

What is Design Creativity?

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Background Creativity is dealt with in the field of psychology and is the center of the design domain. To intuitively embody ideas from priori concepts based on perceptions, experiences and sensibility, design creativity is transferred as one of the solution sets to ill-structured problems in a semi-autonomous condition. Since research on creativity in design deals with one of the themes in design methodologies, an in-depth study, as a large room filled by the scientific approach, is needed.

Methods The purpose of this study is to define creativity in design and to understand the articulation and position of design creativity from circumjacent information and knowledge, cognition and experience, and intuition. Accordingly, the study characterizes design creativity in the 21st Century as the age of knowledge integration and expands the meaning. Based on various empirical studies and case studies, this study employs deductive reasoning and qualitative research methodology in order to clarify the argument. Diagrams are used to imply and complement discussion and to help the reader understand creativity in design.

Results Creative outputs from design come from various solutions, which emerge from the problem definitions of existence. In this process, creativity is the most necessary virtue. Creativity is regarded as the main theme of design methodology. Furthermore, creativity requires an integrated design solution in order to find out design problems that have occurred in different phases and multi-disciplinary areas. Thus, creativity in design is inherently essential. Since design is a science that employs intuition and intelligence and a universal art for a large number of people, design creativity is expressed as an appearance of solutions that specify some ideas based on cognition and experience. Presently, design creativity is connected and promoted in fourth generation design thinking, which demands the process of inter-professional collaboration in a transdisciplinary dimension.

Conclusion Design creativity appears through connection, migration and integration of cognition, intuition, knowledge, experience and the senses of existence. However, design creativity can also be defined as a creative solution oriented towards innovation, which is based on effectiveness and initiated by innate motivation, reflection and transference of contextual factors.

Keywords Knowledge, Creativity, Design Creativity

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1. Background and Purpose of Study

Modern society is referred to as a society of information and knowledge. Vast amount of information is flooding one after another. Scale of such information is so large as to bring chaos and frustration, and the internet is lined with online tools to filter information within information. However, information can only be turned into knowledge after filtering, appropriately securing necessary part, understanding and absorbing it. In other words, this process is similar to the act of panning for gold. Recognizing something is called perception, which is based on priori experience. Since perception also responds to the same resources, information and knowledge are intimately related to creativity. Creativity is mostly acquired through learning and is correlated with perception, intuition and knowledge. For this reason, instant analysis and thinking based on the sensory system is important, but increasing creativity through understanding and exploration is extremely important and essential as well.

Studies on creativity have long been discussed in the fields of psychology, education, arts and humanities. Major topics of discussion includes means and methods for articulation and expansion of creativity, and creative works resulting therefrom. However relatively in the domain of design, studies on creativity have been treated as a topic of design methodology. Studies on the substance of creativity are regarded as a space to be filled by academic approach to design.

The purpose of this study is to specifically define creativity in the domain of industrial design and to understand articulation and position of design creativity from surrounding information, knowledge, experience and intuition. It must be seen as an attempt to understand and explore characteristics of creativity, which requires in both ideas that stand out in the early stage of design doing (individual or group) and solutions derived in the process. Chapter 2 estimated creativity from information and knowledge, examining expression of creativity. Chapter 3 looked into design creativity in the relationship with recognition, experience and intuition. It also aimed to define design creativity required in the era of knowledge convergence in the 21st century and to expand the meaning by understanding design thinking, creativity and its position occurring in multidisciplinary domain. This study paralleled deductive interpretation and qualitative research methodology in order to explain various cases and embody the topic of discussion based on empirical data from different areas. Diagrams used in this study were intended to horizontally summarize contents of each chapter and section as a means to clarify the point.

2. Creativity

2. 1. Information and Knowledge

Cialdini (2002) argued that in the ocean of tremendous information and data on the internet, information is merely information (data): “Our society is referred to as so-called ‘information

era', it has never been called the era of knowledge. Information cannot be instantly turned into knowledge, and it requires the process of finding information, absorbing, understanding, combining and maintaining it (p.381).” The problem of sorting out and managing information is a method of extracting knowledge from vast amount of information. That is, we need to think about how to secure appropriate information at an appropriate timing with appropriate frequency (Lee, 2011, C4). Information for the sake of information can only result in frustration, and information can only lead to decision making (judgment) and execution once it turns into knowledge (Lee, 2011, C4). In other words, information is data and knowledge contains something more than information such as understanding. Therefore, knowledge filtered out of established information performs the role of constituting the foothold of creativity.

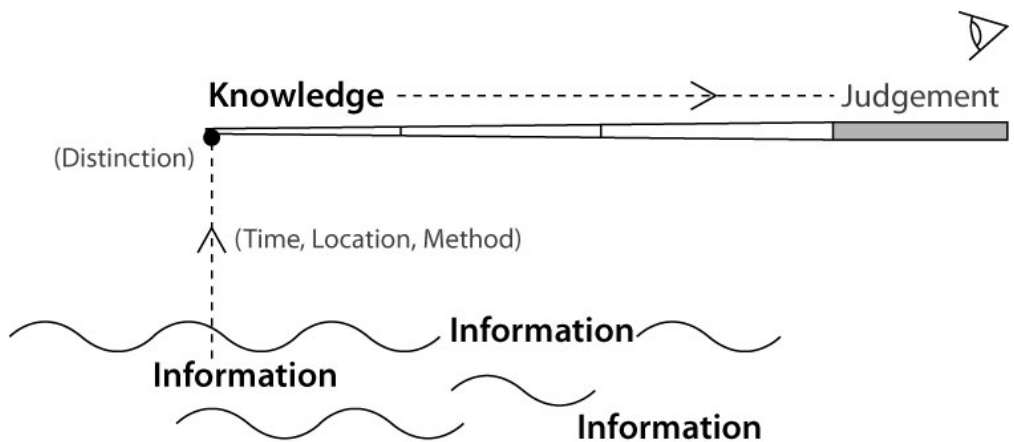


Figure 1 Information & Knowledge¹⁾

On one hand, Peter Drucker named modern society as knowledge society, and the 21st century in fact has become the world overflowing with knowledge. How to refine and sort out information is the method of extracting information, but accumulation of obtained knowledge is yet another problem. According to Arthur Markman, people have limit to their memory and can end up missing important memory when receiving three or more pieces of information or knowledge (Lee, 2012, C3). Large amount of information and knowledge is simply data similar to countless books available at a library. In order to make use of them, we need to remember a few important characteristics. We are regarded as to have knowledge when we can logically talk about it. Generally, 20% of creativity is inherited and 80% can be learned. Predicting the relevance with intelligence under such context, information and knowledge are distinct from intelligence, but intelligence directly and indirectly interacts with knowledge in the process of extracting and utilizing knowledge. It would not be immoderate to associate creativity with intelligence, once we understand the fact that intelligence quotient increases with accumulation of life experience and knowledge.

Intelligence can be seen as separate from creative ability as described earlier, but some types of knowledge are related to creativity on a specific level and domain. This is why many theories describe creativity as creative intelligence (Runco, 2009, p.10). Nonetheless, IQ tests that have been used since early 20th century is trusted as much as to be conducted nowadays,

1) This diagram supplements and further develops the point of argument made by Steve Ellis (CEO of Bain & Company), (Source: Lee, J. (2011). Concentrate on What is Important. *The Chosunilbo*, January 29-30, C4.)

but they are not effective because they fail to demonstrate effectiveness of creativity or present a means to measure creativity (Gardner, 1993, p.20). There had been many efforts to measure creativity, but it still cannot be quantified like IQ tests or guarantee reliability of the results.

Psychologists say that creative people show divergent thinking and intelligent people show convergent thinking. That is, when a data or puzzle is given, an intelligent person can understand the correct answer but a creative person has a tendency to suggest something relevant to many potential alternatives (Gardner, 1993, p.20).

It is not easy to demonstrate valid correlation between intelligence and creativity, but they are closely related to knowledge. Also, while information is merely information, it is appropriately used and filtered in terms of time, place and method to be converted into knowledge. Accordingly, as the correlation between information and knowledge is inevitable, creativity is related to information, knowledge and intelligence (talent) and visualized by interaction among these elements.

2. 2. Codification of Knowledge

Rapid development of human civilization from the arrival of computers and the internet to information and communication society of the 21st century surpasses the development over hundreds of thousands of years ever since the creation of mankind. Such phenomenon in a short time has resulted from easily accessible information networking, explosive amount of information formed, and generation of diverse and strong knowledge thereof. However, there were concerns that generating vast amount of information and knowledge would bring complexity and chaos to our society, and such concerns have already begun to appear in our daily life. Recent statistics that over 70% of information and knowledge floating around on the internet are useless rubbish shows this very well. Nonetheless, computer system (both open and closed) provided by rapid development allowed for systematization of knowledge. Spread of low cost automated computerization enables encoding and quantification of gigantic tracks of information, transforming knowledge into a commodity that can be bought, sold and duplicated (Shenkar, 2010, p.51). This means that codification of knowledge has made an absolute contribution to commercialization of knowledge.

Systematized information is reproduced by blue print or formula. Blue print or formula that produces information is saved, renewed, used and transferred with extremely fast speed, accuracy and conformity in a small part of cost (Shenkar, 2010, p.51). Especially to handle complex problems, a gigantic system demanded by recombination, reuse and accumulation becomes necessary (Shenkar, 2010, p.51). Development of technologies such as computer simulation techniques and artificial intelligence which can create knowledge from the ocean of information using computer simulations (based on digital technology) and the internet is further facilitating decryption and standardization of knowledge. The final inertial force of such knowledge system comes from universally standard certifications, benchmarking, best practices and consultants that supply them (Shenkar, 2010, p.51). In other words, systematization of knowledge helps produce increasingly more derived knowledge and makes imitation easier and feasible.

Thanks to the data analysis capacity of cutting edge artificial intelligence, knowledge is becoming more elaborately refined and systematized. People nowadays can easily access useful data in daily life at any time and place through mobile devices such as smart phones. The use of Big Data has recently become a hot issue. For instance, when an IT device like smart phone, tablet or PC makes a request to translate a text written in a language, the text can be translated into dozens of different languages by making the server send responses in different languages to each device through the internet (Lee, I. 2012, C6). The translation work is independently performed by the machine using artificial intelligence. Machine translation can be seen as a type of Big Data processing technology based on statistics. Though the level of machine translation is not enough to deliver contents of emotional or stipulated documents, it is being developed to make people understand other languages and communicate. Walmart is an example that uses Big Data with size of terabytes (TB) to analyze purchasing behavior of consumers and sales trend for minute-wise price competition using social networking services (SNS) and online shopping. This makes use of precise computer programming technology that comparatively analyzes overlapping similarities among information scattered around the internet.

Codification of knowledge based on computer system has become faster, larger and stronger than ever. Knowledge accumulated on top of vast information is recycled into information and extracted as new knowledge within networking. Therefore, people can gain insight and quantitatively utilize creativity through codification of knowledge, and expand new potential for creativity as well.

2. 3. Articulation and Environment of Creativity

Creativity was studied for long time in psychology. Considering that creativity was regarded as a main topic of discussion in design methodology of industrial design, it is an area closely related to and substantially overlapping with psychology. This is because new and integrated solutions are demanded to solve complex and multidisciplinary problems (Dorst& Cross, 2001, p.426).

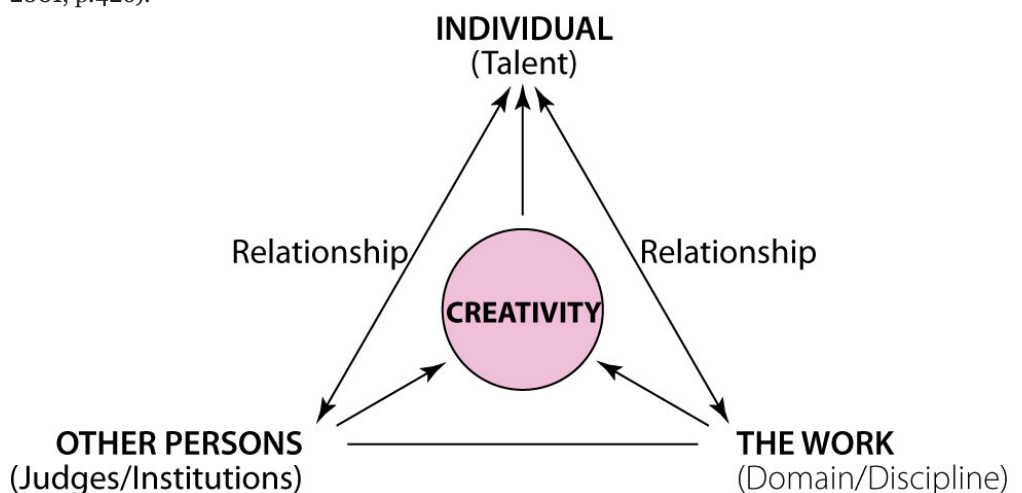


Figure 2 Articulation of Creativity²⁾

A well-known psychologist named Gardner (1993) argued (p.8) that as shown in <Figure 2>, articulation of creativity is made possible in the midst of interaction between three core elements including creative individual, related work (domain) and related other persons. That is, creativity is not placed under the head, hands, practice and judgment of an individual but can be understood as an interaction of three points (Gardner, 1993, p.39).

Many studies demonstrated that when creativity is demanded at least, problem solving of groups is not as effective as individual research (Runco, 2009, p.10)³⁾. However, it is difficult to find the evidence that either of individual and group creativities takes priority or dominance over the other. Group can be effective in terms of collaboration and contribute to composition and organization of team in that members can think from different perspectives. For example if collaboration of a group that consists of individuals is reinforced, brainstorming technique is very effective for group creativity. Nevertheless, in the actual world that requires creative solutions, success of a group is not the same as success of an individual (Runco, 2009, p.199). When an individual belongs to a group, the individual can fall into social loafing phenomenon where one loses sense of responsibility and becomes effortless to suppress creative ideas, or ideas can be neglected by social pressure of the group (Runco, 2009, pp.199-200). When there is a bad unproved idea, it is quickly transmitted (Lee, 2010, C1).

As an example, commercial artists and designers may be unsatisfied about social atmosphere of their organization and show reduced creative capability because they prefer individual work and autonomy (Runco, 2009, p.199). For this reason, global enterprises like HP and Google that created liberal venture culture of Silicon Valley and innovative enterprises like IDEO, professional industrial design company, have created work environment, welfare policy and corporate culture that can guarantee autonomy of workers to maximize creativity. Despite this, creative people commonly require absolute time to develop certain skills, effort, doggedness and pertinacity to make creative and innovative results (Gardner, 1993, p.33)⁴⁾.

According to Amabile, creative solution to a problem results from an innate motivation related to the behavior for extremely pure enjoyment (Gardner, 1993, p.25). Creative maestros such as Einstein and Picasso developed their creativity since childhood through inherent instincts, experiences and help or stimulation of surrounding people (family, teachers, colleagues and competitors). Also, they continued to discover interests and created new systems through ceaseless challenges and efforts on their professional areas. Thus, all creative individuals and groups not only show endless efforts but are, as argued by Howard, greatly affected by interaction with environment such as individuals and surrounding people linked with articulation of creativity and related domains.

2) This diagram was modified and supplemented by the author based on the theory of Howard Gardner.

3) Original source: Paulus, P. B & Nijstad, B. A. Eds., (2003). *Group Creativity: Innovation through Collaboration*. New York: Oxford University Press.

2. 4. Design Technology and Design Identity

Latecomers are likely to surpass a leading product through creative imitation in terms of technical aspects. This is because technical surpass through imitation can be quantitatively demonstrated by performance and functional excellence based on rational judgment. However, demonstrating excellence of design needs to satisfy physical demands based on rationality, as well as differentiation through identity of design for which emotional quality

is secured and settled. To restate, logical analysis to benchmark and improve a tangible or intangible target which has already succeeded may result in technical superiority, but it is difficult for the latecomer to surpass the original in the area of design dominated by intuition of the right brain when it involves similarity and imitation.

For example, there are many products that have technological superiority over BMW (premium automobile brand of Germany) and iPhone (Apple), but it is not easy to find products that surpass them in emotional quality and brand awareness. In addition, Coca Cola the world's no. 1 brand in brand value as of 2009 has continued its status as the origin of carbonated beverages for 125 years through emotional elements like taste, experience and fragrance. Therefore, design technology can be understood as a technical concept embodying intended design as an engineering approach, which includes hardware and software capabilities related to satisfaction of rational demands and emotional desires for product use. Technology with superior design is directly linked to settlement of design identity, and it is very difficult to take the lead through imitation of design. Even if it is possible, it requires a long time. As argued by Chancellor John Maeda of Rhode Island School of Design (RISD), the present era is referred to as 'Post Digital Renaissance' (Jang, 2009, C3). He means that the difference in the level of (digital) technology is becoming insignificant, and the future will be determined by creativity, originality, artistry and design. When design technology is understood as a rational entity embodied through tangible elements, design identity appears through intangible values of trust and conviction drawn in the minds of people. However, tangible values such as function and technology are essential for design identity, and such values can be maximized through differentiation of making creative and innovative attempts.

Values of premium brands like Louis Vuitton are not natural products of time but outputs of design technology and identity proven by strong durability. Therefore, design sensitively responds to technological advancement but has design identity based on high level of creativity and embodiment method (intent). The product receives attention when this identity is acknowledged as a true value by many, and creativity performs an important role in it. Design identity with lack of design technology is similar to an umbrella without cover, and design technology without design identity is merely an empty shell.

3. What is Design Creativity?

3. 1. Design Creativity of Recognition and Experience

Arguing about superiority in an aspect of products against competitors is far distant from the approach to creative design problem solving. In the fact that behavior of end-users can be changed by making products more beautiful and useful to end-users, creative idea and future-oriented design thinking are extremely fundamental. The present, which reflects the era and breathes together with changes and new trends, is connected with the future, but embodiment of creativity must be unfolded based on realism instead of idealism. According to Karim Rashid, 'A designer must reflect the present.' This can be understood within the context that high level of knowledge behavior (creative behavior) is required to define

Note: Malcolm Gladwell, selected as one of 100 Most Influential People around the world by Times magazine of the United States in 2005, supported the argument of Gardner in his representative bestseller titled 'Outlier (2008)'.

problems in reality and to find solutions within the predefined constraints.

Creativity in design can be more deeply understood from eclectic thinking and methods of epistemology and contrasting empiricism back in the era of Descartes. While epistemologists like Descartes considered purely rational function and intrinsic ideas of objectness as priori concept, empiricists argued that the essential ideas and knowledge depend on empirical grounds (Daley, 1982, p.134)⁵⁾.

Creativity itself is not a type of phenomenon or a concept to perfectly investigate the phenomenon within a field (Gardner, 1993, p.36). Since design is an integrated field of study, collaboration of talents in different areas and creativity are required in the process of defining and resolving design problems. Therefore, not all design outputs are creative, but acts of design are based on creative intents.

If design or artistic creativity is an experimentation through perceptual limits, it transcends the boundary of oral conversation (Daley, 1982, p.137). Nonetheless, design handles creativity as an essential element and systematizes our experience in the physical world; thus, design creativity jumps into the initial stage of spiritual life by handling components of actual life in our physical reality (Daley, 1982, p.137). Design is not an abstract science that relies on highly refined and elaborate logics and accurate numbers but a science based on intuition and intellect. Also, design is not an art of original self-expression but a universal art for many (Kim, 2013, p.96). Therefore, design creativity is a type of abstract concept formed by idea or thought recognized from precedent concept or expressed on experiential grounds. Such abstract concepts derive from whether they are regulated collinearly, and combination of multiple concepts is specifically expressed through judgment.

3. 2. Intuition and Design Creativity

According to Kant, the form of perception is determined by logical priori concept. There is no experience that can be intellectually understood without the category of priori concept, and there can be no idea without sensory experience (Daley, 1982, p.134). In other words, perception is the stage of understanding an object, and experience is added to verify existence of the object. To a designer, design creativity is formed by logical system, priori concept understood from the category, knowledge based on experience, and sensory experience. In design, such perception and experience are connected with intuitive understanding, and design creativity is most closely associated with intuitive expression. Kant explains that intuition simply has possibility of regulation and is based on priori concept or experience. Also, since it is a concept of whether it is regulated in the middle of identity, it appears in the form of judgment when concepts are combined (Kim, 2004, pp.50-51). Therefore, both perception and intuition are greatly affected by logical priori concept and experience. While intuition can be diversely explained as an instant analysis / comprehensive thinking process resulting from fundamental background in the same domain of knowledge or experience, it is not replaced by knowledge (Garvin, 1964, p.4). On the contrary, intuitive thinking can be a source of knowledge and may become creative or not through convergence with knowledge (Garvin, 1964, p.4).

As described earlier, knowledge is acquired in the process of understanding and managing necessary information from vast amount of data and information. Perceived information is filtered to form a concept, and multiple concepts are logically verified to become knowledge. Under similar context, while intuition is different from knowledge, it possesses possibility of regulation by predictable information or indication in the midst of priori concept or experience. Intuition has possibility of instant decision making and execution through combination of concepts.

From beginning to end, design is a semi-autonomous creative act to advocate intuitive solution through highly advanced knowledge activity under predefined constraints and newly found problems (Kim, 2010, p.56). Therefore, creativity in design is based on recognition (perception) and experience, and it is expressed as a form of solution intuitively embodying a concept (idea). This requires high quality concentrated knowledge to provide specific explanation on a question.

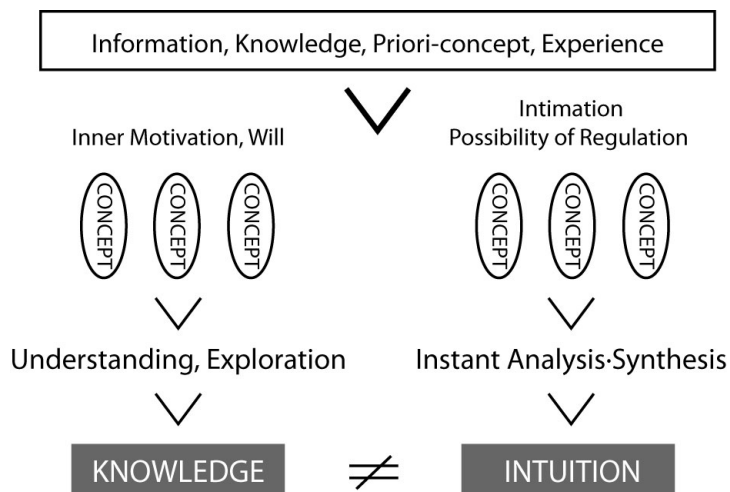


Figure 3 Knowledge and Intuition

3. 3. Design Thinking and Creativity

Design thinking starts from the definition that design is a process of defining and solving problems. What is a problem in design? Does it refer to a bad problem, improvement on the present status, or by-products generated in the process of understanding or collecting a constraint or requirement? Perhaps most of them can be defined as problems in design. As argued by Simon (1984), most of these problems are not quantitative and cannot be solved logically. Since they are wicked, ill-structured and very unique, it is not easy to find a solution in a domain. This is why design has recently been expanded to the stage of finding a solution through collaboration of various experts, crossing the interdisciplinary domains ranging from science to arts, humanities, psychology and business administration. From the 1st generation design thinking that interpreted design doing as liberal problem solving of designers, 2nd generation design thinking from the end-user aspect failed to break away from design doing centered on designers. That is, the 3rd generation design thinking that can transparently and objectively participate in all design processes as glass-box type has appeared after 1990s from the black-box design methodology of the past (Lee, 2005, pp.14-

5) Descartes represented epistemology by his representative quote, "I think therefore I am". On the contrary, George Berkeley an English philosophy who argues that sensory experience is the only source of knowledge said that "Everything that exists is recognized, and everything that is said to exist is recognition (perception)."

17). This is being developed into the 4th generation design thinking by handling resources (knowledge, intuition, pattern and emotion) in diverse domains (collaboration of experts) to define problems and exploring solutions and other possibilities from integrated perspective using scientific methods.

According to Tim Brown (2009), design thinking begins from skills of designers acquired for decades under their exploration to satisfy human needs using technological resources available within the practical limits of business (p.4). Design doing, an exclusive property of expert group, has evolved into design thinking that builds creative ideas in diverse domains and groups. Design is so important nowadays that it cannot be entrusted to designers and requires an integrated solution ranging from the decision makers to the working group to handle much more complex problems than before, rather than simply dealing with physical properties of products (Brown, 2009, pp.7-8). Thus, design thinking can be understood from the domain of designers as an expanded concept of creative approach to problem solving, which has been developed so long as to be accepted by corporations, schools and government institutions.

Design thinking embraces human ability to intuit, discover and recognize a pattern, and build ideas that have emotional meanings and functionalities (Brown, 2009, p.4). Such an act of design thinking involves sharing of information and idea and having joint responsibility about the result (Brown, 2009, pp.27-28). Definition of problems and solution from integrated perspective of diverse members in interdisciplinary team are based on creativity of each member and collaboration to increase such creativity. This can be understood as a process to maximize creativity of individuals in a group by supplementing the disadvantage of group creativity in which creative alternatives can be neglected by members with vested rights or collective reasoning.

When a problem is proposed, can a solution be seen as creative if there are no constraints or limits? Design always has constraints, and differentiated solution within a creative output. Subjects and constraints of design are based on the decision of higher authorities and internal and external factors, but all design problems that occur under a given situation are smartly resolved, based on creative thinking through collaboration of each class including members, exchange of ideas (process of collision, transition and convergence) and embodiment. In this perspective, design is a semi-autonomous creative activity based on creative and explorative thinking, which repeats circulation of divergence and convergence by defining and returning problems occurring in a broad scope and combining them with many possibilities. Therefore, design thinking is a creative approach to problems in interdisciplinary areas and their solutions, and an attempt to maximize the capability of integrated thinking (Brown, 2009, p.85). As the concept and domain of design is shared and expanded to humanities, education, social science, economics, IT, medical science, environment and culture, the use of design will become increasingly conventional.

3. 4. Position of Design Creativity

As mentioned by one of the great designers of the 20th century named Charles Eames that “There is no excellent design without constraints (Bae, 2011, C5)”, Although creativity in

design is sometimes based on rational and agreed suggestion in a group, it mostly occurs from liberal thinking of individuals and is produced within the borders of contextual limitations.

In design process, creativity is characterized by occurrence of an important result or so-called ‘creative leap’. It is based on an important concept that appears from immediate inspiration or during the process of problem solving by designers (creators) (Dorst& Cross, 2001, p.425). Thus, design creativity is innovatively embodied as a solution from economic perspective, and it is intuitively visualized from formative perspective in general. However, while creativity is regarded as an essential requirement of a good design, we must understand that creative design is not necessarily a good design.

Dyson said, “Our design is never original. There is always something connected to it (Roy, 1993, p.427).” Design is an area that makes something out of another, instead of making something out of nothing. That is, design is related to application of an object or idea to another. Instead of using theoretical creative techniques, many creative designers and inventors used prior knowledge and accumulated experience to look for ideas (Roy, 1993, p.440). Therefore, newness of design called creativity is connected, transported, converged and produced by existing information in various fields, perception by knowledge, intuition and experience including senses.

Clydesdale distinguished between creativity and innovation, defining that creativity is caused by innate motivation while innovation is caused by external factors and ‘desire to surpass the previous level’ (Runco, 2009, p.448)⁶. Runco positioned originality and effectiveness on the endpoints of a continuous line to explain the ratio theory on innovation and creativity. Summarizing the arguments of the two scholars as shown in <Figure 4>, the coordinate about the relationship among design, originality, creativity and innovation in design can be understood. Art focuses on original expression based on the presumption on creative intent, but it is not created for the purpose of innovation. While design focuses on innovative output for creative effectiveness, it does not presume originality.

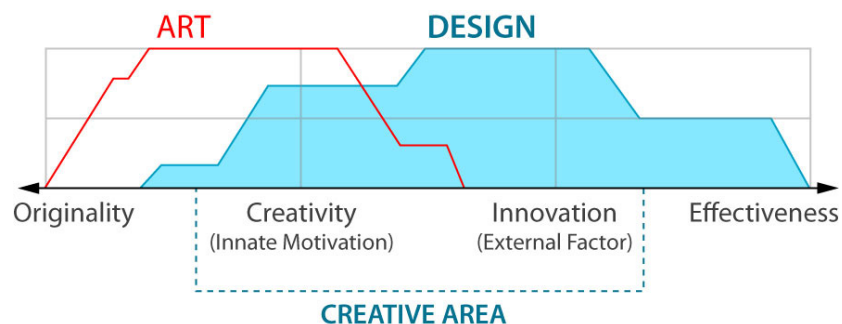


Figure 4 The Position of Design Creativity

Even if a person or object is highly original, it is merely original and may be psychotic unless it is effective in any way; it is not creative (lacks realistic senses) (Runco, 2009, p.452). On the contrary, outputs and actions in which originality and effectiveness are quite balanced

are either innovative (where effectiveness is greater than originality) or creative (where originality is greater than effectiveness) (Runco, 2009, p.452). Effectiveness of innovation is made clear to the public or business in many cases. However, effectiveness of creative things may be personal and involve a problem of self-expression (Runco, 2009, p.452). For instance, all artists create their works with an original intent, but not all artworks are creative. Even if they may be, they are related to self-expression. In contrast as argued by a global economic scholar of the 20th century named Peter Drucker, innovation is deeply associated with economic, social and cultural effects in which commercial success must be presumed. This is strongly bonded to contextual (external) factors for the many. Accordingly, design places emphasis on creativity based on an effectiveness and design creativity is in a position to aim for innovation. Design creativity appears as a type of solution to find measures for improvement from existing things rather than an original or creative approach to create something out of nothing.

4. Conclusion

We are living in an era with difficulty of obtaining knowledge from vast amount of information. Information is simply data, and knowledge can be established as the base of creativity depending on how information is filtered and refined or processed. According to reliable study results, 80% of creativity can be acquired through learning. This implies that knowledge and intelligence are connected with creativity. There is no means to quantify creativity like IQ. Even if such means is developed, reliability of the method cannot be guaranteed. Nevertheless, creativity is partially related to information, knowledge and intelligence, and it is operated by interaction of these.

Computer system has contributed to the systematization of explosive amount of information and creation of knowledge, and it has even facilitated codification of knowledge. Thanks to the analytical ability of cutting edge artificial intelligence, knowledge is becoming more elaborately refined and systematized, and the use of Big Data is a representative example. Knowledge accumulated and mass produced on top of vast amount of information is again returned as information and extracted as new knowledge. With such virtuous cycle and regeneration system, potential of creativity was expanded through codification of knowledge.

In design, creative outputs are derived by defining problems from existing things and by finding solutions. Creativity is the most essential virtue needed in the process. For this reason, creativity has been a popular topic of discussion in design methodology. New and integrated design solutions are demanded to resolve wicked, ill-structured and unique design problems which occur in diverse domains (stages). This is the inherent reason why creativity is centered on design.

Design identity appears through values of trust and innovation drawn in the minds of people based on tangible and intangible elements that are creative and innovative, and superior design technology exhibits its effects on top of identity. That is, end-users need time to settle

6) Original source: Clydesdale, G. (2006). Creativity and Competition: The Beatles. *Creativity Research Journal* 18. p.21.

emotional experience and recognition on the existence of design object as a value (image) of brand or corporation, and this requires a process of social and cultural accommodation.

Since design is a science centered on intuition and intellect, and a universal art for the many at the same time, design creativity appears as a solution when a concept (idea) is intuitively embodied based on perception (recognition) and experience. Also, it is neither too original nor too effective (functional). This is because design is not a form of art that focuses on original self-expression and is not bound to technology excessively leaned to rational function and performance. Therefore in design, creativity is based on perception and experience, and it is visualized by intuitively embodying a concept (idea).

Design creativity is linked with the 4th generation design thinking and crosses the borders between interdisciplinary areas. A process of finding solutions through collaboration with diverse experts is demanded. The 4th generation design thinking, a process that supplements disadvantages of group creativity in which various creative alternatives can be neglected by members with vested rights or collective reasoning and maximizes creativity of individuals, has creativity at its center.

Design creativity is connected, transported and converged by perception, intuition, knowledge and experience including senses about an existing thing. It is expressed as a form of solution that pursues innovation based on reflection of innate motivation and contextual factors under constraints and on effectiveness of transition process. Thus, design creativity is placed in the domain of creative innovation, which combines creativity for innate motivation and innovation for universal effectiveness of external factors.

Design creativity discussed in this study is expected to have significant value for articulation of creativity in both individuals and groups under various environments including education sites, government institutions, enterprises and markets. Also, the argument of Dyson that existing things are always connected to newness is an ordinary phenomenon discovered once the box of creativity is opened. However as argued by Gardner, absolute time and persistent efforts are essential for creative or innovative idea. Based on the discussions of this study, it would be necessary in the future to summarize obstacles of design creativity and approach solutions to them.

References

- 1 Bae, S. (2011, June). Innovative King Euija. *The Chosunilbo*, (pp. 15-16), C5.
- 2 Brown, T. (2009). *Change by Design*. New York: HarperCollins Books.
- 3 Cialdini, R. B. (2002). *설득의 심리학1[Influence]* (Lee, H. trans.). Seoul: Book21.(Original work published 2002)
- 4 Clydesdale, G. (2006). Creativity and Competition: The Beatles. *Creativity Research Journal*, 18(2), 129-139.
- 5 Daley, J. (1982). Design Creativity and the understanding of objects. *Design Studies*, 3(3), 133-137.
- 6 Dorst, K. & Cross, N. (2001). Creativity in the design process: co-evolution of problem-solution. *Design Studies*, 22(5), 425-437.
- 7 Gardner, H. (1993). *Creating Minds*. New York: BasicBooks.

- 8 Garvin, W. L. (1964). Creativity and the design process. *Journal of Architectural Education*, 19(1).
- 9 Jang, W. (2009, July). Technology is Leveling, and the Future Depends on Artistic Originality. *The Chosunilbo*, (p. 4), C3.
- 10 Kim, D. (2010). *The Essence and Value Judgment of Design Criticism*. (Ph. D' s Thesis). Chungang University, Seoul, Korea.
- 11 Kim, D. (2013). Imitation and Design. *Journal of Korean Society of Design Research*, 26(2), 85–106.
- 12 Kim, G. (2004). *Understanding of Kant' s Aesthetics*. Seoul: Philosophy and Reality.
- 13 Lee, D. (2005). *Architectural Design Research Methodology*. Seoul: Sigongmunhwa.
- 14 Lee, I. (2012, November). Computer and Smart Phones with Improved Translations. *The Chosunilbo*, (pp. 3–4), C6.
- 15 Lee, J. (2010, July). Brainstorming is Actually No-brainstorming. *The Chosunilbo*, (pp. 10–11), C1.
- 16 Lee, J. (2011, January). Focus on What is Important. *The Chosunilbo*, (pp. 29–30), C4.
- 17 Lee, S. (2012, May). Professor Markman the Master of Cognitive Science. *The Chosunilbo*, (pp. 19–20), C3.
- 18 Paulus, P. B & Nijstad, B. A. (2003). *Group Creativity: Innovation through Collaboration*. New York: Oxford University Press.
- 19 Roy, R. (1993). Case studies of creativity in innovative product development. *Design studies*, 14(4), 423–443.
- 20 Runco, M. A. (2009). *Creativity: Theories and Themes* (Jeon. K. etc. trans.). Seoul: Sigma Press.(Original work published 2007)
- 21 Shenkar, O. (2010). *Copy cats*. Boston: Harvard Business Press.
- 22 Simon, H. A. (1984). "The structure of ill-structured problems." *In development in design methodology*. Nigel Cross (Eds). New York: John Wiley and Sons.

