Chapter 11
Blending Art Events and HCI Research

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Abstract We present experiences as artists and Human-Computer Interaction (HCI) researchers exhibiting an interactive artwork called *Tweetris* at a public event, and its simultaneous research evaluation. We describe the unique opportunities a public art event offered for achieving our research goals, then discuss three key challenges we encountered: tensions between creative and research goals before the event, ethical considerations during the event and in analysis, and obstacles complicating subsequent evaluation as the work has evolved. We offer observations throughout that are important to consider when conducting HCI research at public art events.

11.1 Introduction

Public art events are attractive venues for HCI research, as we move away from the desktop toward more situated, embodied forms of interaction. As a relatively untested avenue for HCI research, the public art event presents unique opportunities for the evaluation of advances in interactive technology, but also comes with novel challenges. It is critical to report and reflect upon experiences as we experiment in this space, to build a common understanding of what works well and what does not for artists and researchers alike. This chapter presents our experiences with *Tweetris*, an interactive digital artwork employing whole-body interaction in a game-within-a-game format. In particular, we highlight strategies taken when designing an

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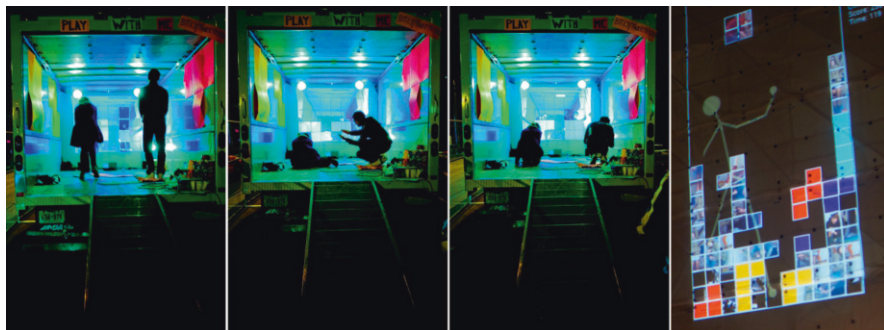e-mail: fanny@dgp.toronto.edu; dustin@cs.toronto.edu

Fig. 11.1 Playing *Tweetris*. *Left three*: a pair of attendees plays the shape-matching game in a moving van. *Far right*: snapshots of the players making the shapes are used in Tetris gameplay which was broadcast onto the street outside the gallery to attract the interest of the art event attendees passing by

empirical study around a rapidly evolving creative art project, ethical ambiguities that arose when taking on the dual roles of artist and HCI researcher, and the challenges encountered when taking the artwork and the research forward into other venues (Fig. 11.1).

11.1.1 Tweetris *at Nuit Blanche*

We developed *Tweetris* as an interactive art project for the 2011 Nuit Blanche event in Toronto. At the core of *Tweetris* is a shape-matching game, where two players race to match the shape of their body to a *tetromino*, a shape composed out of four squares taken from the game Tetris. The gameplay is similar to the segment called *Brain Wall* on the Japanese television show *Tonneruzu no Minasan no Okage deshita*. When the shape of a requested tetromino is successfully formed and held by a player, a video snapshot of the winning shape is tweeted on a public Twitter account, with a semi-random but descriptive shape-related caption. The tetromino snapshots are also used in a game of Tetris that attendees can play using their portable devices.

The shape matching game was set up at two locations in downtown Toronto: at OCAD University's graduate student gallery, and in a moving van on Queen Street West. In both locations, shape-matching players were watched and encouraged by an audience of fellow Nuit Blanche attendees. Shape matching and Tetris gameplay was also broadcast onto the street outside the gallery to attract the interest of the art event attendees passing by. By making the activity of the shape makers public across multiple channels, our intention was to contrast the visceral experience of embodied play with more meditative questions about what it means to engage in a public game.

Fig. 11.2 Close-up of player feedback. Players try to cover *all coloured squares* with their bodies without going outside the squares. They must hold their pose for 2 s while the white progress bar (*top*) completes to score a point, incrementing the tally shown by the *red* and *blue* squares at the *top* of the screen. A *yellow progress bar* counts down a 10 s maximum time to make a shape, after which a new shape appears
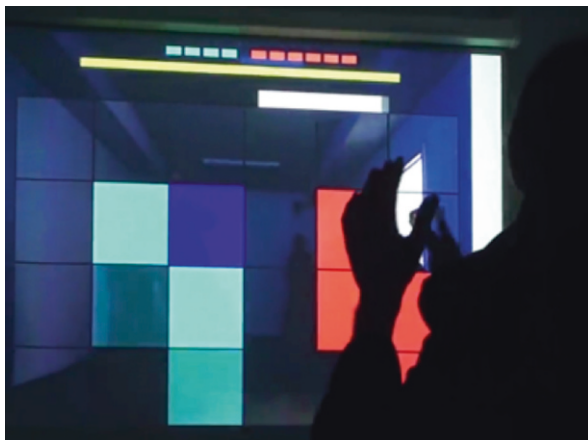
Tweetris was initiated by artists whose interest lay in the creative process and in the outcome of a collaborative interactive art project, and an HCI researcher who believed the project could also be used to study interaction. The main reason for the work was to collaborate on an art project that would give visibility to a new faculty group at OCADU, an art and design university in Toronto, Canada. Exhibiting a piece at Nuit Blanche was an ideal opportunity to this end. As the project progressed and more collaborators came on board, plans for conducting a study alongside the exhibit fell into place, but the creative practice and its relevance for artists and their audience remained the primary concern. Indeed, the HCI researchers were deeply engaged in creating and exhibiting *Tweetris*. Our emphasis differs from Johnston's Chap. 4 ("Keeping Research in Tune with Practice", Johnston (2014), in that, rather than being targeted to practicing performers, this chapter aims to inform HCI researchers about the unique benefits and challenges associated with conducting evaluations at a public art event.

11.1.2 *Playing* Tweetris*: The Shape-Matching Game*

The experience of *Tweetris* from the shape-matcher's perspective is shown in Fig. 11.2. Two players walk into the game area, and the interface presents a video view of the two players in real-time. The video is overlaid with a grid, six wide and four high in which squares will turn a translucent colour to communicate to the player. A light colour, either red (right) or blue (left) indicates that the player should occupy that square to match the shape. Shapes are selected randomly from the set of blocks from the game Tetris (tetrominos).

When a player correctly occupies a grid square, the colour changes. If a player occupies a square that is not part of the goal shape, that square turns purple. Players must contort their bodies in the play area until their body fits inside and fills the

tetromino, before the other player does. When a player occupies all four of the required grid squares for the given shape (and only those four), they must hold their pose for 2 s, while a white progress bar goes across the screen on top. If neither of the players is able to make the goal shape before a 10 s countdown—shown by the decreasing length of the yellow bar at the top of the screen, then a new random shape is selected and displayed. Each player has a counter indicating the number of tetrominos they have made successfully—shown as red and blue blocks at the top of the screen. When one player successfully makes ten shapes, the counters are reset.

11.1.3   A Flexible Play Style

To facilitate fluid engagement and disengagement by visitors to the exhibit, the game does not rigidly enforce play mechanics. There are no written or verbal prompts structuring gameplay. Players are free to enter and leave the exhibit at any time; the game makes no distinction between individual players as they enter or leave; the game will happily run in the background when nobody is playing, and the counters can easily be ignored during casual play. Two players can play simultaneously, but people can also play by themselves, by choosing one of the two sides.

The left player is always blue, and the right player always red. If players switch sides during play, they will switch blue/red assignments. It is also possible for more than one person to work together to form a tetromino, so long as they are on the same side of the play area and stay within the shape squares.

We chose to keep the play mechanics constraints in *Tweetris* as flexible as possible for two reasons. First, by letting visitors drop in and drop out the game at will, we could provide an interactive, engaging and creative art installation where attendees would feel encouraged to actively participate while avoiding frustrations that might occur by set play duration. Second, we wanted to make it possible for the players to collaborate with one another to form a single shape. Whole-body interaction is traditionally designed and evaluated for a single user, and we were curious as artists and researchers to see whether a player would enter the physical space of the other player, either to help them when they have to perform a challenging shape (e.g., one that requires balance), or to "sabotage" their play, by occupying extra blocks with their own body.

During the event, we saw a wide range of creative play, including some acrobatics, sabotage, focused competition, and lots of laughter. Attendees usually played in pairs, playing between 30 s and 10 min, but averaging 3 min (the average duration of one full round of the shape matching game).

11.2 The Opportunities for HCI Research

The desire to conduct HCI research or at least to generate HCI-relevant outcomes was one motivation in the design of *Tweetris* from the outset. We were broadly interested in exploring how whole-body interaction and video-mediated communication over large displays could be used in collaborative play. In this section we consider potential benefits of conducting HCI research of different kinds at public art events.

11.2.1 Perceived Benefits of the Public Art Event

We identified two main benefits that made conducting HCI research using the *Tweetris* exhibit attractive to us. First, as an exhibit in *Nuit Blanche*, which sees over one million attendees in a single night, we had an opportunity to acquire data from a sample that was literally orders of magnitude larger than what we were used to in controlled studies (and to do this over a very short time-span). The challenge was to determine the type of study we could reasonably run given the very dynamic and unpredictable flow of the event. We had to carefully consider how to weave a study into the exhibit in such a way that it did not detract from the attendees' experience.

The second benefit became apparent only as the *Tweetris* concept had been solidified and the interactive elements were being fleshed out. Those on the team interested in HCI research came to view the exhibit as a semi-controlled environment conducive to analysis of relatively focused aspects of whole-body interaction. We also believed that since people might feel compelled to engage with *Tweetris*, they might be more willing to explore and experiment with interaction, in contrast with a controlled study of interaction techniques with tasks designed to assess performance characteristics such as time and error rates, where often participants simply desire to complete the tasks. In fact, we came to view *Tweetris* shape-making as a form of controlled, randomized repeated stimulus that was also inherently fun, engaging a general audience in a public setting away from the research lab—offering some of the benefits of both situated studies of playful engagement and controlled studies of interaction techniques.

11.2.2 Curiosity-Driven and Hypothesis-Driven Research

Our experience with *Tweetris* illustrates that the answer to where and when opportunities for HCI research emerge from art depends on the artistic process as much as on the interests of those involved. While Chap. 2 ("Human Computer Interaction, Experience and Art", Edmonds (2014), establishes that both HCI research and interactive art are concerned with experience and engagement, the ways in which these are assessed in a given type of HCI research might not align with the way they are

generated in a specific interactive artwork. Determining specific research questions and methods was possible only later in our project's development.

The broader opportunities that *Tweetris* presented for HCI research may apply to a wide range of interactive artworks. Curiosity-driven explorations of novel interactive works can occur even in the absence of specific research hypotheses. Such research is often quite robust to (and even focussed upon) the unexpected elements of public art events and exhibits. Chapter 12 ("In the Wild: Evaluating Collaborative Interactive Musical Experiences in Public Settings") by Bengler and Bryan-Kinns (2014), illustrates how a mix of quantitative and qualitative observational methods can illuminate engagement with novel interactive experiences, allowing reflection on the success of design motivations and uncovering questions for further research. Given the right combination of elements there is also room for highly focused, hypothesis-driven research at public art exhibits. As we see with *Tweetris*, interactive exhibits can provide a structured experience that allows in-depth analyses of specific aspects of interaction. Such research often requires a well-defined experience from which to design the study, however, something that is not always amenable to the artistic process, as we discuss in the next Section.

11.3 Reconciling Artistic Aims and Research Goals

Because *Tweetris* was being developed for a specific event, we worked under a deadline. This meant that as the event approached, most effort went into making sure the exhibit would be successful and concerns that the research would be conducted as intended were secondary.

We made a decision early on that the needs of the research should not explicitly influence or constrain our creative process. *Tweetris* is a creative piece first, and one that involved the engagement of a range of contributors throughout its lifecycle. As mentioned, the HCI researchers were also major contributors to the artwork, rather than taking on an observational role; this made it possible for us to adjust our research goals in fairly subtle ways to match the evolution of *Tweetris*, and to be supportive when larger changes needed to be made. We already needed to manage tensions between artistic vision and technical constraints, and adding further constraints due to research concerns may have made such a collaborative project untenable. Our approach was to align our research questions with a major theme of the creative work, specifically the collaborative vs. competitive modes of whole-body interactive play.

11.3.1 Aligning Research Goals with Creative Themes

From a very early stage, our concepts for the artwork involved trying to form body shapes with the help or hindrance of others, given some form of suggestive cue

(for example, floating wishbones would suggest that a "Y" shape be made). Initially, these cues would themselves be controlled by an unseen third party as a *deus ex machina*, who would attempt to establish contact with the collaborative/competitive players through the limited language of shape cues.

In these earlier concepts, some of the shapes presented to players would only be possible to accomplish collaboratively, while others could be done independently. In our desire to make a compelling interactive experience, we felt that it would be interesting to leave it up to attendees to figure this out; to offer incentive for both independent/competitive and cooperative play, and see what transpires. Tying a reward system to shape-making would introduce a tension between collaborative and cooperative modes of play, and we believed this could form the focal point of our research. We were interested therefore in observing how our participants would manage this tension, and designed questions in a *post-hoc* questionnaire to tease out reasons for their behaviour. We also constructed questions that probed whether participants sensed the presence of the unseen third participant, and if so, whether they were viewed as collaborator or foil.

As our concept evolved toward the Tetris theme, our *deux ex machina* ideas evolved into the game-within-a-game aspect of the work. This occurred in two ways. The first was through an explicit attempt to playfully anthropomorphise the game. *Tweetris* would maintain communication across its different components through a Twitter feed, tweeting images of shapes and of players making shapes. The second was to embed some communication between those playing the Tetris game and those playing the shape-matching game: i.e. those playing the Tetris game could request shapes, and the shape-making pair could choose to make the shape or avoid making it, adding an additional "collaborate or sabotage" element to the piece. We revised questions in the questionnaire to assess how shape-matching players managed their relationship with this new type of third player.

Aligning research questions and creative themes in this way made pragmatic sense, as we had good confidence that the research questions could be accommodated within the theme. It would also allow us to explore the research themes from aesthetic and experiential perspectives as well as more rational and scientific ones.

11.3.2   A New Turn: Studying Whole-Body Interaction

Additional research questions on interaction emerged by distilling *Tweetris* down to its basic elements by viewing shape-matching as a relatively unconstrained, *metaphor-free* stimulus for whole-body interaction. That is, the specific shapes themselves didn't hold symbolic or direct meaning (Holland et al. 2011), which could otherwise influence the way players respond to the shapes, and the shapes didn't dictate exactly how they should be made using the body. As such, we became interested in evaluating *Tweetris* as a platform for observing the influence of environmental factors (audience, location) and intrinsic factors (physiology) on whole-body interaction. Since we do not strictly control how shapes are made, we allow

playfulness to emerge and permit an experience of "flow" (Csikszentmihalyi 1990; Nijholt et al. 2011).

By viewing *Tweetris* in these more abstract terms, research questions emerged that did not impose upon the creative work, and that were relatively impervious to deviations leading to the final work, so long as the Tetris shape-making component remained intact. Specifically, how would the game's physical setting impact shape formations, and what kind of shape making patterns would we see across individuals? While these "emergent" research questions were forming during the development process, we were still largely focused on questions regarding collaboration vs. competition in our study design.

11.3.3 Reconciling Research and Creative Process: Challenges

Despite the efforts to align research goals with creative themes, when the final work was created, our primary research questions (exploring how and why players choose to collaborate or compete) were no longer possible to evaluate. We started testing the game with standard Tetris blocks, which could all be completed by a single individual. We considered two approaches to introducing a collaborative aspect to shape making. The first was to introduce more complex shapes that required two people to complete, and the second was to have players play in different locations, using a shared video space to fit into the same shape. In the course of tight development cycles we decided that the collaborative/competitive ambiguity might not be conducive to the walk-up-and-engage game experience that our venue required. Instead, the competitive mode of the game was favoured for its immediacy. Due to issues sending video data we redesigned the game so that two players compete in the same location, with tetrominos side-by-side. Even though we did not prevent players from making the same shape together, the two-player competitive mode was reinforced by the final design, which featured two score bars and two distinct play areas. For similar reasons (technical issues, timeframe and a desire to streamline the experience), we removed the ability of the Tetris game players to request shapes from the shape makers.

These changes prevented an exploration of collaborative vs. competitive modes of play, yet allowed us to focus more directly on the secondary research questions: namely, what body configuration strategies emerge in a relatively unconstrained shape-matching task, and how play environment impacts this. Without the nuances of shape requests and collaborative vs. competitive shape making, we could focus our analysis on how individuals made shapes. This realization came very close to the event though. At the time of the event, our instruments were still predominantly geared toward observing and eliciting feedback on group behaviours. A significant portion of our questionnaire asked about competition, cooperation, and awareness of those playing Tetris. After administering the questionnaire to the first 60 participants at Nuit Blanche we decided it was not worthwhile and left out the questionnaire for the rest of the event. This was because many of the questions dealt with the collaboration vs. competition theme, which was no longer

present in the final version of *Tweetris.* Our software logging captured game state and game events (emphasizing social engagement) rather than skeleton position (emphasizing whole-body interaction techniques). This meant that our analysis of interaction style required a time consuming post-experimental manual encoding of postural configurations for each successful shape made, which was possible only because we had a Twitter snapshot of every successful shape. Again, our focus on game events meant we did not capture "misses" or unsuccessful poses as distinct events (these were simply ignored by the game). Reconstituting these for analysis would require careful calibration of sensor and video data, manual identification of pose sequences along the timeline, and the use of grainy and dark video capture to determine postural configurations. As previously mentioned, the randomized, repeated task of shape making was well-suited to conducting this type of analysis. The flexible play style of *Tweetris*, allowing play without fixed duration and strict rules, placed limitations on our analysis however, and we could not treat the data as though each attendee had the same quality and duration of experience. This limited our ability to identify common patterns in how *sequences* of shapes were made in particular, since attendees played for widely varying lengths of time.

11.3.4   Research Outcomes

This new focus on the secondary research questions allowed us to arrive at and formally propose a new *elicitation protocol* for whole-body interaction styles. During analysis we came to view the tetromino shapes as *discretized silhouettes*, blocks that one had to fill with their bodies, but not in a predetermined way. As such, *Tweetris* "elicited" whole-body poses and patterns of transitions between poses that could be useful for designers of other whole-body interactive experiences in a similar fashion as Wobbrock et al. elicit hand gestures with their User-Defined Gestures protocol (Wobbrock et al. 2009).

In addition to identifying specific impacts of environmental factors such as crowd location, physical layout and flooring on poses, in our analysis we were able to observe and classify shape-making patterns across the hundreds of participants who played during Nuit Blanche. While not the original focus of our research, taking this more abstracted view of *Tweetris* as an instrument for exploring WBI allowed us to derive several useful research outcomes, ones that were more in line with the opportunities for "micro-creativity" inherent in digital interactive art, as discussed in Chap. 9 ("Mutual Engagement in Digitally Mediated Public Art", Bryan Kinns 2014). More details about our evaluation methodology and results are available elsewhere (Freeman et al. 2013).

11.3.5 Lessons Learned

Our experiences with *Tweetris* illustrate the value of remaining flexible with research questions for HCI research at art events. While the strategy of aligning research questions with creative themes made sense, and might work for other projects, it did not work in our case. In *Tweetris*, the creative theme of collaboration vs. competition drove the evolution of the work, but most collaborative aspects were dropped late in the project.

Taking a more abstract view of the experience of playing *Tweetris* allowed us to identify a fruitful research approach. By viewing shape matching as a form of randomized repeated stimulus, research questions formed around an analysis of how players made shapes. The data being captured during the event was not optimized for such an analysis, however, leading to laborious manual classification work. HCI researchers interested in analysing interaction at this level of detail should ensure that they are recording all data produced by sensors and devices, so that analysis approaches identified after the event can be supported.

Our approach was to be intimately involved in both the creative process and the research design. This had the advantage of being able to respond to changes in the creative work quite rapidly, but also made data collection a challenge, since we were also heavily invested in the success of the exhibit, rather than being focused on executing a perfect study. Remaining flexible about research can be difficult to accomplish, especially when there are event deadlines and where there is a requirement to obtain research ethics approval for modifications to study objectives or methods. In the next section we discuss some of the issues regarding research ethics and public art events.

11.4 Ethical Ambiguities for the Artist/HCI Researcher

Conducting HCI research at a public art event raises important ethical issues. First, informed consent becomes difficult to acquire without unduly impacting the attendee's aesthetic appreciation and participation in the exhibit, as the exhibit becomes an experiment to them. Informed consent also implies engagement; attendees may feel engagement with the exhibit carries an obligation to interact with it for a certain length of time, or in a certain way. For these reasons, an HCI researcher is incentivized to delay obtaining informed consent, and even so, may want to avoid drawing the attention of others to the fact that some kind of evaluation is taking place.

For *Tweetris*, we waited until after attendees had engaged with the exhibit before approaching them with consent forms for participation in our study. A more pragmatic but related issue is that following protocol for obtaining consent and administering questionnaires, and doing so while not drawing attention of future participants, can be difficult in the midst of supporting a live, interactive exhibit—particularly when the same people running the exhibit are conducting the study. When

emergency situations arise (in our case flooring coming apart and needing to be affixed, and communication being lost between installations set up across town), this can limit the ability to conduct the study. As artists, the enjoyment of watching people engage with your work can also dissuade you from carefully following protocol for data collection. During Nuit Blanche, we gathered consent and conducted questionnaires for a portion of the evening only.

When conducting HCI research at public art events, we need to grapple with a tension between engagement in a public spectacle and the privacy of study participants. One of *Tweetris*' goals was to explore gameplay as public spectacle. Shape makers not only played in front of an audience, but a video stream of their interactions was prominently displayed in a public location, and their images made "playable" by Tetris players in the audience and made persistent and accessible to the public at large via Twitter. All attendees were made aware of these aspects of *Tweetris* before engaging in the shape making game. From the perspective of *Tweetris* as art exhibit, the shape making data was clearly in the public domain, and actively broadcasted, recorded, and used in a public way. When considering *Tweetris* as research instrument, questions of what resides in the public domain are not as clear-cut. Fundamentally, when one decides to participate in an art event that is clearly public spectacle, they do not also explicitly decide to participate in a study of their interaction. However, just as HCI research makes use of massive amounts of public domain data from social networks (like Twitter), or compiles observations of everyday activities in a public setting without informed consent, one might argue that the public engagement with art, insofar as this engagement resides within the public domain, is by definition available for HCI research without informed consent.

We believe that ambiguity emerges when those responsible for creating the experience also analyze its outcomes, a common situation for HCI researchers involved in public art projects. In a way this mirrors the model of the controlled experiment where one designs a study to answer research questions and then analyzes the results; and so a research ethics review seems necessary. However, the analogy to controlled experiment may not always apply. In our case, the design of *Tweetris* was not explicitly controlled by the research questions, and the researchers wore different "hats" before, during and after the exhibit, being key contributors to the creative process leading to *Tweetris*, and even making decisions that jeopardized the primary research question.

Perhaps more nefariously, the public art event may be viewed as a sort of "honey pot" (Hornecker et al. 2007), attracting people who might otherwise be difficult to recruit in a formal study, and providing a means of evaluating their interactions without obtaining informed consent or perhaps even without conducting a research ethics review. A counterargument is that a public art exhibit is more akin to an urban probe (Paulos and Jenkins 2005), as a spectacle that permits public observation, than to a formal experiment, and that they should be governed under similar policies.

Typically, observational studies of human behaviour in public do not require ethics review when they are *non-invasive* and *non-interactive*, such as when passively

Fig. 11.3 A tweeted pose
snapshot

Fig. 11.4 Broadcast of shape
making game

observing passers-by in a train station.[1] When an art piece defines rules of engage-
ment it arguably does not allow for observation of unfettered public behaviour. The
definition of "non-invasive" is particularly fuzzy for artworks, however. While
Tweetris had specific gameplay mechanics, many attendees chose to instead play
with the interaction more than to play the game. While we believe *Tweetris* in par-
ticular required ethics review, this may not be the case for more suggestive or con-
templative interactive works.

Our ultimate position toward evaluation and informed consent in *Tweetris*
became quite nuanced. We successfully made the case to our research ethics board
that access to all broadcasted output should be available without informed consent,
and that we should be able to record our general observations of the event without
requiring consent from all attendees. Consent was required and obtained for those
who filled out the *post hoc* questionnaire. We analyzed the shapes that were publicly
tweeted regardless of whether an attendee was asked for consent, as these were

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[1] For example, see Canada's Tri-Council Research Ethics Policy, article 2.3. Retrieved November
2013. http://www.ethics.gc.ca/eng/policy-politique/initiatives/tcps2-eptc2/chapter2-chapitre2/

available as public record (Fig. 11.3). We conducted a qualitative analysis of video-recorded gameplay for those attendees that signed the consent form. The entire stream was arguably in the public domain as it was a record of a public event which was itself broadcasted onto a public street (Fig. 11.4), however attendees were not informed that their interactions would be video recorded for later access. We used our recorded sensor data for quantitative aggregate statistics, such as the average duration of shape making engagements, and the percentage of successful shapes made for each tetromino type.

Human-subjects research guidelines at universities typically provide little explicit guidance for research at public art events, especially where these finer details are concerned. Indeed, in our ethics review we needed to be very clear about what we determined to be in the public domain (and why), and about our analysis procedure. We believe navigating the "grey areas" discussed in this section would benefit from clearer guidelines, particularly as this kind of research becomes more common.

11.5   Moving the Art and the Research Forward

We encounter opportunities to exhibit *Tweetris* at other venues with significant numbers of attendees. On face value this is an opportunity to iterate on our evaluation and research questions. We obtained an adjusted research ethics approval to conduct the same evaluation at similar public events rather than at the single Nuit Blanche event.

On reflection, conducting multiple evaluations at different venues poses unique challenges to HCI research. The first is that a venue can greatly impact on how an interactive work is perceived and engaged with (O'Hara et al. 2008). For example, we have found less willingness to engage with *Tweetris* at lab open houses and organized group demos than at Nuit Blanche. Even when the audience is as receptive, attributes of the event can change the experience: at a gaming conference the emphasis was on performance/demonstration during a presentation. The presentation went very well and engendered a great deal of performative play by audience members called up to try it out. However, when *Tweetris* was set up outside the conference room afterward, engagement by attendees was limited. As an art exploration at an interaction conference engagement was strong, but the venue was quite small, meaning that passers-by disrupted the gameplay and made data collection impossible. It is challenging to compare results in different venues, unless the impact of venue is the main factor in analysis.

Secondly, when exhibiting at other venues the artistic impulse to improve upon or change the exhibit can conflict with a need for experimental control. It is difficult, for example, to change an aspect of the work, evaluate it at a different venue, and compare results with the previous version evaluated at the first venue. Even where the venue stays the same or is largely similar, we must still contend with the desire to change the exhibit for aesthetic or experience-driven reasons, and consider how

Fig. 11.5 *Top*: Tweetris installation at Nocturne 2012, Halifax Canada. *Left*: shapes are made. *Center*: shapes are tweeted. *Right*: shapes are fed to body-controlled Tetris

this will impact evaluation. HCI researchers working in this area need to accommodate the artistic desire for change.

Finally, conducting research involving an interactive artwork that is evolving and is exhibited at multiple venues requires careful management of research ethics. We successfully petitioned for a research ethics amendment to cover repeated installations of the exhibit at different venues; however the assumption was that the exhibit and experimental protocol would not change. We significantly reworked the *Tweetris* exhibit in the year following Nuit Blanche, so that instead of playing Tetris with the tweeted body shapes on a mobile device, individual players used their own bodies to control a giant game of Tetris using the shape-images as tetrominos. We exhibited this new variant at the Nocturne: Art at Night festival in Halifax, Canada in October 2012. The shape-matching game took place in a van with exactly the same specifications as in Nuit Blanche, to facilitate comparison between the two events. Winning shapes were still tweeted as before, but they were also displayed to the crowd outside via a projected TwitPic feed (Fig. 11.5).

The new Tetris game was projected onto a white tarp covering a building face on a busy street, giving a 30-ft game board visible from about one block away. The tetrominos were a mix of coloured blocks and the shape-images made in the shape matching game. A stick figure was placed on the game board showing the movements being made by the player to control the game. Moving from left to right moved the active tetromino in the same direction, crouching down on the ground caused the

tetromino to speed its descent, and using the arms to make a broad rotating motion clockwise or counterclockwise caused the tetromino to rotate in the same direction. We were required to submit a new research ethics application for this installation. Most changes involved the new Tetris game, however we needed to consider how the new context (the TwitPic feed and large projected Tetris game) altered the "public" nature of participation in the original shape matching game (Reilly et al. 2013).

Now that *Tweetris* has been exhibited multiple times, we have been able to reflect on some of our research questions from a more qualitative perspective. Specifically, our exploration of how setting and audience influence shape-making behaviour was originally focused on quantitatively measuring the relationship between behaviour (counts of body orientations, amount of kneeling) and setting (location of audience, size of play space). Exhibiting at a range of types and size of venue has provided a richer understanding of how setting influences behaviour. We have seen the influence of a range of factors including weather, exhibit scale and layout, and event characteristics, and have been experimenting with different analytic approaches (e.g., the social-spatial semantics approach proposed by Lainer and Wagner (1998)) to understand these factors.

11.6 Conclusion

Tweetris is a project with both artistic and scientific goals. As an interactive artwork exhibited at public events, it provides an opportunity to observe whole-body interaction in environments where visitors are seeking novel experiences, rather than in a sterile lab. The repeated stimulus of tetrominos in the shape matching game allows us to analyse interaction both quantitatively and qualitatively, and showings at events with different characteristics allow us to build understanding of the impact of venue on engagement with *Tweetris*.

We encountered three key challenges in marrying the artistic and scientific goals of *Tweetris*. First, we needed to be flexible when setting research questions: *Tweetris* as artwork needed the freedom to evolve, right up to the days before its first public showing. Second, we encountered a number of ethical considerations, both during the event and in analysis. As a public art exhibit of our own design, we entered relatively uncharted and murky territory when seeking research ethics approval, particularly regarding what constituted public domain. Finally, we had to continue to manage scientific and artistic aims as we evolved *Tweetris* and exhibited at other events. While we were able to observe the impact of venue on whole-body interaction with *Tweetris*, factors such as lighting, space, and visitor engagement made it difficult to achieve enough consistency to conduct detailed comparative evaluations of whole-body interaction behaviour between venues. We also need to reflect, on an ongoing basis, on how changes to the exhibit impact our research ethics requirements.

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