

# Human-to-Dancer Interaction

## Designing for Embodied Performances in a Participatory Installation

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### ABSTRACT

In this article we describe the creation and exhibit of a participatory installation performance. Graffiti Dance allows the audience to graffiti paint with light onto a buildings side and receive immediate local feedback from a set of dancers choreographed to respond to the movement on the public display. The installation is a holistic experience using a plurality of sources (syndicated news Images and Twitter) and local influences (from mobile uploads) that reflect our understanding of the world around us, how we speak out in public forums, and how we interpret the creative act. We present the results of the performance from the perspective of the audience and the dancers and present new directions for future performances.

### Author Keywords

Graffiti, mobile, projection, dance, community, network, art

### ACM Classification Keywords

H.5.2 Information Interfaces and Presentation: Miscellaneous

### INTRODUCTION

Participatory art performances create collaborative spaces where the audience expresses a statement about the world around them. In group settings, collaborative Graffiti art is a collective statement. Generally identified as statements of vandalism, identity, or politics, the voice of a set of graffiti artists, or taggers, takes time to be heard. Once the graffiti is set in place, the artists must wait for some reaction, usually in the form of mimicry or removal of the work. As technology has grown, so has the graffiti performance. Lasers and lights have made the more so permanent act of vandalism less damaging as removal becomes simply turning a projector off. Yet, the feedback cycle of measuring a response remains as static for light graffiti as it was for its aerosol analog.

Providing real-time feedback during an interactive performance raises a new set of issues. For example, how does one deliver real-time fodder for the artists? Where should fodder be the sourced? How can we provide a more immediate and

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**Figure 1.** The side of the Berkeley Art Museum during the Graffiti Dance performance.

responsive feedback in-situ? Can we support and intensify the experience of both the graffiti artist and the spectator.

We designed a live performance, Graffiti Dance, to instrument the act of content creation with local feedback. Graffiti Dance ran in late October 2009 at the Berkeley Art Museum (BAM) [11]. At its core, Graffiti Dance is a multi-user interactive, light and movement performance that is built on top of the MobiSpray graffiti platform [9]. A set of motion-sensor enabled cell phones (spray devices) allow each graffiti tagger to “paint” via a projection onto an exterior space, see Figure 1. Four people could paint with colored brushes, live images from the Associated Press (AP) news feed, or trending words from Twitter. While the building is being “painted,” several dancers, interspersed within the audience, respond to movement created by the unfolding composition. Each dancers movements are choreographed based on Space and Effort Life qualities within the Laban Movement Analysis system. We aim to transform the graffiti tagging process into an ephemeral, live collaborative experience where the artwork performance carries a direct conversation with the participatory audience.

How does one ensure that all components of an interactive performance provide the viewer with a felt experience of the interactivity? In this paper, we refer to this multi-dimensional performance experience as an embodied interactive performance. Similar to Dourishs description of embodiment [4], we find embodied interaction requires a connection between the physical and social experience rather than the physical linkage of technologies to direct actions.

In this article, we will briefly review dance in media arts and choreography and describe the performance and installation from a design and a systems perspective. Then we

will present how the choreography was accomplished. Finally, we will provide a discussion on some of the successful points of the installation and show future directions.

## BACKGROUND

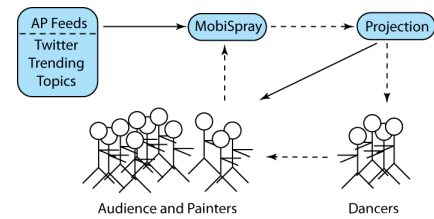
Several systems facilitate graffiti painting through the use of lights and/or lasers. For our installation, we used a modification of the MobiSpray system. In MobiSpray, the cell phone is employed as a virtual spray can to spray dabs of digital paint onto the physical environment via large-scale projections. Other artists have experimented with related projects. Wodiczko has created large-scale projections of politically charged images. Guerrilla Research Lab built Laser Tag which tracks a green laser pointer across the face of a building to generate light tags.

As a platform, MobiSpray is a strong coupling between several lightweight components (some cell phones, a laptop, and a projector). The cell phones serve as analogous free-hand drawing tools, read: mouse cursors, using their built in accelerometers. In effect, four cell phones become the input for a projected paint application from the laptop. The canvas is projected with a video projector onto some landmark or building.

Motion, movement, and video have been investigated in several forms. Recently, Hsu et al. created a semantic mapping of human movement for computer animators [5]. Conversely, much effort has synced a display to a dancer [1]. We are interested in understanding how people can communicate to a live, performing dancer mediated through a collaborative public display. How can a dancers movements reflect a shared display and add presence back to an audience? Similar to research in video production [2] and in tangible computing [3], we find attempts to make one-to-one mappings from the video to the dancer to neglect the ‘rich-action’ of communication between the audience and the dancers.

The partnership of dance and technology began influencing performance as soon as the resources were accessible to artists; from Life Forms computer-assisted choreography with Merce Cunningham to video-projections-as-backdrop with Bill T. Jones. Live performance environment manipulations (light, sound, images, etc.) were pioneered by Mark Coniglio of Troika Ranch with “Isadora”, a software program that is essentially a programmable digital lighting board for stage effects. His 1989 “MidiDancer” created a one-to-one mapping between sound score and the angular changes of movement at several joints of the dancers body.

Researches have begun to favor Laban Movement Analysis (LMA), a codified system for analyzing and synthesizing movement, in interactive environments with a centralized human presence. LMA has been used as a framework to analyze interactive systems [7] and as the means to begin building a computational model of human creativity [8]. Much of the interest and experimentation with dance performance and technology is centered on co-performance and remote interactions, utilizing high speed data conduits like Internet2 to create live telematic performances [12]. Avail-



**Figure 2. An overview of Graffiti Dance. The cycle of feedback is displayed in a dashed line. Images and text come from world sources and are displayed through the audience, to a projection. Choreographed dancers provide feedback response from the projection to the audience crowd.**

ability of high cost (3D video cameras) and low cost (Arduinos) technologies enable the moving body to serve as input for many interactive systems.

A challenge with building an interactive performance involves how the interactive nature is revealed and then developed as an artistic point of view. On one end of the spectrum, the relationship between the moving body and the environment can be transparent and quickly plateau, becoming more of a cool trick or gimmick and less of a meaningful artistic statement. On the other hand, the technology's influence is either so obscure or not specific enough that the interactive nature is not apparent on any level to the viewer. When this happens, the event is reduced to the knowledge that there is an interaction rather than a truly interactive performance experience. In our performance, we wanted to have a visible semantic connection between the display and the dancers but move beyond a direct one-to-one mapping.

## MAKING A PERFORMANCE

The Graffiti Dance installation and performance brought together three artists, each with a particular expertise: one with experience in remix and expression, one with projection experience, and a trained modern dance choreographer. To explain how the system was built from collaboration and technical perspectives, we will describe the system as a case study.

### Design Approach

The team began with an initial goal of taking external sources from the Internet (the fetcher), having the audience project them in a public space (the projection), and having modern dancers interpret and reflect the performance back to the audience in real time (the choreography). See Figure 2. While this flow appears rather linear with respect to the performance, our primary concern was ensuring the dancers connection back to the audience. More specifically, we wanted to ensure that the connection between the dancers movements and the video projections were purposeful and significant. To make sure this connection was not lost, we reviewed what was happening at each step of the building of the installation. This required a considerable amount of time; as each technical component was built, it would be shown to the entire group for feedback and questions. From the usability of the cell phone application to questioning how will the dancers respond to the semiotics of a particular image

feed. As we describe each system component, we will also discuss the findings and effect of the in situ review.

### System

The first component we built was the fetcher. This component retrieved and cached images from the Associated Press (AP) news feed and trending topics from Twitter. Local caching was important for three reasons. First, several cell-phones constantly querying an AP RSS feed and a Twitter JSON query is computationally expensive for a mobile device. Second, Twitter has a limit on how often you can call their API, hence a proxy reduces the overall number of queries to issue. Finally, we wanted the images to be posterized to look like a Warhol or Fairey serigraph, which is also expensive to do on a phone.

The fetcher was first designed to pull AP World News images. These images were locally downloaded via a timed PHP script that cached each image at a reduced size (for load performance). The cached image was posterized using the PHP GD library. A secondary PHP script cached the trending topics from Twitter. Each script created a local RSS feed for the performance to poll; this was updated ever 5 minutes. If the feed changed too quickly, it would be difficult for a person to reselect an image they had just discovered while painting. This design element enabled the audience with a compositional tool, focusing this performance away from arbitrary relationships and encouraging a live, relationship-building conversation between the dancers, the audience, and the projections. Rather than the projections becoming a byproduct of the interactive performance, this allowed the projections to shift into the realm of a communicative language between the performers and the audience. After this feed was built, the choreographer watched the feed for two weeks. She was concerned the “World News” feed was rather broad and would contain too many genres and events to codify and convey to the dancers. To remedy this, we reviewed the available feeds and altered the script to pull the “Top Stories” which provided a more normalized stream.

For the projection, we began with the MobiSpray application as a platform. MobiSpray is a multi-user painting application that uses Nokia cell phones for input. Each phone broadcasts its accelerometer coordinates to a local laptop server. These coordinates are used as a mouse cursor for a traditional painting application written on top of the PyGame framework which provides core functionality such as spraying nozzles like a blob and a brush. Selecting brushes, colors, and sizes was done on the phone using its native user interface.

We modified MobiSpray to offer dynamic web-feed based image and a stencil nozzles. The image nozzle places posterized images from our local image RSS feed on the canvas. Likewise the stencil nozzle places text from the local Twitter Trends RSS feed on the canvas to spray on.

Utilizing LMA, a mapping system was built with varying levels of specificity for the dancers to follow. Color (green, red, yellow, etc.) was matched to Effort Life (quick, direct,



Figure 3. Left: A dancer rehearsing in the studio, tracking her arm movement to the moving line. Right: The dancer (center with hand elevated) tracking a similar movement mid performance in the crowd.

sustained, indirect, etc.). The type of brush stroke (blob versus brush) affected the scale and pathway of the movement. See Figure 3. This varying level of parameters allowed some relationships between movement and the projection to surface as more obvious, which drew the audience in to the experience. Other relationships remained more obscure, creating the foundation for a more long-term exchange. Images were categorized and also triggered specific movements. It was important to have a choreographed structure for the improvisation because we wanted the dancers movements to be cohesive and connected, not only to the system, but also to each other. When the audience witnessed the dancers common reactions, it became clear that the dancers were reading or perhaps controlling the projections. This relationship set the stage for the interactive loop.

The final performance space had our audience on a gentle grassy slope facing the side of the BAM. We hypothesized if the dancers were in between the audience and the graffiti wall, their presence might be too disruptive; an issue Kandinsky raises in *Point, Line, to Plane* [6]. Following a similar framework [10], the dancers should be gradually revealed over time. As a result, we instructed the dancers to start behind the audience and, for the duration of a 25-minute performance, gradually move forward, physically enter and mix within the standing audience, and eventually finish in front of the crowd.

### Discussion

Interactive participatory ecosystems can only be tested when the full feedback loop is in place, during a live performance. The interactive environment cannot be simulated—it must be analyzed as an actual live, interactive performance. To evaluate the efficacy of the performance, dancers, and audience, we carried out informal discussions with the painters, the audience, as well as, the dancers.

The live performance had at most 30 direct attendees and three dancers. The performance began by us handing out four cellphones to people and explaining how to paint and stencil. Since MobiSpray has been in development for 3 years, most of the audience had little difficulty in using the cellphones to paint. Those who needed assistance received help from other audience members. Initially people started painting, unaware of the dancers who were dressed to blend into the crowd. A few people stood next to the dancers and attempted to mimic their movements. Once the dancers presence was seen by most of the audience, we asked the some audience members and the painters for an explanation

of what was happening. The audience members who were mimicking the dancers believed the dancers were in fact controlling the painting on the wall. Many of the painters knew there was a direct connection to the dancers but generally could not speak to its nature or identify its source:

We cant quite see the relationship between what were doing and what the dancers are doing but I think that might be the idea of it. If you knew, if you could directly see the connection between the dancing and the controlling then you might start to try to manipulate it. But right now we cant quite do that. (A1)

One painter tried experiments to find some axis of control; eventually she discovered a sports image would elicit a specific type of movement response from the dancers. Audience members who did not paint expressed similar remarks but seemed less involved to figure it out: “an ambiguous relationship is always the most interesting one.” (A2)

Generally, the dancers did not distract the audience or the painters. One painter (A1) liked how the dancers effect was slowly revealed, citing he was comfortable with painting by the time he noticed them. Other audience members enjoyed having performance movement in the crowd. “I want to just start moving my body so much even though I know it doesnt make a difference.” (A3)

When we asked the dancers, we learned that the audience members who were (standing next to them and) mimicking their motions thought the painting was motion-controlled by the dancers.

They thought we were controlling the images, once they learned that they were controlling it was interesting to see their delight in that and how it brought them to a new place of play with the phones and then they got a little bit more engaged and excited. (D3)

The dancers noted the audience were “definitely not afraid of approaching us to find out how everything worked” (D1) and would often just “also talk to us directly” (D3). This also allowed the dancers to receive in-situ feedback:

We worked really close to the people watching the performance and installation and we were able to hear their own responses to what was going on. (D3)

While many performance spaces allow dancers to gauge an audience, the close proximity in Graffiti Dance enabled more direct exchange between the audience and the dancers which proved to be an invaluable way to receive feedback. This was unaccounted for in our initial design.

## FUTURE WORK

We described the design and live exhibit of Graffiti Dance, a system for providing direct feedback within an installation performance. We found feedback created by the dancers has a positive effect on the audience and encouraged them to play and explore with little attempt to ‘game’ the control of

the dancers. Their presence was effective as a component of our multi-dimensional mapping system, to the point that many believed the dancers were actually controlling the public display. Our approach prioritized embodied interaction in the performance: the choreographic methods and structures as well as the technologies used were added to compliment and facilitate this overall goal.

While we do have a record of the images and texts cached by the system, we do not have the ability to play back the performance. In effect, re-codifying the playback, using the same LMA that the dancers utilized could generate a score for the performance. We are currently creating a series of performances to engage the audience with different performance control interfaces that will record the score.

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