

THE EMERGENCE OF CREATIVITY IN DIGITAL DEVELOPMENT OF ARCHITECTURE

Cognition/society/culture approach

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Abstract. Research into the various forms and processes of creativity has been a topic of great interest in the design field for many years. However, most studies avoid questioning whether digital architecture is inherently creative in a larger social context. This study proposes to use the interacting creativity model of Csikszentmihalyi as the basic structure, to establish the major criteria of testing creativity in the digital era. There are two objectives: first, whether digital architecture can pass the test in society and culture to become an architecture that embodies creativity; second, to find out the role of digital media in Csikszentmihalyi's interacting creativity model.

1. Introduction

Research into the various forms and processes of creativity has been a topic of great interest in the design field for many years. Part of the view is personality (Simonton, 2000). Part of the answer is behavioral, including the extent to which deliberation and skill are involved (Amartya Sen, 1999). Amolst's researches confirm that creative activity includes motivation, persistence, originality and variation (Newell, Shaw & Simon, 1962; Gardner, 1988; Minsky, 1986). However, the understanding of creativity can't be achieved merely by surveying the process in design. Furthermore creativity is explained through the identity of social values and the whole creative preoocess (Boden, 1991; Kim, 1990; Sternberg, 1998). Mihaly Csikszentmihalyi (1988) comments that: "...creativity is necessarily an interaction, a dynamic, among three discrete constituents: the individual

blities, the particular domain and the field that collection of individual and institution.” Inevitably, this leads us to explore the relationships among creativity, society and culture and how they concurrently interreact today. One of the most important changes is digital media as it is used in the design process. With its development, architecture is recasting itself, becoming in part an experimental investigation of topological geometries, partly a computational orchestration of robotic material production and partly a generative, kinematic sculpting of space (Peter Zellner, 1999). These new forms and spaces manipulated by digital media allow architecture to become subverted in the design process and structure (Kolarevic, 2000). Not only do digital media support one kind of indeterminably animative design strategies in architecture, but it will also lead architecture to escape the limitations of traditional constraints. Nowadays, by means of digital media, architecture completely presents the unexpectedness, uncertainty and changeability in its design process.

1.1. CREATIVITY IN DESIGN

Research into creativity has a long history, and numerous fields have studied creativity (Gardner, 1988), including cognition, education, social science, culture study and computer science (Boden, 1991; Gero and Maher, 1992; Kim, 1990). Now, our apprehension regarding creativity remains limited and in the state of resembles broken knowledge. The general understanding of creativity is that it is novel, unexpected and valuable (Gero, 1996; Boden, 1998). Cognition categorizes creativity as the process of finding and solving problems (Newell, Shaw and Simon, 1962; Getzel and Csikszentmihalyi, 1976), and other research addresses the fact that creativity derives from Expert-knowledge and sensitive insights (Akin, 1990; Owen, 1992). In the early periods, some studies of creativity have tried to figure out the factors involved in increasing creativity; such as this studies are always about the new motivation stimulating personal attributes. Additionally, some investigations focus on evaluating new solutions during the design process (MacKinnon, 1962). Regarding design, creativity is not only incorporates new elements into design, but also generates unexpected results in surprising ways. Gero (1996) interpreted creativity as unexpected characteristics in the design process, and combined the evolutionary design using computers to develop the model creativity.

1.2. DIGITAL MEDIA IN ARCHITECTURE

The impact of digital media on architecture has significantly affected traditional values of architects, including both forms and methods of manipulation. New designers use computers, including Greg Lynn, UN

Studio/Ben van Berkel and Neil Denari. The buildings these new designers create are both physical and virtual all demonstrated that designers have already skipped over drawing with pens. Designers not only sketch the contours of their ideal design using a computer, but also establish the real space. Peter Eisenman (1999) has expressed in public that drawing merely reveals what the drawer already knows, but computers open new and previously unknown perspectives. Greg Lynn (1999) also considered computer systems to possess three basic attributes, namely difference from natural materials like paper or pen, typology, time and parameters. Digital media are not only a design tool, but also a thinking method for establishing a site for connecting people and computers, even a distributed computing environment (Anumba and Ugwu, 2002). In terms of computer applications, recently Frank O.Gehry and Peter Eisenman have been the famous architects in this domain, but they always use computers during the later stages of the design process, although not for the whole process. However, the new generation designers introduce computer software and hardware into the design process, for example: UN Studio/Ben van Berkel · Asymptote/Rashid+Couture · NOX · Neil Denari; and so on.

2. Problem and Objective

According to Mitchel (2003), media is absolutely related to creativity. ITCP (Information Technology and Creativity Practice) as well as the digital computers provide us with the means to express human creative capability to its fullest extent. Peter Eisenman (2000), in an interview on creativity, highlighted the new possibilities for creative thinking opened up by the unpredictability of computers and illustrated that computers can keep the thinking process, through the connection of memory to develop creative projects. Besides, digital media can be applied creatively to represent new methods, forms and concepts (Greg Lynn, 2001).

However, from the review of creativity, the development of individual intelligence is insufficient to explain the whole picture of creativity. Creativity must be tested by society and culture. Gardener (1998) has noted that creativity is capable of solving problems and producing. Creativity is controlled by one or multifarious cultures, including personal neurobiology, cognition and unindividual, and social psychology analysis. Creativity involves not only internal mental activities, but also that mental activity generated by a group of people (Gardener, 1993). Creativity is confirmed by the general culture context. Based on the theory of Csikszentmihalyi (1988) : a system of view of creativity which consists of the cyclic influences between three basic elements (person, domain, field) of the society.

Undoubtedly, true creativity comes only from passing the test of social values and related domain based on personal creativity development. Huang and Liu (2001) tested the unpredictability of computers as the crucial stimuli of creativity. Furthermore, their theory illuminated the fact that the characteristics of computers maintain the interconnection between concepts from different periods, which in turn suggests the potential creativity of digital architecture. However, most studies on creativity in designs focus on individual contribution, or that of the computational operation and media. By doing this, one avoids questioning whether digital architecture is inherently creative in a larger social context. If the answer is yes, only then can the so-called digital architecture be truly regarded as socially and culturally durable, rather than just a momentary trend. This will signify the genuine arrival of the era of digital architecture. If this is not the case, we need to consider how to improve the application of media in architectural design, perhaps by adding other elements, and therefore establishing a type of creativity in the discipline of architecture that would be acknowledged by society and culture. Therefore, the major problem of this study is that, in spite of most research having recognized that computers are the key to stimulating creativity (Boden, 1998), there are not experiments or papers to improve if these spaces subverted by digital media in the design process and structure are creative projects based on the perspective of social context. Moreover, the question arises of whether individuals who use computers to change design, such as Frank O.Gehry, creative designers? Exactly, where is the creativity in the whole social cultural identification? Finally, why are specific individuals labeled as creative?

3. Methodology

3.1. RESEARCH BACKGROUND AND ILLUSTRATION OF CASE STUDY

The studies of creativity can be undertaken from numerous different angles. In early period, psychologists generally arrange a phenomenon or result through case studies, interviews and testing. Cognitionalists then analyze human behavior by protocol and experimentation to study creativity. Moreover, computation applies the cognitive theory and model to create computer systems and media applications.

Because my research centers on social study and a large number of scholar like Gruber · Gardener and Csiksentmihalyi all use case studies to analyse creativity. This investigation used case study as its major methodology Based on the characteristics of creativity mentioned above, and also taking into the key points and mode of the case studies of Gardener (1998) on creativity, this investigation proposes six prerequisites for the existence of

creativity in digital architecture : 1. creativity must be novel and unexpected. 2. creativity involves lots of expert-knowledge and special insight in specific domains. 3. creativity is a kind of process to finding-problem and solving-problem. 4. creativity requires an unexpected result or answer. 5. creativity is something can drive the advancement of society and domain. 6. creativity must be able to be accepted by various domain and effect them. The preceding four prerequisites refer to individual attributes, while the others are subsumed to field and domain. Entering the six prerequisites into the theories (figure 1) of Csikszentmihalyi (1988) to study the interactive model of creativity, which consists of the cyclic influences between three basic elements (person, domain, field) of the society, one has to seek information relevant to each of the elements and analyze the phenomena and models related to the individual and interactive operations of all three axis, with which the criteria for examining the creativity of digital architecture could then be established.

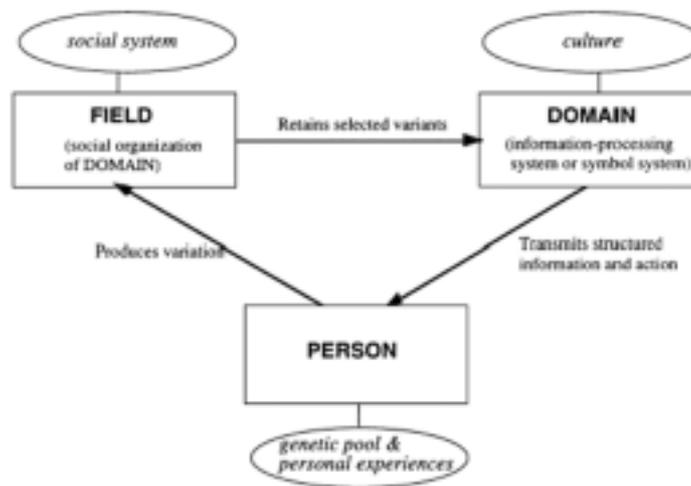


Figure 1. A system view of creativity. (After: M. Csikszentmihalyi, 1988)

Before presenting the case study, the reasons for selecting the subject case are briefly summarized. As Csikszentmihalyi (1996) expounded, “creativity”, as commonly used, is too broad in meaning including describing those who express unusual thoughts, those who experience the world in novel and original ways, and those who have changed our culture in some important respect. Because the last kind of creativity is by definition public and easy to write, this study selects Frank O. Gehry as the case. Frank O. Gehry is famous in architecture and adjusts contemporary architecture with digital

media. Simultaneously, based on Csikszentmihalyi(1998) stated "Time plays an important role in the creative process", I distinguishes the creative process in Frank Gehry into three ages, including 1924-1974、1974-1989 and 1989-now.

3.1.1. The Emergence of Individual Creativity in Frank Gehry (1924-1974)

Gehry's Childhood

Frank Gehry (1929) studied urban planning at Harvard University after graduating from the Department of Architecture of South California University in 1954. Gehry is of Canadian Jewish descent. As a child, Gehry followed his grandmother to the market every Thursday. After returning home Gehry would play with the fish that he brought from the market. On Friday the family would eat fish as required by Jewish tradition. This custom caused Gehry to be ridiculed. Later Gehry changed his family name from Goldbery into Gehry (the same with Picasso and Le Corbusier. They also changed their name.). However, the figure of the fish was planted deep in Gehrey's mind by his childhood experiences, and was internalized as part of his inner conception strongly with emotion, whatever the shapes of fish, the way they swam in the water or the various natural poses of them. Gehry once said when he ran out of thoughts, he would to draw pictures of fish swimming in the water to stimulate his own thinking. Gehry's sculpture of Fish in Barcelona demonstrates his fascination with fish, as do his works from 1983 to 1986, including lamps in the form of fish and snakes. Gehry's free and open architectural sketches can be attributed to his younger life, and prove the comment of Csikszentmihalyi (1996) said that the childhood experience of the creator exerted an essential influence on his work, with fish becoming the origin of his creativity.

The Expert-Knowledge

During his school years, Gehry admired Harwell Hamilton Harris and Rudolf Schindler, and also studied the works of Frank Lloyd Wright (1869~1959). Finally, Gehry recommended Le Corbusier (1887~1965) as the greatest architect of the 20th century. As common people, Gehry's first job was as a designer working in the office for clients, and he spent time studying the techniques of architecture expressionism and drawing perspective immediately after leaving school. During this period Gehry worked for a few famous American architects in the office, and thus became qualified as a professional designer. Gehry drew perspective exclusively for John Portman, who was with fame in the contemporary. The experience of Gehry's youth served as his professional training, Akin (1990) stated that the creator had to be qualified with professional knowledge.

Free sketches out of the designing of furniture

According to Gardner (1983) the thesis multiple-intelligences pointed that the creator occupied diverse talents; the theory also applied to Gehry, who engaged in sculpture and furniture design as well as architecture, which bring people accidentally supervising and exciting.

In the late 1960s. Gehry had the creative new idea of using cheap paper and glue to produce a piece of furniture, forming it sheet by sheet and eventually building it up to become very large and robust. Gehry used a knife to cut it into different shapes, such as tables, chairs, cupboards, doors or floor. This material was cheap and solid, and Gehry could finish all of the work, including design, testing and modification within a day. Moreover, the next day he could effectively work on another piece. This was the so called famous Easy Edge series of furniture. In the series of cardboard designing furniture, Gehry used a free curve, which he did not try to use in architecture, although this curve could only be used in 2D.

New material stimulating creativity

In 1961 Gehry opened his own office, but was not very productive (table 1). The buildings of Gehry tented to express modernism between the sixties and seventies. Gehry did not get identification in the architecture field though the commercial building Santa Monica Place was a successful example. Santa Monica Place was square, with a six story tall parking space, and the outside of the building was covered with a blue metal net with white letters, which frequently served as a fence around the playground in the elementary school, the innovation of using low priced iron was revolutionary at the time. Gehry's repeated use of low priced iron material for different works demonstrated that he was bold in experimenting with new materials, and simultaneously predicted that digital media inspired him to create numerous free sketches by using titanium in the future. *Gehry stated that "buildings under construction look nicer than buildings finished.....I love sketching and fall for the incongruous and illegitimacy system."*

TABLE 1. Projects (1929-1974)

Year	Age	Project	Location
1968-72	39	Davis Studio and Residence	Malibu, California
1969-73	40	Easy Edges cardboard Furniture	
1977-78	48	Gehry Residence	Santa Monica, California
1978	49	Wagner Residence (unbuilt)	Malibu, California

After the seventies, Gehry's work began to attract attention, starting with his design of his own house, which proved to be a turning point in his design career. Gehry gathered different materials, like iron board, iron net, wooden board or plywood, as different materials provided him with different stimulus; using various shapes and materials, Gehry developed his own presentations, working to a budget and schedule that was controlled entirely by himself. Gehry applied his thinking to his own house and concentrate entirely on his own demands, providing the creative thinking he pursuits in the future time.

3.1.2. The Process from Person to Field in Frank Gehry (1974-1989)

The system of creativity of Csikszentmihalyi demonstrates that fine art is influenced by its dispersed structure, and the field will have powerful effects. The field thus will repeatedly evaluate artists. Then, artists will be recognized as having social creativity. That is why artists and architects take longer to become famous than scientists. For example, Gehry was a no-body until his 40s. And only when he reached 50 years old did his remarkable house design Attract social attention. Although negative voices outweigh positive ones, Gehry has attracted public notice. Gehry did possess creative ability before he was 50 years old. However, Gehry initially was accepted by the field during this age. Occasionally, great creative reformulations appear to take place outside of all constituted field. Gardner (1986) makes this case for Freud. The experience of Gehry improves the theory of Gardner.

Fields of Accomplishment

In 1974, Frank Gehry got his first professional architectural honor. This honor sparked his recognition from the field, and made him conspicuous gradually in ten years (table 2). During the early 1980s, although Gehry had no idea of applying how to apply free-form to buildings, he progressively pursued free-form expressions. During this period, a new problem developed which prompted Gehry to trigger new creativity from building materials. The material factory, Formica, invited Gehry to participate in the design competition by using a new material, known as "Color Core". Unintentionally, Gehry broke his lighting design, which made from the new material. Gehry unexpectedly discovered the beauty of fragments with irregular edges. Thus, Gehry collected these fragments to make his famous fish lamps (1983-86). During the fish period, beside fish lamps Gehry gradually figured out how to use specific materials to create a three-dimensional twisted curve by making lamps shaped like snakes, eagles, and octopuses, even crocodiles.

The new and adventurous direction Gehry was taking accidentally matched contemporary developments during the 1980s. Gehry began to build around

the U.S., Japan, and even Europe. Every country began to take notice of this illustrious architect. During the mid-eighties, Gehry completed more than 100 projects. Considering not only work, but also press news reports, no one can be comparable with Gehry. Including the result of investigation, there are 57,300 related data, which can be searched on Internet. Some 30% of these data come from personal web sites devoted to Gehry. Moreover, a further 40% are individual pages that belong to some big entrance sites. The remaining data deal with Gehry or projects of his that are mentioned verbally or on bulletin boards. Compared to Peter Esinman (31,000 related data), far more data exists on Gehry, both in quantity and percentage terms. The media contains at least one news report each month on Gehry, and these stories appear in various languages and countries. Therefore, Frank Gehry undoubtedly can win contemporary recognition as a creative architect. Furthermore, the impact of digital media is the pivotal factor forcing Gehry into the peak of his design life. Consequently, this study minutely discusses the digital media, which impacted Gehry’s creations, by following design cases.

TABLE 2. Award and Honors (1987-1989)

Year	Age	Award and Honor	Sponsorship
1974	45	College of Fellow	American Institute of Architecture
1977	48	Arnold W. Brunner Memorial Prize in Architecture	American Academy of arts and letters
1987	58	College of fellow	American Academy of arts and letters
1987	58	Honorary Doctorate of Visual Arts	California Institute of the Arts
1987	58	Honorary Doctorate of Fine Arts	Rhode island School of design
1989	60	Pritzker Architecture Prize	Hyatt Foundation

The motivation of digital media

Around the period of designig the Walt Disney Concert Hall (1989-2003), Gehry had already extended his prominent fish lamp to architecture. In 1986, Gehry produced a three-stored class sculpture located in the Walker Art Centre in Minnesota. The following year, Gehry undertook an 8-floor sculpture, made by metal nets, located beside the “Fish Dive Restaurant” in Kobe, Japan. Later, in 1987, Gehry produced a meeting room for the Chiat/Day. This meeting room was shaped like a fish abdomen, being some 18 meters in length and is covered with scale-shaped and galvanized sheetmetal. Inside the abdomen, a fishbone-like structure made from wood. In 1992, Gehry designed a colossal landmark in the form of a metal fish at the

Olympic village in Barcelona, Spain. The sculpture structure was made from punched sheetmetal, and was 54 meters in length, and around 12-floor height. In this case, Gehry first utilized the CATIA software, developed by Dassault Systems, to assist in the fish-shaped design. (Digital media lead to new motivations). At this moment, owing to the new stimulation from digital media, Gehry propels his personal creativity into new unexplored directions, and he achieves the highest value from the field.

In 1989, Gehry turned 60 years old and was awarded the highest honour in architecture, the Pritzker Architecture Prize. The unique design style of Gehry got the cheers of field. Since 1990 Gehry has received millions of awards. In 1997, the Guggenheim Museum Bilba, opened in Spain, and became the most famous building to be designed by Gehry. When it was contributing, Gehry looked at the building and praised it, saying: 「 my curve, my curve, I drew that 」 . In this case , Gefry used rare metals- titanium to cover its surface. This material (0.38mm in thickness, 60cmx90cm in size) is expensive. However, since Titanium is lightweight and requires little bracing, the total construction fees are actually cheaper than for using other types of sheetmetal. The success of Guggenheim Museum Bilba is ascribed to the streamline form created by CATIA (a software). The success of the design also derives from the local iron and steel. Digital media have been demonstrated to critically affect the creativity of Gehry.

3.1.3. The Process from Field to Domain in Frank Gehry (1989-now)

The blossom of Digital Architecture

In 1979, Gehry began to teach design at Yale. From 1979 to 1999, Gehry taught in four architecture programs at well-known universities, taking up both short-term and long-term teaching positions (table 3). Gehry currently contributes his expertise to the domain of architecture, to which he belongs. However, what Gehry mostly loved do still are building architecture. Some reports indicate that Gehry's projects have gradually increased since 1989. Some of the projects include multi-national cases. When he achieved a project, there are many publications to report his new project in that moment, in that place, and even in the world. For example, the Apple computer, which is well-known for its design, utilizes an excellent advertisement, where a portrait of Gehry is displayed alongside the slogan "think different", to demonstrate that the Apple brand perfectly embodies the original design of Gehry (figure 2).

TABLE 3. Teaching (1989-now)

Year	Age	Teaching Position
1979	50	The William Bishop Chair, Yale University
1982	53	Charlotte Davenport Professorship in Architecture, Yale University
1984	55	Eliot Noyes Chair , Harvard University
1985-89	55-60	Charlotte Davenport Professorship in Architecture, Yale University
1996	67	Visiting Scholar, Federal Institute of Technology, Zurich
1998	69	Visiting Professor, University of California at Los Angeles
1999	70	Charlotte Davenport Professorship in Architecture, Yale University



Figure 2. Think different (after gehry talks, 2002)

Gehry has not only influenced architecture. Gehry's buildings resemble a declared label standing in different countries. Continuous free curves have altered our vertical and horizontal landscape established from modernism. It also changed the human sensation in space. In 1999, Gehry was awarded the AIA Gold Medal, the best honour in America. At that time, the creativity with a capital C that Csiksentmihalyi indicated in Frank Gehry had circulated in the system of creativity because of digital media. The fluid design process, from calculating and evaluating the design model using CATIA (a computer software) to assessing a price and construction via BOCAD (another computer software), propelled Gehry's rise to prominence. The phenomenon of Gehry not only affected architectural culture but also has changed the world we live in.

Additionally, the influence promoted the designer’s intellect and led to a host of followers, such as Greg Lynn 、Mokoto Watanabe 、UN Studio/Ben van Berkel 、Asymptote/Rashid+Couture 、NOX 、and Neil Denari. Although the design procedures and results of these followers differ from those of Gehry, they resemble Gehry in the way they break traditional forms and create the experience of free space using computer-aided design. Digital media motivate architectural changes. New creators have absorbed new knowledge from the changed domain and combine individual innovation and other new motivations to produce new creations.

4. Some phenomena in the systems view of Frank Gehry’s creativity

In sum, since 1986, digital media have transformed Gehry’s design process and method, which is the best reflected in a visible departure from his past work, marked by remarkably freer forms. This underlines the birth of a personal creativity. On the other hand, Gehry has received numerous prestigious awards and commissions in this phase of his life, including the Pulitzer Prize in Architecture in 1989 and the commission to design the critically acclaimed Guggenheim Museum in Bilbao, Spain, which opened in 1997. One could say that Frank O. Gehry has pushed the architectural tradition into a new era, in the form of a creator, which has attracted numerous followers while winning the approval of society. In examining the forming of creativity using the person-domain-field model of Csikszentmihalyi, the work of Frank O. Gehry not only qualifies as a creative entity, but also highlights the significance of digital media in contemporary. Table 5 lists some phenomena of creativity in Frank Gehry, as follows:

TABLE 5. Some phenomena of creativity in Frank Gehry

Some phenomena of creativity in Frank Gehry	
PERSON	<ol style="list-style-type: none"> 1. Owning multiple intelligences. 2. Childhood experience becoming a source of creativity. 3. Possessing a lot of expert-knowledge. 4. Facing predicaments that are not recognized by field in young age 5. Breaking with tradition and trying previously untested methods. 6. Novel and unprecedented design.
FIELD	<ol style="list-style-type: none"> 1. News reports on professional media including TV, magazines and books. 2. Appreciation from competitions. 3. Individual exhibitions and participation in exhibition organization. 4. By combining new media-CATIA to create the sculpture of Fish in Barcelona, Frank Gehry produced something creative and unprecedented. 5. Financial support and rewards.

DOMAIN	<ol style="list-style-type: none"> 1. The emergence of free form. 2. Producing organic architecture and landscape building. 3. Government promotion 4. Teaching in academic institutes and thus influencing new designers. 5. Greg Lynn, Mokoto Watanabe, UN Studio/Ben van Berkel, Asymptote/Rashid+Couture, NOX and Neil Denari created new architectures in form, design process and construction. 6. A lot of digital media courses in universities
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Restated, through understanding the flows of Frank Gehry in the system of creativity developed by Csikszentmihalyi. This study first induces the facts in Person, Field and Domain (Table5), and expounds the importance of digital media in the creative process. In terms of the phenomena in individual person, the creativity of Gehry during his early age was derived from childhood cultivation, just as in all other creative individuals. Gehry tried to test the free curves he loved through different materials. However, only when Gehry began using computers did digital media make his free forms practicable. Gehry also was recognized by the field. From the person to the field, digital media changes architecture. Because of Frank Gehry, the traditional field began to accept a new aspect or new form and overthrow the original standers. Considerable research has studied the influence of digital media in architecture, mostly focusing on the changes in architecture via the new media. New media as a new motivation I meant has appeared constantly in the case study of Frank Gehry. It proves that: 1. New digital media is important. 2. It must be related to the creativity in social context.

5. Conclusion

The introduction of computers to the design process has multiple impacts on architecture. Sasada (1999) emphasized the importance of computers as a powerful medium, and separated their application to design into three levels. Initially, computers were merely used as a presentation tool, mainly because their manipulation was time-consuming and did not help designers with their thinking. Later, computers came to be regarded as new media for developing design in thinking process. Designers use the computational powers of computers to aid in communication, evaluation, and representation in design process. Furthermore, computers become the core in the design and conceptual process. Without computers, the special concept or free forms built by Frank Gehry could not have been produced. Sasada's theory is the same as that of Liu (1996, 1997, 2001). Liu pointed out that the role of computers in design creativity has translated from being a tool, for example in image processing, 2D drawing, 3D model, animation and multi-media

representation, to become a new media of design thinking. Computers had been involved in human behavior and cognition. Recently, computers have affected the creative stages of design because of the complete architecture created by Frank O. Gehry and Peter Eisenman.

Mitchell(2001) has said of Gehry's projects : "He has created a powerful new architectural language of computer-constructed curved surfaces... ". This investigation tries to study Frank Gehry as the case and surveys the source of his creativity. Digital media appear to play a role in promoting creativity in creativity model of Csikszentmihalyi, and indirectly let the field and domain recognize Gehry as a creative designer. As a result as follow:

- Individual creativity may come from many different motivations (stimulus). When motivations become stronger, the range affected by the motivations widens. However, the revolutionary creativity in humans must occur by a special new motivation. This motivation affects not only the individual but also the social context. Then the human culture significantly changed.
- In terms of time, although Csikszentmihalyi illustrated that "time" is important in creativity and affects the field and domain, he did not note when time passed, there are something new to motivate creativity. The motivation may come from another domain, but a new aspect for the original domain. Therefore, the motivation inspires reformation from person to field and domain. In this study, digital media impacted the architectural domain to change its forms, design process and materials after the period of modernism. Currently, I feel that architectural creativity yields positive results owing to the effect of digital media. The gradual change in architecture from the CAAD started in 1960s. Through the development of digital media over the past 50 years, the individual creativity of designers such as Frank Gehry or Peter Eisenman has becomes the social, capital C (Creativity) via the model of Csikszentmihalyi.
- The researches proves that the motivation as digital media is the key source of creativity. Digital media influences individuals first, then influences the field indirectly when the person goes to the field. The goalkeeper accepts the creativity more easily if the motivation has a greater effect. Owing to the feedback from the field, for example museum exhibitions and media reports, the creative person matures gradually throughout the social context and affects the domain. Meanwhile, the domain accepts the field effect directly and the digital media effect indirectly. The domain started to learn new things and changed existing knowledge. Then the new creator was born, he learned new knowledge from changed domain. The circle of creativity is running and running.

- I The theory of creativity in this study is summarized in the following formula:

$$\text{New motivation} + \text{Old domain knowledge} = \text{Personal creativity} \quad (1)$$

After the lowercase C enters creative system, it becomes the capital C mentioned by Csiksentmihalyi. The capital C will grow dramatically in some period.

6. Significance: the future sight in digital architecture

The study of creativity is essentially interdisciplinary, venturing into sociology and the cognitive sciences. This paper demonstrates two facts: first, it confirms that creativity in architecture is truly valuable in the digital age; second, it proves that in the digital era, individuals, cultures and societies are all impacted by digital technologies. However, digital architecture is still constantly evolving. The future of digital architecture might lead to significant new developments that we are currently unaware of, which is one of the limitations of this study. Also, the limited number of case studies inevitably creates bias. The creativity of Frank Gehry in sociology aspect has been clear because of my inference. Another factor- motivation besides the three elements Csiksentmihalyi bring up has been emerged. In this case it is digital media. Further studies will need to verify with more cases and also to seek more data from different domains. Such approaches can further the role of motivation in creativity.

Nevertheless, the importance of this thesis lies in its confirmation of the significance of digital media in architecture. In the future, with the introduction of various new technologies, the fundamental mission of architecture will be to resist superficial presentations of media, and to create works that are genuinely relevant to the time.

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