THREE DRIVEN APPROACHES TO COMBINATIONAL CREATIVITY

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Abstract

Creativity is a crucial element of design, and a human attribute that has aroused significant attention. However, few studies have focused on the factors and motivations that drive creativity. The aim of the study is to investigate the driving forces behind combinational creativity for developing original creative products. We propose three driven approaches to combinational creativity, the problem-driven approach, the common-driven approach, and the inspiration-driven approach, based on previous research projects on design process, design strategy, and design cognition. A test involving two-hundred practical products has been conducted to validate the three approaches by means of expert evaluation. The test results have indicated the validity of the three driven approaches. The three approaches proposed in this study have provided an understanding of how combinational creativity is driven in design, which could lead to a better comprehension of human creativity in design. The study enables indication that the three approaches can be applied by designers to aid in the production of creative designs for and in resource-limited societies.

Keywords: Creativity, Design methods, Conceptual design, Product design, Driven approach

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1 INTRODUCTION

Design is a natural cognitive function of the human brain (Cross, 2011), which relies upon the generation of alternative ideas (Childs, 2014). It is described by the DESIG (Design Education Special Interest Group of the Design Society) as 'the total activity necessary to provide a product or process to meet a market end' (Pugh, 1990; Childs, 2014). The UK Design Council (2011) described design as a specific end to the deployment of creativity, which links creativity and innovation. However, design is essentially resource-limited. It usually initiates with an idea, alternatively idea generation, and ends up with drawings or computer representations that enable the manufacture and utilisation of a product (Childs, 2014). Idea generation, also known as ideation, is the process of generating ideas in design activities, which essentially determines the type of designs produced (Howard, 2011). It is considered as a vital role to the novel design and marketing of new products, and the key to success in business (Toubia, 2006). Generating creative ideas is significant, as commercial value is generally transformed from creative ideas (Howard et al., 2008).

Creativity is an integral part of design, which is defined as 'the ability to imagine or invent something new of value' (Childs et al., 2006), 'the production of novel, useful products' (Mumford, 2003), and 'the ability to come up with ideas or artefacts that are new, surprising, and valuable' (Boden, 2004). It is considered as a crucial element in design, which initiates innovations, assists problem solving, and increases a firm's market share (Sarkar and Chakrabarti, 2011). Childs and Fountain (2011) indicate that creativity is highly related to business commercial performance. More than a decade ago, 75% of the profits of the UK's most innovative companies were generated from products that did not exist 5 years previously (Cox, 2005). It has been reported that design can create economic value (Heskett, 2009). For example, £71.7 billion in the gross value added (GVA) of the UK, which is equivalent to 7.2% of the total GVA, were delivered by design (Design Council, 2015). This indicates that design is regarded as the bridge which connects creativity and economic benefit and thereby suggesting the significance of producing creative ideas.

A number of methods have been developed to enhance creativity in idea generation for design, for instance conventional creativity tools such as brainstorming (Osborn, 1979) and TRIZ (Altshuller, 1984), advanced design methods such as design by analogy (Linsey et al., 2012), and computational approaches such as the Combinator (Han et al., 2016) and a data mining approach (Shi et al., 2016). Most of the creativity tools do not actually generate creative ideas, but stimulate a user's mind by removing mental blocks that inhibit creativity (Childs, 2014). Creativity is a notoriously elusive phenomenon, which has traditionally been associated with human genius and serendipitous discovery. In recent years, an increasing number of studies are focused on creativity and design tools, especially computational tool, for helping designers promote creativity in design. However, little attention has been paid to the investigation of the factors and motivation that drive human creativity.

The purpose of this paper is to report insights on the driving forces behind combinational creativity, especially in product design aspects. Combinational creativity, which is the easiest method to achieve creativity, involves unfamiliar combinations of familiar ideas (Boden, 2004). Understanding the driven approaches to combinational creativity can lead to a better comprehension of creativity, and thereby significantly improve creative idea generation during design. Additionally, understanding the driving forces of combinational creativity could assist in the development of computational tools that simulate human creativity. In this study, we have proposed three driven approaches to achieve combinational creativity, which are the problem-driven approach, the common-driven approach, and the inspiration-driven approach based on previous research studies on design process, design strategy, and design cognition. In order to validate the three driven approaches, we have conducted a test containing two-hundred creative practical products by means of expert evaluation. The test results have demonstrated the validity of the three approaches and indicated that the three driven approaches were applied, independently and complementarily, for originating the practical products concerned. Significantly, no other driven approaches, which were used to originate the products concerned, have been identified by the evaluators. The three driven approaches for achieving combinational creativity proposed in this study provide a particular understanding of how and why combinational is produced by humans. The study can be used for assisting designers and researchers in understanding creativity and generating creative ideas, as well as in developing computational creative idea generation tools.

2 COMBINATIONAL CREATIVITY

Creativity is a fundamental feature of human intelligence (Cross, 2011; Boden, 2004). The outputs of creativity can be novel, quality, and useful ideas, products, or processes, which are the results of long periods of work with a series of mini-breakthroughs (Carruthers, 2011; Childs, 2014). Creativity can be distinguished into two levels, P-creativity (psychological creativity) and H-creativity (historical creativity) (Boden 2004). P-creativity, also known as little-c creativity (Kaufman and Beghetto, 2009), involves coming up with surprising, valuable ideas that never occurred to the person who generated them. It is not relevant how many people have generated the ideas before. H-creativity, also named as big-C creativity (Kaufman and Beghetto, 2009), involves generating ideas that have never occurred in the history before. It can be regarded as a special case of P-creativity. The distinctions between P-creativity and H-creativity are helpful for appreciating the significant contributions from talented people and understanding the psychology of creativity.

Boden (2004) has indicated three approaches to achieve creativity in our human mind, which are exploratory creativity, transformational creativity, and combinational creativity. Exploratory creativity involves the exploration of the conceptual space or structured style of thinking. For example, the different flavours of the 'Lays' chips. Transformational creativity includes transforming the conceptual space to produce ideas in new styles of thought, for instance, Picasso's masterpieces. Combinational creativity involves exploring unusual combinations of usual ideas. For example, the 'Apple Watch' combines watch and mobile phone, albeit with a very sophisticated operating system; the 'Dyson' vacuum cleaner is the result of combining vacuum and cyclone.

Combinational creativity, which is achieved through associating ideas which were previously indirectly linked, is the easiest form of creativity for human beings to achieve (Boden, 2004). A number of people have used the term 'combinational creativity' to explain what creativity is. For instance, Childs (2014) described that creativity arises from the combination of some essential mental capabilities; Henriksen et al. (2014) explained creativity as 'the process of making alterations to, and new combinations with, pre-existing ideas and artifacts, to create something new', and Frigotto and Riccaboni (2011) indicated the nature of creativity is to combine. Combinational creativity has been used widely in design, but in various forms. For example, analogy is a form of combinational creativity involving the exploration of shared conceptual structure (Boden, 2009); another form is bisociation which connects unrelated and often conflicting ideas in a new way (Koestler, 1964); the three types of concept synthesis, which are property mapping, concept blending, and concept integration, proposed by (Nagai et al., 2009).

Combinational creativity can be composed by elements such as ideas, concepts, words, images, and sounds, as well as more abstract ones such as music styles and artistic genres (Ward and Kolomyts, 2010). Noun-noun combination is the conventional form of combinational creativity, which is focused in the study. In noun-noun combinations, a noun is not limited to a single noun word (such as 'robot') and it can be a noun phrase (such as 'vacuum cleaner'). A number of studies have investigated noun-noun compound phrases as well as how people interpret them, see (Costello and Keane, 2000; Ward et al., 2002). Taura et al. (2007) and Nagai et al. (2009) indicated that a noun-noun compound phrase is generally interpreted by property mapping, hybrid, and relational thinking. According to the methods for interpreting compound phrases, they indicated that a synthesised concept or idea can be interpreted by property-mapping, concept blending, and concept integration. Property-mapping involves transferring some features from an existing idea to another idea, which is considered as the most effective process. For instance, a 'chocolate-potato' can be interpreted as a 'brown potato', as 'brown' is a feature of 'chocolate'. Concept-blending is the process of blending two basic ideas at the abstract level and generating a new idea that inherits partial structural features from the basic ideas and has its own structural features. For example, 'cookie chips', a type of chocolate cookie in the form of potato chips, can be derived from 'chocolate-potato'. Concept integration includes the combination of two basic ideas by using thematic relations. For instance, based on 'chocolate-potato', 'chocolate flavoured crisps' is produced from the scene of situation that chocolates and potatoes are cooked together.

This section has illustrated the interpretation methods of noun-noun combinational ideas in design. Various ideas can be derived from the same noun-noun compound idea by using different interpretation methods. However, how the basic two ideas are selected, why the basic ideas are combined, and what drives the combination of the two ideas are undiscovered. For example, the motivations and reasons of why 'chocolate' and 'potato' are combined or can be combined to stimulate creativity are uncharted. This can be interpreted as the driving forces of combinational creativity are unknown. Therefore, in order to understand what drives creativity, especially combinational creativity, the driving forces or motivations that promote combinational creativity is required to be studied.

3 THREE DRIVEN APPROACHES TO COMBINATIONAL CREATIVITY

In this study, the term 'idea' is regarded as an object or the concept of an object. To be more precise, an idea can be considered as the representations, such as features, functions and attributes, of an object as well as the aesthetics of the object. Here, an 'object' is not limited to a physical object, which also involves abstract objects, such as artistic genres. 'Aesthetics' involves both the physical shape of the object as well as the notion of the figure. The definition of 'idea' is based on Taura and Nagai's study (2013) and in line with the research in design study (Hatchuel and Weil, 2009). As illustrated in the previous section, the study is focused on noun-noun combinations. Here, the two nouns are considered as two ideas which constitute a combinational idea. The following paragraphs illustrate how designs are promoted during the design process. We come up with three hypotheses on how combinational creativity is driven with corresponding practical instances. The three driving forces, which are problems, common representations, and inspirations, are proposed based on previous studies on design process, design strategy, and design cognition.

A problem can be considered as a recognition of an incomplete pattern requiring resolutions (Coccia, 2016). In order to solve a problem, related data are assimilated to discover a solution by means of mental acts. In design, a problem is defined as a gap between a target of an object and its existing situation, and problem-driven is an approach to produce ideas based on the problem (Taura and Nagai, 2013). In addition, problem-driven is the dominant strategy employed by designers, which often leads to quality solutions (Kruger and Cross, 2006). This indicates that solving a problem in design can be regarded as exploring ideas to bridge the gap between the target of an object and its current situation. For example, designing a parasol that can be used all day is considered as the target of the object. A parasol (the object) is generally used to protect from the sun during daytime, which is the existing situation of the object. Thus, the problem or the gap between the object and the target is to use the parasol during the night. A torch is often used in outdoors during the night, and this can be understood as an idea that can bridge the gap and solve the problem. Thus, the target can be achieved through implementing a torch on a parasol. In terms of combinational creativity, this example can be interpreted as combining a parasol (the object) and a torch (the problem-solving idea) to achieve an all-day parasol (the target). A practical design solution of an all-day parasol, which combines a parasol and a garden torch, is the NI Parasol 350 Sunbrella (Foxcat Design, 2014), as shown in Figure 1(a). In combinational creativity, the problem-driven approach can be considered as combining a primary idea and a problem-solving idea to achieve a target idea. In the problem-driven approach, a problem is a driving force of combinational creativity in idea generation.

Two designs can be similar for sharing a set of common representations, such as features, functions, and purposes (Earl and Eckert, 2002). For example, a candle and a light bulb are both used for illumination. Here, a candle and a light bulb are similar for sharing a common representation which is the function or purpose of illumination. The perception of the similarity between two ideas involves recognising surface similarity, which refers to the attributional resemblance, and structural similarity, which refers to the underlying relational resemblance (Eckert et al., 2003; Ozkan and Dogan, 2013). Chan (2015) illustrates that artworks that possess similar critical common features, should have a similar appearance and can be categorised as the same style. This suggests that two ideas sharing a common representation or a set of common representations can be classified into the same idea category. The two ideas belonging to the same category are associated via common representations. Suzuki (2005) indicates that, in human memory, an idea can be recalled with its associated idea due to the capability of associative memory. For example, a pencil is generally recalled when a pen is mentioned. Common ideas are associated in the human brain through learning and experience (Suzuki, 2005). Similar ideas are associated via common representations, which can be regarded as ideas that are subconsciously pre-combined by humans. Although two ideas are already associated, the combination of the ideas can still be novel. Thus, the common representations of different ideas are considered as a driving force for producing combinational creativity, which we named as the common-driven approach. For instance, a spoon and a fork are both used for serving food which is a common representation that classifies spoon and fork into the cutlery product category. Thereby, a spoon and a fork can be integrated into a separate piece of cutlery. With regard to combinational creativity, this instance can be considered as combining a spoon and a fork, which were associated via a common representation, for producing a piece of combinational cutlery. GoBites (Humangear, 2015) is a practical design which combines a spoon and a fork, as shown in Figure 1(b). In terms of combinational creativity, the common-driven approach can be understood as combining a primary idea and an associated common-representation idea to produce combinational creativity. As illustrated above, common representations are considered as one of the drivers of combinational creativity in idea generation.

Inspiration is widely recognised in daily life, which often leads to creative design ideas (Chan et al., 2015). It is defined as the 'the process of being mentally stimulated to do or feel something, especially to do something creative' (Waite, 2012). In design, inspiration is described as a process integrating the use of any entities in any forms that produces creative solutions for existing problems (Goncalves et al., 2014). The descriptions are in line with the inner sense-driven process proposed by Taura and Nagai (2013) which generates new ideas based on 'inner criteria' and 'intrinsic motivation' by referring to existing ideas. Taura and Nagai (2013) explained that 'inner criteria' are which underlie the mind that guide the process of idea generation. 'Intrinsic motivation' stimulates people to perform an activity with no expectations of reward. Enjoyment and satisfaction are typically experienced when people are intrinsically motivated. In design, an idea can be produced by referring to an existing idea with a source of inspiration (Goncalves et al., 2014), which is referred to as the inspiration-approach in this study. Here, the sources of inspiration are considered as inspirational ideas that are explored by designers based on 'inner criteria' and 'intrinsic motivation'. A practical inspiration-driven combinational design example is the Juicy Salif designed by Philippe Starck (1990), which is a combination of a lemon squeezer and a squid, as shown in Figure 1 (c). The Juicy Salif was inspired by a dish of squids which Philippe Starck was having at a waterfront restaurant. With regards to combinational creativity, the inspiration-driven approach can be interpreted as combining an existing idea and an inspirational idea to form a combinational idea. In this approach, combinational creativity is driven by inspirations or inspirational ideas.

As illustrated in the previous section, the study is focused on noun-noun combinations, while the two nouns are considered as two ideas which composed the combinational idea. The first noun is the primary idea or the basic idea, which is called as the base. The second noun, which is the additional idea for forming the combination, is named as the additive. As discussed above, three driven approaches that can achieve combinational creativity are hypothesised as follows:

1. The problem-driven approach: This approach suggests that combinational creativity is driven by design problems. A target combinational idea is achieved through combining a basic idea (the base) and a problem-solving idea (the additive).
2. The common-driven approach: In this approach, combinational creativity is driven by common representations between ideas. A combinational idea is produced by combining a basic idea (the base) and an idea possessing common representations (the additive).
3. The inspiration-driven approach: This approach indicates that combinational creativity is driven by an inspiration or a source of inspiration. A combinational idea is achieved by combing a basic idea (the base) and an inspirational idea (the additive).

From the illustrations above, the three approaches are driven by three different forces which result in three different additives. In the problem-driven approach, the additive is a problem-solving idea which can bridge the gap between the base (object) and the target. In the common-driven approach, the additive is an idea that shares a common representation or a set of common representations with the base. In the inspirational-driven approach, the additive is an inspirational idea that can stimulate designers to produce solutions by referring to the base. However, in actual design idea generation, these approaches can complement each other instead of performing independently. For example, a combinational idea can be achieved by combining a base and an additive which is a problem-solving idea as well as an inspirational idea. A practical instance is the Eggboard light (Artemide 2016), which was designed to absorb sound, is composed of a light and an egg carton, as shown in Figure 1 (d). The egg carton is the additive idea which solved the sound-absorbing problem as well as delivered inspirations. This type of integrative driven approach is in line with the design process indicated by Taura and Nagai (2013), in which inner sense-driven phase and problem-driven phase realise the design process complementarily.

a. NI Parasol 350 Sunbrella (*The problem-driven approach*) **b.** GoBites (*The common-driven approach*) **c.** Juicy Salif (*The inspiration-driven approach*) **d.** Eggboard light (*The problem-driven approach and the inspiration-driven approach*)

Figure 1. Examples of the three driven approaches proposed

4 VALIDATION OF THE THREE DRIVEN APPROACHES

4.1 Validation method and processes

In order to validate the three driven approaches, a test has been conducted to investigate how combinational creativity is achieved in practical product design by means of expert evaluation. The term product design in this study involves a variety of product categories, from cookware and kitchen appliances, to furniture and lamps, consumer electronics and fashion accessories. The evaluation of a design concept or a product is generally considered as a complex multi-criteria decision-making process. The evaluation process, which is mainly based on qualitative descriptions and subjective judgements, is directed by design experts (Zhai et al., 2009). Besides, the identification of the evaluation criteria also relies on design experts (Geng et al., 2010). This indicates that expert evaluation is efficient and effective in assessing practical products. Therefore, expert evaluation was applied in this validation test for practical product analysis and assessment. However, the evaluation result might vary according to the evaluator's experience and knowledge. Two experts, a product designer with over 10 years of experience and a design engineer having over 4 years of experience, participated in the test voluntarily. The designer and the design engineer are identified as expert A and expert B, respectively, for a concise illustration in the following sections. Both of the design experts were highly interested in this research project, and thereby intrinsically motivated to participate in the validation test.

Two-hundred combinational creativity-originated products were chosen from the winners of top international design competitions by means of purposive sampling, in order to investigate the three driven approaches. Among the two-hundred products, one-hundred-and-two products were selected from the Red Dot Design Award and ninety-eight products were chosen from the International Forum (iF) Design Award. Wang and Chan (2010) indicated that international design competitions such as the Red Dot Design Award and the iF Design Award are creativity-oriented, which encourage creative design. Therefore, the design competition winners are often characterised as creative products which are novel and valuable. All of the selected products were analysed by the experts to construct a decision table, as shown in Figure 2. The table involves specific information about the products, such as the name, the image, and the description, which were adopted from the official websites of the design competitions. The name, image, and description of a product were regarded as qualitative descriptions, as they originated from the designer who came up with the product. This indicates that the specific information of a product can be used as a foundation for product analysis and assessment. Thereby, the selected products were decomposed into bases and additives according to the specific information, before starting the evaluation of the three driven approaches. For instance, Sharp 1 was decomposed into a 'knife block' (the base) and a 'knife sharpener' (the additive) based on its image and its description 'the knife block set and its integrated knife sharpener', as shown in Figure 2. According to the name, the image, the description, the base idea, and the additive idea of a product, the experts assessed which driven approach or approaches was implemented in the product. In addition, the experts were required to state if any other driven approaches, which are not included in the three driven approaches illustrated in the previous section, were applied in a product. For example, Sharp 1 was based on the problem-driven approach solely, due to that the additive 'knife sharpener' was combined to the base 'knife block' for solving the problem of 'searching for a tool to sharpen a knife when needed' according to its description, as shown in Figure 2.

No.	Name	Image	Description	The Base	The Additive	Problem-Driven	Common-Driven	Inspiration-Driven	Others (Please State)
1	Sharp 1		This knife block set and its integrated knife sharpener are a space-saving combination of different functions. It saves users from having to search for a knife sharpener when needed.	Knife Block	Knife Sharpener	Yes	No	No	No
2	GoBites Uno		GoBites Uno is a fork and spoon combination utensil following the principle of a two-in-one tool.	Fork	Spoon	No	Yes	No	No
3	Magic Swan		The special feature of the Magic Swan tap is its adjustable height.	Tap	Swan	No	No	Yes	No

Figure 2. A decision table example

4.2 Evaluation results and discussion

All the two-hundred products were assessed by expert A and expert B respectively, and shown in Table 1 and Table 2. In the tables, 'P-driven' is the abbreviation of problem-driven approach, 'C-driven' is the abbreviation of common-driven approach, and 'I-driven' is the abbreviation of problem-driven approach. 'P-driven and C-driven' indicates that both the problem-driven approach and the common-driven approach are applied in a product. Similarly, 'P-driven and I-driven' indicates that both the problem-driven approach and the inspiration-driven approach are applied, and 'C-driven and I-driven' indicates that both the common-driven approach and the inspiration-driven approach are applied. 'P-driven C-driven I-driven' implies that a product was derived by using all the three driven approaches simultaneously. In the last column, 'Others' indicates that approaches other than the three hypothesised in this study are applied for originating a product.

The evaluation results shown by expert A are illustrated in Table 1. The problem-driven approach was implemented in 142 products which were about 71% of the total 200 products, while the common-driven approach and the inspiration-driven approach were applied in 52 and 89 products respectively which were accounted for 26% and 44.5% respectively. For 18% of the products, which was about 36 products, applied both the problem-driven and the common-driven approach. The number of the products that used both the problem-driven approach and the inspiration-driven approach and both the common-driven approach and the inspiration-driven approach were 38 and 11 respectively, which were about 19% and 5.5% of the total number of the products respectively. Among the 200 products, 1% of the products (2 products) were derived by using all the three driven approaches. However, no other driven approaches applied were indicated by expert A.

Table 1. Results by expert A of evaluating two-hundred practical products (Note: P - problem, C - common, I - Inspiration)

	P-driven	C-driven	I-driven	P-driven and C-driven	P-driven and I-driven	C-driven and I-driven	P-driven C-driven I-driven	Others
Total	142	52	89	36	38	11	2	0
Percentage	71%	26%	44.5%	18%	19%	5.5%	1%	0%

As shown in Table 2, the evaluation results provided by expert B indicated that 112 products out of 200 (56%) used the problem-driven approach for achieving combinational creativity. 25.5% and 34% of the total number of the products, which were about 51 and 68 products, used the common-driven approach and the inspiration-approach respectively. In addition, both the problem-driven approach and the common-driven approach were used simultaneously to derive the 7.5% of the products (15 products), while both the problem-driven and the common-driven approach and both the common-driven approach and the inspiration-driven approach were used simultaneously for originating 6.5% and 2% of the products (13 products and 4 products) respectively. Nevertheless, none of the products originated by using the integration of all the three driven approaches. Similarly to expert A, expert B indicated that no driven approaches other than the three hypothesised in this study were applied in the 200 products concerned.

Table 2. Results by expert B of evaluating two-hundred practical products (Note: P - problem, C - common, I - Inspiration)

	P-driven	C-driven	I-driven	P-driven and C-driven	P-driven and I-driven	C-driven and I-driven	P-driven C-driven I-driven	Others
Total	112	51	68	15	13	4	0	0
Percentage	56%	25.5%	34%	7.5%	6.5%	2%	0%	0%

The test has indicated that the three driven approaches proposed in this study have been widely used in the combinational creativity-originated products concerned. Significantly, no other driven approaches have been identified by the evaluators for producing combinational creativity-oriented products. Therefore, the test has indicated the validity of the three driven approaches, albeit with a limited number of evaluators and samples. Although the two experts have come up with different evaluation results due to different experience, knowledge, and subjective judgements, the evaluation results of all the approaches were showing a similar trend. That is, the problem-driven approach for producing combinational creativity plays the dominant approach, as more than a half of the 200 products were originated by using the problem-driven approach. The inspiration-driven approach was used more frequently than the common-driven approach. However, both of the approaches were used less commonly, around one-third of the total number of the products, than the problem-driven approach. Minor proportions of the products concerned applied both the problem-driven and the common-driven approach and both the problem-driven and the inspiration-driven approach for combinational creativity generation, respectively. Very few products, less than 10 percent, were originated by using both the common-driven approach and the inspiration-driven approach. The integration of all the three driven approaches was rarely implemented for deriving combinational creative ideas. The test has demonstrated that the three driven approaches were used complementarily or independently in the products concerned.

5 CONCLUSION

The study focused on investigating the driving approaches to achieve combinational creativity for deriving creative ideas for practical products. Three driven approaches, the problem-driven approach, the common-driven approach, and the inspiration-approach, are hypothesised in this study based on previous research projects in the field of design process, design strategy, and design cognition. A test focused on practical product design has been conducted to validate the three driven approaches by means of expert evaluation. The results of the test have shown the authenticity of the three driven approaches and indicated that the problem-driven approach is the dominant approach for generating combinational ideas. In addition, the test has indicated that the three driven approaches can be used solely and synthetically for producing combinational creativity.

In conclusion, the study has illustrated how designers are driven to produce combinational creativity for creating practical products, especially in the domain of product design. The three driven approaches proposed in this study have provided an understanding of how combinational creativity is driven and produced. It is suggested that this research project could lead to improved comprehension of how creativity is achieved in design. The problem-driven approach, the common-driven approach, and the inspiration-approach can be applied by designers in creative idea generation for originating good designs for and in resource-limited societies. In addition, the three driven approaches proposed in this study can be used as a foundation for developing creative design support tools, and thereby to advance resource-limited societies. However, further research involving more evaluators and more samples is planned to enhance the validity of the three approaches as well as investigate whether any other driven approaches exist.

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