EXPERIMENTAL GEOMETRY

Redefining way of design by human factor

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Abstract. Designing by rules and limitations can minimize the variations of design generation. The paradigm demonstrates how design concepts could be formed and produced by humans as an experience. A system, both digitally and physically, built as a spatial environment offers a tool to compare possible design products by people themselves. At the same time, it offers an opportunity to understand the implications of user interface and to compare technologies that further bridge the digital and physical. We also discuss conceptual foundations of the design process, interaction, collaboration, gamification, in an attempt to explore geometry and its potentials.

1. Introduction

"All forms are reflected to concrete coordinates of Euclidian world. In the nature these coordinates are not exist, there is not a stabile world. This is an abstraction, an unreality." (Zamyatin, 1920) Geometry is a creation to perceive the world, "creation of human mind." (Phaedrus, 274) A complete science of mind needs account for subjectivity, and consciousness. "All consciousness is perceptual … The perceived world is the always presupposed foundation of all rationality, all value and all existence." (Merleau-Ponty, 1964: 13) Relation between mind and body is the key to understand the environment, which is human experience.

The aim of this study is to outline a new approach to geometry and its generation. What is presented, is a paradigm of how the human factor as fundamental parameter during design process in order to generate design or environment based on general approaches, which is based on regular geometric shapes as a starting point. In this experiment, both digital and analog phases of installation were created as a game and also these phases
have similar layered surfaces that users may easily interact with, in addition to a tool connected to provide collaborative design opportunity to users.

2. Problem

Design is a process that is constructed with defined parameters and finalized with defined boundaries by the designer. However it does not reflect the general instability of the real world and its situations and is built with just controllable parameters. In this age, human interaction is central to our experience and, in many ways, is redefining it. It may open up new possibilities and potential, to handle design itself with definitions that allow flexible, changable surfaces to people not just designer. Notification of “people” is significant to understand the reason of searching new areas in design. In experience age also design should allow humanity in itself.

Experimental Geometry project is a way of design. The project was developed with feedbacks by group of a course community. At the beginning, several systems were developed to illustrate the problem. Feedbacks were led to create environment, and a game to compare with each other.

3. Methodology

This experiment focuses on issues and approaches based on the physical interaction between human and digital interface by the help of game console and intervention to physical environment by human. Experiment has two phases, digital and analog based on same fundamentals and created as a game.

3.1. DIGITAL PHASE: RHINOCEROS/ GRASSHOPPER/ ARDUINO/ FIREFLY

We are surrounded by technologies, options, tools that both are very complex and basic, therewithal continue to change and evolve. Thus, this experiment is required effectively real-time intervention to digital interface. Yet, there is a need for a tool, which could provide users as if they are playing games, at the same time getting command from people. Arduino is the one that is used to design a game console, which allows getting data real time to grasshopper code and direct connection to computer.

3.2. ANALOG PHASE: PHYSICAL ENVIRONMENT MATERIAL SELECTION

Main idea about physical environment is a space that is formed vertical surfaces facing each other and surrounds human. "Design process as a
function of knowledge and strategy."(Krishnamurti, 2006) The deeper the knowledge is, the more informed our design decisions become. And the richer a strategy is, the more alternative a design process generates. The notions of the rules and conceptual framework are the beginning structure of design process and human is the one who performs to produce unpredictable design outcomes. As a start, two steel rectangular, triangular grid surfaces are constructed. Specific, flexible rope is selected to make lines vertical, horizontal, diagonal to create patterns which is determined before for users. In this way, users could manipulate intersection points from one surface to other, then creates its own space.

4. Investigation

This study is started with curiosity for definition of geometry, its generations and interaction with human to produce designs.

4.1. GEOMETRY

Geometries are defined relationally with their points, sides, angles and relations. When geometries are defined with points, by overlooking sides, which are formed according to distance between points, and angles which are formed by two sides, it can be fundamentally defined.

With this way, just points in space, start to show different relations and with their coordinates, they start to define different types of geometries.

Figure 1. Point based definition. Figure 2. Sides created by points.

With defining points as nodes of geometries and taking ability of changing those coordinates and communicate with those points, new geometric definitions can be made and this can be called as “experimental geometry”.

Figure 3. Transformation of geometrical definitions by point.
4.2. PATTERNS & EXPERIMENTAL GEOMETRY

With experimental geometry approach, layers of geometries are created but those layers are hidden and with human interaction the system can construct the layers. So the experience with nodes, geometry might started to be defined as lines, surfaces, environments or points again. In a different term, system offers different forms of geometries at the same time only the result is shaped with experience.

![Pattern creations](image)

*Figure 4. Pattern creations.*

4.3. PROTOTYPE

For digital phase, game console is structured. It contains arduino circuit, between two acrylic glass. On front face of console, there are four bottoms, two potentiometers and one joystick. Console has usb connection to connect the computer.

![Console](image)

*Figure 5. Console.*

4.4. INSTALLATION & GAMIFICATION

The installation is prepared as a game that is experienced into two parts as digital interface and physical environment played as pairs.

Game has some basic rules: One of player use game console, the other interact with nodes of gridal surfaces in environment. Group players are selecting prepared cards that consist the commands, which players due to do their parts according to commands. But basically players start to pull and push the grid nodes according to commands. When the levels are done the geometrical environment that created by new nodes are analysed in grasshopper algorithm, and winner is determined by manipulation level. This way, it is considerable simple to compare, digital interface to physical environment with analog manipulation, also perceiving spatial to perceiving interface.
5. Discussion

In an experimental age, design approaches can also cover human experience; “humanity” under calculation system idea and it can generate possibilities from stable definitions to possibilities of experiment. Parametric design is a calculation system and it directs designer to search deeply on possibilities of environment with coming terms; input, output, operation, programmability. However, we reached the end to design with controllable parameters. As designers it is time to shrink back and allow people to experience, produce, manipulate design itself. *Experimental Geometry* is a design approach that found with this idea and focus on flexible, changeable, uncontrollable design process in the center of humanity. With this approach, the aim was to illustrate a system with experiment approach with new questions to overall design process. What is designer factor in an experimental design process? How people can be included design process? Which ways can be used to design something with people who are not designers? Now design starts to change and try to get used to new unfamiliar paradigms and designers are in a possibilities age. With calculation system in design, tools, approaches made rich design term and people not just designer will start to communicate with design language in this experience age.

6. Conclusion

Most of designers have the ability to determine design problems and to propose productive concepts. Yet, not collaborate with users directly. Conceptual descriptions set at the early stages of the design process are used
to frame some general design approach. Interpreting the process of the
design by human offers more variety and belonging. This approach allows
concepts and design artifacts to evolve in parallel. This study revealed some
of clear results about forming design and comparison between digital and
physical environment experiences. The success in the use of technology
consequently leads to the exploration of saving time during process
comparing to physically interaction to environment. To allow human
interacts to design during process with initial rules and shapes, it is
beneficial both designer and users. In brief, it is a computer supported
interactive and collaborative design process and gamification of the process
raises the progress.

The paper claims that defined geometry could be redefined and
reproduced if creations begin with point, basic element of geometry. This
way, new geometrical shapes and patterns could be formed.

Every research must get mature. Hence its first steps, creating more
problems than it solves and increasing more question than it responses.
Therefore, this researches answers some questions at the same time creates
more for further works. Comparison between digital interface and physical
environment, demonstrates both benefits and deficiencies. And interaction
with people in an entertaining way, absolutely abridge the time, increases
progress.

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