



THE CHARACTERISTIC OF THOUGHT OF DIGITAL ARCHITECTS

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Abstrak

Kertas kerja ini bertujuan untuk mengkaji ciri-ciri pemikiran 3D arkitek digital dengan menggunakan kaedah analisis kandungan. Pertama, kami menentukan dua faktor: teori interaktiviti dalam media digital dan kajian pemikiran awal mengenai imaginasi. Faktor-faktor ini ditetapkan untuk menganalisis maklumat yang heterogen pemikiran 3D arkitek digital. Seterusnya, kajian yang dijalankan melalui laman web rasmi dan sumber Internet lain yang telah menerbitkan pernyataan-pernyataan dari empat tokoh popular dalam seni bina digital 3D: Frank O. Gehry, Zaha Hadid, Daniel Libeskind dan Thom Mayne, yang kemudiannya dianalisis melalui dokumen analisis. Kajian ini memperkenalkan ciri-ciri pemikiran arkitek digital; ciri ini menuntut penglibatan maya dan imaginasi. Hasil kajian ini akan menggalakkan arkitek digital untuk mengarahkan ciri pemikiran mereka ke arah maya dan imaginasi.

Kata Kunci: Ciri-ciri Pemikiran, Arkitek Digital, Penglibatan maya, Imaginasi

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Abstract

This paper aims to study the characteristics of thought of 3D digital architects by using content analysis. First, we determine two factors: the theory of interactivity in digital media and the study of early thoughts concerning imagination. These factors are set in order to analyse the heterogeneous information of the thought of 3D digital architects. Next, a survey is conducted through the official website and other Internet resources that have published comments of four popular figures in 3D digital architecture: Frank O. Gehry, Zaha Hadid, Daniel Libeskind and Thom Mayne, which were then analysed through content analysis. This study introduces the characteristic of thought of 3D digital architects; this characteristic demands the engagement of virtuality and imagination. The findings of this study will encourage digital architects to direct their characteristic of thought towards virtuality and imagination..

Keywords: Characteristics of Thought, Digital Architect, Engagement of Virtuality, Imagination.

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1.0 Introduction

What is the characteristic of thought of 3D digital architects, particularly in terms of what encourages their creative process?

Designing with computer-aided design (3D digital simulation) programs contributes to the simulation, generation, and optimization of the design (Radford and Stevens, 1987). The role of simulation and generation is closely associated with the qualitative improvement of imagination and creativity. In *Being Digital*, Negroponte (1995) points out that the digital process allows a process which can be a fantasy and ecstasy of the mind. Janet Murray (1997) also emphasizes such feelings by identifying 'three key pleasures' which are uniquely engaged within the virtual reality simulation: immersion, rapture, and agency; these pleasures produce the sensation of 'being there' or 'being pulled inside' on an interactivity level in the field of digital media.

3D digital architecture is assumed to correspond to the engagement of immersion, rapture, and agency (the theory of interactivity in digital media) which suggest a 'different reality'. The theory of interactivity in digital media does not pinpoint the characteristic of thought; instead, it is concerned with the feeling of simulation. However, it is possible to connect this theory to the study of early thoughts in imagination in order to introduce the various categories of the characteristic of thought.

Studies on early thoughts in imagination seem also to correspond to the engagement of virtuality and imagination in 3D digital architects. As Plato states in *The Republic* (380 BC), a knowledge of art takes advantage of the imagination. The philosophers and intellectuals who followed and who were concerned with the imagination, such as Aristotle, Bacon, Kant, Sartre, Jung, and Antoniadis, pointed out the need for the 'engagement of virtuality' and 'imagination' to bring about a more creative imagination.

2.0 Characteristic of Thought of Digital Architects

Apart from being a tool for digital reproduction, digital design technology helps architects create non-standard characters in new forms. It is interesting to note that the characteristic of thought of a digital architect, which was made possible by the role of digital design technology, led to a different characteristic of thought which produced such a different design style.

Many studies try to capture creativity in design through a problem-solving framework. In contrast with the goal-oriented, problem-solving framework to define creativity in design, Taura and Nagai (2008) focus on the notion of 'something', which not only underlies the designer's thought deep in the mind but also governs it; when a design idea is generated (pulled) externally by a goal, it is





called a 'pull type', while when a design idea is created (pushed) which does not necessarily have a goal that the design idea should satisfy, it is called a 'pushed type'. The characteristic of thought referred to in this study is more akin to the 'pushed type', where architects enter a mental state and are deeply absorbed when they are engaged in their work, known as 'flow'—a state of concentration or complete absorption with the activity at hand and the situation (Csíkszentmihályi, 1996). According to Csíkszentmihályi, flow is a completely focused motivation. It is a single-minded immersion and represents, perhaps, the ultimate force in harnessing the emotions in the service of performing and learning. In flow, emotions are not just contained and channelled but are positively energized and aligned to the task at hand. Entering a flow is characterized by a feeling of spontaneous joy, even rapture, while performing a task (Goleman, 2006).

Here, we may note some keywords when designers or architects engage in their work 'flow'—the state of concentration: joy, immersion, and channelled emotions. This flow of 'pleasure' is what digital architects possibly derive from computer-simulation interaction as a characteristic of their thought. Negroponte (1995) believes that the digital process is that which allows the process, which can be a fantasy and ecstasy of the mind, to be conveyed. In addition, Janet Murray (1997) emphasizes those feelings as a property of digital media which can be divided into three key pleasures—immersion, rapture, and agency—and are uniquely engaged within the virtual reality simulation. Immersion is the sense of being transported to another reality; rapture, the attachment to the objects in that reality (addiction); and agency, the player's delight in having an effect on the digital world. The sensation of 'being there' or 'being pulled inside' becomes tightly connected to the interactivity level in the field of digital media (Platt, 1995). As Platt points out, the interactivity between a user and computer enriches the virtual experience, thus creating a new character. It enriches the imaginative experience and introduces a new, unique character that strongly presents a non-standard form of digital architectural design.

3.0 Aim

This study aims to study the characteristic of thought of 3D digital architects. The study will survey four popular figures in 3D digital architecture by using the Internet, and will perform content analysis on the basis of two factors: the theory of interactivity in digital media and the study of early thoughts in imagination.





4.0 Methodology

This paper is not intended to discuss the technical issues related to digital simulation technology. This paper studies the characteristic of thought of 3D digital architects through content analysis. The method comprised the following steps:

Step 1. Conducting an Internet survey of four popular figures in 3D digital architecture by investigating their comments through content analysis: The comments are obtained from their official website and other websites which publish the architects' comments.

Step 2. Extracting two factors to be used as categories in order to study the characteristic of thought of the 3D digital architects: The two factors are the theory of interactivity in digital media and early thoughts in imagination.

Step 3. Studying the characteristic of thought of the four popular figures in 3D digital architecture on the basis of the two extracted factors which have been obtained in Step 2.

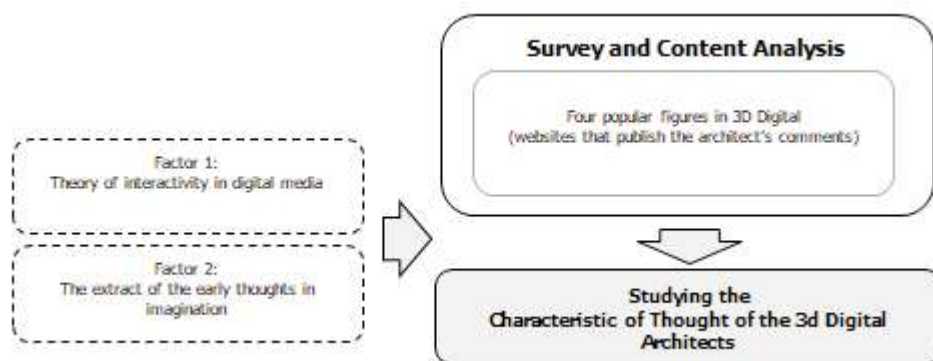


Figure 1: Research Framework





5.0 Procedure of Survey

5.1 Selection

The Four architects were selected on the basis of their pioneering and consistent contribution to design practice, which uses 3D digital design technology, as well as their distinguished works that classified in characteristic of digital architecture.

5.2 Method of Content Analysis

To analyse the characteristic of thought of a 3D digital architect, we first determine the characteristic of digital architecture by referring to prior studies on the classification of the characteristics of digital architecture (Ali and Brebbia, 2006; Chun, 2010). Second, we conduct a survey of four popular figures in the world of 3D digital architecture through the Internet. Third, content analysis is performed through a survey of their comments which are related to their thoughts on their 3D digital architecture works. The comments are obtained from their official website and other websites that publish the architects' comments. Finally, the data is analysed by finding a conformity of the 3D digital architects' comments with the two factors in order to determine the characteristic of thought of a 3D digital architect.

6.0 Survey of 3D Digital Architects

6.1 Characteristics of Digital Architecture

The terminology of digital architecture refers to the aspects of architecture which feature digital technologies. Computer modelling simulation is used to create virtual forms. One of its typical forms is the non-uniform rational basis spline (NURBS): a mathematical term commonly used in computer graphics for generating curves and surfaces which offer great flexibility for the creation of free-form shapes. Computer modelling allows complex calculations which delimit architects and allow a diverse range of complex forms to be created with great ease using computer algorithms (Chun, 2010). Typically, digital architectural designs are produced with a particular expression such as fluid, morphosis, and liquid (Novak, 1991). Chun (2010) analyses some papers on digital architecture and classifies the characteristics of digital architecture as immateriality, interactivity, non-linearity, liquidity, and hyper surface.





Table 1: Characteristics of Digital Architecture,
Source: Jae-Hoon Chun (2010)

Characteristics of digital architecture analysed in previous studies					Classified characteristics of digital architecture
Kim & Jung (2001)	Huh (2001)	Im & Lee (2002)	Yeo (2003)	Kang (2005)	
-Immateriality -Discontinuity	-Immateriality		-Immateriality	-Immateriality	→ Immateriality
-Interactivity			-Interactivity		→ Interactivity
	-Nonlinearity	-Nonlinearity -Non-hierarchicality -Networkability	-Decentralization -Nonlinearity -Multi-linkability	-Decentralization -Non-hierarchicality	→ Nonlinearity
-Liquidity		-Hyperspace -Variation		-Liquidity	→ Liquidity
	-Hypersurface	-Hybridization	-Non-boundary -Hybridization		→ Hypersurface

These classified characteristics imply a non-standard concept of architecture which a subject can grasp as the freedom of imagination as a digital architect. The terms immateriality, interactivity, non-linearity, liquidity, and hypersurface most specifically define the 3D digital architects Frank O. Gehry, Zaha Hadid, Daniel Libeskind and Thom Mayne.

6.2 A 3D Digital Architect

The term '3D digital architect' does not necessarily imply an architect who directly uses a computer. Gehry, Hadid, Libeskind and Mayne begin with manual sketches, but they intensify the use of digital media technology in the whole process of their design.

Frank O. Gehry

Gehry is a Canadian American Pritzker Prize-winning architect. He became known for massive, iconoclastic projects which attracted attention and controversy. Many buildings by Frank Gehry have become tourist attractions. Much of his work falls within the style of Deconstructivism, which is often referred to as post-structuralist in nature owing to its ability to surpass current structural definition. His thoughts on Deconstructive structures indicate his detachment to the universality of form or disapproval of form which follows function.





He uses digital media technology extensively to support his design process to produce complex form and building construction systems. The computer modelling successfully translates Gehry's free-form sketches from model to completion. His most iconic works are the Guggenheim Museum in Bilbao, Spain (1997) and the Walt Disney Concert Hall in Los Angeles (2003).

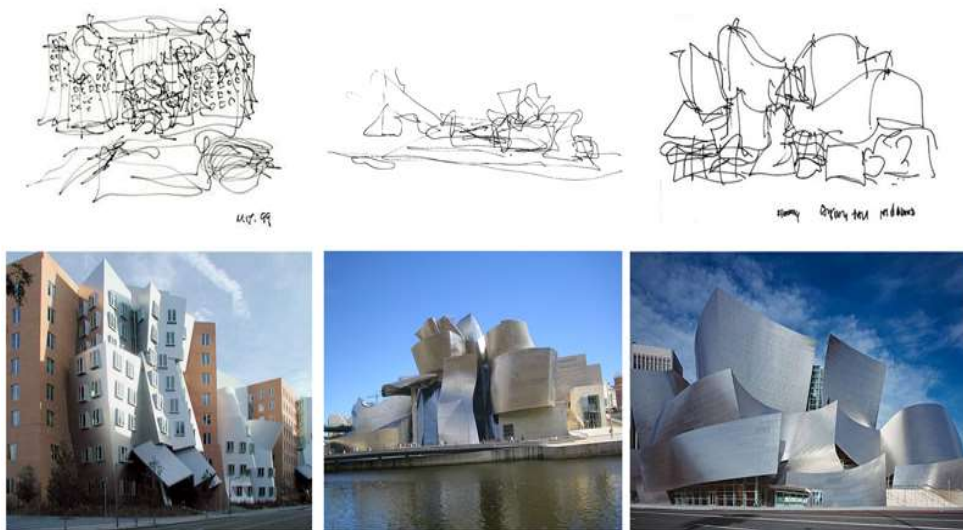


Figure 1: Gehry's sketch and the MIT Stata Center, California (left); Gehry's sketch and the Guggenheim Museum, Bilbao (middle); Gehry's sketch and the Walt Disney Concert Hall, LA (right)

Source: <http://www.sonyclassics.com/sketchesoffrankgehy/> & www.foga.com

We collected some of his comments through an Internet survey and from official websites that publish his comments and works. The data was sorted according to comments related to his thoughts and passions.

"I approach each project with a new insecurity, almost like the first project I ever did. And I get the sweats. I go in and start working; I'm not sure where I'm going. If I knew where I was going I wouldn't do it. When I can predict or plan it, I don't do it. I discard it. So I approach it with the same trepidation" (Gehry, 2002).





"I want to be open-ended. There are no rules, no right or wrong. I'm confused as to what's ugly and what's pretty" (Kasparowitz, 2009).

"Creativity is about play and a kind of willingness to go with your intuition. It's crucial to an artist. If you know where you are going and what you are going to do, why do it?" (Pollack, 2006)

"Imagination is your only limitation" ("Views of a Vision: A Jim Rouse and Frank Gehry Collaboration", 2008).

"You've got to bumble forward into the unknown" (Pollack, 2006).

"What bugs me are these goddamn rules" (Pollack, 2006).

"All an architect can do is to be optimistic about how a building interacts with the surrounding buildings. It can be a passive player, it can be a stoic player, or it can be a passionate player" (Pollack, 2006).

"I'm always scared that I'm not going to know what to do and I do my best work when I don't know anything about it" (Pollack, 2006).

"I am always insecure. I am never in my mind guaranteed that it will be a good building" (Gehry, 2006).

"We need to allow for intuitive impulses that are very informed. What enables you to find the cure for cancer is not to follow steps A, B, C...Some accidental thing in the laboratory will happen... You follow your intuition, it is an informed intuition, and you have the Eureka moment...For me, if I knew in advance where to go, I wouldn't go there" (Gehry, 2006).

Zaha Hadid

Zaha Hadid has the distinction of being the first woman to be honoured with the prestigious Pritzker Architecture Prize. A winner of many international competitions, she is a theoretically influential and groundbreaking architect who is famous for the organic or curvilinear form. Hadid was one of the key protagonists in the field of radical conceptual architecture. The importance of her contribution to the culture of architecture lies primarily in a series of momentous expansions—being as influential as radical in the repertoire of spatial articulation available to architects today (Schumaker, 2000). Hadid intensifies her exploration of dynamic and organically integrated complexity.





Zaha Hadid frequently uses special terms to describe her thoughts and works (Schumaker, 2000). Some of the important terms are 'abstraction', which implies the avoidance of familiar, ready-made typologies; 'analogies', which are fantastic engines of invention of tectonic and organic systems; and 'surrealist mechanisms', which refer to the dynamism and fluidity of her calligraphic hand to directly create equally fluid tectonic systems



Figure 2: Hadid's sketch & the Phaeno Science Center, Germany (Left); Hadid's sketch & the Pierres Vives Building, France (Middle); Hadid's sketch & the Museum of XXI Century Arts, Italy (Right)

Source: <http://www.zaha-hadid.com> (2011), Sketch courtesy of Zaha Hadid (2011)

Through this survey, some of her comments explaining her thoughts and which refer to her use of the terms 'abstraction', 'analogies', and 'surrealist mechanisms' are collected (Schumaker, 2000; Hadid, 2011).

"There are 360 degrees, so why stick to one?" (Broadbent, 1991).

"...experience the object has to excite curiosity and desire. A considerable degree of strangeness is indispensable. The project - like any true object of desire - will at first appear mysterious, an unknown territory waiting to be discovered and explored" (Hadid, 2002).

"...all conceivable constraints into new possibilities for space" (Hadid, 2011).

"Abstraction opened the possibility of unfettered invention" (Schumaker, 2000).





“Do the design maneuvers gain enough fluidity and freedom to play” (Hadid, 2011).

“Playfulness allows experimentation. At the same time, it acknowledges reason. It accepts that at one point...it will be integrated into the structure of intelligence” (Schumaker, 2000)

“The virtual three-dimensionality afforded by 3D modeling software offers a new way of working that combines the intuitive possibilities of physical model making with the precision and immateriality of drawing” (Schumaker, 2000)

“Computing makes it easier to achieve complexity and fluidity at the same time. Technology managed to refine this and allows you to have much more variety and incredible richness” (Noever, 1991).

Daniel Libeskind

Daniel Libeskind is an American architect and has taught and lectured at many universities worldwide. Libeskind was an architectural theorist and professor for many years, and he completed his first building—the Jewish Museum, Berlin—in 1999, at the age of 52 years; this was Libeskind's first major international success. In 2003, he won the prestigious competition of the master plan architect for the World Trade Center site. He founded Studio Daniel Libeskind in 1989 with his wife, Nina. He has held such positions as the Frank O. Gehry Chair at the University of Toronto; professorship at the Hochschule für Gestaltung, Karlsruhe, Germany; the Paul Philippe Cret Chair at the University of Pennsylvania; and the Louis Kahn Chair at Yale University. He has received numerous awards including the 2001 Hiroshima Art Prize—awarded to an artist whose work promotes international understanding and peace; it had never before been presented to an architect. His ideas have influenced a new generation of architects and those interested in the future development of cities and culture. Owing to his interest in radical formalism, critics often describe Libeskind's work as Deconstructivist.





Figure 3: Libeskind's sketch & the Run Run Shaw Creative Media Centre, Hong Kong (Left); Libeskind's sketch & the Extension to the Denver Art Museum, US_(Middle); Libeskind's sketch & the Royal Ontario Museum, Canada (Right)

Source: <http://daniel-libeskind.com/> (2011); Sketch courtesy of Daniel Libeskind (2011)

Below are some of his comments describing his thoughts on and idealisms regarding architecture:

"Don't just go with the trends—think for yourself. Think of the less obvious things" (Marino, 2010).

"... to that extent, every human being is really unborn. And if a building or a work of art is good, it might actually bring to life a dimension that was not there before, something that was not yet clear or not yet articulated, that was only potentially there" (Langer and Steglich, 1995).

"You don't have to say much, but when you look at this site, you realize the response to the site cannot be just one dimensional; one has to think beyond the box; one has to go outside the limitation and really connect with nature: connect with what is out there" ("Architects thoughts on designing The Ascent in Covington", 2009).





“... because architecture is not for itself; it is for people, for their own enjoyment, for individuals, and for the experience of art which is all about imagination, all about the unknown, all about the possible. This is proof that the sense that architecture can evoke is wonder” (Scott, 2008).

“... and of course risk. I think architecture should be risky. You know it costs a lot of money and so on, but yes, it should not play it safe. Because if it plays safe, it's not moving us in the direction that we want to be” (Scott, 2008).

“But I would rather play something completely unheard of, and even with flaws, than repeat the same thing over and over which has been hollowed by its meaninglessness” (Scott, 2008).

“We applaud the well-mannered box. But to create a space that never existed is what interests me; to create something that has never been, a space that we have never entered except in our minds and our spirits. And I think that's really what architecture is based on” (Libeskind, 2009).

Thom Mayne

Thom Mayne is a Los Angeles-based architect, widely regarded as one of the world's most provocative architects. Thom Mayne is only interested in exploring the new, the present, and the now. For him, architecture is not a matter of producing a readily imaginable building, but is instead a starting point for a larger discussion. Mayne won the Pritzker Architecture Prize in March 2005, along with many other honours under the Design Excellence program of the United States Government General Service Administration.

He is the founder and design director of the Los Angeles-based architecture practice Morphosis; his international works range from residential design to large-scale urban planning. Morphosis has won 25 Progressive Architecture awards along with over 100 American Institute of Architects (AIA) awards. Today, the firm continues to produce technologically advanced structures that respond to modern society and culture. In their attempt to redefine how buildings work, both within themselves and within their environment, Mayne and Morphosis are forging dramatic new landscapes for a startlingly modern world.





Figure 4: Mayne's sketch & the Cahill Center for Astronomy and Astrophysics, US (Left);
The Phare Tower, France_(Middle); Mayne's sketch & the Cooper Union, US (Right)
Source: <http://www.morphosis.com/> (2011); Sketch courtesy of Thom Mayne (2011)

He criticizes many architectural designs today as being the same old ideas in a 'new skin', but at the same time, he challenges everyone through his comments:

"Always unique, never systematic" ("The Thinking of Thom Mayne", 2011).

"Produce something that demands inquiries, that is not a status quo. It doesn't matter if people like it or dislike it. The question is does it stimulate you? The horror is to do something neutral. That's the failure" ("The Thinking of Tom Mayne", 2011).

"It's going to begin within a more normative logic, and I'm going to attack it. I'm going to keep attacking it and questioning it and challenging it, and it's going to move through reiterative acts" (Larsson, 2010)

"... but part of it is being—why can't you be completely excited and captivated—and part of captivation is unknowability—recognizing that part of your finite self is incapable of understanding the complexity of our universes" (Patterson, 2007)





“So I am totally aware that when I defend the autonomy of art, I’m going counter to my own development. It’s more an instinctive reaction, meant to protect the private aspect of the work, the part I am most interested in and which nowadays is at risk in our culture” (Tilroe, 2005).

“I guess anybody of my generation would have to have some interest in the location of creativity, the processes of removing certain rational instincts” (Bird, 2011).

“The multiplicity of ideas is what I’m interested in. The hybrid in our society—where there is no singular idea of what is beautiful” (Pogrebin, 2005)

“It is the thing that I am always looking for... a coincidence, genuine, not the orthodox” (Mayne, 2011).

7.0 Factors of Content Analysis

To perform content analysis of a text made up of the direct comments of four 3D digital architects, it is necessary to establish some factors. The two factors are the theory of interactivity in digital media and the study of early thoughts in imagination.

7.1 Theory of Interactivity in Digital Media

Mental imagery comprises not only visuals but also images created through sound, movement, touch, taste, and so forth. However, visual imagery is the most common (97%), followed by auditory imagery (93%), while the least common is imagery associated with physical sensitivity (+/-70%). Therefore, methods of increasing the imagination mostly focus on visual imagery (McKellar, 1968).

The role of computer modelling in architectural design is divided into three categories: simulation, generation, and optimization (Radford and Stevens, 1987).. As such, 3D simulations for architects are considered essential to enrich the spatial experience of the subject. As Negroponte (1995) points out, being digital allows a process which can be the fantasy and ecstasy of the mind. Janet Murray (1997) identifies ‘three key pleasures’ which are uniquely engaged within the interactivity in digital media: immersion, rapture, and agency. Immersion is the sense of being transported to another reality; rapture, the attachment to the objects in that reality (addiction); and agency, the player’s delight in having an effect on the digital world.





The concept of 'pleasure' in this architectural digital simulation context has mainly become an attraction for the architects.

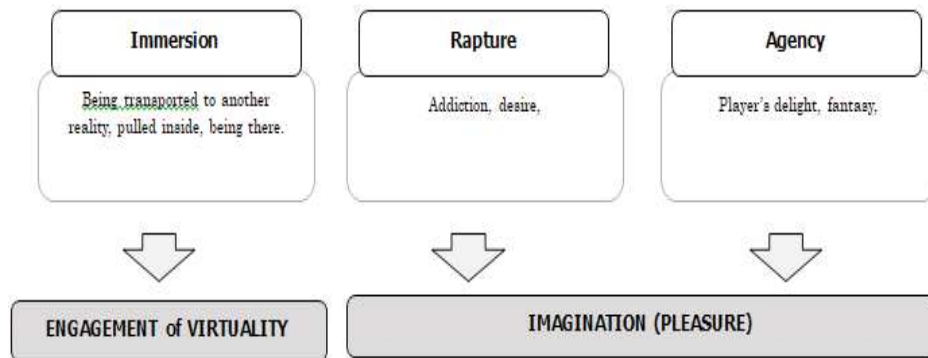


Figure 2: Interactivity of Digital Media (Modified)

Source: Negroponte (1995); Murray (1997).

7.2 Study of Early Thoughts in Imagination

Ancient views

Plato (427–347 BC) believed in only the knowledge of art which takes advantage of the imagination. It is merely perceived to receive and is repeated to reflect into another state (mimicry). He fundamentally draws different lines between imaginations with creativity (Raven, 1965). In contrast to Plato, Aristotle (384–322 BC) concluded that imagination is a position between sensation and ideas. A process that allows an individual mind to reach a degree of freedom and a scope for idiosyncrasy that would hardly have been available from the other traditional faculties (real world), constrained as they were by reality and the laws of logic (Thomas, 2004).

The Renaissance era





According to Francis Bacon (1569–1626), sensation must pass through the imagination first then return to the imagination before it manifests into ideas. Imagination corresponds to the possibilities in another space of reality which gives birth to originality, novelty, or innovation (Collinson, 1988). Hobbes (1588–1679) ideas appear similar to those of Plato, where only certain knowledge is closely related to the imagination. This further confirmed that in his opinion, the imagination is not a creative potential but the potential for replication ((Sorell, 1986). According to Kant (1724–1804), the ‘form’ is that which we usually capture is our way of sensing space and time, and he argued that they are ‘a priori’ in the mind. In short, imagining ‘form’ should be a detached and independent event in order to get a richer experience (Collinson, 1988).

The Modern era

When the Romantic era began at the end of the eighteenth century, the topic of imagination pursued into a form of cognitive theory and epistemology associated with patterns of creative thinking, primarily those that were artistic and literary. Theories of imagination evolved even further into psychology and became more relevant to the issue of aesthetics. An active imagination in Carl Jung’s (1875–1961) analytical method of psychotherapy involves opening oneself to the unconscious and giving free rein to fantasy, while at the same time, maintaining a conscious point of view. He argued that the process leads to surprising result by bringing a consciousness to another reality (Chodorow, 1997). Sartre (1905–1980) expressed that in order to imagine, consciousness must be free from all specific reality, and this freedom must be able to define itself as a ‘being-in-the-world’ which is at once the constitution and the negation of the world (specific reality). In short, he asserted the importance of self-freedom actualization as a process which demands that individuals maintain a separation between themselves and the specific reality. Imagination does not depend on the nature of being but is experienced as a ‘flight’ from a specific reality (Sartre, 1948). Antoniades (1992) points out the imagination associated with fantasy and that it is very important in architectural creativity. Without an understanding of the relationship between the concept of ‘real and unreal/imagination and fantasy’, it is difficult to understand the creative process requirements.

From the text above, the two factors of theory of interactivity in digital media and early thoughts in imagination can be grouped by content to confirm the relation. Although there is different reasoning in imagination, however, both factors share common characteristics, particularly the need to enter a different reality than a specific reality (engagement of virtuality) and a ‘sense of pleasure’ (imagination) (Tables 2 & 3).





Table 2: Relation between Factor 1 and 2

FIGURE		FACTOR 2. Early Thoughts of Imagination Category of Engagement of Virtuality	FACTOR 1. Theory of Interactivity in Digital media		Creativity Related
			Category of Imagination (sense of pleasure)		
Thoughts of Philosophy Dialectical Imagination	Plato (427-347SM)	- Imagination is similar to conjecture and guess - Imagination is informed mimicry	-	-	Unrelated
	Aristoteles (322-284 SM)	- Imagination as a creative process - Imagination is between sensations and ideas	-	-	Related
	Thomas Hobbes (1588-1679)	- Imagination as a tool of imagery record - Imagination is a tool of duplication - Imagination is a tool of expressive reproduction	-	-	Correlated only with expressive works
	Francis Bacon (1569-1626)	- Imagination as a tool of imagery record - Sensation must go through imagination first - Imagination give birth of creativity, novelty - Imagination corresponds to ideas - Image requires Imagination - Imagination requires image	-	Sensation	Related
	Immanuel Kant (1724-1804)	- Imagination is an apriori of space and time - Imagining 'form' should be detached and independent to capture a richer experience - Imagination is intuitive sighting - Blind but indispensable function of the soul - Imagination distinguished three types of pleasure: in the agreeable, in the good and in beauty	Another space and time, Blind but indispensable, Detachment, Independent	Pleasure	Related





Thoughts of Psychology Dialectical Imagination	Carl-Gustav Jung (1875-1961)	- Bringing a consciousness to another reality - Active imagination as therapeutic technique to capture inner vision - Active imagination is working with dreams or fantasy - Active imagination is in between conscious 'ego' and the unconscious	Another reality, Unreal, Uncertainty	Fantasy	Related
	Jean-Paul Sartre (1905-1980)	- Imagining potentially allows direct access to that which is imagined - Consciousness must be free from all specific reality - Imagination does not depend on the nature of being - It is a flight from the world (specific reality). - Freedom in imagination brings up the authenticity - Exercising of imagination evade causal determinism	Flight from specific reality & Free from specific reality	Freedom	Related
Thoughts of Aesthetic Dialectical Imagination	Anthony C. Antoniades (1992)	Imagination is associated with fantasy Imagination and its considerations made sense for human creativity Imagination has different expression with fantasy Fantasy is far wilder than the imagination, Fantasy constructs images that can not be true Imagination is the mind's ability to digest: "what is offered by the fantasy?" Fantasy and imagination as intangible and tangible channels	Intangible and tangible channel	Fantasy	Related





Table 3: Characteristics of Thought of Interactivity in Digital Media

	Characteristic of Thought of Interactivity in Digital Media	
	Engagement of Virtuality	Imagination (sense of pleasure)
Philosophically	Detachment, independent, blind	Sensation
Psychologically	Another reality, uncertainty, free from specific reality,	Fantasy, sensation, pleasure, freedom
Aesthetically	Intangible & tangible channel	Fantasy

8.0 Discussion

8.1 Characteristics of Thought of 3D Digital Architects

Frank Gehry

From Gehry's comments which are related to his thought, he repeatedly stressed the importance of 'uncertainty': an unpredictable situation which he termed 'insecurity'. This status of 'uncertainty' or 'insecurity' is categorized as an engagement in virtuality, that is, as 'being inside' or 'in another reality'. This status is a negation of a specific reality which is considered too explicit and likely to direct to a common predictable thought. In the category of imagination (sense of pleasure), he asserted not to restrict freedom of thought. However, this indicates that the category of engagement of virtuality is more significant than that of imagination.

Zaha Hadid

Hadid, through her comments which are related to her thought, points out the incredible richness of freedom and playfulness. She strongly impresses the sense of pleasure, desire, and playfulness as being vital points to achieve what she believes to be 'complexity' and 'fluidity'. Here, Hadid more significantly emphasizes the category of imagination (sense of pleasure) through her thoughts. She also points out that the willingness to discover 'unknown territory' or 'abstraction' will lead to the discovery of novelty; this represents her thoughts which are related to the category of engagement of virtuality.





Daniel Libeskind

In one of Libeskind's presentations at TED, he stated that architecture is not intended for just the current time and mankind but also for the future and those unborn humans; this statement carries a sense of forward thinking for the next reality. He shared 17 words that underlie his vision in architecture, of which some are highly relevant to his works: unexpected, inexplicable, risky, radical, raw, complex, expressive, democratic, and emotional. These keywords are seen explicitly in his expressive works and fully describe his thoughts on radicalism and risk within uncertainty; thus, they meet the category of engagement in virtuality.

Thom Mayne

Mayne, throughout his career, has been regarded as a rebel against conventions. His works do not ascribe to the standards of proportion, composition, and aesthetics in common typology. Describing him as a Deconstructivist is insufficient; his dissent to status quos, traditional notions, orthodox ideas, and neutralism have led him to explore the multiple facets of unknowability and coincidence. He states that ideas must not be determined by a standard or convention. This idealism shows his bravery in exposing the unpredictable within the engagement of virtuality and is one of his strong traits.





Table 4: Characteristics of Thought of Gehry, Hadid, Libeskind and Mayne

3D DIGI-TAL AR-CHITECT	PERSONAL COMMENTS (related of their thought)	CHARACTERISTIC OF THOUGHT	
		Engagement of Virtuality (Keywords: another reality, uncertainty, blind, free from specific reality, detachment, independent)	Imagination (Keywords: fantasy, sensation, freedom, pleasure)
Frank O. Gehry	<i>"I approach each project with a new insecurity, almost like the first project I ever did. And I get the sweats. I go in and start working; I'm not sure where I'm going. If I knew where I was going I wouldn't do it. When I can predict or plan it, I don't do it. I discard it. So I approach it with the same trepidation"</i>	encourage uncertainty	
	<i>"I want to be open-ended. There are no rules, no right or wrong. I'm confused as to what's ugly and what's pretty"</i>	encourage uncertainty	Unlimit the freedom
	<i>"Creativity is about play and a kind of willingness to go with your intuition. It's crucial to an artist. If you know where you are going and what you are going to do, why do it"</i>	encourage uncertainty	sense of pleasure
	<i>"imagination is your only limitation"</i>	free from specific reality	
	<i>"What bugs me are these goddamn rules"</i>	free from specific reality	
	<i>"I'm always scared that I'm not going to know what to do and I do my best work when I don't know anything about it"</i>	encourage uncertainty	sensation
	<i>"I am always insecure. I am never in my mind guaranteed that it will be a good building,"</i>	free from specific reality	
	<i>"We need to allow for intuitive impulses that are very informed. What enables you to find the cure for cancer is not to follow steps A, B, C ... Some accidental thing in the laboratory will happen ... You follow your intuition, it is an informed intuition, and you have the Eureka moment ... For me, if I knew in advance where to go, I wouldn't go there."</i>	encourage uncertainty	





Zaha Hadid	<i>"There are 360 degrees, so why stick to one"</i>		unlimit the freedom
	<i>"...experience the object has to excite curiosity and desire. A considerable degree of strangeness is indispensable. The project - like any true object of desire - will at first appear mysterious, an unknown territory waiting to be discovered and explored"</i>	encourage uncertainty	sense of pleasure
	<i>"..all conceivable constraints into new possibilities for space"</i>	encourage uncertainty	unlimit the freedom
	<i>"Abstraction opened the possibility of unfettered invention"</i>	free from specific reality/ encourage uncertainty	unlimit the freedom
	<i>"Do the design maneuvers gain enough fluidity and freedom to play"</i>		sense of pleasure
	<i>"Playfulness allows experimentation. At the same time, it acknowledges reason. It accepts that at one point ... it will be integrated into the structure of intelligence"</i>		sense of pleasure
	<i>"The virtual three-dimensionality afforded by 3D modeling software offers a new way of working that combines the intuitive possibilities of physical model making with the precision and immateriality of drawing"</i>	free from specific reality	sense of pleasure
	<i>"Computing makes easier to achieve complexity and fluidity at the same time. Technology managed to refine this and allows you to have much more variety and incredible richness"</i>		unlimit the freedom





Daniel Libeskind	"Don't just go with the trends—think for yourself. Think of the less obvious things"	free from specific reality	
	"... to that extent, every human being is really unborn. And if a building or a work of art is good, it might actually bring to life a dimension that was not there before, something that was not yet clear or not yet articulated, that was only potentially there"	uncertainty	
	".. You don't have to say much, but when you look at this site, you realize the response to the site cannot be just one dimensional; one has to think beyond the box; one has to go outside the limitation and really connect with nature: connect with what is out there" ("Architects thoughts on designing The Ascent in Covington")		unlimit the freedom
	"... because architecture is not for itself; it is for people, for their own enjoyment, for individuals, and for the experience of art which is all about imagination, all about the unknown, all about the possible. This is proof that the sense that architecture can evoke is wonder"	uncertainty	
	"... and of course risk. I think architecture should be risky. You know it costs a lot of money and so on, but yes, it should not play it safe. Because if it plays safe, it's not moving us in the direction that we want to be"	uncertainty	
	"But I would rather play something completely unheard of, and even with flaws, than repeat the same thing over and over which has been hollowed by its meaninglessness"	uncertainty	
	"We applaud the well-mannered box. But to create a space that never existed is what interests me; to create something that has never been, a space that we have never entered except in our minds and our spirits. And I think that's really what architecture is based on"		sensation





Thom Mayne	<i>"Always unique, never systematic"</i>	free from specific reality	unlimit the freedom
	"Produce something that demands inquiries, that is not a status quo. It doesn't matter if people like it or dislike it. The question is does it stimulate you? The horror is to do something neutral. That's the failure"	uncertainty	
	"It's going to begin within a more normative logic, and I'm going to attack it. I'm going to keep attacking it and questioning it and challenging it, and it's going to move through reiterative acts"	free from specific reality	unlimit the freedom
	"... but part of it is being—why can't you be completely excited and captivated—and part of captivation is unknowability—recognizing that part of your finite self is incapable of understanding the complexity of our universes"	blind, uncertainty	
	"So I am totally aware that when I defend the autonomy of art, I'm going counter to my own development. It's more an instinctive reaction, meant to protect the private aspect of the work, the part I am most interested in and which nowadays is at risk in our culture"	uncertainty, detachment	unlimit the freedom
	"I guess anybody of my generation would have to have some interest in the location of creativity, the processes of removing certain rational instincts"	Free from specific reality, detachment	
	The multiplicity of ideas is what I'm interested in. The hybrid in our society—where there is no singular idea of what is beautiful"		unlimit the freedom
	"It is the thing that I am always looking for... a coincidence, genuine, not the orthodox"	Blind, uncertainty	unlimit the freedom





8.2 Engagement of Virtuality and Imagination

Engagement of Virtuality

The first factor, which is the theory of interactivity in digital media, is one of the key points to study the characteristic of thought of 3D digital architects. Similar to Negroponte (1995), Murray (1997) identifies the interactivity in digital media as immersion, rapture, and agency. These three terms lead us to study the characteristic of thought through content analysis. However, a more concrete category for immersion, rapture, and agency is needed. One of the categories is the engagement of virtuality: a status of the characteristic of thought within another reality/uncertainty and blind/free from specific reality. The category of engagement of virtuality allows us to justify the characteristic of thought of a 3D digital architect by referring to the accompanying keywords (another reality, uncertainty, blind, free from specific reality, detachment and independent).

Imagination

After the first factor is categorized into two engagement of virtuality and imagination then the second factor early thoughts in imagination confirms the relation. The category of imagination is always related to these accompanying keywords: fantasy, sensation, freedom, and pleasure. Imagination is a standard for the formation of ideas, namely, the nature of mental representation (Ferrarin, 2004). From ancient views to present-day studies on the creative process, imagination is considered key. Wallas' (1926) most popular creative process model also points out the interesting phases of intimation and illumination (preconscious into conscious) when explaining imagination. The category of imagination allows us to justify the characteristic of thought of 3D digital architects in terms of a 'sense of pleasure'.

8.3 Finding

The four investigated 3D digital architects Gehry, Hadid, Libeskind, and Mayne possess a common characteristic of thought: they stress the importance of freedom from specific reality (the uncertainty) and the need for a 'sense of pleasure'. While freedom from specific reality represents engagement of virtuality, a 'sense of pleasure' represents imagination. Engagement of virtuality and imagination are known to be characteristics of thought in the interactivity of digital media. Such thoughts are always encouraged naturally so that they lead to the discovery of novelty. Although Gehry, Hadid, Libeskind, and Mayne keep sketching manually, their characteristic of thought is similar to the interactivity in digital media. The four of them





possess the same strong characteristic of thought through the engagement of virtuality and imagination; however, Gehry, Libeskind, and Mayne's characteristic of thought appears to be more significantly based on engagement of virtuality, while Hadid's is on imagination (sense of pleasure).

In cognitive science, the theories of domain specificity argue that the skills, traits, or knowledge that underlie successful performance (or creativity) in a given domain are largely unrelated to the skills, traits, or knowledge that underlie successful performance in other domains (Runko and Pritzker, 1999, p.591-596) (Nagai and Junaidy, 2015). The two types of creativity are domain specific and domain general. Feist (1999) mentions that certain personality traits consistently co-vary with creativity; yet, there are some domain-general attributes that creative people possess in common (Ward, 2003, p.863). Referring to this paper, the characteristic of thought of engagement of virtuality can be considered a domain specific to 3D digital architects, whereas the imagination (sense of pleasure) is considered domain general. The engagement of virtuality is expected to contribute to the success of 3D digital creative achievement.

This research, however, has some limitations. It investigated only a limited number (i.e. four) of 3D digital architects. In future works, it is necessary to accumulate more knowledge by carrying out research on a larger number of 3D digital architects.

9.0 Conclusion

This study explains the characteristics of thought of 3D digital architects through content analysis. In this paper, we introduced the characteristic of thought of 3D digital architects as being their engagement of virtuality and imagination. This study will help digital architects by encouraging them to engage in virtuality and imagination more seriously in order to develop their design thought. This research might be developed more extensively in the future.





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