Figure 2 above shows three participants competing with one another to see who could throw a virtual stone further.

### 3.3 ChromaFlow

Like *RippleCast*, *ChromaFlow* is a WiiArts application that draws ripples on the screen. The interaction and program use exactly the same methodology as *RippleCast*, but while *RippleCast* emphasizes self-reflection through the experience, *ChromaFlow* instead

promotes a more collaborative interaction among users. In this work, each person's Wii Remote draws single colored ripples. When each stroke with the Wii Remote is made and a virtual water drop is cast on the surface, it bounces several times as in *RippleCast*, like a splash. Currently, this application supports interaction for up to three people at a time. Thus, if three participants work together, they can cast ripples in three different colors from three Wii Remotes. The ripples cast by the participants flow on the surface of the screen. When they spread and diffuse near other ripples, they start to mix, creating a colorful image, as seen in Figure 3.



**Fig. 3.** ChromaFlow

Sometimes ripples are dropped at unexpected locations, much like occasional random drops in watercolor drawings. This kind of effect can bring about unpredictable results created only by chance. *ChromaFlow* is reminiscent to one of Jackson Pollock's drip paintings in the sense that the audience can draw abstract images with ripples through diverse and active body gestures [13]. Unlike Pollock's canvas, which was placed on the floor, the canvas screen in *ChromaFlow* is set up vertically on the wall. Also in *ChromaFlow*, the shared canvas becomes an open field for the creation of many different kinds of abstract visual works. Similarly to *RippleCast*, the position of where ripples drop on the surface are mapped from the Wii Remote interaction in a way that is unpredictable. This is because the gestures with the Wii Remotes are made in open space; thus, every time a movement is made, its direction or position is made a little bit differently. With the waving colorful water surface on the screen, the audience becomes immersed in a calm and reflective mode.

## 4 Design Implications

In this section, we first describe the summary of our observations in terms of users' engagement time, the number of people in collaboration, and their drawing patterns. Then, we propose that user engagement should consider two factors: situated interaction and collaborative creation. The exhibitions were held in three different countries: Seoul, Korea; Atlanta, Georgia, USA; and Bonn, Germany, respectively. The first two exhibitions were parts of the author's solo and group exhibitions. The last one in Germany was a part of the second ACM Tangible Embedded and Embodied Interaction Conference Demo session [12]. Due to the characteristics of the exhibition, most of the audience members were adults.

Our user engagement analysis focused on the duration, number of people, and drawing patterns. We tried to answer three research questions: (1) How much time did the audience spend playing the WiiArts application? (2) How many people (up to a maximum of three users) played the WiiArts application together? and (3) Did the audience create specific meaningful drawing patterns?

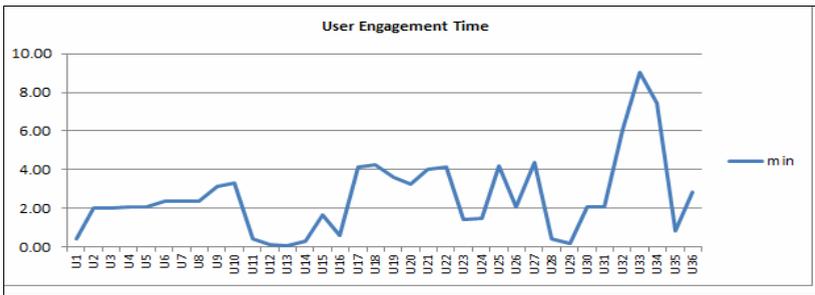


Fig. 4. User Engagement Time

Figure 4 shows the graph of an individual user's engagement time. A total of 36 participants played with the WiiArts applications. Overall, the time people spent on the applications is diverse (min: 27 seconds and max: 9.03 minutes). Some people played in pairs or groups of three. Some of them would play alone after collaborating with others to further explore the interactivity and its unexpected outcomes. Since we do not have enough data to co-relate each application with its playing-time, we did not conduct more in-depth playing-time analysis. However, the overall time shows that people really enjoyed using the applications – the participants spent an average of 2.6 minutes interacting with the applications in the public exhibitions.

Our observation analysis clearly shows that three attributes such as interactivity, collaboration, and creation can increase user engagement in a public art exhibition. We frame the attributes by calling them “**situated interaction**” and “**collaborative creation.**”

First, **situated interaction** can be defined as situations in which people would engage more when the interaction is truly situated within specific contexts. For example, let's take a look at the *RippleCast* application. When the participants first see the screen, they may not understand the purpose of the image of the lake. Since it

is displayed in a gallery, they may assume that it is an artwork as part of an exhibition. They may also recognize that it does not seem to match with the semiotic reading of art photography or art videos. Yet, still they may feel liberated looking at the imagery of the pond, which transports them into the feel of being in nature, in the countryside. From the moment they find three Wii Remote controllers with bright blue LED lights in a corner of the room, they start to discover a connection between the controllers and the natural scene. They may not get a response immediately, since the interaction requires that they press a specific button to interact with the image. Nevertheless, occasionally some of them would be able to, either by luck, by accident, or by exploration, create a small ripple reflection on the surface of the pond. At that moment, they suddenly realize that they can skip stones over the still pond, as if they were actually in front of water in nature. Thus, the interaction (interacting with the system) is truly situated. Comparing the participants' feedback between *RippleCast* and *RippleCast 2009* also shows the importance of contexts. Participants who played *RippleCast 2009* were more engaged by spending more time because the lightly wavering water in a pond enabled participants to feel more situated in the context.

Second, **collaborative creation** can be defined as the positive relationship between the activity of co-creating and the levels of engagement. We observed that most people played the application as a pair or in groups of three. As expected, participants spent more time when they were collaborating with others to draw something with *Illumination* or competing by throwing his or her stone to see which one would go further using *RippleCast*. In addition, how a group of participants used the shared space (a big canvas in this case) also illustrated the importance of collaborative creation. For example, in *Illumination* application when one participant drew a line from the top-left corner, another participant drew some object in the middle. Then the third participant used the top-right space to draw his own star. Seamlessly, the one big-shared screen was smoothly utilized by the group. The collaborative creations facilitate smooth interaction and encourage positive user engagement.

## 5 Conclusions and Future Direction

This paper explored how users, especially exhibition visitors, interact with the WiiArts interactive art applications in three different places. Based on our qualitative and quantitative analyses, we concluded that audience engagement is intricately correlated to situated interaction, as well as collaborative creation. This work derives from investigating user engagement through the lens of interactive media art. Our study can shed lights on designing a system to support non-task-based work, such as an explorative system. For future work, in order to gain a more in-depth understanding of the co-relations among users, engagement, and systems, we plan to deploy the WiiArts Applications for a longitudinal study in a public exhibition.

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