NATURE REPLAY

An immersive installation

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Abstract. This project aims at addressing playgrounds and their utilization in current urban scenarios, in developing and under-developed countries. It experiments with digital technology to re-create a play space wherein children can actively engage with each other and the space utilizing upon a unique medium of play. As playgrounds have traditionally always been situated within a natural habitat or environment, this further reinforces the concept of developing the idea- based on something closely related to nature. Working around notions related to nature, music and how can children play around them; conceptualized 'Nature *re*Play"; an immersive environment making use of interactive digital media in both real urban settings and performing arts.

1. Introduction

1.1. CONCEPT AND GOAL

'Nature replay' - deemed to be the working title of the project- is an immersive installation that encourages multiple engagements. It takes off from the idea of human connectedness, of which a playground has always been a lively and networked model in the built environment. Just as in a playground there are various medium of play such as swings, see-saws, slides, merry-go-rounds etc., this play space is about people-centric play with pendulums as the prop and medium.

1.2. DESCRIPTION

The interaction design will take advantage of mobile physical qualities of a pendulum (oscillation, collision, swing and inertia) and the human input required to bring these movements and interventions. The tangible nature of these pendulums constructed at an ergonomic scale and the intuitive interface will promote face-to-face collaborations. Upon interaction with these pendulums, sound and corresponding visuals are created, allowing multiple users to engage, play and contribute at the same time.

Children are induced to ride on the pendulums and start swaying and colliding with other players while observing the changes caused by their physical moves on the screen, which will start teaching them more about their positions in space and their sense of direction and orientation.

As an immersive installation it engages live artists and performers to play with their fingers with the pendulums, see and hear the corresponding visuals and sound, allowing multiple users to play, connect, and collaborate at the same time. The audio and the visuals constantly generate interest, creating a sense of curiosity to experiment and play with the pendulums.

Within a very subjective communion between the instruments of play and its consequent audio and visual field, one can feel a certain fluid crossover of –action and response. In effect, this immersive play brings the physical science and the creative act together to generate an interactive experience of the multitude at the same time.

1.3. METHODOLOGY

For the purposes of the project, the play-space model is created at a reduced scale. It is constructed as a self-contained portable enclosure, where participants can modify sounds and images using their fingers to control a number of pendulums. The experience takes place in a physical environment and its corresponding exploratory content is generated upon the screens. Thus- making it a ground for experimentation and spatial performance.
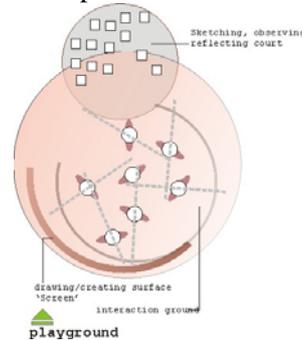

Figure 1. Sketch plan of imagined play-space

By recording movements in real time brought about by children tinkering with the pendulums and tracking these with electrical circuitry and physical programming makes the device live and responsive. The programmed multimedia interface is based on artistic digital visualization and processing of sound in real-time. The visuals are an effect of the sounds created within the system which is directly related to the movement of the pendulums. Using numbers and logic which are set to certain parameters within the multimedia application, it helps us derive many interesting results based on the concept of layering of sound and geometrical recursion, of which some famous examples can also be found in Fractal art and geometry.

As with 'nature' itself being a rich ground filled with endless patterns and visual iterations, we use the 'leaf' as small figment of 'nature'. The intricacies present within the leaf are geometrically broken down and the lines and dots become our construction material for generating more patterns and endless moving imagery. The Digital software's that aid us in doing this are two multimedia applications: MaxMSP(by Cycling 74) and Processing (Open source platform for Visual designers based on John Maeda's DBN, or Design By Numbers)

As the computers continue to design on the screen space, they inconspicuously become Show managers in the performance, guiding and moving the activity in all directions on the screen and in real-space.

2. Explorations

In our explorations for "Nature replay" we had to investigate three main elements and their relationship with each other. These were -nature, music and children.

2.1 NATURE

2.1.1 Paul Klee and Nature
In this work (Figure below); Klee looked at nature as surfaces formed by flowing lines that move towards and into each other. He dealt with time as a fourth dimension that is of flow and movement. While emphasizing upon the pictorial qualities, his works also opposed the original form of structure. He called it 'like Nature" which to him was about creating spontaneous instances of the process of growth and transformation in Nature.
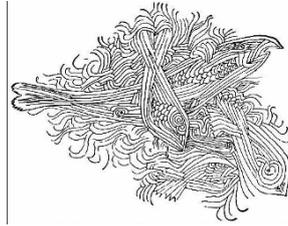
Figure 2. Fish in the brook, (Haftmann, 1967)

We picked one element from nature which was the leaf. We experimented with the potentials that lie within the structure of a leaf. Using lines, points and planes, we explored tactile visual qualities.
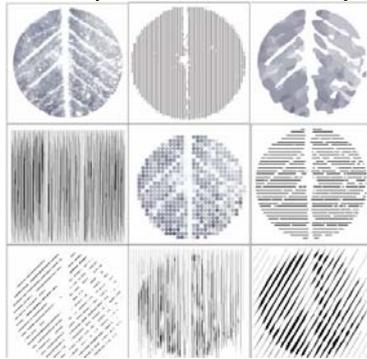

Figure 3. Illustrations by author exploring leaf structure

Paul Klee in his 'Pedagogical Sketchbook', details his perception of design aesthetics as a play of rhythms in nature and giving these a new expression through pictorial means obeying natural laws.
".. Let the first act of motion be set beyond the dead point (line). After a short time, pause to draw breath (broken line or if repeated, rhythmically interrupted line)... The active line, given time, can progress from one point to the next; in this way it can reunite with itself and make a figure-rectangle, triangle, circle." (Haftmann, 1967)

Paul Klee's interest in growth and timelessness of visible objects led him to explore basic geometries in an unhindered and free manner. According to him "Movement is the basis of all becoming. When a dot becomes movement and line, time is involved." (Haftmann, 1967) Always starting with a simple thought, he progressed upon it with -'hand' as a vehicle of taking –it- along, and the rest flowed freely of its own accord. "In Klee's view, any play of rhythms set up by or made perceptible through the pictorial means, inevitably corresponds to some rhythm in nature..." (Haftmann, 1967)

Here, lines and dots acquire movement and start generating planar organisms that were earlier frozen upon the canvas. These translucent self-propagating veil forms fit into a rhythm established by the moving lines and dots. They scatter, split, unite; disallowing any formal constructive forms. Shapes in formation keep going into an endless loop, transgressive and mutating as though it were a live being changing and growing in an infinite manner
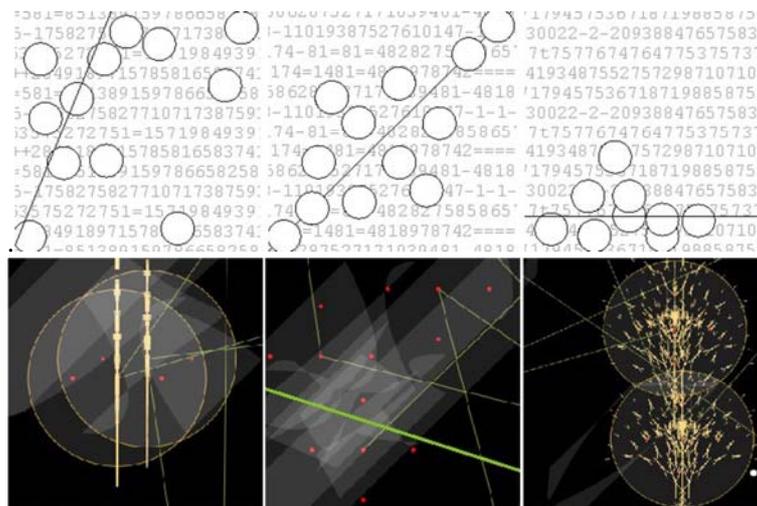

Figure4. Visual maps in formation-the endless iterations of leaf surface and veinal mosaic

2.1.2. Design by Numbers
"Design by Numbers? Numbers can't design; only Humans can!" (Maeda, 1999)

John Maeda (1999), in his book 'Design by Numbers', illustrates this new language- DBN. This fluid language in its very minimal mathematical style helps designers and visual artists to experiment with numbers as if they were pens and paints. It encourages exploring a different realm of drawing. "First, give every point on the screen a unique number. Now take that number and stick it into a formula; you'll get a result from the formula. Take that result and stick it back into the formula. Keep doing this and watch what happens to the numbers you get. Color each point based on what happens." (www.fractalus.com. 2004.)

Trying to combine between Klee's vision of illustrating nature and John Meada's designing through numbers, the intricate veinous anatomy supporting the leaf is experimented upon with numbers resulting in a plethora of points and lines that seem to shift away from the axis, at once loosing contact, and transforming into interesting mosaics that seem to trace

and re-trace, split and repel. The formations keep regenerating till the computation behind it is put to stop.

2.2. SOUND

Sound is defined as "a disturbance of mechanical energy that propagates through matter as a wave." (wikipedia.org)

Sound plays a major role in giving people a sense of direction. People identify spaces, events, and situations based on audio and visual symbols and signs that would trigger their memory. From the beginning of humanity people register sounds by the day; creating an aural archive that would be later on used to help them identify the space, or their mode of interaction. Nature has dramatically changed in concept, context and content. From the wild unaltered green forests to the industrialized mechanically operated concrete and steel jungle. "The twentieth century is, among other things, the 'Age of Noise'. Physical noise, mental noise, and noise of desire – we hold history's record for them." (Huxley, 2004)

Generally noise is defined as the "unwanted sound" or a "by-product of other activities." (wikipedia.org) But many visual and audio artists are looking more into the unwanted items, by-products and residues, and then create a whole new mode of perception for both the visual and audio culture. "Every manifestation of life is accompanied by noise. Noise is thus familiar to our ear and has the power of immediately recalling life itself." (Russolo, 2004) This would mean that noise doesn't eliminate us from 'nature' rather it engages us more to interact and give us space to reflect and recall previous archives of similar noises or events.

And this is one of the ambient music characteristics as Brian Eno said: "And immersion was really the point: we were making music to swim in, to float in, to get lost inside." (Eno, 2004a)

2.2.1. Brian Eno | Ambient Music
Brian Eno is an English composer, performer and music theorist. He sees himself as a "non-musician". Eno is well-known for circulating the term "Ambient Music". "Ambient Music must be able to accommodate many levels of listening attention without enforcing one in particular; it must be as ignorable as it is interesting." (wikipedia.org)

In his series of Ambient Music he explored his own perception of this emerging musical style. He composed pieces that are considered low-volume yet they will change the way people behave and interact in any given environment. In his manifesto of Ambient Music which he released with his first album of this series he said "an ambience is defined as an atmosphere, or a surrounding influence: a tint. My intention is to produce original pieces ostensibly (but not exclusively) for particular times and situations with a

view to building up a small but versatile catalogue of environmental music suited to a wide variety of moods and atmospheres." (Eno, 2004a)

2.2.2. Steve Reich | Pendulum Music

Steve Reich is an American composer that follows the concept of minimalism in his work.

One musical piece of Reich is "pendulum music"; that falls into another concept called process music which is a music that happens as an outcome of a certain process. The idea came to him while he once was swinging a microphone as a cowboy lasso. So what he did later on is suspending 3 or more microphones as pendulums using cables over speakers and then start swinging the microphones back and forth. This oscillating motion produced feedback tones that were recorded as "pendulum music". The microphones were only pulled back once to give them the first force to swing and then they were brought back to rest without any external force.

2.2.3. Concepts and Notions

Improvisation –"Is defined as the act of making something up as it is performed" (wikipedia.org) Improvisation is known in many forms of arts, whether music, theater, poetry and dance. Improvisation in art adds a new dimension to any art piece since it allows the audience to anticipate and think about what might come next rather than know exactly what is coming. "Improvisation tells us: anything is possible – anything can be changed-now." (Rzewski, 2004)

On the other hand it engages the artist more with his art piece since rather than being passively performing according to pre-determinate script, score or plot, the artist becomes actively thinking what next move he can take. This makes the creative process continuous yet instantaneous. Also there is a sense of playfulness in improvisation since this creative impulse is never static and the artist can amaze himself or the audience by doing something totally new.

Entropy – It is a concept in thermodynamics which describes how much energy has been exchanged in a system. Later on entropy has been used in other fields rather than physics like information theory. In information theory entropy is related the amount of information in a signal or an event. It also relates to the uncertainty of a system and how many probable outcomes of a certain event. Entropy is also connected with the measure of disorder of a system which again is derived for the duality between movement and equilibrium over the arrow of time.

In one of the experiments done by Brian Eno (2004c) he explored notions related to the concept of Entropy where he was looking into the idea of how a system can go from being random into a more balance [harmonic] state by

eliminating possibilities as the time progresses. Relating with the notion of entropy, you create a system and you put some controls on how this system should operate or perform but then there are elements of interaction that it is up to the performers, the environment and the interaction between different performers that will change the way the system would go about.

2.3. CHILDREN AND PLAY SPACE

"A child's play is his work" (Froebelweb.org). According to Friedrich Froebel, who started kindergarten; it signified a space for children to learn, observe and interact with nature. Education practices worldwide are now encouraging new models of learning within settings where children can learn through play activities and develop through interaction with others.

The Gurukul system in India is a type of ancient Hindu school that is residential in nature with the students and the teachers living in proximity. The 'Gurukul' is the place where the students reside together as equals irrespective of their social standing.

Eyck van Aldo –architect and designer from Netherlands has worked extensively on design of children's playgrounds. According to him the design of play objects should not only offer children new medium of play but, also take into account the visual qualities of the city. "… van Aldo was convinced of the "visual importance of the child in architecture', but above all in the total image of a city too" (van Aldo)

"There is substantial value in the exercises of the Kindergarten, which pleasurably bring out the active powers of the children – their powers of observation, judgment, and invention – and make them at once apt in doing as well as learning." (Froebelweb.org)

2.4. CHILDREN AND MUSIC

Children were always introduced to music in the classical way, where they were taught how to read notes, play an instrument and perform well. This process takes time before a child can actually have a sense of achieving something or even enjoy what he is doing in a playful mood.

Now, new ways of engaging children with music has been emerging especially with the advancement of technologies in computer software and hardware interface. The idea of engaging children more and transform what seems like a solo learning experience into a more conservational atmosphere where children can play with sounds together and produce music instantly according to their creative minds and imaginations.

2.4.1. Kids Digital Movement and Sound project | JPMorganChase

This project aims to introduce children to music and sound in a new way. To look at sounds as mediums or materials that can not only be heard but seen, touched and manipulated.

In this project, which is based in New York, USA children were introduced to new ways of dealing with sound. Children were encouraged to walk around and pay more attention to sounds around them, to play around with the environment around, look for sounds, and record them. This project also aims to develop social skills for children through engaging them, by working together, exchanging and sharing the sounds they are recording and creating.

Two of the sub-projects that were based on these ideas were:
- In a Walk Through Harlem; Children collected sounds from the environment and then modified them using some computer interface.
- Kids in (Sound) Space: Children used their bodies and moved to change certain qualities of sounds. Sound files that are recorded from everyday life are projected on a screen as moving balls and then children by moving their hands and bodies can alter these sound balls moving them in the space and thus modifying and playing around pitch, volume and tempo of the sounds.

2.5 INTERACTION IN ACTION

Based upon the idea of children's play and their medium of play within outdoor settings, this project explores a new dimension of playing. It combines the physicality of playing with sensory experiences to model a healthy and inclusive playground for young people, designed to assist in counteracting children's sedentary growing lifestyle. This playground brings the physical science and the creative act together to generate an interactive experience of the multitude at the same time. It addresses group dynamics to re-contextualize space and to map user navigation within a space.

We created an interactive learning environment within outdoor playground settings, exercising creativity and the physicality of playing. The re-mediated play space encourages better use of under utilized public space and desolate parks.

Figure 5: Conceptual images of the playground in relation to the urban fabric

The mobility of play with the pendulums encourages multiple points of interaction within the space. By creating a combination of a real object (pendulums) interface and the corresponding virtual effect of interaction with those objects, participants are able to observe themselves and others perform in a common space.

3. Installation

The engagement with the scaled model happens through fingers. The hands become a tool of interference. As they advance further and touch, they infuse the balls with kinetic energies that get translated into oscillations and collisions. At this point; the balls start getting activated into continuous play and rhythm, while the computers continue to design on the screen space.

The enclosed space comes to life with activity with the installation, as sounds and visuals fill the air in a response to play with the interface.
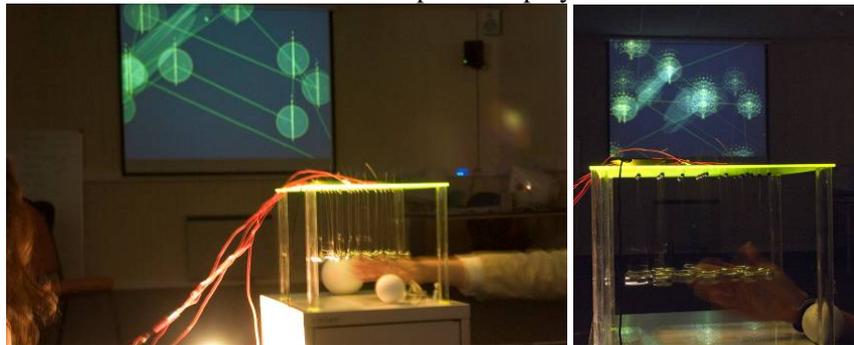

Figure 6: The Installation

3.1. THE PHYSICAL MODEL

In the installation- we made a 1:50 scale down model of the imagined playground (size- 15m x 15m). This prototype model dimensions is 30cm x 30 cm x 25 cm.

The device at a diminished physical scale makes it a ground for experimentation and spatial performance. By recording movements in real time brought about by human interference, tracking these with computer circuitry and programming makes the device live and receptive. The hitherto isolated pendulum interface acquires new relationships within the system and with the participant.

3.2. DIGITAL INTERFACE / TOOLS AND TECHNIQUES

What did we want to communicate from the physical world to the computer world? How did we want the computer to interact to the input? What interactions did we want in the physical world such that the computer could process them in real time?

To find answers to these questions and reach probable results we undertook several experiments with different hardware and software. Each of the experiments was an attempt at tinkering with interfaces, circuits and the subjects of the experiment. Reordering and making multiple versions of each of those experiments allowed for more play and manifold relationships between ideas and the computing environment. While gaining fresh insights into physical computing and the virtual world of the computer, helped identify the concepts of 'input' and 'output' and what makes an interface-Interactive; it was also important to describe the whole environment from the point of view of the person experiencing it and that formed a storyboard or a framework to write the computer program and build the circuits to make it happen as a sequence of electronically triggered events.

In effect, we had a system that could now communicate and react to the interactions in the physical world. Simplifying the tools further, allowed for more iterations on the concept without thinking about technology, hence breaking the project down into defined stages of 'input', 'output' and 'processing'.

3.3. CONCEPTUAL DEVELOPMENT

3.3.1. Nature and the leaf

For the visual creation we used the open-source programming language [Processing], which was able to transform the streamed input of numbers into corresponding visuals in real-time.

The processing environment has the ease and functionality to let non-programmers find their way around easily without getting into complex frills or syntactical rules, as with other object oriented languages such as JAVA or that in C++. Since it is developed by artists and designers, it has more flexibility and functions that make it seem closer to actual drawing and visualizing. "Computation is intrinsically different from existing media because it is the only medium where the material and the process for shaping the material coexist in the same entity: numbers. The only other medium where a similar phenomenon occurs is pure thought." (Maeda, 1999). Understating of primary trigonometric functions in relation to a circle helped in complex experimentation at later stages.

3.3.2 Audio; water and wind

The first exploration was to sounds related to nature and children in playgrounds. Then working the model interface, with the steel balls swinging and colliding; it triggered other qualities of sound that were short, snappy, sharp sound events.

The idea of layering was implemented where the first layer was actual real-time audio input of the model after being filtered and processed. Then comes layers of sound events; which were being triggered responding to each key ball. Hence the concept developed to create an environmental sound- which is related to nature since the audio input resembled sounds of water and wind.

When the installation was active, people were interacting with the model in different ways - trying to make the balls collide, playing with the strings attached to the balls, or hitting the balls from different angles. Since the basic layer of the audio output is derived from an input received from the balls in colliding and oscillating states, people were able to adapt to the system and make more conscious play or improvisations.

4. Learning Outcomes

Educational practices today are helping to transform the way people learn. New learning technologies are being experimented upon that involve interactive and imaginative activities in both indoor and outdoor settings. As we are now challenged with bigger issues ranging from environmental concerns (Global warming) to 'Brain-drain' in developing nations and many other pertinent matters local to every region, it thus becomes important that the children of tomorrow be made more aware and conscious of Nature and its various manifestations.

New digital technologies are now acquiring a fresh role to support these discourses and help in creating a learner-centered educational system. Virtual worlds, e-learning are now seen as synonymous to the 21st century school education and the world that lies outside of school. New methods within the curriculum are employing these digital tools to make younger people apply what they observe outside of school to their thinking processes within the classroom. The role of multimedia techniques also extends into group engagement and 'learning from others', in such a way that learning becomes fun and collaborative.

Nature replay is an attempt to address these concerns and engage children in a play-led educational activity. As a child's mind is always curious and more open, this therefore allows them a free and flexible platform to express themselves and reflect upon observation of their peers. As the project closely deals with Nature and its smallest manifestation-'the leaf', the outcomes have a direct relationship to what the children learn in their Science-Biology

lessons in school. It gives them a visual mode of expressing what has already been delivered through classroom sessions.

As with this being an outdoor activity, it can very easily be implemented into the sports, performing arts or a craft workshop thus building upon every individual's diverse strengths, interests, abilities and needs. It can be used as a stimulant to one's creative learning process outside the traditional mode of a more democratic way of teaching, which will in-effect encourage children to enquire and channelise their learning in the classroom more openly and fearlessly.

- This projects role also expends into social engagement, which brings children together in a shared activity. With the idea of their own movement represented on the screen opens them to interact more. As a group activity it encourages team-work and participation, which is an important factor in children's growth outside of school education. 'Learning by doing' gives them a better understanding of the subject and also helps in countering an otherwise sedentary lifestyle.

- As the project explores both sound and visual aesthetics derived from Nature, children are able to develop a deeper understanding of these two prime qualities related to their sensory perceptions of sight and hearing. As we grow older – we start becoming more and more immune to certain immediate sights and sounds owing to a plethora of noise and all other forms of visual media (like TV, Internet, billboards etc) that surround us as we go through each day. This project helps in finding that very primordial quality that is inherent in all of us but gets lost within the monotonous sonic and visual fields of a city.

- The system could be very therapeutic for children suffering with a range of conditions including elective mutes, traumatized children and those with cerebral disabilities. These special individuals cannot mix freely with the other children and they live a life of isolation and deprivation. As they are not exposed to the real world, they have fewer opportunities to acquire the skills of interaction and working together.

In order to fit in with the real world, education in some form is a must. A learning approach that is conducive to their development of special needs and the social and emotional skills therein. Motivation is a key factor and this has got to stem from within. To make that happen there has to be external motivation. Play is an important factor which children enjoy. The dual benefit of learning and having fun at the same time can be achieved. Creating sound and visual behaviors that these kids can relate to, that respond to their inarticulate gestures, something that they can personalize with; in an imaginary world that is only of these special children could bring about an 'ability in disability'.

SECTION X: Design Methods

4.1. MUSIC THERAPY

The healing power of music has been well-known and explored since ancient times. After the world war, music was used to entertain and relax the injured soldiers and veterans. And it affected the speed of their healing process and lifted up their spirits. After that Music, an established healthcare discipline came into existence.

Nowadays there are special schools and training courses given for a music therapist before they can start practicing. The role of a music therapist is to assess the physical and emotional health of any patient and then design music sessions which would be better suited to the patient taking into consideration the communication abilities and the cognitive skills of the patient. The patient can either listen to the music passively or can actually engage himself in making music.

Music can help ease the pain, calm or sedate and it can elevate the spirits of the patients, eliminate stress and tension which in return will help them get well sooner. And music as a therapeutical substance is powerful yet non-threatening unlike some chemical medicine.

4.2. VISION THERAPY

"Vision therapy -- a type of physical therapy for the eyes and brain -- is a highly effective non-surgical treatment for many common visual problems.
In the case of learning disabilities, vision therapy is specifically directed toward resolving visual problems which interfere with reading, learning and educational instruction…" (visiontherapy.org)

Vision therapy is closely linked to behavioral disorders that help in overcoming grasping and attention problems in children with low IQ and to increase responsiveness and treatment of learning problems. Many therapists are working closely with brain scientists to develop new research techniques that can be experimented upon children to gauge lateral thinking and to accumulate a better understanding of the brain and its two distinct- left and right side cerebral hemispheres. By studying responsiveness to visual exercises, scientists can record and analyze patterns generated on a graph which can therefore inform them more about Lateralization processes within the brain.

At the same time Visual or Art therapy is also being implemented in hospitals whereby patients are engaged in a therapy using Art materials and creating posters, postcards and murals for therapeutic effect. Using art as a creative language patients are asked to question and reflect upon their creation thus creating an avenue of exploration and personal insight.

Nature replay can be aimed to encourage a similar health benefit. Being closely linked to Art and nature, it is a relaxing, stimulating and imaginative

activity through which disabled children and those with other vision impairments can embark on a voyage of self-discovery and healing.

The future of learning is also closely linked to the architecture and interiors of school, and the communal spaces therein. Creating a learning environment that allows more interaction as opposed to a traditional row-by-row arrangement of desks is the first step towards changing the physical environment. For example- making children sit in circular hubs rather than straight boring lines will itself encourage more face-to-face interaction.
The next step is to generate workshop oriented activities, where children can be assigned roles and tasks, or any other activities that lay more emphasis on inter-personal skills. All these factors are now becoming important for a child's growth, and are being implemented at early stages for a well-rounded development of the individual.

As more and more schools are now becoming safe, secure and comfort zones; children are becoming rather inactive and introvert. While this maybe important in the current global context filled with terror and other social ill's, an effort should be made to counter problems arising out of this situation and to find avenues through multimedia techniques, flexible learning environments and DIY (Do-it-yourself) activities.

4.2.1 Case Study: Imagination Playground/ Rockwell Group and New York City Department of Parks and Recreation
Imagination Playground is a sculptured environment with features that children can manipulate, such as sand and water. In place of traditional fixed equipment are the raw materials of creativity and sensory exploration. Working with experts in the field, Rockwell Group and the city sought to enhance a child's play experience by creating a flexible armature for many types of activities. Imagination Playground will be a magnet for families from all the boroughs and a new community hub for Lower Manhattan. (imaginationplayground.org)

5. Conclusion

We feel that Nature replay is an ideal platform for children to stretch their imagination beyond the classroom. As children are now getting hooked to various other forms of entertainment, like Play-stations, Internet chatting, TV-channel surfing, Mobile messaging etc., it is retarding their learning process as well as awareness of the world at large.

As a result of these new entertaining gizmos and gadgets, the playgrounds are becoming desolate and are being rendered obsolete. Just as children are easily lured into virtual gaming and mobile dating, they have to be lured back into the playground. This project is an attempt at creating

another gizmo or play activity in that very communal space that encourages free play and makes every move an enriched experience.

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