Research Note

Playdates with Big Brother: Playfully Repurposing Surveillance Cameras to Build Communities

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Abstract

This paper examines the process of repurposing “Big Brother” surveillance cameras as a public utility. The authors set out to create a large scale game with two principal objectives: first, to challenge the conventional and unequal relationship in the design and deployment of surveillance technology; and second, to test surveillance cameras’ ability to reconfigure social relations in public spaces so as to encourage collaboration among strangers. The system uses motion sensed in surveillance video feeds towards completing a shared goal in a game context. This paper describes two major design iterations and installations of the authors’ game system and assesses the strengths and failings of both in pursuit of the stated social aims.

Introduction

Our agenda at the Game Innovation Lab at New York University is to build games that bring players into interesting new experiences with technology, with particular attention to the social elements of playful interactions. In a partnership with Bell Laboratories and the Liberty Science Center of New Jersey, we built a game to experiment with the social potential of surveillance cameras. We had two social aims in particular: first, we wanted to challenge the unequal relationship that is conventional in the design and deployment of this technology; and second, to test the ability of surveillance cameras to reconfigure social relations in public spaces to encourage collaboration among strangers.

Surveillance cameras are a ubiquitous technology intended to serve both public and private interests. The consequences of how this technology is designed and put into service, however, foster a fundamentally uneven power dynamic between the surveiller and the surveilled. The reality of this dynamic resembles the panoptic societal structure that the philosopher Michel Foucault references (Foucault 1977), in which the unconfirmed threat of surveillance is utilized as a method to discipline those who are potentially under the purview of some form of surveillance. In this arrangement, the surveilled may experience the feeling of being singled out and under suspicion, without any real feedback as to how the camera is being used or viewed. This inequitable relationship is furthered by the fact that the surveilled have no access to the camera stream, nor readily apparent direct benefit from being monitored.

We believe this interaction can and should be transformed, with cameras functioning instead as a public utility, offering access and service to the people within their purview.

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This technology that is pervasive throughout public spaces should be accessible by the public to strengthen community. Now that many surveillance cameras are IP-based, there are not major technical reasons why they could not be repurposed so that their video streams are publicly accessible. The video streams from these cameras can readily be accessed via the internet, unlike earlier technologies that utilized closed networks and that stored video recordings of footage to physical media such as DVDs. Other technologies that were initially in the security and safety domain (e.g. the internet and GPS technology) have made the transition to public utility, over time. Our project focuses upon taking steps toward and exploring the implications of this end goal.

In designing a playful interaction with this technology, we hoped to create opportunities for intergroup awareness and collaboration, to establish social connections in these spaces where there may not have been any previously. Through an iterative design process, we have assessed various different game designs making use of cameras in public and semi-public spaces to understand how this technology and environment can be utilized to meet our social objectives. What follows is a description of the two major iterations and installations of the system, and assessments of the strengths and failings of both, in pursuit of our aims.

Technical Infrastructure

The core system we created to augment and enhance interaction with these cameras included the following elements: surveillance camera, large public display, motion vector map, and a local server running a game. We added the display to provide ready visual access to the camera stream for the public. The motion vector map software was provided by Bell Labs (O’Gorman et al. 2012). This software tracks motion within the camera’s view, presenting a visualization of this motion by overlaying a colorful pixelated “heat map” that indicates where motion was detected and the direction of that movement [Figure 1]. It is important to note that this means we do not track individuals but rather regions of motion. So we are not “locking onto” particular individuals but detecting the overall flow of movement. The software has the capacity to erase motion areas in the video stream and replace them with an anonymized visualization of the movement.

Figure 1: Motion Vector Map. Motion flow overlay on video stream

The motion vector map software was originally developed by Bell Labs not as a tool for surveillance or security, but as a tool to help facilitate mutual awareness in public spaces. It was deployed in their facility's hallway to provide an abstract visual representation of the activity that occurred in that space. In this venue, the motion vector map software translated the activity monitored in the hallway as anonymous, somewhat amorphous silhouettes in motion. In both of the games designed and described in this paper, we make use of the motion that this software detects as the player input to the game. However, in various iterations of our design, we made use of this anonymization feature to different extents.

First Iteration: Brooklyn Blooms

Figure 2. Lab and Media Wall. Our media wall has a 4x6 array of high-resolution monitors, which can be seen from the public plaza.

After creating several prototypes and iterations, our first major design installation was the game “Brooklyn Blooms.” With this game, the objective was to make the camera stream recording a public space more accessible and engaging to those populating that space, by creating a whimsical environment that prioritizes the community’s sense of privacy despite the presence of the camera. For this game, we installed an IP-camera overlooking the public plaza just outside our lab. We utilized our lab’s large multi-screen array that faces the plaza as our game’s display [Figure 2]. These screens can be viewed from the plaza through the building’s story-tall glass facade. This display featured our game (iOS-based), which included three windows: the play screen, the motion vector map system, and a live stream view of the plaza [Figure 3 overleaf].

Brooklyn Blooms’ game mechanic transformed the activity in the plaza detected by the vector map in the plaza into an animation of flowers blossoming. The gameplay screen featured a still image of the empty plaza, onto which the responsive blossoming graphics were superimposed in the same location that the activity had been detected. If players moved together, they could generate more and more flowers, eventually creating a tree of blossoms in the center of the screen. The idea was to catch the eye of passers-by, and engage them in collective movement in front of the screen.

Figure 3. Brooklyn Blooms' Game Screen Components. (Clockwise from top-right) motion vector map, live camera stream, and gameplay screen.

This game was deployed during a public event that was held in the plaza during the World Science Festival (World Science Festival 2012). During the festival, the game ran for several hours with several hundred people wandering past the exhibition. Of those that passed by, 18 per cent were attracted by the display, and 5 per cent stopped and interacted. The average interaction time was 1-2 minutes, with a maximum time of 10 minutes. Interaction was primarily individual-based, and when it was group-based, did not involve interaction among members of previously separate groups. We did not observe instances of intergroup collaboration or mutual awareness.

We were happy with the game mechanic we developed for using the motion vector map to drive gameplay, but we did not achieve the aims we had for social interaction in the context of the system. Over the course of a day, very few users took note of the display and even fewer engaged with it. This lack of engagement did not further our efforts to build a sense of community, collaboration, and mutuality among those within the camera's view. The majority of the interactions were pedestrians in transit who merely became aware of the display, but did not engage with it as they continued on their paths. This design iteration did not achieve the values that we sought for the technology.

Reflecting on Brooklyn Blooms and Design Implications

We believe this first iteration of the interaction was not successful for two reasons: 1) the interaction lacked structure (a common and clear goal for players to work together toward), and 2) the anonymization feature took away the visual appeal of seeing oneself in the image. The values that may have originally been designed into the experience to honor the user's relationship with the panoptic technology interfered with user's preferences to see themselves in playful interactions. Recent studies suggest that users are more engaged by, and responsive to, public displays in which they can see a mirrored or silhouetted representation of their own image (Müller et al. 2012).

We knew we could not truly track individuals with the system, only overall motion flow. Thus we ran the risk of setting up overly high expectations in gameplay (encouraged by systems in the home that do truly track individuals, such as the Kinect). However, we set out to create an interaction that reflected players back to themselves, and made use of their presence in the image stream, despite this limitation.

Second Iteration: Pixel Motion

In the end, we embraced the system's inability to single out and respond to individuals. We realized this actually served our larger objective of joining and identifying communities. We inverted our game mechanic so that motion *uncovered* an image—as opposed to the previous iteration in which motion translated to a superimposed image over a static image. In the new game interaction, the activity detected by the motion vector system reveals the image of the live camera feed capturing the users playing in that very space. Players are motivated to move throughout the space to reveal an image of themselves and the space that they are occupying at large.

Deployment Environment

We were asked to adapt Brooklyn Blooms for a local children's museum, the Liberty Science Center in Jersey City, New Jersey USA, for an exhibition about surveillance technology in everyday life. Visitors are predominantly children ranging from 3-15 years old traveling with their families or on school trips. On weekdays, the museum attracts between 2-3 thousand visitors a day, and on the weekends 2.5-4 thousand visitors daily. The specific space our exhibit was deployed in resembles a public plaza, as it is a transitory, in-between space. Visitors travel through this otherwise empty space, which is sealed off from the main exhibit halls, while in transit from one location to the next [Figure 4].

Figure 4. Museum Exhibit Space. Left: floor plan of museum, exhibit space in blue; Right: view of exhibit space which functions much like a public plaza as a transitory space connecting several different entrances.

We conducted onsite ethnographic research at the museum to analyze the behaviors and expectations of visitors in this particular exhibition space as well as the museum at large, to develop a context-sensitive design. Researchers visited the museum for four to six hours at a time over the course of several days. These visits occurred at different points during the week (weekday morning, weekday afternoon, weekend morning, weekend afternoon) to account for the variety of levels of activity and types of visitors. Researchers observed how visitors moved through particular spaces over the course of half hour segments

of time as well as how they engaged with the exhibits, displays, docents, and other visitors. Additionally, docents, children visitors, and their guardians were informally interviewed regarding their experiences of the museum. These observations were recorded with notes, photographs, and in short videos, and were compiled and grouped according to what themes had emerged. We observed that the majority of exhibits that were already deployed in the museum did not foster cross-group collaboration or integration, and were determined to redesign our game to achieve this end.

Figure 5. Wireframe of Pixel Motion System Components. Display is projected onto the wall, above which is the surveillance camera. In red: field of camera vision and area within which it detects motion. Three associated kiosks line the left wall.

The technical components of our system remained largely the same: camera, display, motion flow software, game software (in this case html-5 based). The surveillance camera is mounted approximately 11 feet off the ground facing the exhibit space. Immediately beneath the camera is a white wall, upon which the 10-foot tall image of the game is projected from across the room. The exhibit space also has three kiosks dedicated to the exhibit [Figure 5]. The room is outfitted with speakers for a surround sound effect. The system runs off a server local to the museum over the facility's internal wifi network.

Game Interaction

As opposed to the more exploratory mechanic of Brooklyn Blooms, Pixel Motion uses a short, structured game cycle that alternates between a game round and the leader board. During each 30-second round, players use their motion to erase an opaque screen of randomized pixels. Groups of players are ranked by how quickly they are able to reach the round's win state. The time pressure of each round encourages players to rely on the assistance of other players to produce as much motion as possible to complete the round rapidly and receive a higher ranking [Figure 6].

Figure 6. In-Game Play. More players moving in game space aids in faster game completion, and higher score.

When players have reached the win state, a collection of props appears on the display creating a digital postcard that players can pose in. A screen capture is taken of this postcard scene by the game and can be accessed and sent by users via email or Twitter from the exhibit's kiosk [Figure 7]. The other two kiosks on that wall contain educational literature about the exhibit itself and data from the system that the users can manipulate, study, and sift through.

Figure 7. Sample Digital Postcard. After winning a game round, a screen capture is taken of players in postcard scene. Players can send these digital postcards from the exhibit's kiosk.

After the photo is taken, the play screen transitions to the leader board [Figure 8]. The leader board features four postcard snapshots ranked according to which games were completed the fastest. The most recent photo taken is also featured prominently on the leader board for everyone to admire.

The game user interface has three elements: the progress bar, which indicates what percentage of the screen remains to be cleared; the timer, which counts down the 30-second game round; and the motion vector map. Through observation and semi-structured interviews with visitors of various ages, both adult and children, it was clear that the different interface components were understood.

Figure 8. Sample Leader Board. After game round, game cycles to the leader board. On the left: most recent postcard snapshot. On the right: four postcard snapshots from the rounds completed the fastest.

Reflections on Pixel Motion

We are currently conducting a comprehensive analysis of group and individual behaviors during Pixel Motion gameplay. Preliminary analysis confirms that Pixel Motion's design is a more successful and promising use of surveillance cameras towards building communal experience and collaboration. Whereas engagement was an issue for Brooklyn Blooms, it is not for Pixel Motion. This design is successful at engaging users in both independent and collaborative game play [Figure 9].

Figure 9. Cross-Group Collaboration. From the perspective of the game's surveillance camera: an example of collaboration across groups. Three different school groups, each wearing shirts of different colors, collaborate on the game play.

As was the case with Brooklyn Blooms, prototyping allowed us to iterate and improve. An important finding during the prototyping process for Pixel Motion was that the placement of the game interface elements had a dramatic effect on players' sense of and use of space during gameplay. What we found echoes the observations of social scientists such as Edward Hall and Erving Goffman about space and communal interaction. We initially had placed all three of our UI elements (the timer, progress bar, and motion vector map) along the base of the display. It was our intention that this would keep users from getting too close to the screen as their close proximity to the wall would obscure the projection with their

shadow. Instead, the placement of these elements along the base of the display had the opposite effect. Children approached the wall assuming that it was haptic, or that the elements directly in front of them were what they should be interacting with. These elements after all, were just at their height [Figure 10].

Figure 10. Earlier Design with Low Interface Elements. In early testing of our designs, lower interface elements were misinterpreted as the game interaction.

This enticed players forward into what Hall characterizes as the intimate zone of interaction. Attention and focus at this distance took away a sense of shared social presence and engagement in the room as a whole (Hall 1966). In Goffman's language, users were too close to have any mutual awareness of others, or the actual space for social interactions (Goffman 1963). A communal experience was not possible when our interface elements were evoking intimate-distance interactions. And so we moved the elements off the base of the screen and up towards the upper edges of the display [compare Figures 5 and 6 for reference].

Players' interactions with the game and their fellow players dramatically and instantly changed once these game interface elements were out of reach. Now players were utilizing all of the play space and were aware of one another. We had successfully designed for a collaborative and communal experience to occur.

Conclusions

We believe our second iteration of playful and collaborative interaction with a surveillance camera shows the potential of repurposing this technology for the public good. By augmenting the camera with technologies that allowed for playful interaction, real-time feedback, and in the case of Pixel Motion, ready appropriation of images from the photo stream, we shifted the experience of being "watched" by the camera from an isolating and potentially off-putting one to a collaborative and playful one, with value for the surveilled as well as the surveillers.

Both iterations of these games were deployed in semi-public spaces. While Brooklyn Blooms ran in a public plaza, it was still displayed behind a glass wall of a private building. Pixel Motion on the other hand was on display in a space that functioned similarly to a public plaza, but was accessible to a select

audience that paid fees for museum entrance. Deploying this system in a semi-public area was helpful for tuning the dynamics of the interaction and the game, but it is still a step removed from the larger founding principle behind our project. Our objective is to find ways to appropriate surveillance cameras in public spaces to make them a bilateral utility as opposed to a unilateral mechanism that invokes the unequal power dynamics of surveillance. The design process and iterations described in this paper helped us identify strategies to put forward for developing this interaction for fully public spaces. With the findings from these previous iterations we are prepared to take our next steps and develop for pre-existing cameras in public plazas, as opposed to cameras that we installed for the purposes of our project. We plan to deploy the project in the NYC area, but are actively seeking collaboration partners in other cities as well.

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