Cubieo: Ambiguity in Tangible Collaborative User Interfaces

Magnus Flyckt
Södertörns Högskola
Alfred Nobels allé
Flemingsberg
magnus.flyckt@gmail.com

ABSTRACT
This study investigates how ambiguous qualities in a tangible user interface can generate collaboration between the users of the artifact. The goal of the ambiguous qualities is to not have an interface with a generally accepted way of interaction. In this manner the participants are challenged in their own perception of what a tangible user interface consists of. Interactions with physical objects instead of a standard mouse/keyboard input can explore new techniques of interaction.

KEYWORDS
TUI, Ambiguity, Collaboration, Tangible User Interface

INTRODUCTION
Cubieo (see figure 1) is a tangible user interface that responds with musical feedback to tangible interaction. Cubieo was developed in collaboration with another student at Södertörn University as a tool for investigating how ambiguous qualities in a tangible user interface can spawn collaboration between users while they interact with the artifact. Gaver [8] views ambiguity as an opportunity in human computer interaction design instead of a problem. These opportunities include: "engage users with issues without constraining how they respond, allows the designer’s point of view to be expressed while enabling users of different sociocultural backgrounds to find their own interpretations".

Cubieo uses physical tangible objects that interact with light and movement in order to create musical feedback. The framing of the question of the study is how the ambiguous qualities in the form of interaction, perceived affordances and physical representation in Cubieo can have an impact on collaboration between the users of the artifact. In this sense the study is explorative and uses the same notion of ambiguity as Gaver [8] where he views ambiguous qualities as an opportunity in the design.

Tanja Döring [5] provides the following definition of TUI interfaces as "Tangible user interfaces (TUIs) offer a graspable way to interact with ubiquitous computer systems, as they link physical objects to the digital world. An important quality of TUIs is the materiality of the objects used for the interaction."

In her study “Exploring Material-Centered Design Concepts for Tangible Interaction” [5] she explores the meaning of material qualities and how material and haptic sense feedback can help designers in structured approaches to design tangible user interfaces. She also discusses that materials have cultural meanings in the objects that the users are familiar with. This can also be used in the way objects are constructed in the design for tangible interaction. This approach to designing user interfaces takes into consideration the users, prior knowledge and experience or what Norman defines as perceived affordances [9].

Phoebe Sengers [10] argues that system designers need to understand the complexities of user experience when designing a system. This goes beyond the code itself, opposed to an engineering approach and encompasses practices such as cultural studies, anthropology, speculative design, surreal art, culture jamming, story-telling, cultural
history, sociology, improvisation, and autobiographies. She
doesn't express the need for models to formalize the
complexities of human experience but instead recognizes
the role of the artifact, not just as fun but also intended for
serious play in the context of usage in the everyday lives of
the users.

In artwork installations it is also important to take in to
consideration the way the artifact can engage users to
interact. Dalsgaard et al. [2] identifies four different
elements of engaging user experiences, that consist of:
cultural practices, physical conditions, the content and
social practices. Cultural practices according to Döring [5]
refers to “the fact that we behave in certain ways depending
on the situation and that we expect a certain behaviour of
others. Designers have to bear this in mind as it affects
engagement”.

RELATED WORKS
ReacTable takes on the form of tangible user interaction
with blocks to create different sounds from music files and
the way the user manipulates the blocks on a table. With a
projected user interface they can alter the sound. This is a
more direct approach to create a music sampler but with a
different take on interaction than a regular music sampler

Ullmer et al. [12] present the notion of token+constraints in
tangible user interaction. The basic concept consists of
physical objects as a representation of digital information
and computational operators. These interfaces have two
modes of interaction where the tokens represent
information and can be placed in the confines of the
constraint structure, which establishes a computational
relationship. Removing the token from the constraint
structure can also reverse this relationship. This type of
interaction and design pattern were utilized when designing
some of the physical objects in Cubieo.

Paul Dourish [4] defines embodied interaction as "the
creation, manipulation, and sharing of meaning through
engaged interaction with artifacts" and embodiment as the
relationship between action and meaning. Djajadiningrat et
al. [3] also analyses embodied interaction of physical digital
artifacts. The focus lies on the affordance of digital artifacts
as an inviter of expressive behaviour. Both appearance of
the artifact and the physical action is linked to the aesthetics
of the product in order to represent meaning. Tangible
interaction has historically had a standpoint in a data
centered view, whereas Djajadiningrat et al. [3] take the
possibility to investigate a perceptual-motor-centred view
on tangible interaction. Cubieo uses Djajadiningrat et al. [3]
notion of embodied interaction where physical
representation is the key factor of inviter of behaviour but
in addition encompasses ambiguous qualities.

Nimio is a project that further investigates Gaver’s [8]
notion of ambiguity as a resource for design. The Nimio
project incorporates visualization feedback of collective
actions including touch and sound and explores the tension
between ambiguity and legibility of the design in a
collaborative setting. The design is deliberately open ended
in order to engage the users not constraining them on how
to respond [1].

CONCEPT
The first idea for the project was in the form of using
representation that captured the playfulness of interaction
but not necessarily encapsulating the feedback in form of
sound. This idea of representation consisted of a whale with
capacitive sensors on the back of the whale that responded
to touching and feeling and gave response in the form of
different synthesizer feedback. This idea was early on
dismissed due to the lack of complexity in the interaction
and also without the representational form of a whale it
wouldn’t actually differ much from the interface of a real
synthesizer. The second factor was that it wouldn’t support
collaboration between the users based on the simplicity of
the tangible interface.

Instead the main concept developed for the prototype was
to utilize ambiguous qualities in order to make something in
between an art installation and a music instrument. A music
instrument is typically designed for effectiveness in usage
whereas an interactive art installation often focuses on
engaging users in interaction and the interaction in itself is a
part of the installation. The ambiguous qualities were a way
to explore how different users collaborated with the artifact
in order to understand how the input and feedback elements
coincided without necessarily focusing on the effectiveness
of usage.

The prototype was developed using different sensors
attached to a Phidget USB interface. In this manner the
different sensors could be embedded into playable objects
and a computer was only utilized for the music feedback.
The exploration of different sensors showed that it was
most effective to use sensors that responded to the users
interaction with a numerical feedback. Expressiveness
related to music is where you can convey a feeling, mood or
an idea with an instrument. In order to incorporate the
feeling of expressiveness there was a need for a non-binary
input and the light sensor was the best choice for both
ambiguous qualities and the feedback aspect. Since the light
sensor responds with a numerical feedback depending on
the amount of light detected by the sensor.
The numerical feedback in a Nintendo Wii controller was also utilized in Cubieo. Since it’s possible to get a non-binary feedback depending on the positioning of the Nintendo Wii controller on different axes. The music feedback was created using the software MAX/MSP, which is a tool to graphically program music, sound, video and interactive media applications. See figure 1 for the full technical schematics.

The first step was to build a simple drum machine. We felt that a drum sound would provide a very direct feedback for the users to comprehend. The light sensors were used to specify which drum sound is played on a drumbeat on a four by four drum pattern. A metronome then controlled the drum pattern. Four different drum sounds were used, where three were programmed from scratch in MAX/MSP and one was sampled from an old Icelandic funk record.

The second step was to control the tempo and pitch of the drums. The possibility to get values from the Nintendo Wii depending on it's position on the horizontal axis and it's wireless functionality using Bluetooth technology, it was the perfect choice. The position on the horizontal axis determined the pitch and tempo of all the musical feedback.

The third step was to incorporate some form of musical feedback. Seven different music samples containing strings, synth and piano were used and adjusted in tempo according to the drums. The same adjustments were made to three different vocal acapella’s. Two light sensors were used to control the volume output of the music and vocal samples.

In the final version two RFID-cards and an RFID-reader were used to change the samples in a random fashion.

In order to engage users every sensor was embedded in playful objects. The light sensors was embedded in cubes made of styrofoam and hard paper in different bright dotted colours. The colour scheme was chosen to enhance the ambiguous perception of the artifact. The Nintendo Wii controller was put inside of a foam rubber ball. The two RFID-cards was put inside of two cuboids in two distinct colours and the RFID-reader was placed inside of a rectangle cube with a hole fit for the RFID-cards cubes. There was also a LED-light from the RFID-reader that was utilized in order to provide a more direct response for the participants.

The affordance and representation of each object was carefully planned in order to incorporate three levels of abstractions in the interaction with Cubieo. These levels was a way to approach the interaction where the first level was a more direct and visible way of interaction to the third level where the interaction was more abstract.

The first level consisted of the six light sensor cubes, four to control drums, two to control volume of each sample. On this level the interaction was solely based on the amount of light that was detected by the sensors.

The second level consisted of two cuboids with a built in RFID-card, one container with a built in RFID-reader and corresponding LED-lights. The interaction triggered the different samples randomly and was tightly coupled with the volume from the cubes hence a more abstract approach.

The third level consisted of a rubber foam ball with a built in Nintendo Wii controller controlling the tempo and pitch of the music, vocals and drumsounds. On this level the interaction was tightly coupled with all the light sensor cubes being triggered. Since there are numerous ways to interact with a ball and it’s only the ball’s horizontal angle that controls the pitch this was the most abstract approach to the interaction in Cubieo as opposed to the prior levels mentioned.

**PILOT STUDY**

The pilot study was conducted with 7 participants. The participants consisted of 2 female and 5 male teachers, from the Department of Media technology on Södertörn’s University. The study was conducted in a classroom at the University. The main goal was to investigate if the ambiguous qualities of Cubieo could prone collaboration.
between the involved participants. The participants interacted with Cubieo as a large group.

Cubieo did spawn collaboration between the participants but the feedback from the participants suggested a far greater direct response from the different objects. The controllers for the music and vocal samples were only changing the volume output depending on how much light the controllers received. This gave the participants a feeling of direct response. This was in contrast to the controllers connected to the different drum sounds. In the first iteration Cubieo consisted of 4 controllers where each controlled one beat on a four by four drumbeat. Each controller had 5 different settings where 4 settings was different drum sounds on one drum beat and the fifth setting was the drums completely off, depending on how much light the controller received. In order to make the drum pattern flow better all controllers also switched on a hi-hat that played on all drumbeats of the four by four drum pattern. This proved that the response was far too non-direct in order for the participants to understand the interaction of a single cube.

The number of participants in the group for the pilot study indirectly suggested that the user study should be conducted with smaller groups. This is due to the fact that it would be easier to interpret the interaction and every participant in each group could interact at the same time, which wasn’t really possible during the pilot study.

In the first iteration of Cubieo also contained two pads that could randomly change the vocal and music sample. The perceived affordance of the pads suggested that these controlled drums according to the participants. Since the feedback of the pads was directly linked to the two controllers adjusting the volume of the samples it took quite some time for the participants to understand the input/feedback of the pads.

**IMPROVEMENTS CUBIEO VERSION 2**

For the real observational study there were some major changes made to Cubieo. In order to make the controllers for the drums response more directly to the interaction, the hi-hat on all 4 drumbeats were switched off. Mainly because it was hard to tell which unique sound was linked to each controller since the hi-hat were switched on for every drumbeat. For each controller linked to each drum beat there had been five different settings. Four different drum sounds and one were the drum was completely switched off. The light sensor could read from a scale of zero to thousand depending on how much light the sensor received. From the pilot study it showed that when the participants finally figured out the interaction with the lights, they only thought that the drums had two different settings, one setting where the drum that played when the light hit the controller and one setting where the drums where completely switched off. To make the interaction more responsive to the participants’ actions the controllers for the drums were changed from five different states to three. These three contained two drum sounds in two specific intervals depending on the intensity of the light and a third state where only the volume of the second drum was adjusted according to the light. The hi-hat that played on every drumbeat on a four by four pattern was completely removed.

From the pilot study it was evident that the playful colouring of the different cubes made it hard to understand how they interacted with the light. In order to clarify the relationship between the sensor and the light, the side of each cube where the light sensor was placed, were all coloured white.

The second major change was that the pads controlling the samples were replaced with an RFID-reader and two RFID-cards. The cards were placed inside two different boxes. The RFID-reader was placed inside a box that contained a compartment that was the size of the boxes. The LED function of the RFID-reader was also used in order to get a direct light response each time one of the RFID-cards were in contact with the RFID-reader.

**USER STUDY METHOD**

An explorative observational study was conducted in a public space in hallway corridor at Södertörns University. It involved a total of 6 groups, with 2-3 participants in each group, with a total of 14 participants. The users were filmed during each session. Each group was informed that they could do whatever they wanted with Cubieo and our role was only to observe each session. The participants consisted of 9 female students from the ICT, Media and Design programme, 4 male students whereas 2 came from the Business and Economics Programme and 2 from Computer Games Programme and the last male participant is a technician/teacher within the Media and Design Programme. The user study was filmed in order to analyse the results afterwards.

This is according to Fällman [6] where he explains the difference between design- oriented research and research-oriented design. In design- oriented research, research is the area of expertise and the productions of artifacts is merely a means to an end in order to study user behaviour and user experience and not the artifact in itself. The specific user behaviour being studied is the participants’ different ways
to collaborate using the artifact. The artifact encompasses different ambiguous qualities that are used in order to observe the users behaviour.

The goal of the study was to see how the participants interacted with Cubieo, how the qualities of Cubieo in form of interaction methods, perceived affordance and ambiguity could spawn collaboration between the participants in each group.

**METHOD CRITIQUE**

There could have been more groups included in the study and from a broader population and not a majority of Design and Media students. But since the study was conducted in a hallway corridor at the institution for Media and Design students the number of groups was limited due to on-going classes. The reason for conducting the study in this hallway was in order to use the sound system associated with this open lecture hall. It was evident from the pilot study that it was important to have proper musical feedback because Cubieo mainly consisted of this element of feedback.

The room had to be very dark in order to use the light sensors properly. This could have had an impact on the invitational elements of usage of the different objects.

From an analytical standpoint we could also have used better microphones and placed the camera in a better angle than we did. But this was a minor problem since notes were kept during the study so the small elements of interaction that wasn't captured in a good manner on the film was instead observed and written down during the study.

**ANALYSIS APPROACH**

In order to evaluate the merit of the study Zimmerman's et al. [14] model to evaluate design research is used. The model consists of so-called four lenses to evaluate design research:

1. **Process:** Evaluate the methods used during the process and provide arguments for why these methods were used. Document the process in enough detail so the process can be reproduced. Even though Zimmerman et al. [14] acknowledges the fact Gaver [7] states the same results will not be reproduced. But in order to show some validity it’s important to show the whole design process.

2. **Invention:** The research must contribute with a significant invention.

3. **Relevance:** The benchmark for good research is the relevance of the research. The research should motivate the benefits of the design attempts and why the community should consider this relevant.

4. **Extensibility:** The ability to build on the results of the outcome of the interaction design research. Either by employing the process for a future design problem or understanding the knowledge from the resulting artifacts. The process should be documented in a way that the community could understand the benefits of the result of the research.

The design-oriented research is evaluated as follows:

1. **Process:** The process is documented throughout the whole design process. It’s possible to recreate the artifact even though as Gaver [7] states the results from the study will not be reproduced. Since the context of use, how the study was conducted and the users will not be exactly the same and therefore the results will differ.

2. **Invention:** The invention in this case refers to the explorative approach to observe patterns of collaboration and how the ambiguous qualities in the artifact might impact the collaboration between users.

3. **Relevance:** The artifact in itself doesn’t really have a counterpart either physically analogue, digitally or encompasses both. But in this case the artifact is used for its ambiguous qualities in order to evaluate these qualities and what impact they might have on the collaborative aspect between users. Hopefully the knowledge provided can benefit the community in the development of collaborative tangible user interfaces or incorporate ambiguity as an opportunity in the design of tangible user interfaces to serve a specific purpose.

4. **Extensibility:** In this study the benefits of the research are the ability to use the results and knowledge from the context of use conducted in the study. This is referring to the incorporation of ambiguity in design and how it can impact the use such as in this case the collaborative aspects of usage. The knowledge provided should also benefit people outside the research community. In this case it could be companies willing to explore incorporating ambiguity in their product as a mean to engage their users in a collaborative fashion. However it’s difficult to see how the results will benefit the users of the artifact other than reflect on how ambiguity in tangible user interfaces may affect their own interaction with the artifact and with other users.
RESULTS
The open platform of the study brought different results since there were no right way or wrong way for each group to use Cubieo. Out of the six groups, it was only two groups who fully understood the whole artifact in the sense how each element intertwined and the function of each element. But each group at least figured out one function of Cubieo.

Since there were so many elements and the ambiguity of each element it could actually be their understanding that this was the furthest extent of the interaction and the function of Cubieo.

The main first step for each group was to investigate each object of Cubieo separately. This often consisted of turning each object to find a common thread. One group also tried to see if there was a possibility of opening each object, which resulted in that the Nintendo Wii controller was removed from the rubber foam ball.

The common thread between the two groups that figured out every function and how they intertwined was their view on Cubieo as a challenge to figure out every part. One of the participants even stated that the user study seemed like a test of their intelligence. Their communication between each other was a vital part of understanding Cubieo. For example when one member of the groups understood that the rubber foam ball controlled the pitch of the music he stated the similarity to a pitch control on a record player. In these two groups there was also no one taking the lead on how to interact with the objects but instead they were verbally expressing their thoughts on how each part fit together or how they interpreted the function of each object.

Other groups viewed Cubieo more as a puzzle. Where they were trying to find patterns in form of colour and shape of each object in order to fit them together. This manifested itself where they paired objects with matching colours, stacked objects on top each other, placing the objects in an organized manner around the table based on colours and shapes and placed them inside the both the RFID and rubber foam ball container.

In some groups a facilitator emerged, whose role became to engage the different participants with actions. The facilitator’s instructions could be “to lift the cubes at the same time” or to “tap the cubes at the same time”.

There were a couple of interaction patterns that emerged during the study. These patterns could be a result of the users sociocultural background, previous knowledge and what Norman [9] defines as perceived affordance.

The main interaction patterns consisted of:
- Pair cubes with each other based on form, shape and/or colour
- Stack cubes and cuboids on top of each other based on form, shape or colour
- Tap the cubes with fingers
- Pair the cubes with the light source
- Cover the holes of the light sensors of each cube in order to create different sounds.
- Find and create patterns in the placement of the cubes based on form, shape and/or colour
- Moving the rubber foam ball in different directions such as rolling the ball on the table, moving it side to side, moving it near objects or flipping the ball in different angles

DISCUSSION
In the same manner as Gaver [8] where he views ambiguity in design as an opportunity the users where freely open to interpret and create their own meaning of use. Since the design was deliberately open ended it created opportunities for the participants to interact with Cubieo in any way they felt.

What becomes evident from the user study is that the users own interpretation of use of Cubieo differs quite a bit between the different groups. There are different factors to take into consideration interpreting their use.

One conclusion is that between the groups that fully understood the whole concept, knowledge is drawn from previous experience with actual music instruments. In this manner sociocultural background and previous knowledge together with the participants’ perception of the artifact played a huge role defining how they would use it. These different factors are the same as the different practices Sengers [10] proposes in order to define the complexities of user experience.

Other groups complained that there wasn’t enough information supporting their use. This could also stem from their views and perception of what a tangible user interface should consist of. The participants’ prior knowledge and views on ubiquitous computing devices or tangible interfaces could have had an impact on how well the design should support their use. Also what Döring [5] defines as cultural practices could have an impact on how the
participants interacted depending on the situation and the expected behaviour of other participants.

One major conclusion is that Cubieo in fact supported collaboration between the participants in each group but on different levels. The different factors that supported collaboration consisted of:

The ambiguity of the design:
- The shapes of the cubes and cuboids and the containers helped spawn the idea of pairing the objects with each other or stack the objects on top of each other. This activity usually meant that at least two participants in each group tried to pair the objects simultaneously.
- The colours of the cubes also spawned collaboration in the same manner as the shapes and sizes.
- The shape of the rubber foam ball meant that in some cases the participants felt like throwing the ball to each other.

The ambiguity of interaction:
- The interaction between the light and the sensors in the cubes helped to spawn collaboration in each group. Once the groups figured out the interaction of the light cubes, there were at least two participants in each group trying to pair the cubes with the light since there were so many cubes.
- The interaction with the cuboids and the container for the RFID-reader worked in the same manner. There were at least 2 participants trying to pair each cuboid with a one of the containers. This is referring to both the container for the rubber foam ball and the container for the RFID-reader.
- The collaboration also took a further stance once the participating groups figured out the intertwined relationships between the different objects. This meant for example that one participant could be controlling the sound of a drum or sample while the other participant were controlling the pitch and tempo using the rubber foam ball.

The user study also showed that there were some constraints that could have implications on how willing the participants were in collaborating with each other and with Cubieo. These constraints appeared mainly due to the way the user study was conducted. The prior relationship between the participating users played an important role on how outspoken the interaction became. This showed evident when a teacher from the faculty joined one of the groups. Before he entered the room the participants that consisted of students were willing to try a different set of strategies on how to interact with Cubieo. But afterwards he took on some form of facilitating role. In the same manner what Döring [5] defines as cultural practices.

The major difference between the groups that actually figured out all of the elements of Cubieo and those who only understood parts of the elements were communicative aspects. The groups that verbally expressed their thoughts on the interaction came to conclusions on Cubieo faster and it also helped them to further engage with the different objects. The verbal communication that emerged was still very limited so it’s difficult to draw broader conclusions regarding these patterns.

Another aspect that limited the interaction could come from the context which the user study took place. The darkened, closed off room and the fact that the whole thing was filmed could have impacted on how freely the users were engaging with Cubieo. This is similar to what Döring [5] identifies as social settings on how users engage depending on the social situation. The fact that the users were observed during the whole session meant that some actually expressed the feeling that the user study was a test of their intelligence. This most certainly was not the intention and somehow this may have lost the participants’ feeling towards playfulness in Cubieo.

CONCLUSIONS
The ambiguous qualities in both design and feedback from Cubieo indicated that it helped the participants’ willingness to collaborate with each other. Whether or not these collaborative interactions had an impact on the feedback response from Cubieo, the ambiguous design itself actually helped the collaboration. There were different patterns that emerged in the aspects of the ambiguity of the design and the ambiguity of the interaction as discussed earlier that had an evident impact on the collaboration.

There were some improvements that could have been made in order to draw further conclusions regarding Cubieo. There is no way of knowing the users prior knowledge since it’s such a vague artifact and doesn’t really have a counterpart but some form of questionnaire about music instruments, tangible interaction and ubiquitous computing could have been helpful establishing how prior knowledge could how affected the usage. But a questionnaire could have in the same manner affected their thoughts on the artifact and the interacting elements. Another factor that was really hard to determine was the impact of the visual feedback. There was a LED-light connected to the RFID-reader but there wasn’t many users that acknowledged that form of feedback. In this manner visual feedback could have been far greater.
One of the most interesting aspects of the study were the way some of the groups started to create their own sounds using different methods with switching on and off the light sensor. This wasn’t really the intention on how the musical feedback should have worked. This could be defined as emergence of use, which is a property of the design that is not intended at the time of creation but rather an emergent discovery [13]. In this case the emergence of use is the unintended ways the participants interacted with Cubieo to make their own music that wasn’t intended in the design itself. As Gaver [8] stated in an open-ended design of ambiguity the main factor is to not constrict the users how to react and respond to the artifact and in a sense this was a result in the interaction of the open-ended design. Also the three levels of abstractions in the design didn’t really hinder the users in the understanding of the interaction and function. The most difficult input and feedback response of the interaction seemed to be the way the relationship between the different objects intertwined.

According to Zimmerman et al. [14] so-called four lenses of evaluating design research, the process of the study was thoroughly documented. The ambiguous qualities in terms of interaction and design of the tangible user interface Cubieo were utilized in order to evaluate its impact on collaboration between the participants. The invention showed the different patterns emerged in terms of ambiguous design and interaction that affected collaboration. The relevance of the research stems from the results that showed the different aspects of the artifact, the context of the study and the participants’ influence on collaboration. The extensibility of the study is the ability to further build on the results such as the ability to utilize Gaver’s [8] notion of open-ended design in ambiguous tangible interfaces to spawn collaboration and how this in some cases can lead to emergence of use [13].

In a world where ubiquitous computing becomes more and more common and is not constricted to the usual human computer interaction inputs, ambiguous qualities of interaction is a field worth investigating even in corporate settings. Also a further study could have interpreted the different communication patterns.

Hardware for constructing this types of interaction is also getting cheaper which spawns a whole new marketplace for the DIY and hacker community to come up with solutions for everyday problems or how to interact with different tangible interfaces. Since these types of tangible user interfaces aren’t constricted to the usual desktop setup the need for investigating further ways to engage in collaborative interaction is evident.

REFERENCES

9. Norman, D.A. Affordance, conventions, and design. interactions 6, 3 (1999), 38–43.
13. Vogiazou, Y., Rajmakers, B., Geelhoed, E., Reid, J., and Eisenstadt, M. Design for emergence: experiments with a mixed reality urban playground