# Publicly Displayed Interactive Installations: Where Do They Work Best?

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*Abstract*— **In this paper, we discuss user experience (UX) with an interactive installation that we have developed in order to study its relation to physical space where the installation is used. The installation utilizes Kinect motion sensor to provide movement based, single or multi user, interactions with graphical and sound interfaces. The installation was tested in various settings, including private interactions in the lab, and public space interactions in a library and a museum. Our findings show that for an open, explorative kind of interactions such as ours, spaces where one is expected to explore, e.g., a Maker Faire or a museum, provide for the longest and most pleasurable interactions with the installation.**

*Keywords— interactive installations; play; public space; user experience; Kinect.*

## I. INTRODUCTION

The field of Human Computer Interaction (HCI) can be viewed through the lens of three different paradigms: human factors, classical cognitivist, and the phenomenological, situated paradigm, see Harrison, Tatar and Sengers' work [1]. It is the latter that is of interest for us. It emphasizes a range of more abstract and fuzzy factors that affect HCI, including dynamic use contexts, socially situated action, non-task oriented computing, emotions, etc. [1]. *"It focuses on the experiential quality of interaction, primarily the situated nature of meaning and meaning creation"* [1, p. 1]. This paradigm seeks to produce 'thick', qualitative, subjective, and situated knowledge rather than objective and generalized design rules and models. *"The epistemological stance brought to this site is generally hermeneutic, not analytic, and focuses on developing holistic, reflective understanding while staying open to the possibility of simultaneous, conflicting interpretation"* [1, p. 13].

In particular, user experience, as a field emerging within the phenomenological paradigm, is relatively new and still lacking in theoretical work; see Obrist et al. [2]. Some researchers argue for the use of measurement models and structural models to develop a theoretical understanding of causal aspects of user experience, which can be used to inform design. Others argue for a more holistic approach, where studies of real, situated use are used as the basis for the development of theories. We think this division is artificial. Both approaches are important for an understanding of UX, and should be applied selectively depending on the specific design context. We try to combine the use of theoretical models of user experience with a holistic and open-ended exploration in the wild.

To this end, we have decided to use the increasing interest in public space interactions. Examples of human-technology interactions in public spaces include interactive displays such as large touch based information boards, mobile systems enabling projection in public spaces, tangible interfaces, interactive art and interactive public media. The interaction between a human and the system then becomes public and visible to others who happen to be in the same space. This creates enormous possibilities for interaction and user experience design, yet it is also challenging. One of the challenges we address here is how people feel when exposed to others while trying to interact with the system, see Fig. 1. Many feel silly when making funny gestures in order to interact with or control the system.



Figure 1. Interacting with a nervous robot in the hallway of the school may be intimidating while others observe.

Koppel, Bailly, Muller, and Walter [3] discuss large screens in public spaces in relation to three known major problems: noticing the display, developing motivation for interaction and designing for parallel or collaborative interaction. Their paper looks into configurations of the screen area into flat, concave and hexagonal screens and how these configurations influence users behavior, see Fig. 2. The conclusion they reach is that configurations influence users' behavior: "*Flat created the highest honeypot effect, triggered individuals to position themselves at the extremities of the display, triggered groups to divide and occupy multiple screens, and fostered social learning. Hexagonal allowed strangers to comfortably play on adjacent screens. Concave created the lowest amount of simultaneously interacting people, and caused groups to split into actors and audience*", [3, p. 9].

In this paper, instead of screen configurations in a public space, we consider how the kind of public space influences interactions between people and a system.

Figure 2.   Diverse screen configurations lead to different behaviors, [3].

In Section II, we discuss enjoyment, pleasure, play and games. In Section III, we present our methodology, the inspiration for the exhibit, the design concept and the final set up of the exhibit. Users' behavior while interacting with the system in different public spaces is presented in Section IV. Finally, in Section V, we discuss our findings, and, in Section VI, concluding remarks and future work.

## II.   ENJOYMENT: PLEASURE, FUN AND PLAY

By using enjoyment as an overall category, Blythe and Hassenzahl discuss the semantics of pleasure and fun [4]. Enjoyment can be thought of as an experience fleeting somewhere between distraction and absorption, where, on one end, fun represents distraction, and pleasure represent the absorption side of the scale. In short, fun is described as the counterpart to seriousness. As a distraction, it represents a spontaneous escape from the tasks and worries of everyday life. The self, the hedonic 'be-goals' of UX, does not matter in this short-lived break from reality, but fun still satisfies an important psychological need.

Pleasure is found on the opposite end of the enjoyment scale, taking on the role of absorption. It represents a deeper, longer lasting, more meaningful experience. Here, the connection to people's inner self is made through immersion and devotion to an activity. Elements of challenge, progression, and demand for absolute concentration can be present, and thereby overlaps with Csikszentmihaly's concept of flow; see [5] and [6].

Play is another fuzzy term to corner, as illustrated quite well by Sutton-Smith who has dedicated a whole book to this topic: *"We all play occasionally, and we all know what playing feels like. But when it comes to making theoretical statements about what play is, we fall into silliness. There is little agreement among us, and much ambiguity"*, [6, p. 1].

Although the term play represents a myriad of experiences, it has been broadly described as a "*free movement within a more rigid structure*" [7].

Some of the most influential work on play is done by the French sociologist Caillois. He divides play into four forms and two types of play [8]. The four forms of play are competition, chance, simulation and vertigo, and the two types of play are free play and formal play [9].

Playful behaviour is described as an oscillation between exploration and engagement [10]. Playful behaviour starts with exploration, and play occurs when the unfamiliar becomes familiar [11]. When the familiar gets boring, the focus returns to exploration. In this context, the goal of exploring is described as "what can this object do?" and the goal of play is described as "what can I do with this object?".

In relation to our installation, we chose exploration, but in retrospect saw that many of our users would have benefited from having more explicit elements of game. It is possible, as a future work, to change the installation so that users can make explicit choices in terms of more playful or more gameful experiences, according to what gives them a more enjoyable experience.

## III.   THE INTERACTIVE EXIBIT

Our installation focuses on the pleasurable experience for its own sake. It does not solve a problem, nor does it aspire to help people reach meaningful life-goals, though it is designed in such a way that it may be, with minor effort, turned into an exercise installation or a game. Our aim was to design an installation that allowed us to observe and evaluate user enjoyment and behaviour in both public (library and museum) and private (lab) contexts.

### A. The methodology used

Grounded theory is an inductive research methodology well suited for interpretive research [12, p. 283]. In contrast to the positivist approach of hypothesis development and testing, where the tests are conducted to prove or disprove a predefined hypothesis, grounded theory starts with empirical observations and data, and tries to develop theories from this basis. By grounding our theory development in observations and data gathered from the use of the installation, we attempted to gain some insights into the constitution of enjoyable user experiences and how those experiences are affected by the specific use context and space.

### B. What inspired the installation

The motion detection was a starting point. An important initial part of the project development was a few months dedicated to exploration of what other similar projects have achieved with installations involving the Kinect sensor or related technologies and concepts. This included scouring the web for videos, tutorials, project description, tools, and examples. A great starting point to look for such resources is the Creative Applications website [13], which is a digital art blog, focusing on *"...projects, tools and platforms relevant to the intersection of art, media and technology"*. The most influential pieces for the present work were the *V Motion Project*, based on creating music through motion; and the Firewall installation, based on manipulating the speed and volume of music by touching a stretched sheet connected to sensors. In addition, we were inspired by calligraphic movements, martial arts, and different dance styles.

### C. Physical set up of the installation

In all locations, the installation was exhibited in the setup as shown diagrammatically in Fig. 3, and in the actual space in Fig. 4. Each of the locations had, at least, an area of four by four meters in front of the Kinect sensors. The installation consisted of:

- A long and narrow table placed by a wall.
- Two Kinect sensors mounted on the table on top of each other.
- One Shake 'n' Sense device [14], fastened to one of the sensors to eliminate interference.

- A wall-mounted screen, either a flat screen TV or a canvas lit by a projector.
- Two amplified speakers placed on the table on each side of the screen.
- Two Mac laptops placed outside of the installation area, one running the audio and the other the visual system.

The final installation consisted of two completely separate systems, one controlling the audio and one controlling the visual display. This separation was made to keep the systems as stateless as possible. By stateless we mean that the systems did not keep or store any information on previous states or actions. This means that the systems reacted only to what a user was presently doing, and was not based on what has been done earlier by this user or any other user. The systems were tuned to work together and appeared for the user as a single installation.
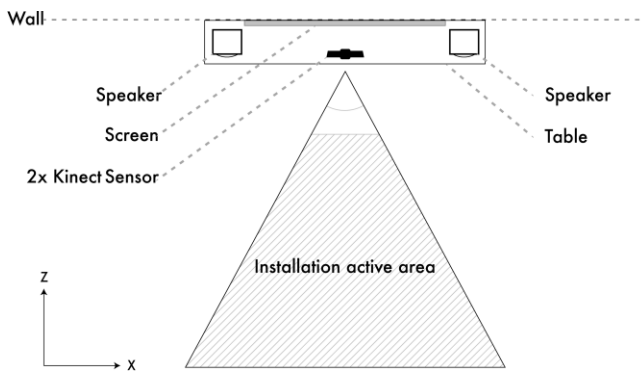


Figure 3.  Diagram representing the physical setup of the installation.



Figure 4.  Actual setup of the installation in the museum during the Maker Faire, with interaction area marked on the floor.

When a user, or several users, walked into the range of the sensors, the system automatically calibrated them and started tracking their movement and playing the sound track.

The main way a user could start interacting with the installation was by extending an arm away from their body. More specifically, a horizontal hand movement away from the chest would trigger the system and start the calibration processes, engaging both audio and visuals. The distance for this horizontal hand movement was set to 25 cm.

## IV.  THE SPACE AND THE USER BEHAVIOUR

The first public test of our installation, apart from one exhibit in the lab open to general audience, was at the Science Library at the University of Oslo. The library actively encourages students to develop different kinds of systems and technologies to be used in the library. We were invited to set up our installation in the foyer on the ground floor of the library building for three consecutive days. This provided a good opportunity for us to observe how people reacted to and interacted with our installation in a real public setting; see Fig. 5.



Figure 5.  The installation in use in the Science Library at the University of Oslo.

At the library, two researchers were present to observe and take notes. In order to ensure that notes would be comparable, a simple coding system was designed. Seven different pieces of information were recorded for each user engagement: something to identify a person or a group by; start- and end- times; single user or a group; if they actively engaged with the installation or just passively observed; body language; facial expression; and finally, notes. Body language was categorised into: shy, curious, engaged, uninhibited, frustrated, self-conscious, indifferent, joyful, and sceptical. Facial expressions were recorded as emoticons.

The observations were done over a three-day period, in two different locations within the library. The first two days, the installation was placed in the foyer of the library, in the vicinity of the cafe. This was the most trafficked area in the library. The third day, it was moved to a more quiet area. The set up was as follows:

- Duration of observation: 7 hours 49 minutes over three days (2h + 2h 36m + 3h 13m).
- People observed: more than 52 (52 interaction sessions, some of them involving groups).
- Active: 35 (if a group, all participants took an active role)

- Passive: 17 (if at least one member of a group was just observing)
- Age: mainly from 17-40 years old, a few in forties, fifties or sixties.

The granularity of our time-registrations were not fine enough to draw any certain conclusions regarding time spent with the installation, other than that hardly anyone spent more than three minutes. However, when comparing time spent to whether the person was alone or in a group, we saw that people who were in a group spent more than twice as long (1.2 minutes in average) than a person who interacted with the installation alone (0.5 minute in average).

Perhaps in contrast to the usual absence of music in the library, people soon learned that whenever the music started, there were people interacting with the installation. This allowed them to look up whenever the installation was in use, thereby slowly building an understanding of how it worked. This also allowed them to build both curiosity and courage to try the installation for themselves. We saw several examples of people coming up to investigate after having observed others interacting with it for a while. There were also examples of single persons and groups of people who were hanging around in the background, queuing when others were interacting with the installation. As soon as the people using the installation left, they would walk up and give it a try. This worked like a honeypot effect, a positive feedback loop, where use attracted attention and instigated more use. However, the installation was unable to keep people's interest for more than a minute or two, which meant that there would have to be a constant stream of people to keep the installation in continuous use. When the installation was allowed to go into standby mode, people quickly returned their attention to whatever they were otherwise doing.

In terms of level of engagement, those people who explored the installation together with others seemed to get more out of it than those that were alone. They would talk to each other and explore cooperatively, discovering more functionality than those that were alone. There were also several examples of people who had been interacting with the installation earlier came back with friends.

Verbal reactions were usually immediate and short, perhaps also because the observers were hidden, looking just like everyone else, so people were more or less talking either to themselves or to their friends:

*"Awesome! Motion sensor, cool!"* – Man X
*"Shit! Wow!"* – Girl A
*"Very cool!"* – Man Y
*"Pretty cool!"* – Man Z

There were also more reflective statements:

*"It responds to my movement."* – Man W

After exploring for a minute, one man, of about 60 years old, exclaimed: *"One could stand here all day, fooling around!"* – Man P.

Many participants have thus explicitly mentioned the word cool. Coolness of technological objects may be an important factor for their consequent acceptance; see [15].

The second public test took place at the Norwegian Science Museum, during the Mini Maker Faire in Oslo; see Fig. 4 and Fig. 6.



Figure 6.    Interacting with the system at the Norwegian Science Museum.

Doing the same coding as for the library, we found the following:

- Duration of observation: 42 minutes, one day.
- People observed: 33.
- Active: all
- Age: from about one year old to somewhere in the sixties.

Average interaction time was over 2 minutes.

## V.    DISCUSSION OF THE GENERAL FINDINGS

In this section, we will discuss how the user experiences appeared to be affected by the different public contexts the installation was tested in.

The audience at the library included mostly students, faculty, and other staff. They were there because they had some business there, either going to or from a lecture or the library, hanging out with friends, studying, eating lunch, and so on.

At the museum, on the other hand, there was a greater mix of people, ranging from toddlers to grandparents, but with an overweight of children in the pre- and primary school ages. They mostly arrived in groups, with family members or friends, and were there to experience, learn, and enjoy themselves.

The physical spaces our installation was exhibited in were quite different. The two locations at the library were exposed and crowded, particularly the first one. This meant that anyone interacting with the installation would draw attention from not only the immediate surroundings, but also from galleries on the floors above. The sound would naturally draw attention from the surroundings, and given the open layout of the building, it was allowed to disperse throughout the building. Furthermore, as we accidentally discovered when the installation was run without sound output, people did not take notice of the installation at all when it did not produce any sound. This may be explained by the term *display blindness*; people have become so used

to all kinds of public displays and advertising that they can selectively ignore them. *Interaction blindness* refers to the fact that it is difficult for people to understand whether a given display is interactive. Houben and Weichel [16] have described how display blindness and interaction blindness can be overcome by use of curiosity objects, e.g., objects that are designed to draw attention by sparking interest and curiosity. Although not intended specifically as a curiosity object, the sound certainly worked as one, effectively drawing attention to the installation whenever it was triggered.

The space we were assigned at the museum was partly confined, making it close to impossible for others to observe the installation, or the people interacting with it, from afar. This seemed to give participants a sense of privacy and allowed them to let themselves get more carried away than at the library. Also, our preparation of the installation space with chairs for onlookers to sit on along the sides was very beneficial. It allowed the ones who did not want to try the installation to sit down and relax, but still be able to communicate and take part in the experience with their friends who were interacting with the installation. Several onlookers also eventually got up and tried the installation after having grown curious by watching others.

A very central concern for many people seem to be a reluctance to appear conspicuous or out of the ordinary in public spaces. Breaking social rules and norms is a big deal. As Roto et al. [17] pointed out, *"UX is rooted in a social and cultural context"* .

Most of our interviewees at the prototype evaluations in the lab readily admitted that they would restrain their involvement with the installation in a public setting, if they would be willing to interact with it at all. The most central reason they gave for this was the fear of breaking social rules and norms, and of "behaving like an idiot"*,* as one participant put it. It was their fear of being perceived by others as doing something people do not normally do in public that would keep them from getting too involved. There were also comments to the opposite effect, indicating that breaking social rules and norms can be liberating and empowering. However, the prevailing notion was that social rules and norms would have a dampening effect on people's level of involvement with such an installation in public settings.

This concern seemed particularly evident at the library. The openness of the location and the number of people in the surrounding area seemed to make people self-conscious and vulnerable when they triggered the installation, particularly if they were alone. At the museum, there was clearly more headroom for expansive and expressive behavior. Many of the permanent museum exhibitions are designed for interaction and exploration, and the wide variety of strange projects taking part in the Maker Faire clearly made people less concerned about how their behavior would be perceived by others, as this behavior was expected in this context. Nevertheless, there were examples at both locations of people showing an interest in the installation but being too shy to dare to try it for themselves. But by having the opportunity to watch others interact with

it and build an understanding of how it worked, the shyness was often overcome by curiosity, resulting in them engaging with the installation after having observed for a while.

Next, we present the general findings from the evaluation sessions and public tests of our installation. Through the analysis of our evaluation sessions in the private lab context, we located many statements indicating an enjoyable experience. In this section, we want to look at aspects of the participants experiences related to the concepts encompassed by the term 'enjoyment', as discussed in Section 2.

### A. Fun

The installation in itself was described by most as 'fun'. Blythe and Hassenzahl defined fun as a short-lived distraction from everyday life [16], coinciding well with the way the word is used in describing the experience by the participants. But, what exactly was fun about the installation? The participants answers points first and foremost to the exploration of the installation and its functionality, then secondly, the immediate responses the installation gave to movement, and the sensory aesthetic experiences they resulted in.

Pleasure was never mentioned directly by the participants, but several interviewed participants described an experience of 'flow' [18] when they were interacting with the exhibit, which can be linked to pleasure [4]. These experiences were described in terms of being 'lost', mesmerized, having a mental break and entering a relaxed 'kind of mode', and the majority of the participants agreed on this being an essential part of their experience. It's worth noting that some of the participants pointed out, both explicitly and implicitly, that this flow-like state disappeared over time as the participants ran out of elements of the installation to explore.

### B. Play

Several of the participants described the installation and the experience as playful. Their descriptions indicated that they placed the experience more in line with the definition of free play, rather than formal play (game).

The playfulness the installation facilitated for was deemed as very important, and the participants linked it strongly to the exploration part and the open-endedness of experience, but also to the lack of control. The openness of the installation was described as an advantage, in the way that it encouraged interpretation and exploration. The lack of control was described as not important by one participant, as the point is not to steer something, but to play with the system and get responses from it, which resulted in a 'good feeling'. In relation to the concepts of goals, rules, and competitive elements of play, even the self-proclaimed 'competition-focused' participants acknowledged that those concepts were not the point of this installation.

In the playful behavior, there is an oscillation between exploration and play, where exploration is triggered by boredom [10], [11], [19] and play is triggered by learning or discovery [20]. We found multiple instances of this in the way participants described their explorative behavior, which

strongly resembles the process of playful behavior, emphasizing the strong relation between playing and exploring: *"It is just exploring, really. Until you feel you master (the installation) a bit, then it's really exciting and makes you want to continue. You never know if you have explored everything and that's positive, you never reach an end."*

### C. Aesthetics

In terms of aesthetics, both the audio and the visuals were described as fascinating, atmospheric, different, beautiful and soothing. The participants thought the combination of the two fit well together and resulted in a coherent expression and created a good ambiance. It was also pointed out in a positive manner that the expression was kept to an abstract nature. That way it became easier to accept the audiovisual expression, in comparison to trying to depict or simulate something concrete.

### D. Exploration

As stated earlier, exploration was the activity and experience deemed the most important successful aspect of the installation. Several of the participants expressed bluntly that exploration *is* the installation. The exploration was fuelled by the responses given by the installation and their abstract, mysterious, unknown nature. Or, to put in other words, the immediate responses to movement and actions, combined with lack of explanation, made the participants curious and eager to investigate. Their descriptions also highlighted one of the common characteristics of the human brain, namely the constant search for patterns and connections, which was described as an essential part of the process of exploring.

### E. Discovery, learning and understanding

On some aspects of the experience, the participants were quite divided in their opinions. One of these aspects was the lack of explanation, or guidance, in the user interface of the installation. The majority of participants highlighted the absence of explanations as something positive. It was seen as a catalyst for, and a component of, exploration. However, two of the participants found it confusing, frustrating and incomprehensible.

One of the participants, who favored minimal explanations, pointed out that an installation such as ours would not be suitable for people who are not interested in exploring.

The discovering and learning were described as closely related to exploration. For example, one participant described discovery as a direct result of the exploration.

The process of understanding was the challenging part of the installation. When exploration led to discoveries and understanding, the participants had a sense of progress and achievement, giving them motivation to continue to explore. However, the lack of 'new things' to discover and explore eventually led to boredom and loss of interest.

Some users considered the lack of progression and control as negative aspects of the installation.

### F. Progression

Progression was an aspect of enjoyable user experience that was originally overlooked by us in the design process, but which surfaced through the evaluation of the prototype as the most important missing aspect of the participants' experience. As mentioned earlier, Blythe and Hassenzahl link the concept of pleasure to the concept of flow, but they also argue that pleasure can in fact be thought of in terms of progression [4]. In retrospect, this actually comes across as self evident, when comparing our findings to the overlapping definitions of flow and pleasure, as a longer lasting, more meaningful and immersed experience devoted to an activity.

The participants wanted more depth to the experience. They wanted more to explore, and gradually increasing variation and difficulty. When they felt they had exhausted their possibilities for exploration, they became bored, and this coincided with the earlier mentioned loss of flow state.

### G. Control

The second most sought after aspect was control, and on this topic the participants of the prototype evaluation was close to unanimous. They expressed frustration over not getting the expected responses from the system, and this put limitations on what they could do. It prevented them from being creative and expressing themselves through the installation, both in terms of visual and audio expression, and this was emphasized as important to them. Some acknowledged that they attained a certain degree of control, but it was expressed that the threshold for gaining this control should be much lower in order to make the installation accessible to more people.

The lack of control linked very strongly to the absence of mastery, and on this point the feedback from one of the users was quite direct: *"[The installation] lacks possibility for mastery."* And another user on the same topic: *"I don't think I would master it more if I used it for another 20 minutes."*

The only positive feeling described that related to mastery was through exploring and discovering, but even then, this process was described as fumbling.

The lack of control highlights the relation between the second- and third- paradigms of HCI, and between usability and user experience. In our phenomenological approach, the focus was on enjoyable user experiences, and not so much on usability and ease of use on a specific level. Also, the explorative and abstract nature of the installation meant that it was difficult to define specific usability criteria for it.

This is not to say that control was not a focus in our design, but the lack of precision in the tracking data from the Kinects, and our experiential focus led us to design a system that did not need very specific and precise controls. Nevertheless, our findings clearly show that lack of control detracts from the experience. This is in line with the fact that good usability is a prerequisite but not a guarantee for good user experiences. It also underlines the importance of both second- and third- paradigm HCI approaches for the overall user experience; neither approach is complete on its own, but must be combined selectively according to the

specific design context in order to make the user experience as enjoyable as possible.

VI.    DISCUSSION OF THE FINDINGS RELATED TO SPACE

We now focus on presenting the space related findings specifically.

In terms of time spent by participants interacting with the installation of the two locations, we see the time spent at the museum was significantly higher. At the library, no one spent more than three minutes with the installation, 41% spent less than one minute and 72% of the observed spent two minutes or less. At the museum, the time spent with the installation is spread much more evenly across the intervals noted: 59% spent two minutes or more interacting, and some people seen outside the time frame of observations were exceeding the intervals noted significantly.

Looking at the distribution of facial expressions observed in the two different contexts (Fig. 7 and Fig. 8), expressions of a positive nature are the predominant ones in both settings, but at the museum as many as 86% were smiling and even though 5% were noted as indifferent, 95% of the observed were deemed positive.
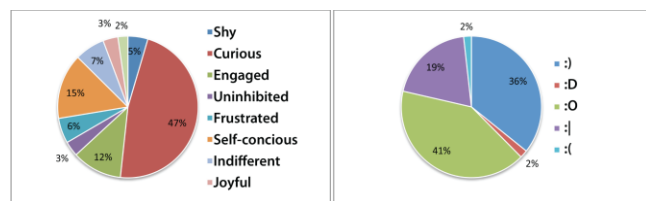


Figure 7.    Body language and facial expression distributions at the library.
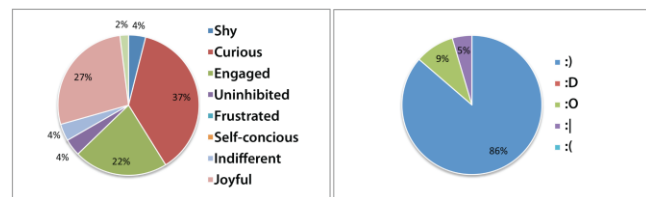


Figure 8.    Body language and facial expression distribution at the museum.

Comparing the observations of body language between the contexts, a high degree of curiosity is observed in both settings, with 47% recorded as displaying a body language suggesting curiosity in the library setting, while 37% were recorded at the museum. The most striking difference between the library and the museum contexts was the high percentage of joyfulness (27%) and the low percentage of shyness (4%) of the museum setting, contrasting the low degree of joyfulness (3%) and high degree of self-consciousness (15%) and shyness (5%) (combined 20%) seen at the library. The reason for combining self-consciousness and shyness is that they are very similar traits. Seen in retrospect, separating these terms into two coding categories might have been unnecessary, considering their similarities and the fallibility of observation.

During our prototype evaluations, testers consistently underlined that they would be less likely to interact with the installation on the street or in the shopping center than if they encountered it at a destination like a museum or a gallery. One of the participants expressed this as follows: *"It would be a lot more socially acceptable in a museum to interact with it. I would say my experience would have been much better in a context like that. If the installation were set up in Karl Johan* [note: central shopping street in Oslo] *I wouldn't have stopped to check it out, also because I'm going somewhere"*.

Applying this thinking to the library and museum, we see that the foyer of the library is a place which one passes through on the way. The museum is a destination in itself. The library foyer is thus more similar to a 'street' setting, in that the installation is unexpected and disrupts passers-by. At the museum, on the other hand, visitors expect to explore and have an experience. If we also take into account the fact that people spent considerably longer time interacting with the installation at the museum (Fig. 8) than in the library, this might support the notion that the museum / Maker Faire setting was a better-suited context for the intended use of the installation, namely facilitating for spending time exploring. An interesting observation is that the amount of people marked as being fascinated by the exhibit varies significantly between the two observation places. At the library, 41% were recorded as fascinated, in contrast to only 9% in the museum context. This might suggest that fascination was expected in the context of the museum, while unexpected in the context of the library.

If we look at the distribution of the differences observed in the body language (and especially the differences between joyfulness and the combination of self-consciousness and shyness observed in the two contexts), it seems that the library context was perceived as a less comfortable one. We attribute this to the 'deviant' nature of the interactions from what is the norm at the library. Waving their arms in mid-air makes participants of the installation stand out and calls attention to them from people situated nearby who are not aware of what the participants are doing, thus making many participants uncomfortable. This situation was predicted by some participants of the private evaluation sessions. They said it was important for them to make their actions understandable to onlookers, if they were to engage with such an installation in a public space.

These suggested effects of breaking social rules and norms and disruption (or surprise) indicated, especially by the observations in the library, are not necessarily to be considered negative. We may consider the installation, as it worked at the time, better suited for the museum / Maker Faire context, but through alterations to the installation based on feedback from the evaluation sessions, we imagine we could have facilitated a better user experience at the library as well. This could be to make the 'tools' or controls more obvious to help the shy/self-conscious but curious understand the basic workings before they reach the stage of giving up, preventing potential frustration and embarrassment. To help avoid the perception of 'unnatural' behavior to onlookers, we could make the connection between participants and their screen presence much clearer, hopefully making it more obvious to the onlookers what the participants were doing.

## VII. CONCLUSION AND FUTURE WORK

We have designed and implemented an audiovisual interactive installation for the purposes of exploring playful and pleasurable interactions in public spaces.

For the purposes of this paper, we explored the differences in user behaviors in two distinct public setting: at the university library and in the science museum, during a Maker Faire.

The results show that the context in which the exhibit is installed and used strongly influences user's behavior. Exploration, discovery and learning in public space need to be supported properly. The museum is the context suitable for such endeavor and participants have used longer time to interact with the exhibit, have shown much less frustration, were less concerned with on-lookers, and showed clear signs of pleasure, e.g., smiling. However, in the museum setting, it was harder to fascinate the users of the exhibit. The visitor's expectations in this regard are high. People in the library are there on other accounts and thus are harder to engage, more shy but easier to solicit a "wow" effect from.

Our evaluation of the installation was qualitative, and it was analyzed through applying grounded theory techniques, such as coding. The analysis gave us valuable insights, also highlighting some weaknesses of the installation in terms of, for example, the lack of control and progression during interaction.

We envision several possibilities for future work based on the installation, such as modifying it into a game. Furthermore, some important concepts from UX theory may be studied through interaction with the installation, such as immediacy of understanding and affordance, and how they are influenced by the fact that several people may interact with the installation simultaneously.

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