

A Phenomenological Analysis of Divergent Experience of Digital Visualization in Graphic Design

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Abstract: *Divergent thinking is a process that is associated with creativity. As quantitative studies dominate creativity research, this article presents an idiographic interpretation of the Divergent Experience in Digital Visualization. As experience is the object of study, this study employs the phenomenological method. Data are collected through protocol analysis from seven participants. The data is then analyzed through the phenomenological reduction. The findings presented the varying degrees of divergent experiences followed by discussions or a critical dialogue with theories of creativity, knowledge representations and analogical thinking.*

Keywords: Creative Process, Divergent Thinking, Graphic Design, Digital Visualization, Phenomenology

1. Introduction

Divergent thinking is a process associated with creativity. In particular, divergent thinking is closely related to ideation (Runco & Acar, 2012; Runco, 2008). This study explores how several divergent thinking is experienced during digital visualization among Novice Designers. Understanding how it is experienced would yield insight into the thinking process or contribute to the understanding of Design thinking processes in Graphic Design.

2. Literature Review

In the past, several studies and argument have been made to show that visualization is a unique ability that is associated with perception and experience, which led to cognition (Sharps & Wertheimer, 2000; Bruner, 1964; Thurstone, 1950). Guilford (1956) describe this particular ability as divergent thinking which is a sub-process of the intellectual mind that exhibits creation or creativity. In his influential work, he introduced several concepts thought to be divergent, namely 1) fluency, 2) flexibility, 3) elaboration and 4) originality. Elaboration is closely related to visualization. And while fluency and flexibility are commonly exhibited verbally, the need to produce iterations and versions of artwork, or satisficing, during the process of Graphic Design shows that it can be observed in visuals.

However, the process of Designing is cyclical or in iteration (Goldschmidt, 2014, p. 13) and thus require a thorough investigation. For instance, the iterative process of research, ideation and implementation (Brown & Katz, 2011) accounted for the whole task to be successful and therefore requires a multitude of complex processes. This is evident in a study that shows other processes — such as convergent thinking—happened concurrently with divergent thinking during the design process (Goldschmidt, 2016; Goldschmidt & Weil, 1998). The attitude of

'satisficing' or the search for optimum solutions (Simon, 2001), and going back and forth between problem and solutions spaces shows that cognitively, Design is historical (Dasgupta, 2019). This means that separating the processes of Design, each with its own objectives will not yield a holistic account of its creative process. Although nomothetic or quantitative studies, which dominates creativity research (Long, 2014), an idiographic understanding of these processes can provide a description on how it is 'lived' and thus provides insights that are transferable (Lincoln & Guba, 2006).

Therefore, this article presents a different approach in studying divergent thinking in Design by looking at how it is experienced, and thus an idiographic account of the creative process in Graphic Design. Suggestions of an idiographic study of Design has been encouraged in particular through the lens of phenomenology due to its philosophical tradition and position of experience as an object of study (Giorgi, 2009).

3. Method

A Phenomenological study is often motivated by broad questions (Moustakas, 2010). The question that this study attempts to answer is: How divergent thinking is experienced during the process of digital visualization in Graphic Design? to answer this question, data is collected from seven novice designers or undergraduates of a Graphic Design course in a public university in Malaysia. Data are collected through protocol analysis by way of concurrent and retrospective probing (Ericsson & Simon, 1980) that is common in Design research (Goldschmidt, 2014, p. 37). Participants are given graphic design tasks with the use of Computer Graphics Technology such as Adobe Illustrator and Adobe Photoshop, to call forth the divergent process into 'being', or in simpler terms to elicit divergent responses that include ideational fluency, flexibility and elaboration. Data are verbalized by the participants, audio-recorded and transcribed.

This study uses Giorgi's (2009) method of descriptive phenomenological analysis. It is a phenomenological reduction that includes several steps. The steps are 1) reading for the sense as a whole, 2) identify units of meaning, 3) variations of the meaning units with psychological dimensions, and 4) the description of the general structure of the experience.

4. Findings

The findings will be presented according to the steps of analysis. Therefore, the order of the findings is reported in the sequence of 1) the summary of the experience, 2) thematic analysis, 3) the psychological meaning of themes, and 4) the constituents of the psychological structure of experience.

4.1 Summary of experience

It is crucial for a phenomenological analysis to be described through experience. To summarize each of the participants' experience will produce a lengthy article. Therefore, all of the participants' experience is summarized in this section. The summary is retold in the paragraph below.

The experience of divergence in digital visualization is a process of transforming symbolic ideas into figural representation. All of the participant experience visualization in varying degrees; It is experienced when ideas are fluently produced on the mind by recalling concepts that pertain to visuals (1). When ideas are

decided, it is elaborated and refined, and thus creates several iterations with the addition of newer concepts to complement the visual whole (2). Technical skills are required in elaboration, and in some sense, it is experienced with conceptual skills as a benchmarking procedure to seek appropriateness (3). Elaboration is also experienced independently from concepts, and this can signify the process of achieving completion or fixation (4).

From the summary above, this study has identified four varying degrees of experience that forms several themes namely: 1) fluency through conceptual mapping, 2) Fluency and elaboration through concepts and skills, 3) Elaboration based on skills and concepts, and 4) elaboration based on skills.

4.2 Thematic analysis

The previous section has identified the themes found in the data. Each of the themes is not an isolated event but instead happens along the process of digital visualization. This means that each of the participants' experienced at least one, or all of the themes presented to a varying degree. The analysis of these themes is shown in the next subsections.

4.2.1 Theme 1: Fluency through conceptual mapping

From the data, it is revealed that fluency is a result of a combination of concepts. When problems of a design task are given, it stimulates the participants' ability to recall concepts from memory or encourage the search for information on various sources such as the internet. Concepts can be abstract or concrete and are used to inform the participants on what they should elaborate. Concepts are used in combinations, in which it is controlled by a larger superordinate structure or a visual whole.

I: Can you tell me about your idea?

P2: Earlier in the process I try to convey the concept of Cubism

I: Ok

P2: And after a while, it looks similar to a video game that I have played. And then I intentionally make it look realistic so that the message will be straightforward.

I: So... the video game that you played... what was it?

P2: The game had an apocalyptic theme

The vignette above shows that during the design process, P2 fluently states several concepts such as 'cubism', inspiration from playing games, and how the game had an 'apocalyptic' visual theme. 'Cubism' in particular, is a concrete concept that provides explicit visual attributes. 'apocalyptic' on the other end is abstract and is recalled solely from his experience of video games. This means that the characteristics of an 'apocalyptic' visual style are based on P2's own interpretation. From this brief vignette, we can see that P2 at that moment produce ideas by recalling 'cubism' with his own concept of 'apocalyptic' for his artwork. These two concepts are combined to form a visual whole or a larger superordinate structure. This process of ideation occurs at a symbolic level.

4.2.2 Theme 2: Fluency and elaboration through concept and skills

Another feature of the divergent experience is ideation produced through elaboration. This often involves the retrieval of concepts and skills. In this particular theme, ideas are produced

after the participants reflect on their produced artwork. This means that unlike the previous theme, this theme happens after or during elaboration.

P3: I want to do 'semi-details'...
I: What do you mean by 'semi-details'?
P3: Like details in the shapes...my concept is, I don't want it to be too realistic
I: Too realistic?
P3: Yes...
I: So... can you explain more on the details?
P3: It's like...I tried to do a bit of 'hatching'...

I: do you really need to do it like that?
*P3: I'm afraid that if I didn't, viewers would not understand the visual object...
 that's the reason*

From the vignette above, P3 mentioned the incorporation of 'semi-details' through the technique of 'hatching' on a visual object. The reason for that is to avoid the artwork to become 'too realistic'. From this instance, we can see that all of the concepts recalled (semi-details, too realistic) are abstract and used as a benchmark while reflecting on the artwork. Moreover, both concepts are implemented or elaborated through the technique of 'hatching'. All of these concepts and skill are combined to provide a visual that is not 'too realistic'. This is an example of ideas produced as a result of elaboration. When ideas are implemented after specific elaborative procedures through skills, the generated artwork gives room for reflection. And at times results in the evolution of the artwork into a newer version or categories which is akin to *ideational flexibility*. Therefore, this ensures that ideas are produced are appropriate.

4.2.3 Theme 3: Elaboration based on concepts and skills

This theme is similar to theme 2; however, it is discussed separately as this theme had a minimal activity that exhibits ideational fluency. This means that the retrieval of concepts such as in theme 1 and 2 rarely occur. Often times, ideas are sourced from ready-made sources from the internet. Below is a vignette that exemplifies this theme.

I: Is this image common?
P4: image?...
I: Can you tell me...among all of the images(ready-made image), why did you choose this particular one?
P4: When I browse the internet for images, I sensed that not a lot of it is original...so I tried to create my own style.
I: Is this the reason why you placed the images on the canvas?
P4:Yes... to view the styles...For instance such as this one, it is much more complex(to be done)...and this one, it seems the strokes are thicker...

I: You seem to take a lot of time doing this Design?
P4: Usually, it will take a longer time... I feel lost a bit...
I: Did you know the reason?
P4: I'm not sure...

The vignette above illustrates the elaboration procedures of P4. However, P4 seem to understand the concept of originality, much of the time spent on evaluating ready-made images obtained or downloaded from the internet. P4 is also aware of the feeling of being lost despite

not knowing the reason for it. Ideation is minimal, perhaps due to the improper concepts that dwell on P4's mind. Instead of concepts that pertain to the development of visuals, P4 verbalized vague productive measures such as 'originality' and how the design process 'take a long time'. Moreover, as the probes above show, the lack of conceptual input encourages P4 to evaluate or conform to concepts found in ready-made images. In addition, her evaluation is mainly technical or only related to skills, such as 'thicker strokes' or being 'complex' which is not tied to any concepts related to visuals in further probes.

4.2.4 Theme 4: Elaboration based on skills

This theme only involves skills during elaboration. In one way, skills inspire the creation of new visual objects which concepts can be attached later on

I: Where did the idea for this artwork come from? What inspires you?

P7: What I did was...how would I say it...there are times where I edit points, and I move the object around, and from there I got the idea.

I: so it is a different concept then?

P4: it's becoming a different concept, similar to the usual visual representation of 'data corruption'.

From the above, P7 produce a visual object mainly from 'tinkering' on specific skills. P7 mentioned how at times he edits 'points' — a feature of the tools that P4 use to create visual objects — and how he moves the object around while not even mentioning any concepts during this process. Furthermore, the result of the tinkering provides an insight of other visual styles ('data corruption') that P4 recalled. Further probings indicate that 'data corruption' is inspired by a video game that he had played. This illustrates how ideas are produced only with skills, and it is appropriated by attaching concepts after the artwork is done.

On the other end, elaboration solely based on skills or techniques caused the change of ideas in its entirety. Below is a vignette of P5 and the technique called 'double exposure' in.

I: What's the idea behind the 'double exposure'?

P5: Initially, I wanted to fit the text into the illustration...and then I thought...it is a bit hard to do...so I tried double exposure

...

I: Is this the first time you tried 'double exposure'?

P5: Yes... it is a technique that I saw in an online design competition.

For P5, his work is an attempt to conform to technical requirements. Before venturing on 'double exposure', P5 had another idea in mind. But since the concept is hard to implement, he shifted to the 'double exposure' technique as a solution despite being fully aware that it has not been done before. Recalling the technique from an online competition highlights the absence of conceptual justification. Further observation of P5's design process shows a frequent diversion of ideas instead of a constructive and evolutionary design process. Although this can be viewed as a form of divergence (ideational fluency and flexibility), the artwork rarely achieved the desired outcome or achieving towards completion.

4.3 Psychological meaning of themes

The previous section presents some of the probes to identify units of meaning. It is evident that within the examples before, the meaning units of the experience of divergent thinking or

ideation can be broken down into two categories namely 1) the use of concepts, and 2) skills. The table below is a list of words from the data group within these two categories.

Table 1: meaning units revolve around conceptual information(left) and skills(right)

| Conceptual | | Skills or techniques | |
|---------------------------|-------------------|----------------------|------------------|
| Concrete | Abstract | Tools | Efficiency |
| Cubism | Semi-details | Hatching | A bit hard to do |
| Visuals from a video game | Original | Complex | Longer time |
| Realistic | Apocalyptic | Thick strokes | Ready-made image |
| Data corruption | Not too realistic | Double exposure | |
| | | Editing points | |
| | | Move objects around | |

From table 1 above, we can see that the categories of conceptual information and skills had subcategories. On the left side of the table, some concepts are concrete such as *cubism*, *visuals from games*, *realistic* and *data corruption* in which directly informs the participants the manner of visual objects to create. The abstract concept on the other end such as *semi-details*, *original*, *apocalyptic* and *not too realistic* requires interpretation through the combination with other concepts to form a unified visual whole (e.g. Apocalyptic with cubism) or with techniques (e.g. Semi-details with the technique of hatching) to produce figural presentations or visuals to further for reflection. On the right side of table 1 is the knowledge that relates to skills. Participants verbalized skills that are associated with computer tools or describing technical procedures. *Hatching*, *thick strokes*, *editing points*, and *moving objects around* signify creation with the use of tools. *Complex* and *double exposure* represent a group of techniques to achieve a single visual outcome. Skills are also described as associated with efficiency, for instance, the notion of 'a bit hard to do', how it took a 'longer time' and the use of 'ready-made' images sourced from the internet that provides aid in elaboration.

4.4 The General Psychological Structure

The previous section demonstrated the reduction of the data through the overall summary, constituents or thematic analysis and the content of its psychological meaning. The findings so far are adequate to provide the general psychological structure of the divergent experience in digital visualization. The structure can be described as follows:

The experience of divergence in digital visualization is a process of using and combining information that is most relevant to the practice of Graphic Design. When ideas are required, conceptual knowledge, either concrete or abstract, is retrieved internally from memory such as experience or from external sources such as the internet. Ideas are produced by firstly going through a symbolic combination between concepts (theme 1). When ideas are symbolically decided upon, elaboration ensues by retrieving technical skills or knowledge to transform symbolic ideas into figural representation on the computer. In this experiential phase of elaboration, other ideas can be produced to complement previous symbolic ideas along with technical skills (theme 2). During elaboration, concepts are also experienced as a benchmarking procedure (theme 3). This means that new ideas are not produced, but rather technical skills are used to complement symbolic ideas. Elaboration is can also be an experience of the domineering of technical skills (theme 4). This is experienced when visualization is working

towards completion or can be viewed as a fixation, as at this phase of elaboration, ideas are not produced.

The summary above, it is clear that divergence is experienced through four varying with an underlying conceptual knowledge and technical skills.

5. Discussion

The findings show that the divergent experience consists of ideation fluency, flexibility and elaboration influenced by conceptual and technical skills. In this section, critical dialogue with theories that pertain with the findings is discussed.

Conceptual or technical skills, or sometimes described as declarative and procedural knowledge influence the experience of divergence. This conforms to the model of cognition and creativity, whereby knowledge is one of the main components along with motivation (Runco & Chand, 1995). The use of knowledge found in this study also supports the argument that creativity is domain-specific that require domain-relevant skills (Baer, 2015). In regard to knowledge, declarative or conceptual knowledge plays a larger role in ideational fluency as it paves the way for the mind to think technologically (McCormick, 1997). Furthermore, declarative knowledge allows ideas to be defined accurately (Kirkhart, 2001) and thus informs divergent elaboration tasks. As is seen in the findings, the involvement of conceptual knowledge allows a combination to produce a larger schema that becomes a superordinate structure that corresponds to the visual whole. The dominance of technical or procedural knowledge in elaboration on the other end shows that during the creation of a product —instead of creative thought that is symbolic—the creative process must converge towards the use of Computer Graphic Tools. This is similar with the notion of creativity and constructivism in which, accommodation —the process of adapting assimilated ideas to the environment— is the focus during implementation and the creation of a product (Ayman-Nolley, 1999). In a constructivist sense, the varying degrees of experience might resemble an equilibration process in which the design process is a cycle of assimilation and accommodation. Therefore the findings are consistent with the notion of 'satisficing', and the element of constructive thinking believed to be the values of Design in general (Cross, 1982).

Conceptual or declarative knowledge found in this study resembles an analogical — will be discussed in a later paragraph — and symbolic representation. Symbolic representation preserves extrinsic qualities; in other words, concepts that are abstract which are inherent in its surface but can be represented through different structures in mind. For instance, in producing some participants use abstract concepts as a superordinate structure and define it by adding other concepts (McNamara, 1994). One such example is found in P2 in which the concept of 'Apocalyptic' is a larger symbolic concept that is later reinforced with the concept of 'cubism'.

Procedural or technical knowledge is used to implement ideas during elaboration. The verbalized account of the participant broadly describes knowledge that is closely associated with the tools that they use. It is believed that procedural knowledge is not consciously acquired (Lewicki et al., 1987). The account of '*it is hard to do*', '*complex*' and require '*a lot of time*' might explain how procedural knowledge is used in predicting technical difficulties. This is because the criteria for each of this verbalized account is not made explicit, despite showing a sense of understanding. This means that it is solely gained from the participants' past experience in designing. The use of procedural knowledge in this study is used mostly after the use or combinations among declarative knowledge. No substantive evidence directly shows or imply

its combination with conceptual or declarative knowledge. Such combinations will occur if procedural knowledge outgrows and evolve into declarative knowledge through an extended period of time (ten Berge & van Hezewijk, 1999). This is an area of interest in design research due to the technical culture of Design, and evidence of the transfer of Procedural knowledge to different tools and technologies among experts (Lang et al. 1991)

As stated before, knowledge, in particular, declarative knowledge is also analogical (McNamara, 1994). This means that it is possible that what underlies the divergent experience is the process of analogical thinking. The combination among concepts and declarative facts, or possibly to a certain extent with an outgrown procedural knowledge is probably a mapping procedure typical of analogical thinking (Holyoak & Thagard, 1995). And numerous studies have shown interests in its influence on various aspects of Design (Jia et al., 2019; Alipur et al., 2017; Choi & Kim, 2017; Casakin, 2010; Dahl & Moreau, 2002). This study supports analogical thinking as a process that underly divergence based on three reasons. Firstly, the retrieval of concepts which are one of the earlier steps of analogical reasoning (Holyoak & Thagard, 1995) which is common in the findings.

Secondly, the reason for analogy is the combinations of concepts to produce a larger structure for a 'visual whole'. This study believed that analogy is obvious as tasks, aims or goals — or in this sense, producing graphic visuals — which are declarative and factual, facilitates the retrieval of concepts for ideation. This represents the induction of schema through analogy facilitated by concrete semantic structures (Gick & Holyoak, 1983). Future studies can investigate if this is the reason for domain specificity of creativity among designers.

Third and finally, the varying degree of experience or themes. It is possible that the different degrees of experience are a response to satisfy analogical constraints (Holyoak & Thagard, 1997). For instance, the use of the ready-made image as aids for elaboration is perhaps constrained by surface similarity (Trench & Minervino, 2015) as it provides explicit visual attributes for the participant to map with symbolic ideas. In addition to surface similarity, the easiness in obtaining ready-made images as guides increases the possibility of an isomorphic or structurally one-to-one mapping (Holyoak & Thagard, 1989) which explain the reason why these sources are approached and the subservient use of conceptual knowledge; as images from the internet provide ideas, the mind shifts its focus towards implementing it instead of analogizing concepts. In addition, analogies can be constrained by pragmatic concerns (Spellman & Holyoak, 1996). The notion of inefficiency and unproductivity such as too 'complex' or 'hard to do' signifies an ideal purpose which facilitates the analogical process. Instead of taking an adventurous route in experimenting with various concepts and ideas — that sometimes require more significant mental effort or time—Analogy is constrained by the urge for quick completion. The shifting of techniques which influence the change of ideas is also a systematic constraint or systematicity (Clement & Gentner, 1991). In this sense, instead of finding novel solutions, an analogy is facilitated through 'tried and trusted' procedures that have become systems. For instance of P4, in which the use of 'double exposure' —which is a system or a group of procedures— is favoured, as it is a highly regarded technique—or trusted— that is celebrated in online competitions.

6. Conclusion

The findings and discussion described the psychological meaning of divergent experience in digital visualization. Design can be a form of mental synthesis (Kokotovich, 2000), and therefore, it is possible in different types of studies, other processes can be revealed. Future

studies are required, especially in providing more evidence of the relationship between analogy and divergent thinking. Its implication can be applied in nurturing creative talents as a comprehensive explanation of the creative process of Design can inform educators to deliver effective thought processes as Design is dominated by a technical culture that utilizes studios and workshops instead of classrooms. In this way, the training of craftsmanship can be expanded and perhaps leads to novel innovations.

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