Traces Upon:
An Interactive Public Installation in a Shopping Mall

by

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Abstract

This thesis project investigates the possibility of generating a sense of connection in a shopping mall's space and enhancing the experience of this "non-place", a space composed of transient activity and retaining no engagement as described by Mark Auge. An engaging interactive public installation has been designed which allows participants to have a lasting effect on the space by leaving a trace of their activities. The three core values in this project that act as a foundation throughout the development process are accumulation, identification, and meaningful outputs. The research is conducted with a horizon scan of the existing literature and knowledge, as well as existing interactive projects in various fields. Critical design, Reflection-in-Action, and user-centered design are the three main design approach and method.

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1.0 Introduction

This thesis project is an exploration in the design of an interactive public installation in a shopping mall. The shopping mall is one of the categories of spaces described by Mark Auge in his seminal work *Non-Places: Introduction to an Anthropology of Supermodernity*. In this book, a non-place is defined as a space that does not have an anthropological connection and that lacks identity, relationships, and history. Auge identifies airports, shopping malls, and exurbs as non-places that people pass and use, but where they do not feel a sense of belonging (Auge, 1995).

The aim of this project is to investigate whether it is possible to create a sense of connection in a shopping mall that will enhance the experience of this type of space. This sense may be created by offering some type of engaging interactivity and by allowing individuals who make use of the space to have a lasting effect on the space by leaving their traces. The core proposal of this project is that the output or the trace of each individual's participation will be kept. As a result, there will be an accumulation of aura embedded in the installation (*Figure 1*). These traces are abstract representations that could be recognized by the person who left the trace, but they are not identifiable to others and do not provide any identity information about the participant, so that the rights and privacy of the participant are respected. The three fundamental values of this project are accumulation, identification, and meaningful output.

When references are made to the architectural history of shopping malls, it is important to examine Southdale Mall, which was designed by Victor Gruen, who is known as the father of shopping malls. This structure built in 1956, which was the first mall ever, was based on the concept of evoking a European city centre and creating an atmosphere of excitement, leisure, and pleasure. The concept also included the integration of art works (Gruen & Smith, 1960). Southdale reflects the original vision of shopping malls. In addition, the shopping mall was seen as a "place of enchantment," as described by James B. Twitchell in the book *Shopping as an Entertainment Experience.* This project aims to capture or reestablish this quality by attempting to generate an enchanting experience through the accumulation of people's traces within an interactive installation. The project includes no intention to change the functions of the shopping mall's space or to transform a "non-place" into a "place." The intention is to recognize and embrace the existing characteristics of the space, to add a new feature that will enhance the space, and also to create the excitement and enchantment that malls were originally meant to have.

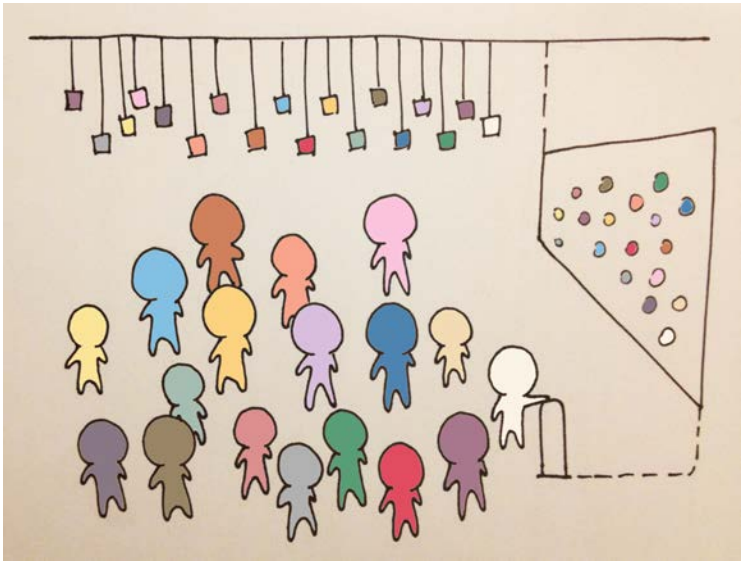


Figure 1. Initial conceptual sketch

1.1 Non-places

According to the *Oxford English Dictionary*, the main definition of the term "place" is "a particular position, point, or area in space; a location" or "a building or area used for a specified purpose or activity." Non-place is not a term found in dictionaries, but the assumption can be made that it is the opposite of a "place." "Space" is defined as "a continuous area or expanse which is free, available, or unoccupied." In the context of this paper, these basic descriptions are embedded along with many more implications that are associated with the intricate aspects of the descriptions. *Non-Places: Introduction to an Anthropology of Supermodernity*, a book by Mark Auge mentioned above, is the main source in this thesis for references to and definitions of non-place. Place is "encrusted with historical monuments and creative of social life" (Auge, 1995), and non-place is where "individuals are connected in a uniform manner and where no organic social life is possible" (Auge, 1995). The main distinctions between place and non-place are the

contrasts between transit and dwelling, identity and anonymity, passenger and traveller, and communication and language. Marc Auge refers to a place as an anthropological place characterized by identity, relationships, and history. Anthropological place does not wipe out the footprints of its occupants, but instead evolves through this relationship. It also becomes a result of its surrounding cultural context. These characteristics are absent in non-places, which can be found everywhere and are independent of localities. Non-places are the consequences of supermodernity and contemporary practices of spatial production, and people's experiences in these places are transitory (Auge, 1995). People pass through as anonymous individuals and do not relate to the space with any sense of connection or intimacy. All of the occupants of non-places, such as airports, shopping malls, supermarkets, and even motorways, share the same identity.

In the early stage of this project's process, the goal was transformation that would change a shopping mall's space, a non-place, into a place by creating the aforementioned qualities that define a place. More research about other perspectives on non-place and place and more development made it obvious, however, that "a space can be either a place or a non-place, or a place for some and not for others" (Auge, 1995). For instance, an airport is a classic example of the ways the definition of non-place can begin to break down in relation to different types of occupants. People who work there have colleagues and relationships within the space;

therefore, social ties are created, and the qualities of a place are developed. In contrast, a passenger passing through this space only once would define the airport as a non-place (Auge, 1995).

The notion of non-places is used in a subjective manner because all individuals perceive non-places on the basis of their own perspective and experience. A hallway is an example of a small-scale non-place. If people temporarily relate to it, a hallway can become a place as well (Andriesen, 2007). People can create a certain place within a space by acting. "Place derives from a tension between connectedness and distinction, rather than from three-dimensional structure" (Harrison and Dourish, 1996, as cited in Andriesen, 2007). Thus, a statement that an interactive public installation will attempt to transform a non-place into a place is not convincing, since the designation of place or non-place depends on the different circumstances of every individual and can be interpreted in multiple ways. The project's intention therefore is to recognize and embrace the existing characteristics of the space in a shopping mall, and also to enhance the experience of its qualities in order to stimulate richer connections with the mall's occupants.

1.2 Shopping Mall Context

Shopping is a part of people's daily lives and routines, whether the shopping is for necessities such as groceries or for leisure purposes, such as a casual trip to the mall. People enter stores that correspond to their passions, hobbies, and desires. Shoppers also look for stimulation and entertainment.

As a public-oriented structure and setting, the shopping mall allows for optimal accessibility. Anyone can visit a shopping mall and be part of this installation. The places where people would normally expect to encounter an interactive installation are galleries, exhibitions, and similar events or structures. Situating an interactive installation in a shopping mall can create a sense of surprise along with an uplifting feeling that may arise when the elements of interactivity and engagement are discovered. In this situation, the installation may create more impact than it would in a setting that is already engaging passersby and that is full of vibrant dynamics. The installation can serve as a landmark feature that is unique in the shopping mall's space. Furthermore, the relaxed, informal nature of shopping malls makes it more likely that visitors will be willing to engage in spontaneous and often unpredictable activities, both individually and in groups (Hinrichs et al., 2013).

During the era of the early evolution of the shopping mall, a relaxed and stimulating atmosphere, as described by Gruen, was envisioned:

> They should create opportunities for manifold activities. They must be busy and colorful, exciting and stimulating, full of variety and interest. They should surround the shopper with pleasurable experiences. All of the senses should be rewarded. Trees and flowers, music, fountains, sculpture and murals, and the architecture of free-standing structures are vital parts of the over-all composition. The combination of water,

> in ponds, basins, or fountains, with sculpture and landscape is as old as man's artistic endeavors. Playing water appeals to the eye and to the ear. Like fire, it holds eternal magic. (Gruen & Smith, 1960)

This account reveals that the pre-eminence of a sense of place that included the integration of natural elements and artwork was actually embedded in the origins of malls (*Figure 2*). Today's shopping malls seem to have lost some of this vision as commercialization has prevailed. Early shopping emporiums were also linked to notions of dreams and "places of enchantment" (Moss, 2007). These emporiums were associated with a conception of enchantment as if they were magical and alive with contagious desire (Twitchell, 2004). In such a setting, people can move into escape mode when they enter a mall and are stimulated by the environment, which can tempt and excite, or calm and soothe. Twitchell also indicates, with reference to Ira Zepp's work, that the purpose of the common use of flowing water and fountains in shopping malls is to serve as a soothing and appeasing agent for tired shoppers. Flowing water refreshes them when they are exhausted and revitalizes them for more shopping (Moss, 2007). This idea of enchantment and the use of water are embodied in the current design.

Figure 2. Southdale Mall in Edina, Minnesota by Victor Gruen (1956)

In an expansion of the escape notion, shopping can be considered an escape when it offers alternatives to a chore that one is supposed to perform. Shopping lets people escape from the tension or daily normality they are facing. People sometimes need a break and enjoy the sense of losing their identities for a while (Shaw, 2010). Non-places thus have features that people desire. This notion of shopping confirms that it is not necessary to transform a non-place to a place, since being in a non-place is not necessarily a negative experience.

1.3 The Project's Core Values

The foundation that drives the project's development consists of three key values: accumulation, identification, and meaningful output. Accumulation is the growing collection of the output, that is, the trace from each individual's participation that will be kept. Identification is tightly linked to the aspects of authorship and ownership, which will be explored in a later section. Identification allows participants to be aware of the output

they contribute and to know that it might be possible to recognize the traces they have left if they return to the installation. Thus, identification does not suggest revealing identities. Individuals remain anonymous and share the same role of contributors. Meaningful output depicts the idea of digital interaction that results in a matter of consequence and creates an effect. The participants need to understand what they have done and affected. This understanding would enable them to make connections and appreciate the meaning of the experience. Meaningful experience is different from identification because it does not mean only clear feedback; it allows participants to understand the context and the way that they have become part of a great public contribution. Their presence and decisions to leave traces have affected the overall experience of the installation to other people.

The use of digital technology allows for greater possibilities in the execution of the work and is most appropriate for this context. In a shopping mall, some of the main factors at work are the high concentration of circulation and the large number of people. The issues of durability and maintenance arise, especially since the project holds the value of accumulative output. Digital interaction can also contribute to the development of magical and enchanting features in terms of creating fantasized visualization and hiding the interactive system being employed, thus the experience of the user is seamless as only their presence causes the interaction. It is also not common to find a digital interactive public

installation that has not been set up for commercial purposes in a shopping mall.

1.4 Thesis Statements and Hypothesis

An interactive public installation can have a role in enhancing the experience of a space in a shopping mall. This thesis project's aim is to improve the characteristic of transience in a public space within a mall by offering passersby a digital interactive experience that enables them to contribute to the overall experience in the space and allows them to leave their traces in way that does not reveal their personal identities. A stronger and richer engagement between the occupants and the space can be established since the output of the interaction remains even after the participant has left and is not just a temporary effect. Over time, the accumulation of traces will contribute to the overall spatial experience of the shopping mall's space and help to develop a more humane, people-centered experience.

1.5 Research Questions

The main research question is how an interactive public installation might enhance the experience of a shopping mall so that the experience is less transient and offers people a meaningful connection or a sense of place through participants' involvement in accumulation and identification. The form of a display screen or physical component, the content, and the nature of the interactivity are in question. An exploration is needed to determine if

the accumulation of the interactivity's output will reside in both the digital and physical components. The nature of the relationship between the digital and physical forms if they are both integrated has to be established. Stimulating content is required in order to motivate people to participate. The level of interaction needs to be suitable for the public setting and understandable to a wide range of audience members. Another secondary question is about the way digital technology might be used for participants to identify their output in the space. Identification is one of the key values, and there are number of ways technology can achieve it. Questions about the most appropriate way to proceed within the context of this project have to be posed.

2.0 Literature Review and Relevant Works

A horizon scan and research were executed, with a focus on public interaction design in relation to aspects of the requirements and considerations, the identification and ownership of participants, the connection to physical space, and the concept of aura. Knowledge gathered from existing works has contributed to the project's inspiration and level of awareness.

2.1 Public Interactions Design Requirements and Considerations

Public space is full of a diverse range of people who differ in age, interests, and experience with interactive technology (Hinrichs et al., 2013). In the process of designing a public interaction, the main concerns are attracting, engaging, and motivating the people who are passing by. Because of the nature of public space, people are not expecting to interact with anything, and there are also many other things competing for people's attention. The depiction is significant, especially in the shopping mall setting. The first important step is to grab a person's attention. Then, when the person at least turns his or her head toward the interactive feature, curiosity and then motivation must be stimulated. There needs to be an incentive for engagement in the interaction. The traditional task-oriented design of a human- computer interaction deals mostly with the "how," but not the "why," so that questions about motivations are unanswered.

There are five main factors in motivations: challenge and control, curiosity and exploration, choice, fantasy and metaphor, and collaboration (Muller, Albrecht Schmidt, & Michelis, 2010). The factor of challenge and control encourages the participants to figure out what to do and receive direct feedback that enables them to sustain their control of the system. The sense of curiosity and exploration stimulates the feeling of wanting to find out and inspires exploration. The use of this factor might involve a hint of what the interaction is about that tempts and invites the participants. The offer of choices could generate a feeling of belonging and provide suitable options to each individual, but this offer needs to happen in moderation. Fantasy and metaphor involve the use of imaginary settings. Lastly, collaboration is the process of allowing participants to develop the ability to influence other people's interactions, but the level of collaboration depends on the users' experience and also their level of competitiveness or collaboration.

It is also necessary to be mindful of certain boundaries in public spaces. People might want to maintain a certain impression, image of themselves, or role in public, and therefore they probably would not do anything that might embarrass or force them out of their comfort zones (Muller, Albrecht Schmidt, & Michelis, 2010). The level of each user's introversion and extroversion can also affect the level of participation. Another issue is that, if passersby bump into participants while they are

interacting, then their level of engagement could lessen. Participants might not feel comfortable continuing if it seems that they are disrupting others.

The relationship between the performers (or active participants) and the spectators (or people passing by) also has to be considered. There are four general design strategies for the interface manipulation, which affects both the performers and spectators. The first is a "secretive" one that inhibits the spectators from seeing the manipulations and effects. The "expressive" one allows the spectators to see everything. "Magical" means that only the effects are shown, but not the manipulation. "Suspenseful" means that only the manipulation is shown, and the effects are discovered when the spectator takes his or her turn to perform (Rico et al., 2010). There is also the model of "seeing-myself-seen," which describes a user who is all at once, the "operator of, performer in, and spectator to their own interactions" (Rico et al., 2010, p. 520). A combination of these strategies, particularly "expressive" and "seeing-myself-seen," seems to be most appropriate within a shopping mall context since this combination involves simple, non-time-consuming interactions. Allowing people to see everything means that they are also allowed to learn about the interactivity from others. This way of operating could encourage and add a further incentive to participate, as people become aware of the capabilities.

2.2 Sense of Ownership and Identification in Public Display Interaction

In the process of enhancing the qualities of a non-place, which features transient activity and no participation, it is crucially important for the interactive display feature to have qualities that promote engagement and meaningful output. It is clear, as discussed above, that the main factors in a successful and engaging public interaction design need to be based on the attention the design is able to grab from the passersby, the motivation for people to participate, and the whole interaction process.

Interactivity affects the role of the artist and audience, as Margot Lovejoy (2010) discussed in *Context Providers: Conditions of Meaning in Media Arts*. Artists were thought of in the past as the content providers, but now they are also the context creators. Context is offered so that the audience is able to interact accordingly, and the audience is also allowed to generate the content. In contrast to the traditional approach, in which the artist has full authorship of the work, the artist now is the one who designs the "framing" that allows viewers to participate. The line between the two roles becomes blurred as viewers who participate also become artists creating the work, and the work can keep evolving. The work is a structure of dialogue that is communicated through a form of collaboration instead of an individual effort. These conditions undoubtedly illustrate the shared authorship of the participants, as well as the sense of agency that each person is free to “create, change, and influence” (Lovejoy, 2010, p. 19). All of these assets promote

meaningful engagement; however, the quality of this co-authorship is then in question. The instant one participates, one is considered to have authorship, but how much effect does this authorship have on the individual? A sense of ownership in addition to authorship is necessary. The process of acquiring authorship does not necessarily mean that the participants can literally see or identify what they have contributed. "Reactive Sparks" (*Figure 3)* is an example of this type of case. Information about passing traffic is collected, and waves are displayed on vertical screens. The LED saves become bigger as more vehicles pass by the sensors. The drivers of these vehicles all share authorship of this work, but there is a lack of ownership. The participants cannot identify their output since they are all integrated in one wave. A sense of ownership means having an awareness or implicit sense of being an owner of an action, movement, or thought; personalization, a sense of control, territoriality, and involvement are also integrated (Killeen, Evans, & Danko, 2003). This sense of ownership adds another level of engagement and connection to the interactivity. "Nature Trail" (*Figure 4*) at the Great Ormond Street Hospital in London is constructed along a corridor with a combination of integrated LED panels and graphic wallpaper. As children touch the surface, images of abstract animal movements appear. In addition to shared authorship, the children can feel a sense of ownership of the animals they activate.

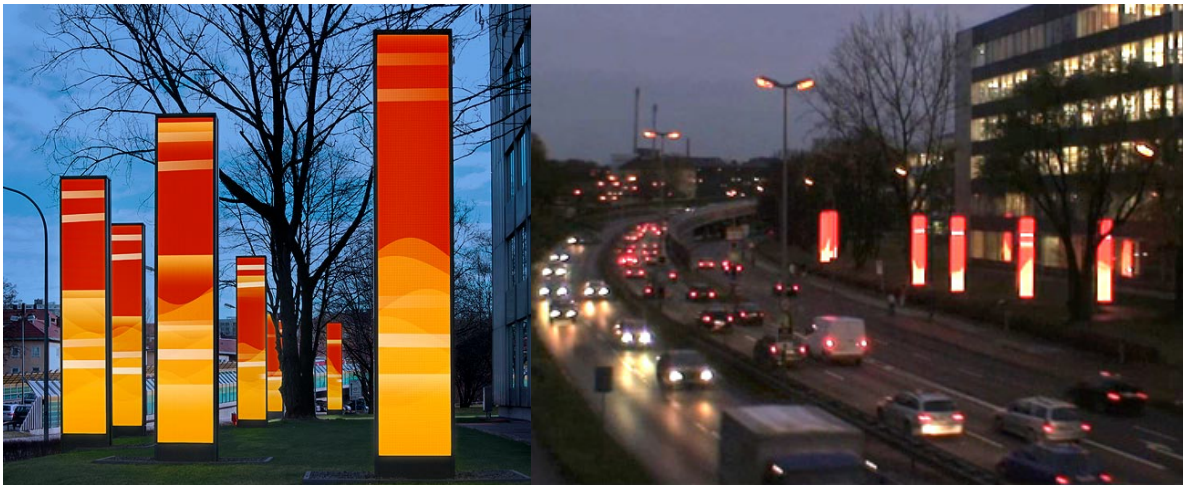


Figure 3. "Reactive Sparks" in Munich, Germany by Markus Lerner (2008)

Figure 4. "Nature Trail" at Great Ormond Street Hospital, London
by Jason Bruges (2012)

In an analog form, the sense of ownership can be much more direct. A simple example is the process of hand-drawing or handwriting an artifact. In a digital form, drawing or writing would be mediated through technology. Consequently, the user and the maker are distanced by a series of mechanical intermediaries that are aspects of technology. When people are chatting, one click of a button can be used to send an emotion. The sense of ownership is totally different in scenarios where people send the same smiley emoticon

through WhatsApp and in scenarios where ten people draw smiley emoticons by hand and send them. If the labour and the action involved can be seen, the outcome can be understood and appreciated more. This outcome contrasts with the reception of an automatic digital output that might not have required as much effort or have been affected as much by people's interactions. In the former case, the sense of ownership would be more alive and vivid. The distance that is caused by mechanical intermediaries can also be narrowed (Cella, 2005). The fundamental principles that a design should consider include: visibility, affordances, mapping, feedback, and conceptual and mental models (Norman, 1988). In the process, clear feedback from the interaction is critical so that people can identify what they have done (Muller, Albrecht Schmidt, & Michelis, 2010). This feedback further develops the sense of ownership that enables participants to be aware of their control and involvement.

The sense of ownership is closely related to identification. When a person has the ownership of something, the person typically knows what that thing is. There is an ability to identify one's artifact. In interactive projects, this is not always the case. Sometimes the participants create an output, but might not be able to identify it or might not be totally clear about what they have done. In a research study, "Instant Places" (a web-centric platform for place-based screen media), a metaphor of pines and posters is used (*Figure 5)*. In this study, people participate in the publication of digital

public displays that offer them the choice to create an identity and attach it to their "poster." After the project runs for six months, interviews are conducted with the participants. The questions deal with perceptions about authorship, moderation, and appropriateness (Jose, Pinto, Silva, & Melro, 2013). The feedback reveals that there is a preference for letting identities be exposed. It is clear that many people might have this preference because they are using the poster as self-promotion. Still, the overall feedback indicates that they would like to have a choice and to know what they have done. It would be unsatisfying to feel at some point that there is a lack of control about where their posters are being displayed, and that they do not know when or if their poster is being presented. It might not be necessary for other people to know the identity of the author. What matters most is that the authors themselves know.

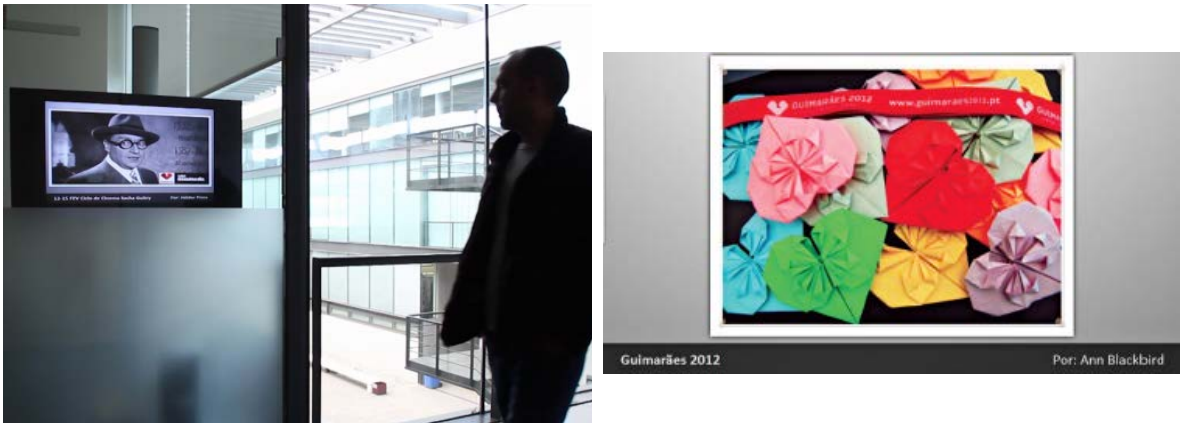


Figure 5. "Instant Places" at University of Minho, Portugal by Ubicomp Group - digital public display and poster with title and author's identity

2.3 Ubiquitous Technologies and Physical Spaces

Technology is a significant part of the environment where people live, but the connection between the physical and the digital is not fully developed. The physical environment is not just a background of the interactivity with the technology. The environment also has an effect on the user's experience. Objects or the physical environment can be part of the input and control device. The act of the technologies taking a position in physical space can result in a change in the space and can also create new places and presence. Ciolfi articulates the notion that the sense of place involves, not just its physicality or appearance, but also memories, experiences, and patterns of behaviour. It is not enough to consider the physical properties of the environment as the relationship between people's behaviours and environment is not only based on a stimulus-response mechanism but also on the interlinking relationship of the space's structural properties with people's experience of it. All personal, social, cultural, and structural elements need to be considered in the process of gaining an understanding of the space's experience (Ciolfi, 2004). This impact links back to the process of defining place and non-place, which may be subjective for each individual. The memories of their experience then in turn impacts the patterns of behaviours and the accumulating experience in the respective space. "Place is the concept of space inextricably linked with the wealth of human experiences and use occurring within it" (Tuan, 1977). This wealth of

experience is invested by values, attitudes, and cultural influences. In the humanistic school of geography investigates the understanding of the dimensions of human experience with in a physical environment and states that place is an "experienced space" (Tuan, 1977). This relates back to Auge's investigation of non-place which space is considered as a mere shell or simply a location, and he suggests to look at the space as a setting for action, experiences, and communication (Kaminskas, Fernández-Tobías, Ricci, & Cantador, 2013).

In relation to this thesis project, the usual traffic of people's circulation is passing through or lingering as they wait without any particular focus in the space, except if they go into the shops. This installation encourages an addition to the pattern of behaviours by pausing and padding through. In the design process, not only the physical properties of the shopping mall are investigated but also the current behaviours and experience people currently encountered are observed. With this new public interactive installation on site the experience of the occupants can be now changed. They have the ability contribute and leave a lasting effect to the space. The pattern of behaviours of passersby could change to a slower pace as they appreciate the installation and the interaction it offers. Their memories of the space are also deepened as they have become part of a public involvement. The level of values and attitudes resulted from the

present of the installation still depends on the audience engagement. But the installation aims to offer enrichments to the wealth of experience.

Ciolfi's concept of understanding the individual, social, cultural and physical aspects of human experience also influences the design approach, such as the data collection component of the design process. User-centered design is preferable and suitable. The users need to be involved in the process so that a range of feelings and attitudes associated with a specific locale can considered and analyzed in the movement toward the final design, which should meet the user's need. The designer alone can never know all the various ranges of reactions, attitudes, and perspectives that users might have.

In the field of interactive architecture, one of the key foundations is that "an environment can create a dialogue with inhabitants based on either satisfying an interpretation of goal states or creating a new emergent state… Key to such a dialogue is that the user is engaged: asked, enticed, manipulated, directed, or coerced. To do this, the environment must operate on a simple, even intuitive, level of communication" (Fox & Kemp, 2009).

2.4 Aura and Engagement

The project's core values of accumulation, identification, and meaningful output are closely associated with the concept of aura, since they can be contributors to the level of aura. In turn, aura depicts a powerful character that this project possesses. Aura also has a significant role of

measuring the user's sense of emotional engagement. Through the use of interactive technology, the accumulating output or traces from the participants, which contributes to the aura emerging in this thesis installation, are produced. The connection and knowledge of the participants about the traces are crucial to the existence of aura; this is discussed as the concept of aura is examined.

"Aura describes the cultural and personal significance that a place or an object holds for an individual" (MacIntyre, 2004). Cultural significance denotes the shared meaning for a large community, such as meaning based on known history, which influences the community's shared interpretation of an object or a place. Personal significance means the individual sense of connection that the object or the place may contain for a person. In precise terms, the key sole depiction of aura is as a personal phenomenon, since aura describes the psychological response of one individual to an object or place. Aura has a personal nature, since "aura can only exist if the individual can connect the object or place to his or her own understanding of the world" (MacIntyre, 2004). Without each person's connection and understanding, a cultural significance cannot be formed. If there is a lack of knowledge about the work, then there is a lack of significant meaning or aura for that person. An example is an elephant's painting, which at first glance can be seen just as a simple painting. The meaning and aura emerge once a person obtains information about the painter.

Presence and aura are closely correlated. Even with presence in the physical space, the participants' awareness of a personal relationship to the place is important for the generation of the feeling of aura. In this thesis project's context, the importance of this awareness strongly indicates that the generation of meaningful output and the capacity to enhance the characteristics of and engagement in a shopping mall's space require a process that enables participants to receive clear feedback and identify what they have done. Participants would also understand the process and involvement for the traces that other people have left. When this capability has been developed, aura can be built up and accumulated. Aura is generated as the audience becomes aware of the story behind the project.

2.5 Relevant Works

The qualities that this project is trying to realize have been attained mostly in analog form. There are a number of inspirational public installations that have influenced the development of the concept. . The digital installations that are examined are focused on on-site participation and simple interactivity. There are also interactive works in shopping malls, which relate to the kinds of activities people in shopping malls are already participating in and also reveal that there is opportunity to do something new.

2.5.1 Inspirational Analog Interactive Public Installations

The analog form is the most basic and possibly the most powerful form for accumulation of traces that can be perceived. In relation to the concept of aura, it should be noted that handwriting is directly linked to the fact that someone was physically present, made contact with an area, and made this product. Thus, this product creates a sense of more intimate connection. A number of public installations have encouraged people to participate, and the result is an accumulation. Identification is automatically achievable because people know their own handwriting and probably remember what they wrote or drew. *Figure 6* shows the "Before I die" project by Candy Chang, which is a wall that is transported around the world. People are asked to express their wishes and hopes on the wall. *Figure 7* shows a wall at the Leslie subway station in Toronto that contains wall tiles that are full of subway users' handwriting. The important specification regarding the uniqueness of individuals' contributions and the requirement for physical presence for each output are maintained in this thesis project.

Figure 6. "Before I die" wall in Portland, Maine by Candy Chang (2013)

Figure 7. "Ampersand" by Micah Lexier (2002)

There are also other types of analog effort that involve physical manifestations. They might not be elements of a design project, but instead matters of belief and tradition. This role of this kind of manifestation strongly communicates a quality this thesis project attempts to attain. This quality is not related to any new social belief and tradition that the project is trying to create, but to the crucial aspect of the impact of the accumulation and

association on individuals. Another main goal of the project relates to the effect of the space. *Figure 8* shows an example of well-known love locks. Each small physical lock adds up and contributes to the great, powerful collection. This characteristic of small pieces forming a well-defined corpus inspires the physical design of the installation.

Figure 8. Wall of love locks in Cologne, Germany

2.5.2 Digital Interactive Public Installations

It seems that most digital interactive installations offer temporal output. When participants walk away, the output of their interactions does not last, or the output may last until the next person passes by and changes it. These changes are not gathered, and there are not any consequences. These are successful projects, but their temporal natures suggests that there are opportunities for new creations that this thesis project may investigate. The aspect of on-site participation is crucial. Existing works offer examples of simple interactions and reactions by members of the public. A study of

"Magical Mirrors" (*Figure 9*) by Daniel Michelis indicates that the ability to view the consequences of one's interactive activity is the most important element and is a significant motivational factor (Muller, Albrecht Schmidt, & Michelis, 2010). This insight supports the use of reflection in the thesis project, and even though the reflection is not literal, participants can see the outlines of their bodies in the installation. This kind of reflection is also the simplest yet effective form of interactive feedback. "Light Brix" (*Figure 10*), by HeHe association, is a wall of light systems that are touch-sensitive and that brighten and dim in response to people's touch. The very simple, intuitive system creates an impression. Another project, "Body Movies" (*Figure 11*) by Rafael Lozano-Hemmer, is a large-scale installation of projections on the exterior of a large cinema complex in Rotterdam, where thousands of portraits taken on the street are projected onto giant screens. When the source of projection is hidden, a sense of wonder is also created. A person may wonder where all of this is coming from, and the possibilities of graphical language are limitless. This possibility of wonder informs the use of projection in the installation.

Figure 9. "Magical Mirrors" in Berlin, Germany by Daniel Michelis (2006)

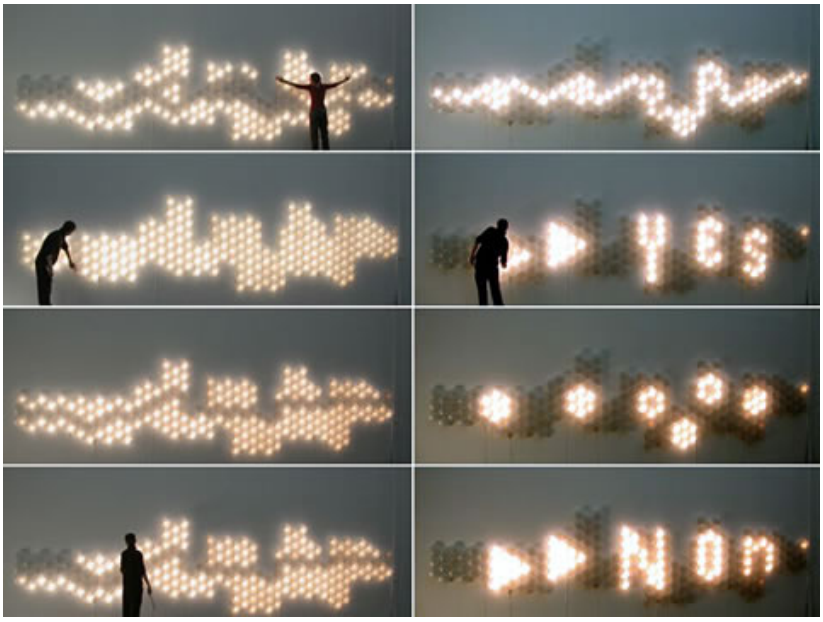


Figure 10. "Light Brix" in Milan, Italy by HeHe association (2004)

Figure 11. "Body Movies" in Rotterdam, Netherlands by Rafael Lozano-Hemmer (2001)

2.5.3 Interactive Projects in Shopping Malls

Generally, there are not many interactive installations that reside in shopping malls. Most interactive works are for campaign or commercial purposes, for example, interactive floor plans or small-scale interactive play spaces that occupy small areas in the mall. The interactive floor projection (*Figure 12*) arouses the curiosity of passersby and assumes their willingness to spend time on spontaneous interactions. Its effectiveness shows that people are generally aware of this technology. The surface of projection in a shopping mall commonly is the floor; this thesis project departs from that normality by manifesting projection on a more organic and sculptural surface

that in turn affects the visualization itself. Even though other works that are examined are for commercial purposes, they are of such a nature that there is a high level of potential for people to at least turn their heads or stop to see the interaction that is going on, and then decide if they would like participate or not (*Figures 13, 14, 15*). All of these examples illustrate the simple, carefree, enjoyable features that have worked and would help in the development of the project. The 3D interactive piano and "Art of the Heart" shares a whimsical and playful aspect and the ability to interact without steps of instruction. They are "expressive" as everyone can see the participants' actions and results. This supports the strategies discussed in the interaction design of the project. They show the existing acceptable interactions that people are ready to undertake in shopping malls.

Figure 12. Interactive floor projection at E-Square Multiplex, Pune, India (2010)

Figure 13. Ad Pods at Eaton Centre, Toronto (2010)

Figure 14. (left) 3D Interactive Piano in a German mall by Metrilus (2012)
Figure 15. (right) "Art of the Heart" in Chicago by T2 Studio Company (2012)

3.0 Design Development

The design development is based both on a synthesis of the knowledge from the literature reviews and precedents of inspirational work in the field and on the foundation of the thesis's three values: accumulation, identification, and meaningful outputs. The core research approach and method is a combination of Critical Design, Reflection in Action, and User-Centered Design. On-site research is one of the early brainstorming steps. Prototype testing and short interviews are conducted as components of the development. The preceding prototypes demonstrate the challenges and struggles faced before the current design was attained. The three values are sustained throughout the project, but the physicality and concept of the project evolve.

3.1 Research Approach and Methods

Reflection-in-Action and User-Centered Design are the key methods integrated in the process of this research, while Critical Design is the main approach. Critical Design "often challenges its audience's preconceptions and expectations thereby provoking new ways of thinking about the object, its use, and the surrounding environment. Critical Designers generally believe design that provokes, inspires, makes us think, and questions fundamental assumptions can make a valuable contribution to debates about the role technology plays in everyday life." (Bardzell, Bardzell, Forlizzi, Zimmerman, & Antanitis, 2012) This project provokes thought about the virtues of an

interactive public installation as it offers a distinctive concept of individual accumulation and leaves traces.

Throughout the prototype development stages, there are reflections about what has been done. The reflection looks at the core design values of the project and the lessons from preceding works that serve as respected guides for the development. Similarly, when feedback is received, reflection is engaged in to evaluate the weight of the comments and the need for implementation of changes in priority. The Reflection-in-Action method and active documentation encourage a process of constant reminders to ensure that the project is still on track and that the actions undertaken are beneficial to the thesis development base on the project's core values. Active documentation also allows the evolution of the project to be seen and ensures that there is an ability to make references to previous stages in the development. In this project, there is no specific restriction that arises from any external position regarding the visual language or physical form. Therefore, the process is an exploration, since there can be endless routes of forms and visuals that this project can take. The search is to find the most suitable and stimulating concept. Reflection-in-Action helps to keep the process in check and to ensure that there is evaluation of the best direction to take.

The users of this project are members of the general public, that is, all kinds of people, who are diverse in aspects such as age, gender, background,

and knowledge of digital media. The basic user requirement is simplicity and comprehensibility to anyone. This requisite, along with the need for awareness of appropriate performance in a shopping mall setting, acts as fundamental user requirement guides. The users who participate in the process of this project are both inside and outside of the OCAD University community. The users begin to take dominant roles during the prototype testing and interview stages, where their feedback is sought regarding improvements. The importance of user-centered design can be discerned since this is an interactive public installation where people are the contributors to the work. Their reactions and response can determine whether the installation works or not.

3.2 On-Site Research

On-site research was conducted as a component of the initial brainstorming and idea development. Observations were made in public areas of Toronto shopping malls and noted in form of points. The information recorded was not related to the identity of any occupants or passersby in the area. The observations only provided insights and materials regarding the general behaviour and activities that occur within the open space of shopping malls. There are two main types of areas where the observations were made to investigate people's behaviors in different environment existed in a mall as information in designing the installation and also to determine the appropriate location for the installation. One is the open area between

entrances and stores where there is no interior or focal feature; another type is an area that contains a certain feature or centered piece. *Figure 16* and *Figure 17* illustrate the typical characteristics of the two types of areas.

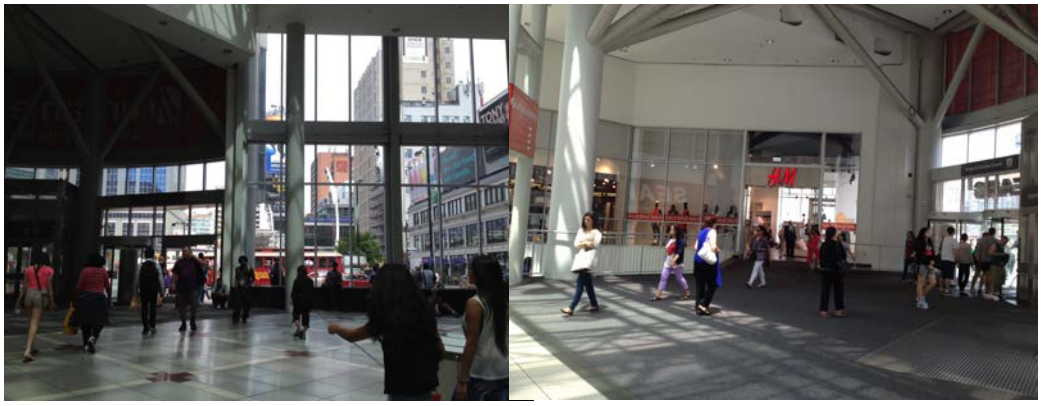


Figure 16. Shopping mall's space open area (Eaton Centre, Toronto, 2013)

The observations in type 1 area are as followed:

- the amount of traffic is usually high, especially at the main entrance areas, and amount of people varies throughout the day but there are always movement within the area
- a lot of people occupied this area as waiting area and meeting points
- people usually stay around the perimeter of the space, leaning against the walls and the railings, sitting around the edges
- there is no common focal point where people pay attention to – they are either playing on their phone, talking among themselves, look into the shops, look outside the window, or just looking around in general
- it is not treated as a destination, it seems to be more like a rest stop

Figure 17. Shopping mall's space with interior feature
(Eaton Centre, Toronto, 2013)

The observations in type 2 area are as followed:

- the traffic is also generally high and varies throughout the day but there are always people occupying the area
- it is used as waiting area and meeting points
- the difference with type 1 area is that there seems to be more of a purpose of coming here ,which is to see the feature (ie. fountain in Eaton Centre – people were waiting for the fountain's water jet to activate) or it is an alternate destination point, some people were having their lunch in this area facing the fountain
- most of the people were sitting closer and around the feature
- common focal point is the feature in the space

From these observation points, an initial reaction to the question about what the project can offer is that character can be added to a space, and that people can be allowed to contribute to the work. These reactions support the main principles of the project. Currently, there seems to be no opportunity for the occupants of the malls to affect or influence the environment they inhabit. Their only role seems to be the role of an audience. There is no dialogue. The interactive activity that the installation would offer needs to be simple and easily comprehensible. Shopping malls are full of activity and various ranges of people. Not everyone has the same level of awareness about digital interactivity, and the installation will not be effective at all if the interactivity requires a set of instructions. In terms of the architectural space, high ceiling is common in such open area and this suggests the possibility of a hanging installation. The open space in malls' configuration allows the occupants' sightline to be widened and further, they would be able to see the installation as they approach the area. In close proximity, there needs to be an indication on the floor that would imply them to look up. In type I area that doesn't contain a certain feature, people naturally stays around the perimeter, as there is no reason for them to linger in the area. In contrast to the type II area, where the concentration is at the fountain feature and there is a motivation for people to approach. It can be assumed that this consequence could occur with the thesis installation.

The level of traffic also suggests that the time and action required from each individual should be simple and flexible as people are in this area for different reasons, some are just passing by and might not have a lot of time, or some are waiting and have time to spare. They can spend as much or as little time as they want. The constant rapid movement in the space can serve as a catalyst for the ongoing interaction of the installation as well. One of the positive aspects of a shopping mall setting is that people are usually not on a tight schedule, and they probably would not mind stopping for a short time to try out an activity. The installation needs to promote a sense of welcome and a simple interaction that does not require an instruction guide. It needs to be designed in a way that ensures that people will not feel uncomfortable engaging in the interactive activity in public. An ideal location for this installation is an open area, which people usually walk pass by, with no central feature, and also offers generous space allowing people to linger and pause as the installation invites people to participate. The sightline, visibility and participation rate need to be optimize. The key issue of audience engagement can be addressed on the basis of the strategy of performers and spectators and the principles of motivation as basic design guidelines. The strategy and principles can be combined with the evidence from on-site research and already existing projects. The later user tests can suggest some level of confidence in the general public's interest and engagement in the project.

3.3 Preceding Prototypes

Before the establishment of the current design, two previous prototypes were created. Both of them took the form of a digital installation on a wall without any physical installation piece. They both attempted to embrace the main principles of accumulation, identification, and meaningful output. Even with this common foundation, the design concepts of these two prototypes were different. They reflected the preceding perplexity and struggles, which helped to pave the way for the development of the current installation design. The first version is called "share your beat," and the other version is "photo block."

3.3.1 The "Share Your Beat" Version

There were two inputs from a user: his or her pulse rate and an answer to a question. The pulse rate was used because it is very intimate and powerful, and it strongly suggests the concept of individuality. The concept plays on the term "beat." The participant's heartbeat was detected, and the question "what keeps you upbeat?" was asked. The question was intended to generate a discussion and a compilation of answers from the public. People could learn something about others from the answers. *Figure 18* illustrates the primary interactive display screens.

Initial Screen

As user puts their finger on the pulse sensor

The question is asked

Accumulation of heartbeats and answers

Figure 18. "Share Your Beat" version

3.3.2 Feedback and Reflection

The following feedback is from the Thesis Colloquium session that was conducted with students in the Digital Futures Program and professors at OCAD University. This experience also included a post-presentation phase where informal feedback was given. The feedback is listed in order of its importance.

- it is seen as 'random' as there is no clear connection or strong reason why this question would be asked in a mall
- it is too explicit, very much like just entering data and questionnaire
- there is no clear and coherent relationship between why is it this question and the graphic being used
- the use of pulse rate require physical contact from every participants and given that it is in a shopping mall it might not be that suitable and practical to have pole or physical set up, there is a concern in the durability and feasibility
- the motive and interaction are not strong and engaging enough
- only one person can participate at a time
- it was raised that the word "beat" suggests something of music, like musical beats and notes, yet the design doesn't have any of that

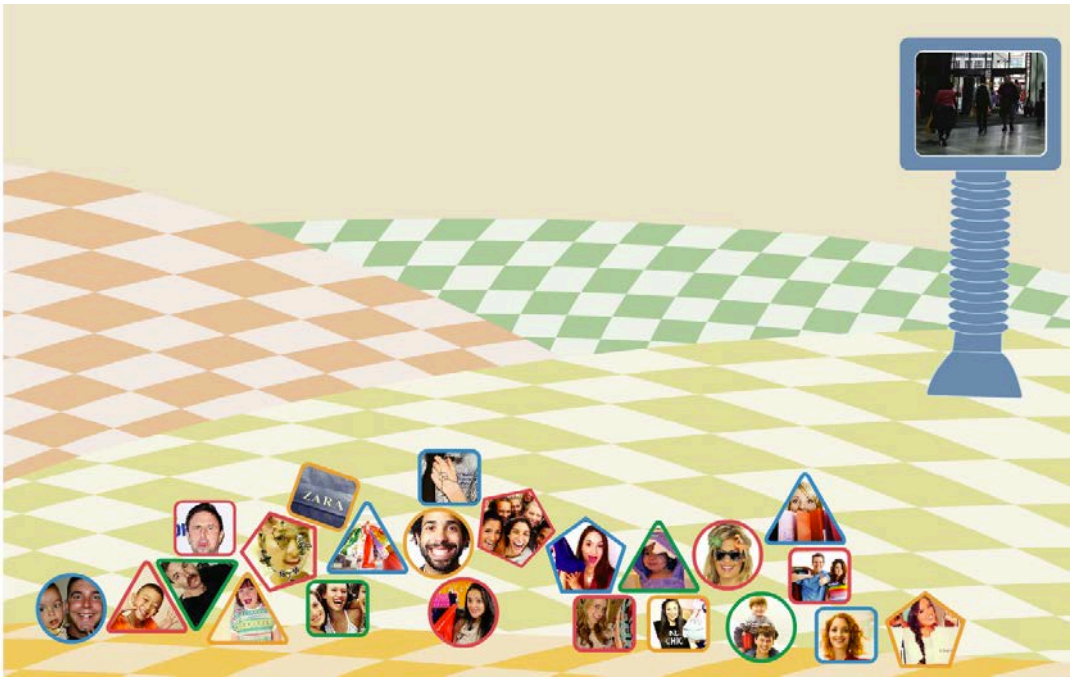
The main struggle that this prototype reveals was the process of discovering the question. It was designed with the idea that this project could serve as a hub of information and discussion that people could share in public, but it

lacked focus. There was not a clear and a strong reason for the selection of the question that was to be asked, and it did not relate to the setting of shopping mall. The use of this particular question could be perceived as merely random. This insight led to the realization that perhaps a question is not necessary. The installation could be something more carefree that would not act as a data collector. Still, the installation would adhere to the original principles of accumulation, identification, and meaningful output. The generation of some sort of direct data would not be as important. The use of the pulse rate was a strong gesture that could create a meaningful and momentous character for the project, but the physical set-up requirement might not be suitable, as suggested in the feedback. The feedback also suggested that, if there was any physical installation, it would be best to keep it clear of circulation paths and people's continuous contact out of concern for the issue of durability.

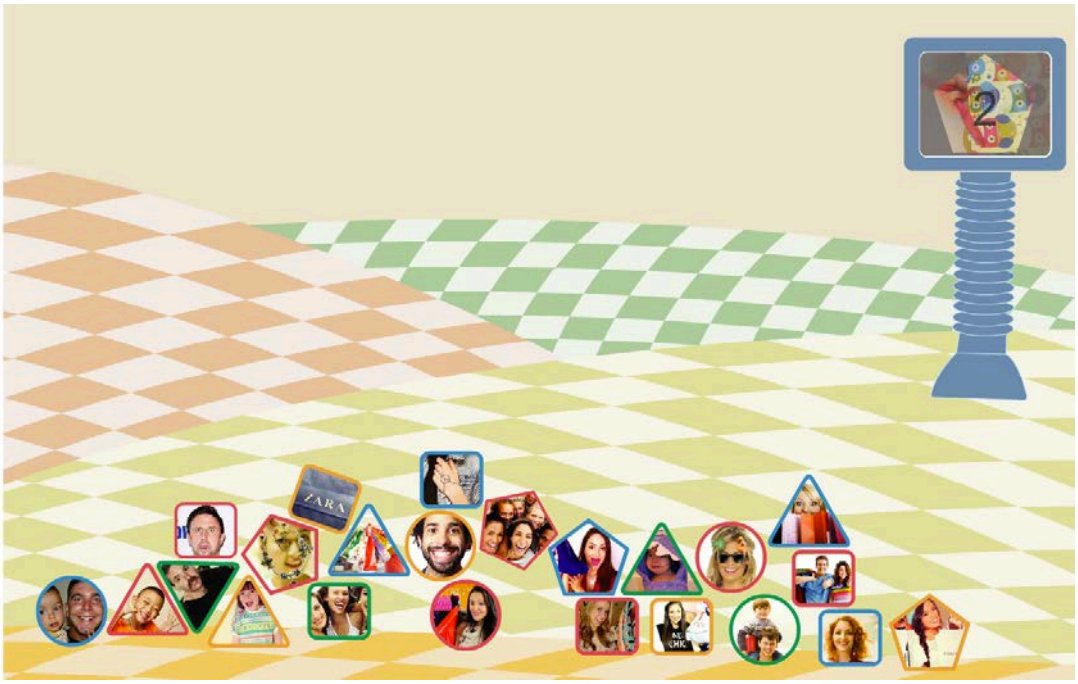
3.3.3 "Photo block" Version

In a move away from direct data entry, this version took on the casual photographing and building block concept. This prototype started to include more graphical language. The graphic and illustration style suggested playful imagery and fantasy, since there was no real note about the location where this was taking place. The colourful landscape also meant to imitate the notion of "never ending." The colourful geometric blocks were used to remind people of the building blocks that were commonly played with when

they were children. They were encouraged to play with the blocks. The graphic style attempted to capture the imagination and enchantment concepts. *Figure 19* and *Figure 20* in the following pages show the interactive display screens.

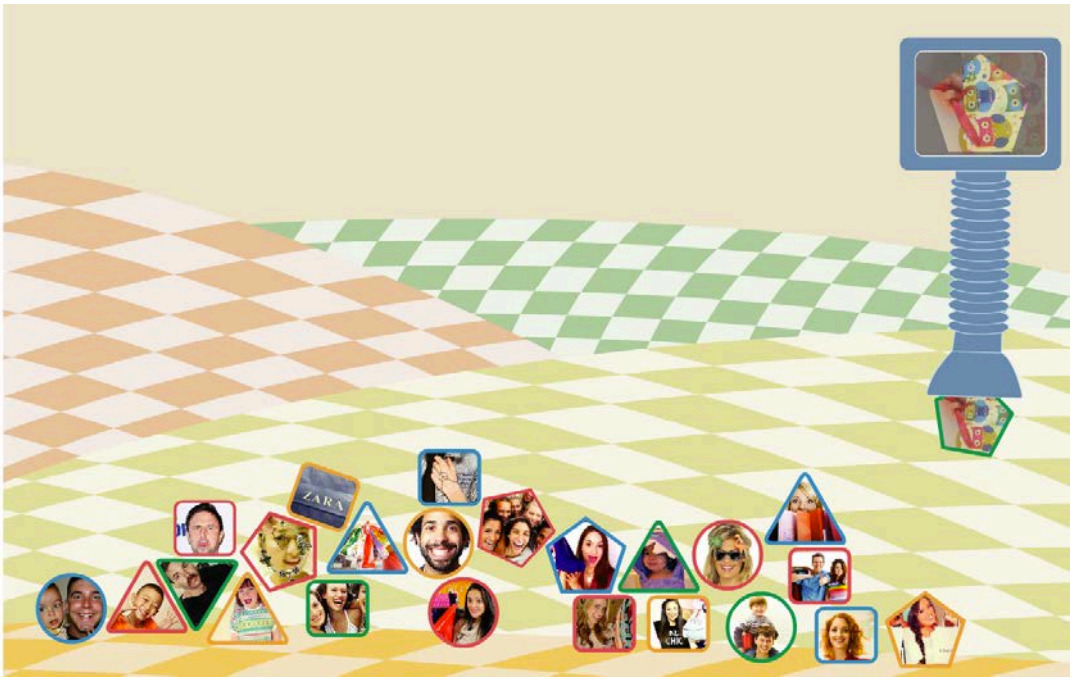


Initial screen – camera view is in the top right corner

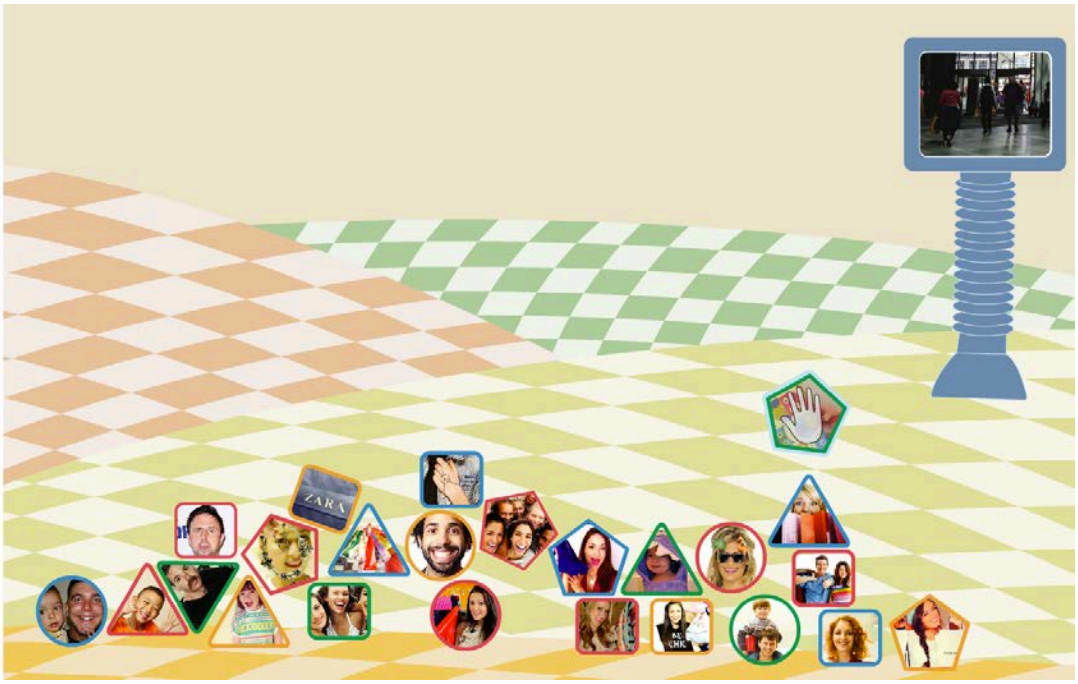


Photograph countdown is activated as something is in front of the camera

Figure 19. "Photo Block" version



A block with the photo taken is generated



Users can play with the blocks

Figure 20. "Photo Block" version

3.3.4 Feedback and Reflection

The following informal feedback is from OCAD University professors and students. The points are listed in the order of their priority.

- taking photos and keeping the photos to use in the display is a serious and sensitive matter
- agreement from the individual needs to be given or it can be seen as violation and issue of privacy
- photographing concern is very crucial especially for children
- the graphic and countdown suggesting that a photo is being taken is not clear enough, someone could just be looking at the display and trying to figure out what's going on and their photo is taken, the problem is then can they delete the photo if they don't want it?
- the aspect of photographing could steer people away from participating - people might not like having their photo display in public, don't want public embarrassment, want to look good in public
- people might not like having other people arranging their photo as anything can happen – someone might place someone next to something that's inappropriate – can lead to many unforeseen or uncontrollable cases – similar as if we let people write on walls, they can write anything and we have no control over the content
- the idea of collaboration is stimulating, however it doesn't seem convincing that people would play with these building blocks

- there is no clear motivation or purpose in getting people to play with these blocks and there is no apparent theme
- the idea that one can construct stories from these blocks is not supported given the context that the photos could be anything

The feedback made it clear that the most crucial drawback was the use of photographs. Still, this version marked a move away from a direct and literal data collection approach and was geared toward more relaxed, lighthearted activity. The idea of collaboration rather than just individual accumulation was formed at this point. The use of colourful graphics also brought forth a later stage in the development of the project.

3.4 Current Version and Prototype

As mentioned above, the core principles of accumulation, identification, and meaningful output were always maintained, but they were explored in different ways. Appropriate methods to express them had not been found yet. The current design moves away from being only a digital installation on a wall and embraces a greater gesture. Since the foundation of the project is to develop a design that would affect the space, it is appropriate to pursue a bigger vision that combines the physical and the digital. Even though the physical aspect is stationary, the digital aspect adds movement and, together, they create a living piece in space. The design is intended to include simple physical components that form a dominant collection, and the content of the interactivity, with respect to all the lessons learned from

previous prototypes, calls for material that is less literal yet still comprehensible. There are also the important aspects of implicit interaction and ambience. The installation is always in effect, but it does not jump out to grab people's attention. It also aims to have a light physicality and a lighthearted character. The content is a familiar aspect of human life that everyone can relate to and appreciate. There were a couple versions prior to the current design, which shares the same idea of colours and ripples (*Figure 21*).

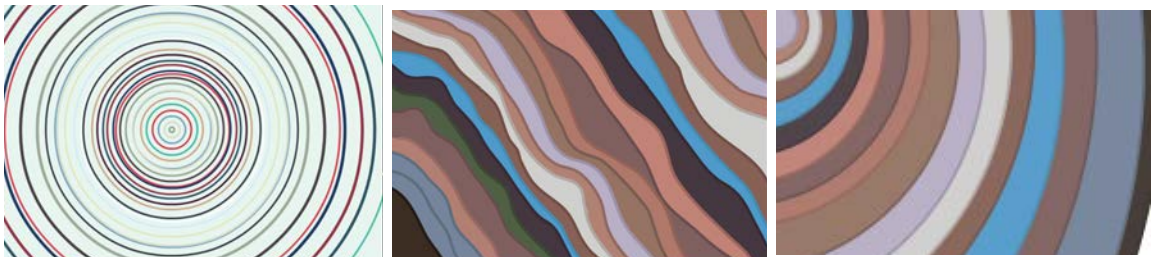


Figure 21. Preceding graphics

The core theme of the current design is a vision of colorful raindrops projected onto pure particles. The intensity of the rain reflects the level of circulation and the number of people in the space. As people pass by, they generate trails of raindrops. They can also leave traces in the rain field by standing under a designated spot. The people standing under the installation's area affect the colors. The choice of water is results from the search of a subject that general public can comfortably relate to and appreciate. This subject would be used as the visualization and also the interaction associated with this subject needs to be intuitive. Water is a

natural element that every human is familiar with and also aware of its physical properties, like water ripples and raindrops. There is also refreshing nature of rain and the whimsical and playful language of raindrops (*Figure 22*). This is incorporated into the visualization of the interaction that participants contribute. In addition, the use of water is supported by the history and design of shopping malls as discussed at the beginning. The common use of flowing water and fountains in shopping malls is to serve as a soothing and appeasing agent for tired shoppers. This installation can be seen as another form, a new and innovative form, of a water feature. It can be noted that the level of the audience's action actually kept decreasing in the steps from the early prototypes and became more intuitive.

Figure 22. Rain and traces reference images

3.4.1 Materials and Forms Exploration

The selection of material that is manageable, that works in a modular manner, and that contains good qualities for projection is essential for the project. Various materials were explored. The initial reaction to the light

physical intention was the use of fabric, since it is a common and effective material in projection. Rear projection fabric and a different type of light-coloured fabric were tested (*Figure 23*). The quality of projection was good, but the test confirmed the challenges of making the fabrics meet the boundaries of the intended forms. There were also shadows in the fabric's folds. Overall, the fabric did not manifest the desired aesthetic qualities and actually looked heavy.

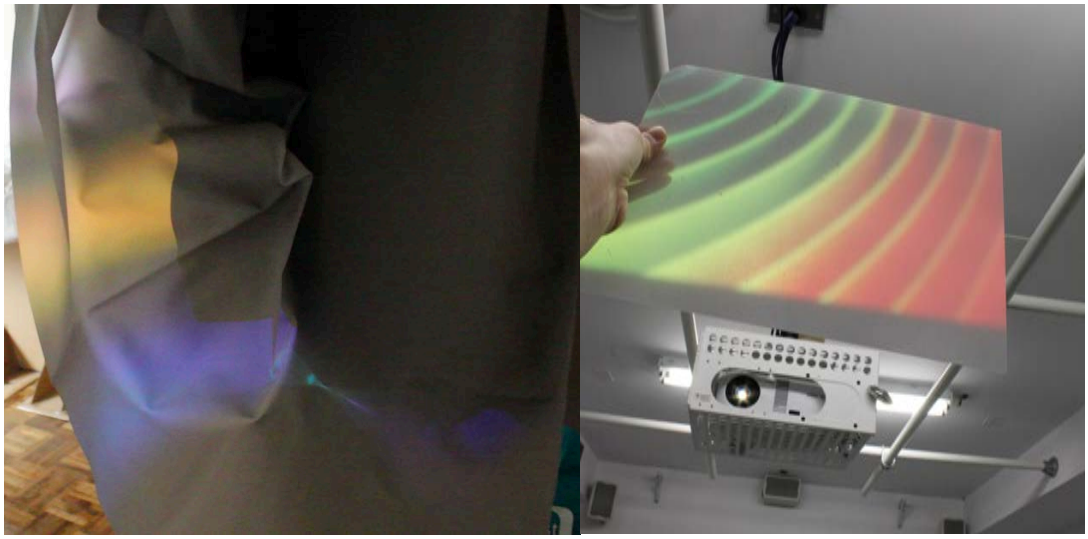


Figure 23. Fabric and acrylic preliminary projection test

The current choice of material is acrylic applied with spray paint to create an effective surface for projection (*Figure 23*). It is a rigid but light material that is easier to manage and install, and that also works for fabrication in modules. Different shapes were considered as well as the play of various scales and angles. A circular disc was the first form developed since it can be associated with the movement and graphic language of raindrops as they hit the water's surface (*Figure 24*). The challenge

discovered after testing was done with the models was the insufficient volume perceived from various sightlines (*Figure 25*). A change was made in the breaking out of the closely associated form by exploring linear forms and the use of curves to soften the appearance of and response to the graphical language. The scale of the pieces was also reduced through the application of the concept of suggested or implied volume, which means that the volume is formed from the collection of smaller pieces (*Figures 26, 27*).

Figure 24. 1:5 scale model

Figure 25. Full-scale model

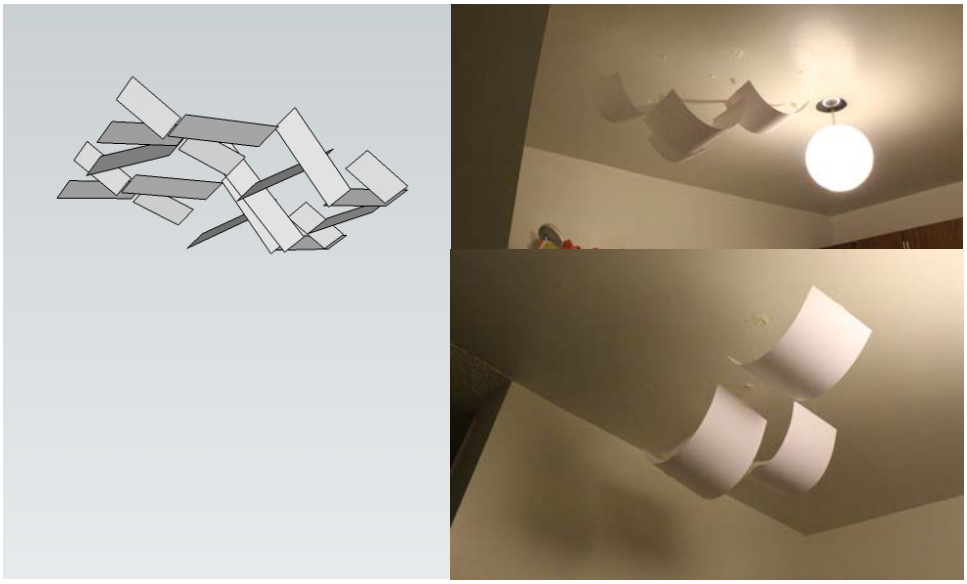


Figure 26. Sketch Up and paper model

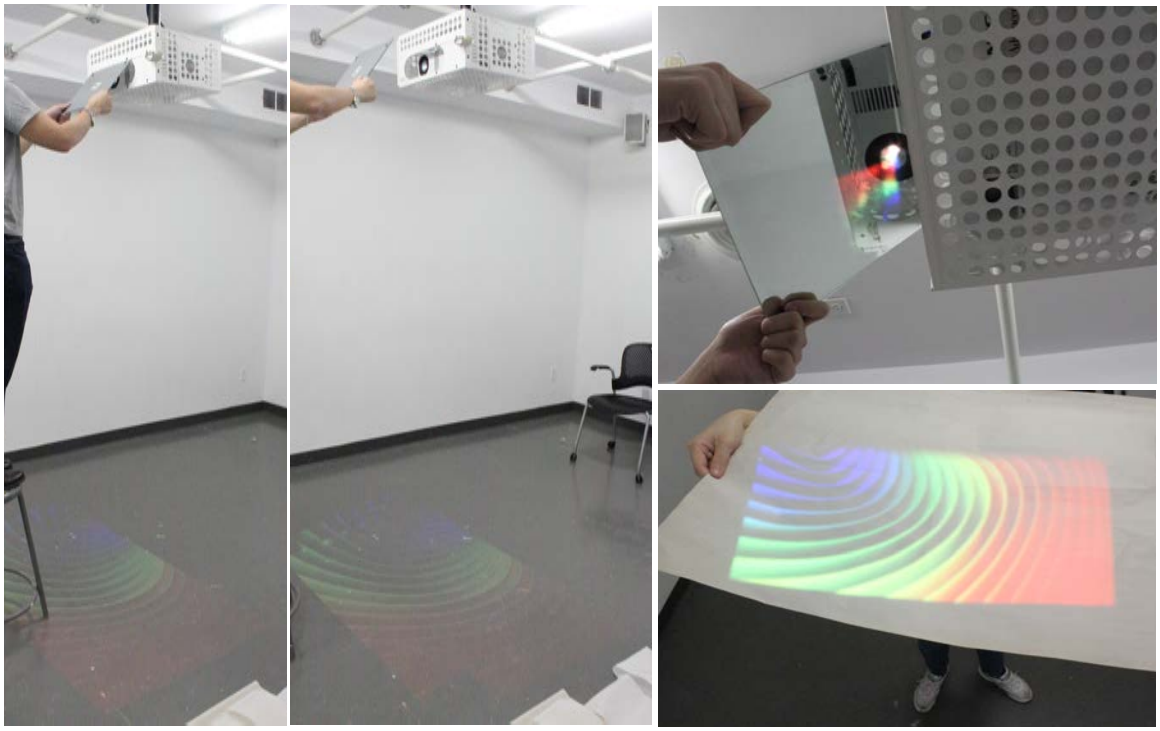
Figure 27. Full-scale acrylic model of the current design

3.4.2 Physical Mock Up

A full-scale mock-up was built in the Experimental Media Space within OCAD University. The first part that was tested was the projection system. Initially, it was seen as ideal for the projector to be located above the installation and to point downwards. However, the school does not own a projector of that type, and it was not possible to acquire one from an external source. The method of using a mirror to reflect the projection down was used, but the throw distance was a problem. *Figure 28* shows the test and the result. The ceiling height in the testing space is 2.4 metres, and the ceiling height of the exhibition space is approximately 3.5 metres. It was impossible for the throw distance to be big enough to achieve the desired dimension for the installation. The distance between the projector and the installation

would be too great, and this issue would cause the installation to be lower than the height of members of the general public. A frame would also be built to hold the prototype, and the shadow of the frame would be cast if the projection was coming from above. Please note that the image used for projection in these tests did not reflect the actual graphic for the project.

A resolution to this problem involved placing the projector on the floor and projecting it up towards the installation instead. There will be an allocated area that people will be asked not to enter, since an entry would disturb the path of the projection. This set-up system is not ideal, but it serves the purpose in an environment where there are restrictions, and resources are limited. The original integrity of the design is maintained as much as possible. *Figure 29* demonstrates the current set-up. A test showed that there is a problem related to the gaps between the pieces that cause the projection to be cast onto the ceiling (*Figure 30*). The solution to the problem was that the pieces had to fully cover the inner projection area. Extra parts outside the boundary could be masked digitally, or conventional methods could be used to block the projector lens where blocking was necessary. An occurrence that was discovered was the light fragmentation of the projection images from the acrylic pieces onto the wall. The images become more visible as the lights dim, and this increasing visibility adds a surprising effect to the installation (*Figure 31*).



The projected image on the floor in the first trial is 1.5m x 0.8m. As the mirror is moved further away the projected image is bigger. However, in these 2 trials the distance of the projected image's location is too. In the installation, the image would be higher up as the projection would be on the physical pieces. Here it is tested as shown on the piece of paper held up at 0.4m below the projector. The projected image reduced significantly and is too small for an effective physical installation.

Figure 28. Projection distance test

Figure 29. Current set up

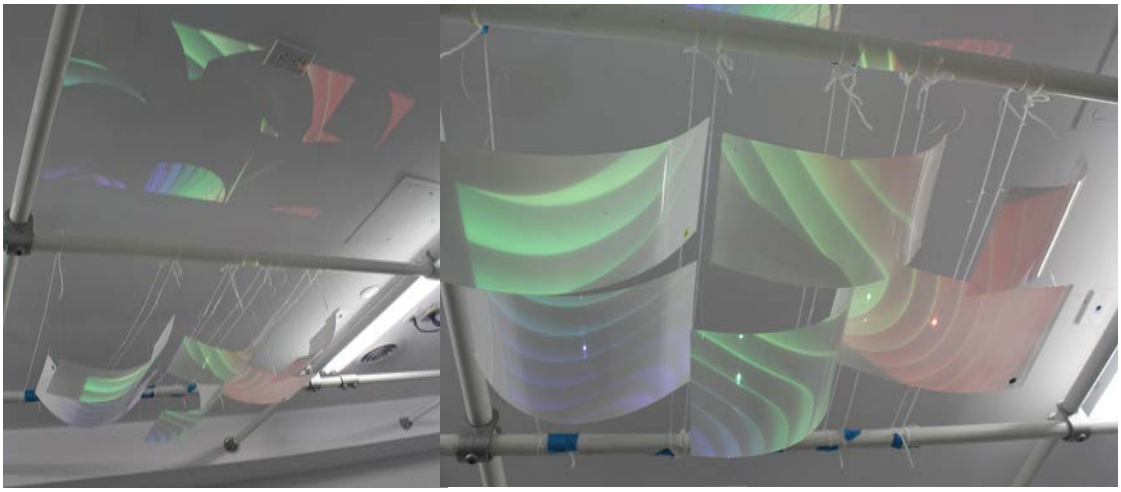


Figure 30. Projection test

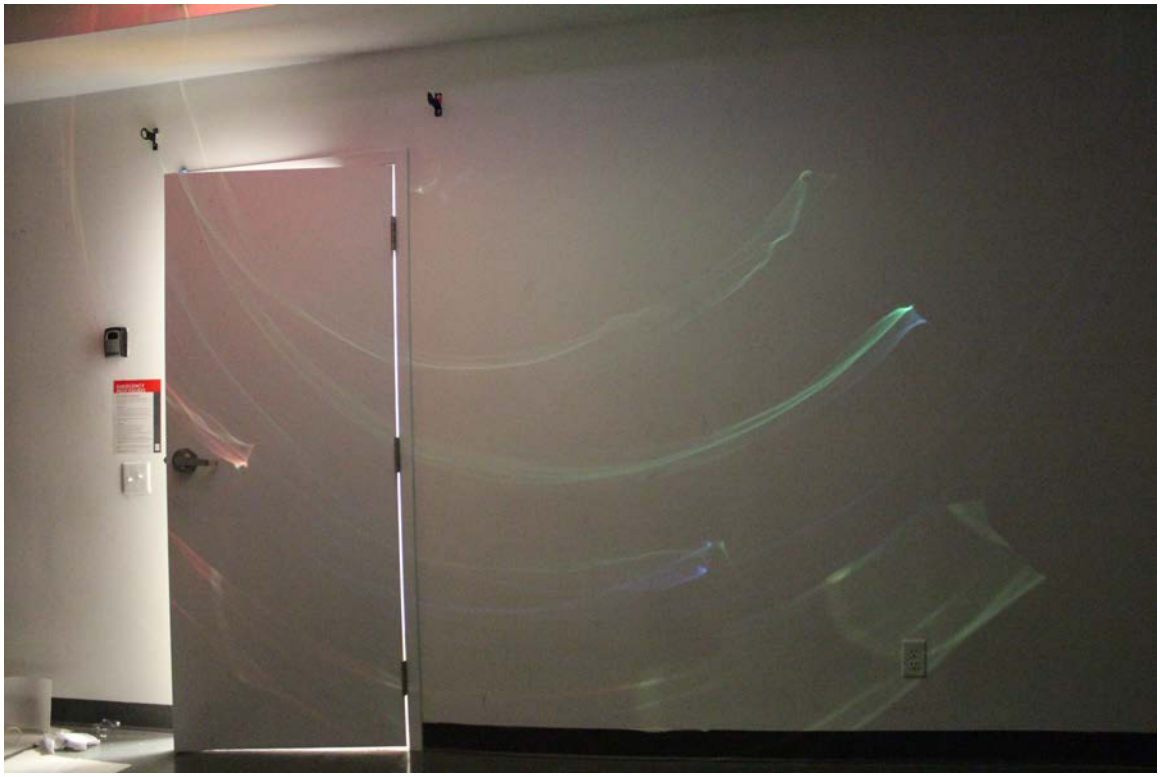


Figure 31. Light fragmentation from acrylic

4.0 Prototype Testing and Development

The strategy of breaking down the prototype into portions and testing them in different sessions was used. As noted in the previous section, the projection system, the material, and the physical form were tested. This process was followed by the testing of the digital interactions. The testing of the prototype was done within OCAD University. The interaction work was performed with the visual programming software Max/MSP/Jitter and with a programmer, Simon Jarvis.

4.1 Selection of Site and Participants

The prototype testing sessions took place in the 205 Richmond Street West building of OCAD University. The primary site selected was the Experimental Media Space, which is equipped with bars at ceiling height that make it a suitable for hanging the prototype and also for testing purposes, even if the height of the ceiling in this room is not similar to the heights in shopping malls (*Figure 32*). There was a limitation on bookings for the Experimental Media Space due to other thesis exhibitions that had priority. The Ambient Experience Lab was selected as an alternative site.

Since the final product would be an interactive public installation, there were no preferred specifications for participants. There were participants from OCAD University, which has a population that is fairly diverse in background and age. There were also some participants who were not in the school and not in the design field. The participants ranged from 19

to 65 years of age, and both genders were included in the group of participants. The diverse demographic characteristics of the participants reflect the nature of the project, which would be on display to the general public. The testing session was conducted at a time that worked for all parties involved.

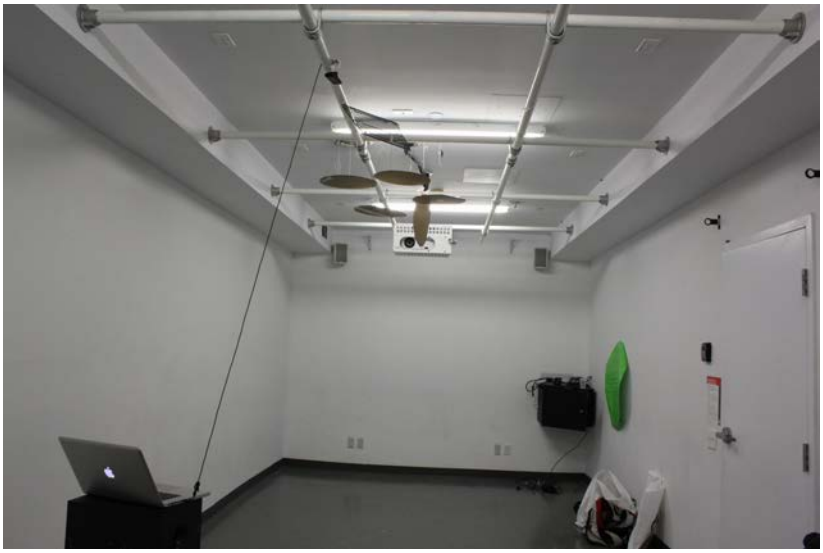


Figure 32. Experimental Media Space

4.2 Data Collection and Recording

The participants are brought into the room where the prototype was already installed and running. They were given a brief introduction to the project, but were not told about the interactivity functions or about the form or visualization of the prototype. No video recording of the participants was done during the testing session. The think-aloud method was used, and participants were asked to speak about what they were thinking and feeling. The recording of information took the form of writing. Point notes were

taken down as participants expressed their thoughts. Observations of their behaviours and interactions were also made and noted. After the interaction portion, there was a short interview. A set of questions served as a guide, but the questions were flexible, depending on the information participants had already provided in the prototype interaction section. Their replies were also noted in written form. Please refer to Appendix A for the complete package of the research overview, which includes the interview questions and procedure.

4.3 Ethical Considerations

All the participants' rights and protections were ensured and were assigned a high level of importance throughout the study. There were no ethical risks involved in being a participant in all the prototype testing and in the interview session for this project. The participants played a role in the development of the project that contributed to the positioning of the interactive public installation. They were informed that they could withdraw from participation at any time and have the right to ask that their data not be used. If they do so, the data, that is, the written notes, will be deleted immediately. The principal investigator's contact information was provided so that the investigator can be reached if the participants have question or concerns, or if they decide to end their participation after the user test. Throughout the process, participants' identities are not revealed, and data collection has been done anonymously. Each person has been assigned an ID

number that is linked to his or her respective data, including the feedback offered. Participants' names and other identity information are stored separately and securely on a master list that is accessible only to the principal student investigator. All the data from prototype testing and interviews is stored in the investigator's laptop, which has a log-in password, and the data will be deleted after the project is completed. A consent form signed by all participants approves the use of quotations and of their statements. Please refer to Appendix B for a copy of the approval letter from OCAD University's Research Ethics Board.

4.4 Prototype I

In this test, the focus was on the functionality of the projection and on tracking people's movement (*Figure 33*). Other elements, such as capturing colours and recording traces, would be tested later as the program work became ready. Here, the graphic was black and white since it was still under development (*Figure 34*). *Figure 35* shows the projected image and the response, namely, people's movements in the form of trails of raindrops. The user was informed that this was not a complete experience of the project. A brief explanation was provided about what was projected to happen in the part of the programming that was still in progress. In addition, since the graphic was in greyscale, the light had to be dimmed for the visuals to be visible. Thus, this test might not have presented a completely accurate version of the project. The intention of the test was to focus on the

functionality of the tracking and also to gain feedback regarding the physical components.

Figure 33. Test set up

Figure 34. Projection on acrylic

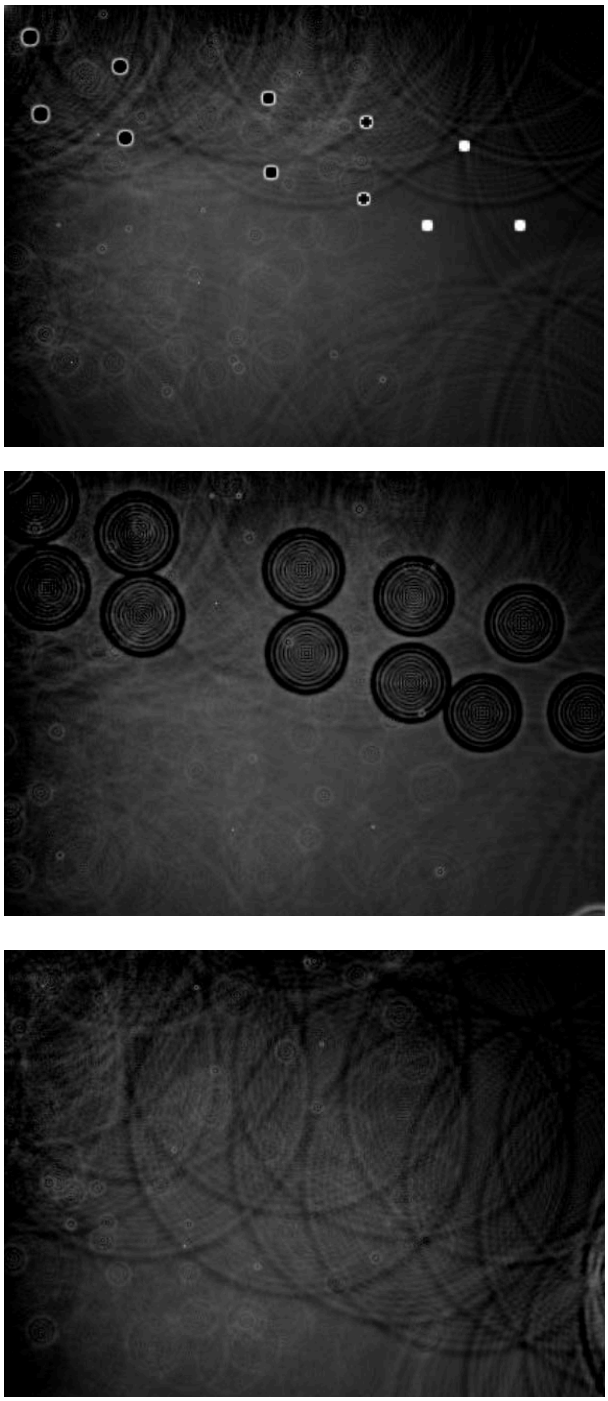


Figure 35. Projected image – response to people's movement

4.4.1 Feedback and Reflection

The feedback and observations from this test are as follows, in the order of their significance.

- The room has regular ceiling height but for an actual installation it would be much higher, there is a concern about the visibility and having to look up
- There can be play more and variation with the physical pieces' height and angle, it looks quite uniform now
- Some pieces are casting shadows onto others, this might be a matter of spraying thinner coat of spray paint
- There is an uncertainty as the camera is meant to capture colors from the people, if there would be enough color, if it would be colorful enough
- Using people's circulation to generate movement is interesting as it offers dynamic and ever-changing graphic. This can also make people feel the straight forward connection with the installation
- It could be better if the trails are more unified or be reduced to only 1 line of trails for 1 person. Right now each person generate a couple trails of raindrops and seem a bit confusing
- the raindrops graphic doesn't look that natural yet, it looks a bit stiff and it would be great if this can be improved
- Use of rain is nice – the ripple gives a serene ambience

The users seemed to be able to interpret the way that the graphics and movements are referenced from raindrops. The installation still needed to be greatly improved, as per the comments. The shadow problem from the projector was inevitably caused by placing the projector on the ground. This problem could potentially be solved by spraying thinner coats of paint, but this adjustment needed to be done in balance with the quality of projection. Any adjustment would be further tested along with more placements of the pieces at various heights, since such placement could create more interesting volume and form. In the test, the placement of the camera was clearly visible, and people seemed to have a common expectation that they would interact within the camera area. The intention was that, in the installation, the camera would be integrated within the physical pieces. Thus, there would need to be a clear indication of the camera's location.

4.5 Prototype II

After the test of the first prototype, improvements were made on the basis of the concerns expressed by the participants and the technical challenges encountered in the process. Initially, the design was that the colours of the raindrops would be captured from the passersby. However, the testing showed that the aesthetic quality would not be satisfactory. The webcam was mostly capturing people's heads, and there also would not be enough colour variation in people's clothing. The idea was tweaked to deal with this challenge. A video showing graphics and a color palette based on "rainbow clouds" was used as an underlay. The use of rainbow clouds was inspired by the ongoing concept of rain and enchantment. If no one passed by, this display might seem to be a static installation with no interaction. When someone walks under the installation, the trail of raindrops is created, and the colours of the rainbow clouds are discovered. The trails and colours slowly disappear as people walk away. The colours will remain as participants leave their traces.

A 100 x 80 cm wood frame was built for hanging the acrylic pieces (*Figure 36*). The set-up was similar to the set-up in the previous test, but the installation's height was increased to three metres. The projector was positioned pointing upward. The webcam was also hung on the frame (*Figure 37*). The webcam's view was set to match the size of the installation, plus 30 cm on all sides. The installation is 100 x 80 cm, so the interactive area under

it is 160 x 140 cm. The extra distance was added to compensate for a detection issue. Due to the view of the webcam, only half of a person's body is detected if he or she stands close to the perimeter.

In this prototype, the programming was fairly complete. The users were able to test the interaction. *Figures 38, 39, 40,* and *41* are photos from the test session. There was a clear issue with the projection image on the ceiling, which would be solved as more acrylic pieces were added to complete the physical composition. The issue also related to the matter of keystoneing the projector, the level of zooming, and the height of the projector's position.

Figure 36. Prototype frame

Figure 37. Prototype set up

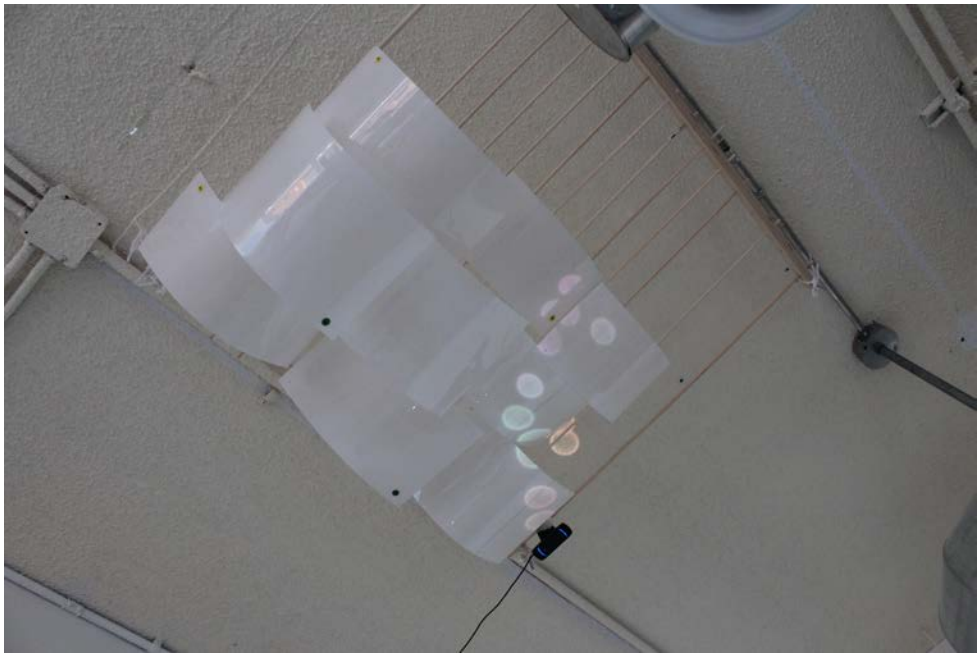


Figure 38. Raindrop trails as a person walks under

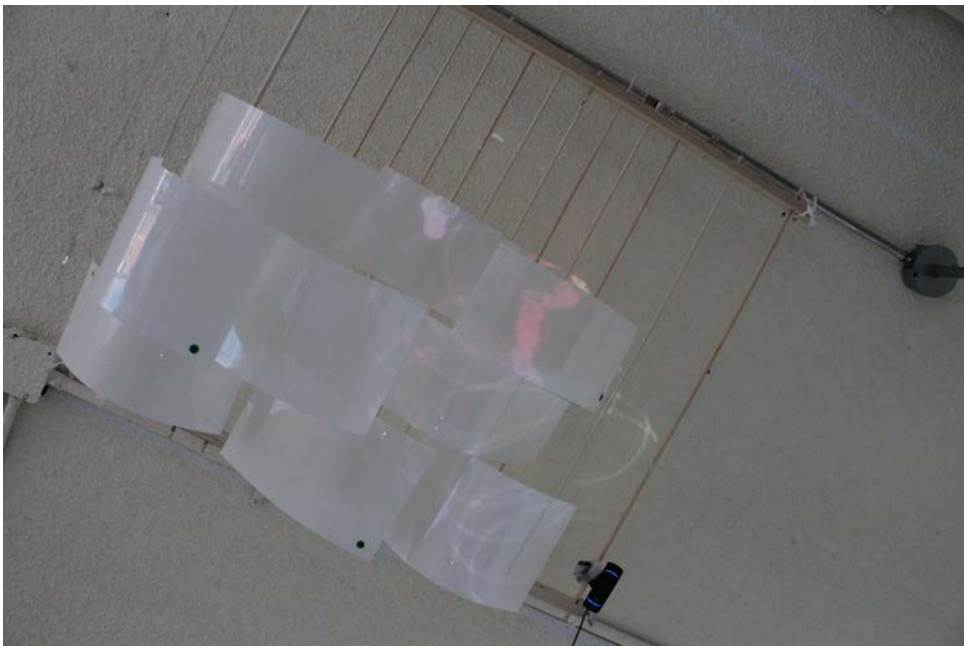


Figure 39. Raindrops fading away as people leave

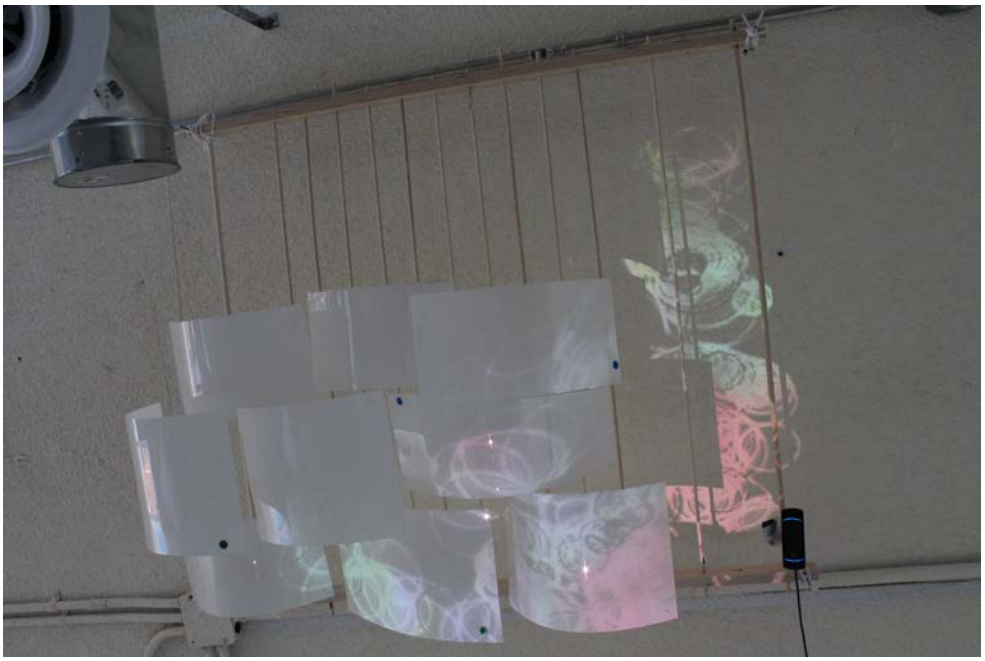


Figure 40. When there is a lot of people's movement

Figure 41. Individuals' traces place on random coordinates

4.5.1 Feedback and Reflection I

The following comments, ranked by level of importance, are from the first test of Prototype II.

- need clearer indication of where to stand for the 'leaving trace' interaction
- need something stronger to catch their eye and grab their attention
- the current marker under the webcam is small and does not stimulate enough attraction or curiosity
- they might see that they are generating the raindrops but they are not sure that everyone who pass by will actually look up

- from the ‘leaving trace’ spot the user needs to look up and they feel they need to look up too high and it hurts their neck
- the installation’s height could be lower for this exhibition scale

The most important observation that came from this test is that the participants were not fully aware of the spot under the camera. As they mentioned, the current marker was not attractive and indicative enough. This point is crucial, since the important aspect of the project is that people can leave their traces. With regard to the concern about the installation’s height, it would be reasonable to propose that it could be hung a little lower. The context of this installation is meant to be a shopping mall’s space, where a certain height has to be maintained, but, due to the smaller setting and scale of the prototype, the height also needs to be scaled down. Another way to help solve this problem is to increase the distance between the webcam and the traces’ location, so that the viewing angle is less steep and the participants would not have to tilt their heads back as much. Another observation made was about the location of the traces. Currently, the location is on a random system, which causes the traces to sometimes appear between different pieces (*Figure 41*) and thus become difficult to see.

4.5.2 Prototype II Revised

A graphic for the floor was created as an agent that would grab people's attention and stimulate their curiosity. *Figure 42* is the preliminary design of the sticker. The design avoids the use of text in order to maintain the implicit nature of the project. The locations of the individuals' traces are now randomly generated within a range of designated coordinates and thus are prevented from appearing between different pieces (*Figure 43*).

Figure 42. Preliminary design of floor sticker

Figure 43. Locations of individuals' traces are coordinated with the physical pieces

4.5.3 Feedback and reflection II

The feedback below comes from the second test of Prototype II. The observations are listed in the order of their significance.

- there is an interest in trying to activate the 'leaving trace' spot again to see if there will be a different effect produced
- different gestures were made under the camera to see if it will trigger something different

- the graphic gives a clear indication of where to stand but it also creates a sense of territory and assumption that this is the only interactive area
- the colors of the projection image need to be more vibrant especially for during the day
- there was a question of "how far can I go out after the recording starts?" – the user tried stepping further away from the spot and didn't know that the recording stopped, and then a new recording start when they stepped back in but they didn't want to start another trace
- after they stepped on the spot they looked up on the area right above them first and then looked around
- in a scenario where many people walk under the installation it could be hard to tell that trails are being generated
- they might assume that the raindrop trail is made by people but cannot confirm until they try it themselves – then it is clear that people's movement cause the raindrops
- because the prototype's scale is smaller, the ripples of the raindrops and the trace can fill up the area quickly and cause some difficulty in seeing the new interaction output
- it gets difficult to find which one is their trace when there are many traces already made

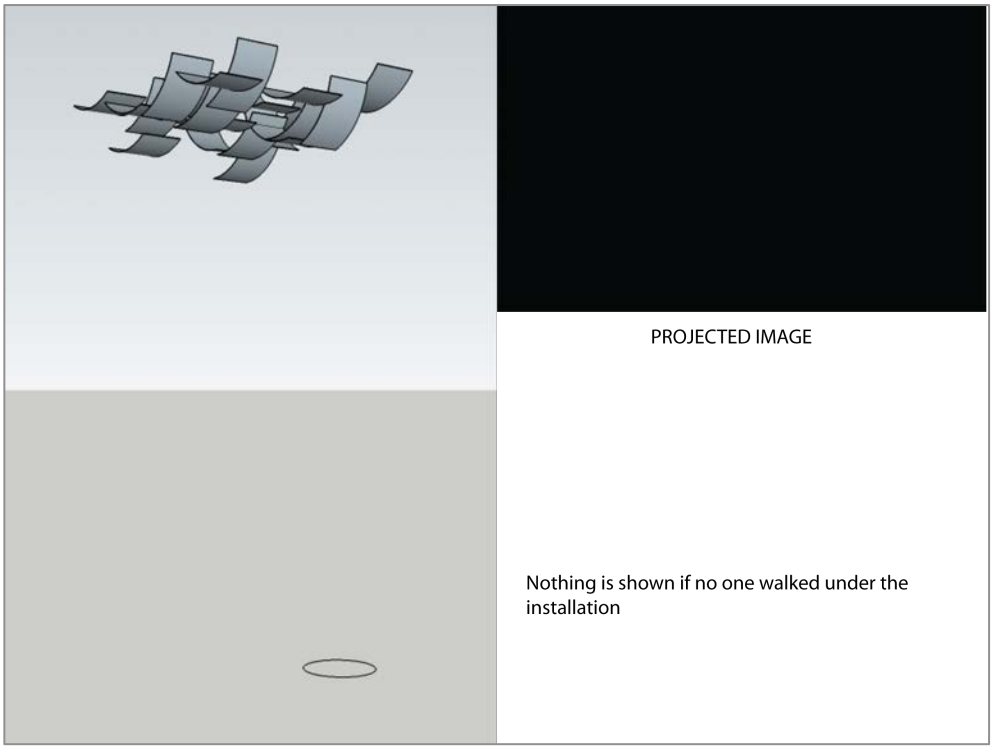
- a comment was made – “it feels like my body is in the water and I’m swimming”

It is interesting to see how the impact of the graphic on the floor can be double-edged. The graphic provides a clear indication, yet it can also restrict users. In a public setting, people can see the interactions and learn from others. At this point, a reference back to the relationship between performer and spectator in situations where audience members can see other people’s actions and the results may be helpful. This kind of observation may allow participants to see that the interactive area is not restricted to just that one area. In addition, the operation of “the honeypot effect” suggests that, if some people look up, it is probable that others will do so too (Hardy, Rukzio, & Davies, 2011). These dynamics suggest that it is not necessary to have texts on the floor telling passersby to look up. The size of the raindrops and traces would need to be adjusted to better fit the scale of the current prototype.

4.6 Prototype III

Figures 44, 45, 46 show the final interaction scheme. The main revision is the timing of the start of the recording. The trace of a participant will be in a unique solid colour that makes it easier for the participant to spot himself or herself. As the participant steps off the area, the recording would stop, and the trace’s colour would change. The designated coordinates for the traces’ locations are sure to be visible from the “leaving trace” area. The current prototype is smaller scale and only a section of the intended

installation. The prototype works in modules, and therefore it can be replicated in a full-scale construction. *Figure 47* demonstrates the proposed installation in a shopping mall setting. The prototype can be scaled up according to the appropriate proportion for the site. It can be built on the basis of the current module and allow for multiple "leaving trace" locations. A framing system can hold the installation, and the projector can be positioned below the frame, pointing down. This arrangement can prevent the frame's shadow-casting problem.



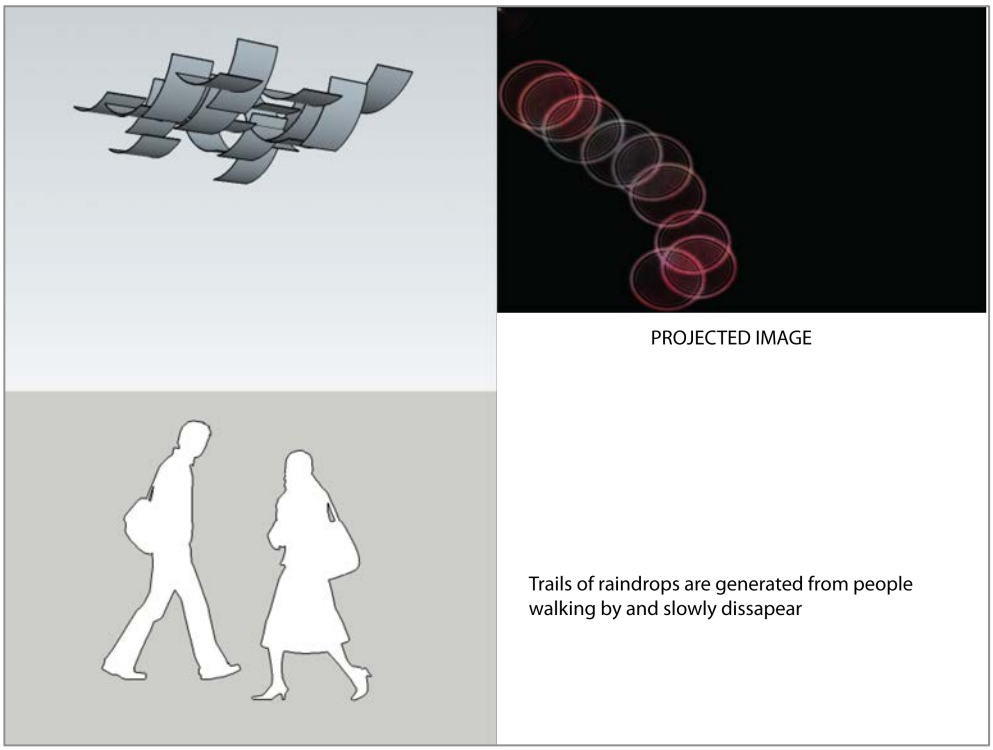
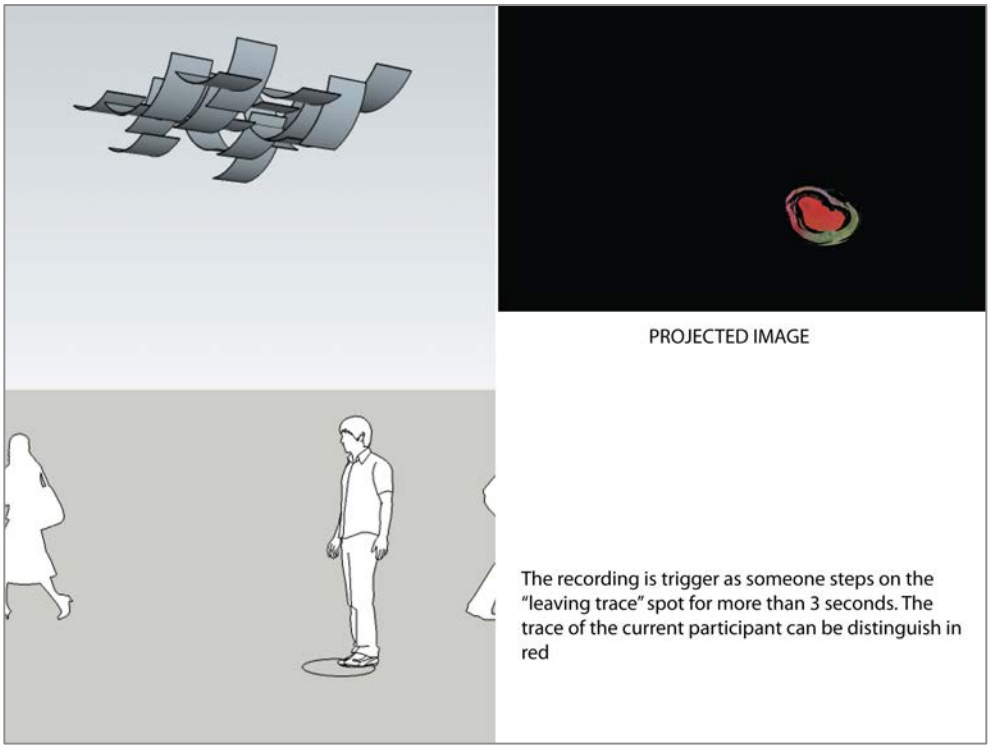


Figure 44. Interaction Diagram



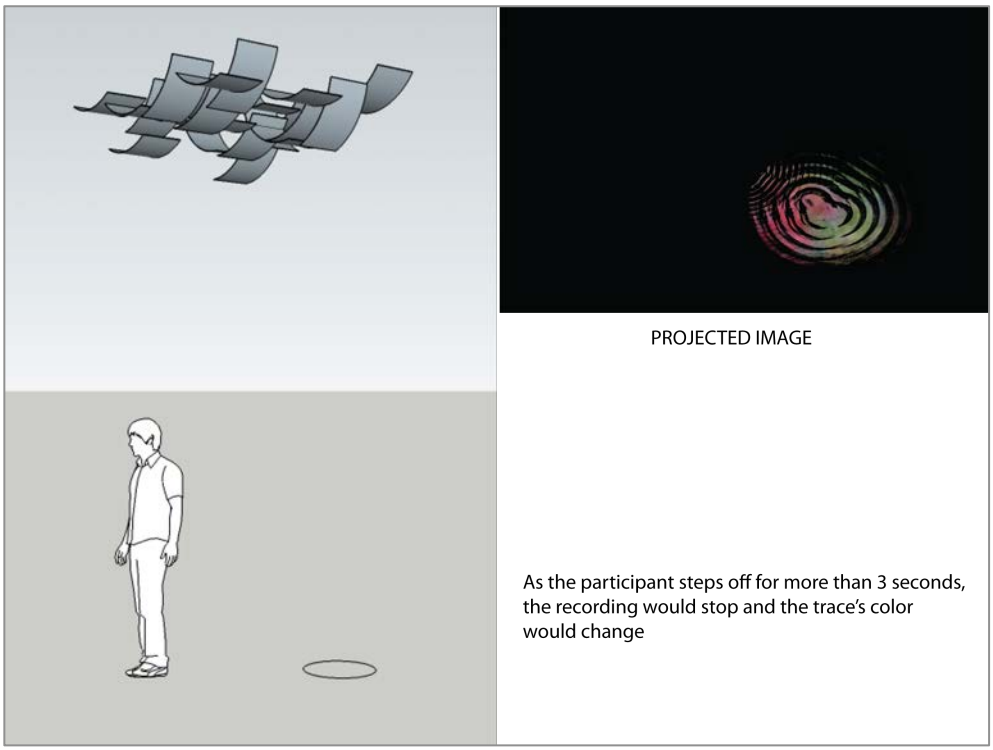


Figure 45. Interaction Diagram

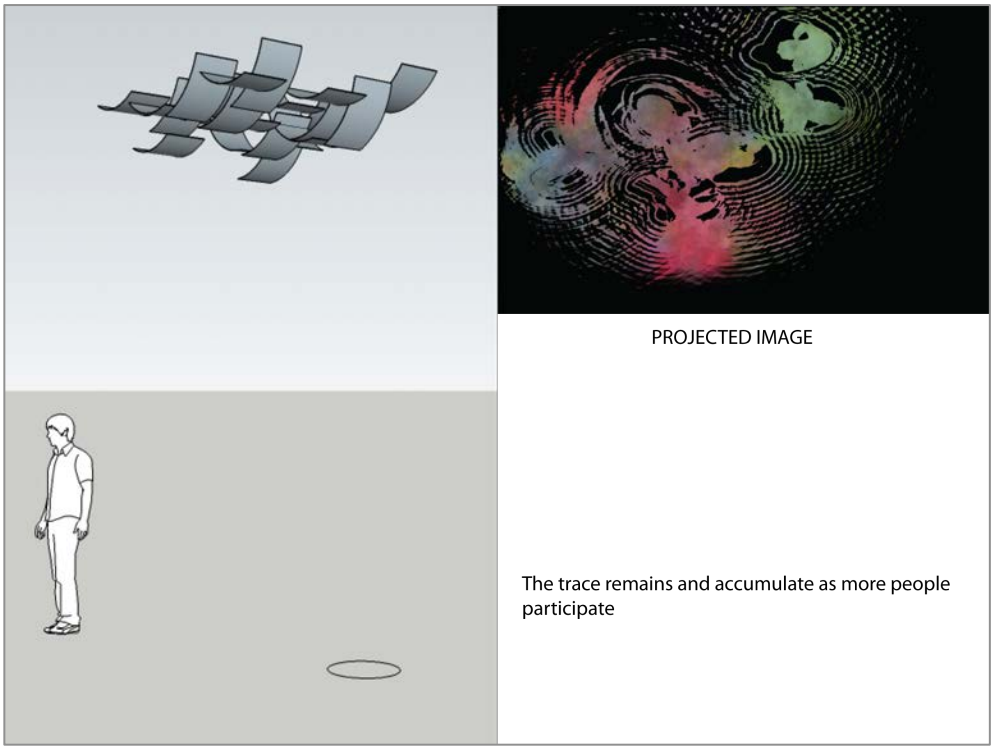


Figure 46. Interaction Diagram

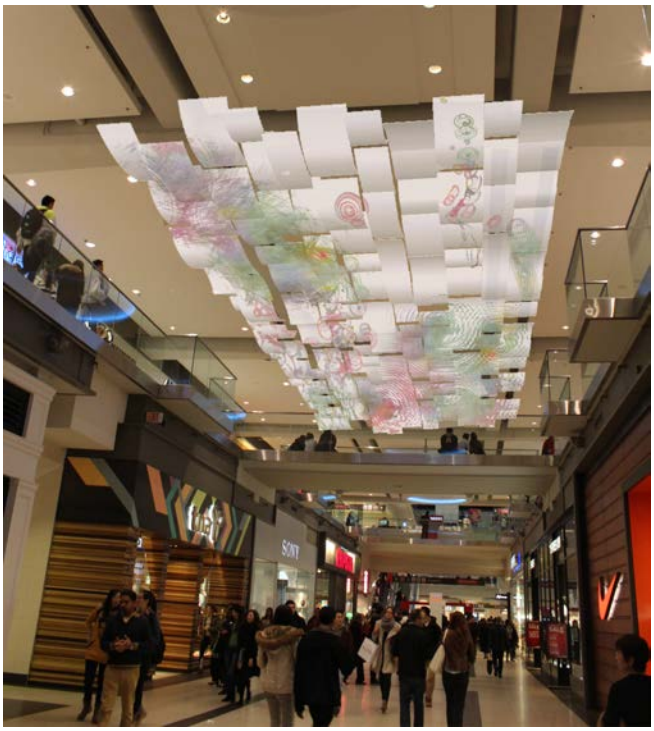


Figure 47. Preliminary image – proposed installation in a mall's space

4.7 Prototype III at Exhibition

Prototype III was exhibited at the graduation show. The set up is similar to how it has been carried in the test. The height of the installation and the mounting angle of the projector are influenced by the width and height of the site and the intention to maximize the area people can occupy without blocking the projection. As the mounting angle of the projector gets steeper the depth of the projector's container is reduced. The set up process involves a lot of adjustment and correlation between the height and location (how far it is off the wall) of the physical installation and the mounting height and angle of the projector, as well as the dimension of the projection image that needs to be fairly match with the physical installation. *Figure 48* shows the final installation. Please refer to accompanying CD for more images and video of the final installation.

Figure 48. Final installation at the exhibition

Informal feedbacks are received from the general public who has attended the exhibition. Observations of their reaction and behaviours around the installation were also made.

- the use of colorful raindrops is fun and as it gets more attractive as the more of the rainbow colors are reveal
- the shape and composition is nice and it looks like a sculptural piece on its own
- it looks better as it gets darker, the light coming through from the skylight really compromise the projection
- most people understand that their body is affecting the ripple movement
- people seem to like it when they see the immediate feedback – as they walk under the trails of raindrops are generated
- some people were stepping on the sticker without realizing so unintentional traces were made
- many people figured out to step on the sticker by themselves
- more people approached the installation if something was displaying (raindrops or traces)
- a number of people were taking photos of the traces
- almost everyone didn't see that there was a webcam hidden and most assumed that the interactions are from a use of sensor
- a lot of people didn't realize where the projector was

- a comment was made when a user steps on the sticker and saw the body outline on the projection – “it gives the feeling of stepping into a puddle”
- a comment about the slow ripple movements – “it actually makes it feels like time has slow down”

Many lessons were learnt from this exhibition. In general, the feedback to the installation was positive and it didn’t take a lot for the people to understand the interaction. The site limitation was quite compromising to the project. The light penetrating through the skylight was an inevitable issue. It emphasizes that in a real setting the installation should be indoor and avoid major light source that could affect the projection. The scale of the piece is efficient as a proof of concept and the interaction design. Hiding the webcam and the projector enhance the experience as the attention is solely on the installation and it brings wonder to people of how this is all happening. This wonder stimulates curiosity, and causes people to ponder, investigate, and explore the installation. As people discover the interactivity, it may create a sense of surprise and uplifting feeling, as discussed in the early section of this paper. As traces generated it also attracts more people to the installation. Attention is raised in contrast to the beginning where nothing is being displayed. This also supports the value that the participants have contributed a lasting effect and influence to the space. The lasting effect of the trace is the key to the core value of accumulation and adds enrichment to the user’s

experience. The experience could change if the trace doesn't last. It can be compare to the difference between writing on a beach where seawater soon washes it off, in contrast to engraving on a tree. Accumulation also couldn't happen with the lack of lasting traces. Technically, these traces would last until the number of available spots is filled up and then the old traces would be replaced by new ones.

5.0 Conclusion

The shopping mall is a non-place according to the definition that has been cited. However, the designation of all spaces is a subjective process. The definition relies on the connection through knowledge and experience that each person has with that space. The interactive public installation for this project has attempted to enhance the mall's qualities and offer a sense of place to the audience. Members of the audience make the choice to engage in this experience or not. The principles of motivation and design strategies, along with existing works, have provided basic design guidelines. The project has had a long journey from existence as data entry on a flat screen to the integration of digital and physical components. The progressions made through user feedback and reflection resulted in an interactive design that is implicit and intuitive rather than a design that requires formal audience actions, which were called for in the earlier prototypes. The simple, intuitive interaction is appropriate in a shopping mall, since it is a high traffic space that is full of people with diverse backgrounds. The physical extension beyond a screen on the wall results in a greater impact and ambient effect. The physical component corresponds to the content, which was in question at the beginning of the research. The use of rain, a natural element that people can relate to, also connects to the origins of shopping malls, which were pictured as places that included the integration of natural elements. It brings back the original intention that malls were not only about

commercialization but it is as much for the purpose of leisure and excitement. It also carries on the use of water feature in malls in a new and interactive form. The use of rainbow clouds also adds colours to the stimulating and enchanting experience. In contrast with preceding prototypes, this design is one that the user can relate to quickly. The installation is above eye level, and the development reinforced the notion that there needs to be an attractive, indicative agent that will stimulate curiosity. The graphic on the floor serves this purpose, but users also generate assumptions about the interactive area from this graphic. Thus, there needs to be a balance and careful consideration of the public's reaction to the design. Immediate, clear feedback from the digital interaction is crucial, since passersby are not expecting to attend to an intensive interaction process in a public setting. The user tests have provided great support for the project's development.

5.1 Reflection

There were certain limitations in terms of the physical installation and projection system, but the execution of the set-up was done in a way that best represents the intended design. During the process, there were struggles to find the right direction for the interactive content and physicality of the installation. Even though the core principles were defined in the early stages, the possibilities for the content were broad. In the course of the project's development, there was an evolution of different concepts and entities. The

user tests significantly shaped the interaction design. The “Share Your Beat” and “Photo Block” versions can be seen as not having a strong enough connection to the mall setting. The solution to the struggle was found through a look back at the history of the mall. The early conceptions of the mall as a site of enchantment and of the use of natural elements provided a strong foundation for the theme and interactive content.

5.2 Future Directions

A placement of the installation in a public location would allow for further investigation. However, the prospects for obtaining a place in a big shopping mall might be far-fetched at the moment. Exhibitions spaces or conferences could offer more exposure and opportunities for collaboration, possibly with an artist or a design firm that focuses on public installation. There is also the expectation that a more versatile, suitable projection system could be utilized. An opportunity to build this prototype on a larger scale would greatly benefit the research.

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7.0 Appendix
7.1 Appendix A: REB Package

Research Activity Overview

Contributive Accumulation

I will be conducting prototype testings for an interactive public physical display as a part of my design research. The project will be installed within OCAD U. The design intent is for it to take place in shopping malls' public space.

The basic concept of the design is a combination of digital and physical installation. A projector is hung on the ceiling projecting downwards on to a physical surface hung lower from the ceiling. This surface is composed of a series of fabric (material could change as the design develops) installed in a cone-like form. A camera will be set up at the same level as the surface and used as a point of interaction. The participant's presence will be detect by the camera and this will generate a graphic output. Each individual's graphic output will be projected on to separate pieces of fabric and accumulate as more people participate. The technical and interaction details will change as the project develops but the basic idea is the projected graphic will be corresponsive to the individual's presence and this graphic output will remain as the person leaves. This graphic output is not identifiable to the identity of the person. Accumulation of people's presence aura is embeded in this physical installation.

Prototype testing

I will start by asking people within OCAD U to participate in a user testing for the design protype. If it is possible, in the later stage I will recruit people from outside. Potential people from outside are acquaintances, and people who are not in the design field to represent the different groups of people in the general public.

During the user test, a think aloud method will be used which would allow me to be aware of what the users are thinking and provide points of improvement in the design. I will also be making observations of their behaviors and interactions. After interacting with the prototype, a short interview will be conducted. The following pages will provide the consent and introduction statements, and a series of possible questions that may be used. There is no strict order of the questions. The intent is for me to receive more feedback about their experience with the prototype.

Consent/ Verbal Script

1. Identification of prototype testing candidates

I will be asking people in OCAD U to participate in the user test. The first group of people I would ask will be my classmates and professors within the school that I am familiar with. Then I would expand the circle to others who are within the school, and if it is possible, I will also recruit people from outside.

Prior to the test, I will send out the Invitation/ Consent Form via email to the school community. I will then organize the appropriate time and testing sessions with people who have responded to participate. The participant will need to sign the Invitation/ Consent Form before I proceed with any further data collection procedure.

2. Prototype testing. I will introduce the basic feature of the prototype and ask them to use the think aloud method

Please allow me to hear your thoughts along the way as you are interacting with the prototype. It is very valuable for me to be aware of what is going through your mind as this can provide a lot of feedback and points of improvements for the design.

3. Once they acknowledge that, I will ask if they mind if some notes are taken.

Is it all right if I take some notes throughout the testing session? I don't need to know or record any personal identification. I just want to be able to remember what you said and what I learned. If you don't want me to, that is fine, but please tell me.

4. After the testing session is over, I will conduct the short interview.

I just have a few more questions for you about your experience with the prototype.

5. Closing off statement (after the testing and interview is over)

Thank you so much for taking some time to do the prototype testing and talk with me. I want to assure you that no information that you have provided will be used for any other purposes than my thesis development. As I said before, no personal information on you or any identifiers (like sex, physical characteristics) will be collected or used. If you feel in retrospect that you would like me to rather not use the information then please let me know now and I will give you my notes. Again, I can be reached via my contacts on the form if you have any further questions or concern. Thank you again for your time.

6. Depending on the atmosphere of the interview, if it is positive and the person seems to be very interested in the project, I will ask them about future prototype testings.

As I will be developing this prototype in reflection of your feedback, I will also be conducting another user test after I have improved it. Would it be of your interest to participate again? The test will be of similar format and location as this time.

7. If the person agrees, I will discuss about getting in contact with them.

I will contact you when the prototype is ready and provide you with an invitation/ consent form. But at any point if you feel that you would not like to participate anymore, please let me know and I will not keep your contact information. Thank you very much again for your time.

Interview guide

Depending on the feedback the participants have already provided during the prototype testing session, I may ask one of the following questions, using the order of topics as a loose framework:

Have you ever seen or experience this type of interactive public physical display before? If so, can you tell me about it?

Did you find it difficult to comprehend what you have to do? on a scale of 1- 10 (10 being the highest)

Did you see the connection with what you're doing under the camera and the graphics being projected? What did you think about the interaction? Was it difficult to figure out what you were doing?

How would you rate your experience on the interaction? on a scale of 1- 10 (10 being the highest)

If you walk pass by this in a shopping mall, do you think you would stop by and participate?

Any final thoughts? What do you think about this overall?

Invitation / Consent Form

Date: December 6, 2013
Project Title: Contributive Accumulation

Principal Investigator:
Principle Student Investigator: Pavika Chintraruck (Pui)
OCAD University
416-875-4160
pc12nk@student.ocadu.ca

Faculty Supervisor (if applicable):
Job Rutgers
Faculty of Design
OCAD University
(416) 977-6000 Ext. jrutgers@faculty.ocadu.ca

INVITATION
You are invited to participate in a study that involves research. The purpose of this study is the exploration in designing an interactive public physical display in a shopping mall. This project aims to investigate if it is possible to create a sense of connection or belonging in a shopping mall, to enhance the experience of this type of spaces by offering an engaging interactivity and allowing individuals who make use of the space to have a lasting affect to the space by leaving their trace (yet not identifiable for others). The output from each individual's participation is kept, so there will be an accumulation of people's presence aura embedded in this physical installation. These traces are abstracted representations, which may be recognized by the person who left the trace, but would never be identifiable to the identity of the person. This project intends to recognize and embrace the existing characteristics of the shopping malls space and add a new feature to enhance it.

WHAT'S INVOLVED
As a participant, you will be asked to interact with a design prototype and join in a short interview conducted by me. The interview involves questions about your experience with the prototype. Participation will take approximately 20-30 minutes of your time.

POTENTIAL BENEFITS AND RISKS
Possible benefits of participation are that you will become a key part in helping with the development of a project that contributes to the field of interactive public display and installation. The aspect of accumulation of individual's output and leaving traces resulting in an affect to the space offers a new perspective to the relationship of people and interactive public display in shopping malls. There are no known or anticipated risks associated with participation in this study.

CONFIDENTIALITY
The information you provide will be kept confidential, i.e. your name will not appear in any thesis or report resulting from this study. However, with your permission attributed quotations may be used. Data collected during this prototype testing and interview will be stored securely in my laptop with a log in password. Data will be kept until the design prototype development is completed, after which time they will be immediately deleted. Your contact information will be retained only if you wish to receive further information about the project and the result of the study. Access to this data will be restricted to Pavika Chintraruck (Pui).

VOLUNTARY PARTICIPATION
Participation in this study is voluntary. If you wish, you may decline to answer any questions or participate in any component of the study. Further, you may decide to withdraw from this study at any time, or to request withdrawal of your data, and you may do so without any penalty or loss of benefits to which you are entitled.

PUBLICATION OF RESULTS
Results of this study may be published in reports, professional and scholarly journals, students theses, or presentations to conferences and colloquia. In any publication, data will be presented in aggregate forms. Quotations from interviews will not be attributed to you without your permission.

If you wish to receive any further information about this study or the result of this study, you can contact Pavika Chintraruck (Pui) via email: pc12nk@student.ocadu.ca

CONTACT INFORMATION AND ETHICS CLEARANCE
If you have any questions about this study or require further information, please contact the Principal Student Investigator, Pavika Chintraruck (Pui), or the Faculty Supervisor, Job Rutgers, using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University [file #]. If you have any comments or concerns, please contact the Research Ethics Office through jburns@ocadu.ca.

AGREEMENT TO BE CONTACTED ABOUT STUDY DETAILS

If you would like to receive further information about this study and the result, please check the box below and fill out your contact information

☐ Yes, I would like to hear more about the study. You may reach me by (provide contact information):
Email:
Post:
Phone:

AGREEMENT FOR ATTRIBUTING QUOTES

Your attribute statements/ quotations maybe used. Your name and any identifiers will not to attached upon its release. If you would permit this, please check the box below.

☐ Yes, I wish to be attributed for my contribution to this research study. You may use my statements and/or quotations that you have collected from me.

CONSENT FORM

I agree to participate in this study described above. I have made this decision based on the information I have read in the Information-Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

Name: _____

Signature: _____ Date: _____

Thank you for your assistance in this project. Please keep a copy of this form for your records.

7.2 Appendix B: REB Approval

Research Ethics Board

January 21, 2014

Dear Pavika Chintraruck,

RE: OCADU 137 "Contributive Accumulation."

The OCAD University Research Ethics Board has reviewed the above-named submission. The protocol and the consent form dated January 21, 2014, are approved for use for the next 12 months. If the study is expected to continue beyond the expiry date (January 20, 2015) you are responsible for ensuring the study receives re-approval. Your final approval number is **2014-02.**

Please note that you need to make sure that when you ask fellow students to participate, you must ensure they feel no undue obligation to you to participate and are free to say no.

Before proceeding with your project, compliance with other required University approvals/certifications, institutional requirements, or governmental authorizations may be required. It is your responsibility to ensure that the ethical guidelines and approvals of those facilities or institutions are obtained and filed with the OCAD U REB prior to the initiation of any research.

If, during the course of the research, there are any serious adverse events, changes in the approved protocol or consent form or any new information that must be considered with respect to the study, these should be brought to the immediate attention of the Board.

The REB must also be notified of the completion or termination of this study and a final report provided before you graduate. The template is attached.

Best wishes for the successful completion of your project.

Yours sincerely,

Tony Kerr, Chair, OCAD U Research Ethics Board

OCAD U Research Ethics Board: rm 7520c, 205 Richmond Street W, Toronto, ON M5V 1V3
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