The in-depth cognitive levels of imagination of artisans and designers

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Abstract: This paper investigated the in-depth cognitive levels of artisans (craft artisans) and designers (design trainers) as they observed design problems (in the early stage of idea generation) during design training. A concept network method based on the associative concept dictionary was employed to extract the verbalised thoughts of four artisans and four designers. We then identified semantic relationships based on a factor analysis. We discovered that, in contrast to designers, artisans tended to activate lower in-depth cognitive levels. Our study demonstrated that artisans placed greater focus on product appearance and technical aspects, such as operation (replace, reduce, etc.) and shape (waist, body, etc.). In contrast, designers paid greater attention to the presence of issues related to surroundings, such as scene (silverware, norm, etc.) and appeal (fresh, dish, etc.). These results demonstrate that closely or remotely associated concepts correlate with shallow or in-depth cognitive levels based on creative solutions.

Keywords: creativity; cognition; imagination; craft artisan; design trainer.

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1 Introduction

Currently, rural industries in many developing countries are receiving serious attention because they offer the potential for new job creation and they help maintain national and cultural identities. Local governments have begun to implement technical assistance programmes, such as design training, to improve artisans' skills and creativity levels so that they can create products that are more desirable. However, some countries lack capable design trainers who are able to translate indigenous cultural values into improved designs (Suzuki, 2005). More importantly, gaps in the design thinking process during the idea generation stage can occur between artisans and designers. At times, artisans may become uneasy if problems develop. They may feel sceptical about unconventional design concepts. Previous research suggests that design trainers failed when they attempted to introduce an unconventional design domain to inspire artisans to develop unconventional ideas (Suzuki, 2005; Nagai et al., 2011). This may have occurred because of differences in the nature of creative cognition that influences the respective designers' and artisans' design thinking processes. To clarify, we used the following terminologies in this paper:

- Design training consists of a nationwide governmental HRD programme that operates in developing countries. It provides in-studio type design and creativity training for traditional craft artisans. The aim of design training is to enhance artisans' creativity and improve the quality of products.
- A craft artisan (hereafter referred to as 'artisan') is a traditional master craftsperson who resides in a developing country. He or she may possess limited formal education. However, he or she has acquired special artisan skills and gained expertise in his or her local village's traditional crafts that have been passed down from one generation to another.
- A design trainer (hereafter referred to as 'designer') is an industrial or architectural design graduate who possesses work experience as an instructor in a design training programme aimed at the promotion of traditional crafts.

1.1 Design and creativity training

Numerous international forums and official reports of local governments have identified the existence of a main problem in the design and implementation of training programmes in developing countries. The gap that exists between designers and artisans primarily results from conservative viewpoints and limited understanding of the creative process by the artisans. Moreover, no concrete curriculum reference is available for designers to use as material during training. A conservative or conventional viewpoint is a traditional viewpoint that invariably arises as an issue during discussions of creativity. The term is used to describe the quality of being governed by custom. Alternatively, it can refer to an opinion that is subject to the control of social agreements (Pariser, 1999). Therefore, teaching design and creativity to artisans can be a difficult task. However, scholars believe that creativity can be taught by instruction and training. Efforts have been made to provide direct instruction that involves students' cognitive abilities and processes (Ripple, 1999). At a basic level, creativity and design training hope to introduce widely known design methods. These methods hope to encourage creativity. During training classes, artisans are given an introduction to design principles (e.g., balance, proportion, and so on). Initially, they engage in creativity icebreakers. Then, they participate in design exercises and develop prototypes. A typical training programme may last between five and seven days. Artisans were given the options to use their existing craft skills or traditional styles, however, this gesture is more or less an appreciation of artisans' culture, because the fact that design trainers do not have adequate knowledge on the artisans' distinctive creative cognition and how to empower it.

In this paper, we assume that differences in creative cognitive abilities exist between artisans and designers. Perceptual barriers or fixations are obviously rooted in each individual's unique experiences, interests, biases, and values (Davis, 1999). Gaps that may develop in the conceptual design process between artisans and designers during design training programmes (Nagai et al., 2011) may correspond to the most obvious barrier to creative thinking: habit. The term, habit, refers to an individual's well-learned ways of thinking and responding (Dodds and Smith, 1999). At the same time, a design training programme cannot simply rely on the typical conceptual design process because this process may become another fixation. Hence, we believe that an investigation of cognitive levels of creativity that operate in artisans' design processes can provide fertile ground for the development of more effective teaching methods for design training programmes.

1.2 Cognitive aspects of creativity

It is difficult to find scientific references that focus on traditional artisans' distinctive creative cognition, including design training that respond that issue. Little is known about the way in which knowledge and skills within domain-specific knowledge are actually acquired and used (Christiaans and Venselaar, 2005). Design training programmes are frequently devised to develop crafts that will meet consumers' needs. Trainers are often solely concerned with the appearance of these crafts. Strong evidence has revealed that when designers create design training programmes, they tend to recycle whatever information they learned at university. Many designers report a lack of clear understanding of the tasks involved. Thus, they may miss opportunities to enhance creativity (Suzuki, 2005).

In general, cognition has been recognised as a major factor in the creative process (Finke et al., 1992). Most of the conceptualisation of creativity in the design process is based on an exploration of the cognitive aspects of creativity (Casakin and Kreitler, 2011). Extensive studies have been conducted to capture the cognitive levels of creativity used during the design process. These studies attempted to understand users' affective preferences, such as taste, and the feelings they may experience that can result in successful impressions of products (Cross, 2007; Nagai et al., 2011). However, only a limited number of studies have explored the cognitive levels of creativity that occur during the design process at the very early stage of idea generation.

1.3 Early stage of idea generation

Idea generation is an essential step in the design thinking process. It involves the interplay between cognitive and affective skills that leads to the resolution of recognised difficulties (Houtz and Patricola, 1999). It also involves iteration, a cyclical process of idea generation, evaluation, and design improvement to gather and filter information during the stage of generating and evaluating possible solutions (Smith and Eppinger, 1997). The general steps involved in design thinking are listed below. The most discussed step is the early stage of idea generation.

1 Imagination (early stage of idea generation): The stage during which artisans and designers observe and reframe the design problem.

2 Ideation (later stage of idea generation): The stage during which artisans and designers employ sketches, graphs, or paper models to generate visual ideas.

3 Prototyping: The stage of making rough models to convey ideas concretely.

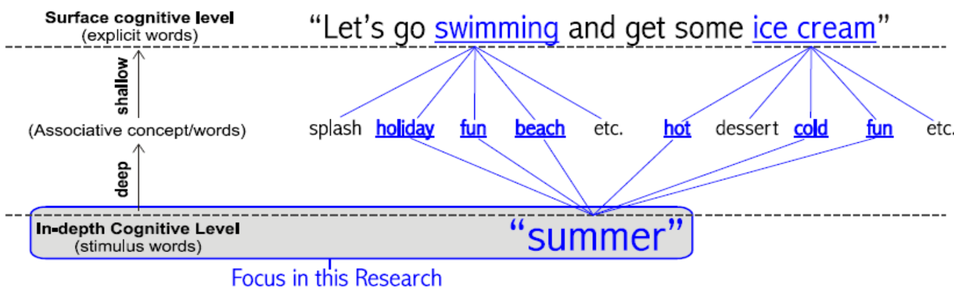
4 Evaluation: During this stage, users' feedback is acquired by evaluations of affective preferences. (The step that occurs after the design thinking process consists of realisation or production for commercial purposes.)

The early stage of idea generation involves observations by artisans and designers based on first-hand experiences. This stage is associated with a greater diversity of ideas (Leijnen and Gabora, 2010). In particular, this stage of imagination is associated with differences in creative cognition. Therefore, it is reasonable to assume that an individual's fundamental thoughts are captured to a fair degree at this point. This is an appropriate stage to examine artisans' and designers' first-hand experiences as they observe and reframe design problems.

1.4 Surface and in-depth cognitive levels

Our explicit expressions and/or words may result from shallow analysis. During the early stage of idea generation in design training, individual's explicit expressions and/or words may result from shallow analysis, which occurred from immediate interpretation when imagining a product. The impression serves as a basis for activating explicit expressions. Therefore, in all likelihood, these expressions and words operate on the surface cognitive level. However, the term implicit impression refers to that which is not explicitly recognised or verbalised (Reingold and Colleen, 2003). This underlying form of cognition may be difficult to express. Thus, it is referred to as the in-depth cognitive levels (e.g., feelings, tastes, and impressions) (Taura et al., 2011; Nagai et al., 2011; Georgiev and Nagai, 2011). Implicit impressions are implied beneath explicit impressions that relate to deep impressions. This process establishes extremely rich metaphorical concepts that become key features of cognition during the creative design process (see, Figure 1). Additional studies have focused on the use of metaphors to enhance creative design solutions. These studies hoped to discover how rich metaphorical words formed the basis of creative design (Goldschmidt and Tatsa, 2005; van de Lugt, 2005; Yamamoto et al., 2009). To examine cognitive levels based on subjective experiences, researchers may employ think-aloud methods as part of protocol analyses that to produce verbal reports of thinking processes (Ericsson and Simon, 1993).

Figure 1 Capturing in-depth cognitive levels by the use of the associative concept dictionary (see online version for colours)



1.5 Associative concept network analysis

To examine the structure of thoughts collected from subjective experiences, a think-aloud, as a part of protocol analysis, was employed to produce verbal reports of the thinking process (Ericsson and Simon, 1993). Subjects were instructed to describe their thoughts and observations and reframe design problems by verbal expression. Verbalised thoughts reflect some aspects of the regular cognitive process that can be investigated by the use of the concept network method that is based on the associative concept dictionary.

An associative concept is a representation of an individual's expression. It is a stimulus that can lead to another associative meaning. It is comprised of six sub-types: connotative, collocative, social, affective, reflected, and thematic (Mwihaki, 2004). The conceptual network depicts human memory as an associative system, in which a single idea can contain multiple meanings (i.e., it is polysemous). A concept network employs a computational model to reproduce observable aspects of expressions associated with an individual's mental state. It is a suitable tool for associative analysis because it can be used to explore latent links that exist among concepts. The concept dictionary utilised in conceptual networks originated at the University of South Florida Free Association Norms database (USF-FAN). It consists of free associations, rhymes, and a word fragment norms database. It is the largest database of free associations ever collected in the USA (Nelson et al., 2004; Maki and Buchanan, 2008).

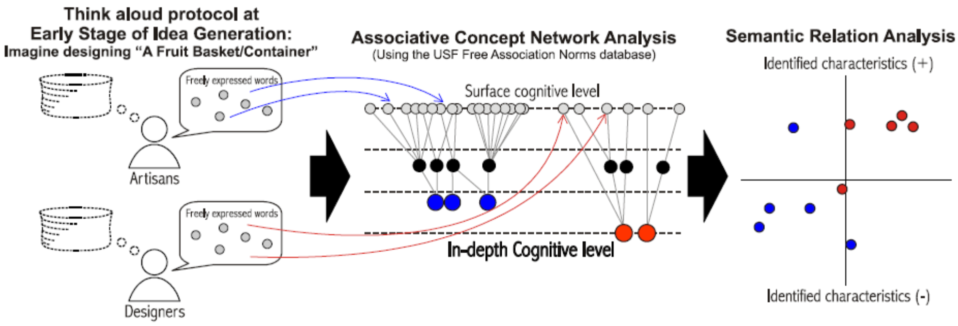
2 Aim

Our goal was to develop an effective design training programme that will be suitable for artisans' creative cognition and that might provide effective teaching methods and resources for designers. To achieve that goal, we investigated the different characteristics of in-depth cognitive levels that occur in artisans' and designers' imaginative approaches at the early stage of idea generation.

3 Method of research

To capture associative concepts that occur at in-depth cognitive levels of imagination at the early stage of idea generation, we conducted a think-aloud protocol in which artisans and designers were instructed to freely express their ideas verbally. We employed a concept network analysis based on the associative concept dictionary to extract verbalised thoughts. The framework consists of the steps listed below (see Figure 2).

Figure 2 Research framework: identification of the different characteristics of in-depth cognitive levels (see online version for colours)



We chose eight participant subjects for this experiment: Four artisans were widely known as master craftspeople who possessed special skills in artistry. Their special expertise in their local village's traditional bamboo crafts has been passed down from one generation to another. An additional four participants were designers. They were graduates of industrial design programmes. Each had experience as an instructor in several design training programmes that focused on the utilisation of natural materials.

3.1 Procedure

The participants (artisans and designers) were not required to engage in specific activities, such as drawing or observation of stimuli. In this experiment, participants were conditioned not to engage in specific activities, such as drawing or observation of stimuli. We provided only the instructions required to understand fundamental associative concepts. We avoided rigid instruction about determinations of design themes, market segmentation, or design functions because we believed that the provision of excessive information might be unfair and misleading. The provision of a minimum of instructions created a fair playing field. It allowed us to observe artisans' and designers' responses and motivations on their very early attempts in reframing design problems. The think-aloud protocol experiment was carried out separately with each participant to avoid copycat thinking. We placed no constraints on the subjects when they verbally expressed their ideas and engaged in spontaneous thinking that mirrored their process when they searched for new design ideas.

The main instructions for the think-aloud protocol experiment asked participants to imagine designing a fruit basket/container. We encouraged free expression of their ideas. The direct instructions are listed below:

- 'Please imagine designing a fruit basket/container'.

- 'Please freely express any ideas that arise'.

No time limits were imposed on participants during the think-aloud protocol experiment. On average, participants took about six minutes to express their imaginative thoughts. All procedures were recorded as verbal data that would be sorted later.

Data was sorted based on grammatical rules that addressed connecting words, such as prepositions, a few general verbs, articles, and pronouns. We omitted other less relevant explanations. Finally, we transcribed the sorted verbal data, which was comprised solely of nouns, adjectives, adverbs, and verbs, into English. Furthermore, the data was visualised by the use of Pajek 2.05 software based on 2D layers in the Y direction. The data was analysed according to the concept network method, which was based on the USF Free Association Norms database. The resulting visualisation presented an observable conceptual network that displayed low or highly weighted associative words as indicated by the out-degree centrality score (ODC). The concept network depicted the structure of participants' surface and in-depth cognitive levels. Next, we identified the concept network by analysing semantic relationships.

4 Analysis

During the first stage of the analysis, we obtained 201 sorted verbalised thoughts (i.e., nouns, adjectives, adverbs, and verbs) from artisans, and 213 sorted verbalised thoughts from designers. At that point, it was difficult to identify the tendency of these expressions (see Table 1).

Table 1 Sorted verbalised thoughts (shown in part and in alphabetical order)

Artisans (201)	*Designers (213)*
Above, abundant, add, adjust, angle, appear, apple, apply, artistic, Asia, attach, ball, bamboo, base, basic, basket, beak, between, big, body, booming, boss, both, box, businessman, buy, buyer, capable, capacity, capital, category, centimetre, ceramic, choose, circle, coating, colour, combine, concern, consistent, consumer, contain, container, corner, correspond, cost, count, cover, craftsman, curve, cut, dark, decor, delivery, demand, depend, design, develop, diameter, dice, differ, different, difficult, dimension, duck, easy, economy, edging, egg, end, Europe, experience, extraordinary, five, flat, flower, food, form, frame, free, fruits, fulfil, function, Gambier, general, glue, good, goods, grape, grip, handle, head, height, heron, high, hobby, idea, ideal, imagine, income, increase, insert, international, joint, leaf, leg, light, living, local, long, loose, made, main, make, mark, marriage, material, …, etc.	Accommodate, according, added, aesthetic, age, appeal, appear, apple, apply, appreciate, artificial, attention, attractive, available, bamboo, banana, base, basket, big, bowl, box, bread, break, buy, ceramic, chance, character, children, clean, clear, coating, coiling, colour, combine, commercial, community, concern, consider, contain, container, conventional, craft, craftsman, create, crowd, crush, culture, curve, cute, cutlery, damage, decorate, delicious, design, develop, different, dignity, direct, display, distinct, durian, dust, dye, easy, eat, environment, everyday, example, expensive, experience, explore, extraordinary, facilitate, factor, first, frame, fresh, fruits, function, general, grape, habit, hand, hang, hoe, hygiene, idea, identical, imagination, imagine, immediate, impressive, inform, inside, instance, interaction, interesting, invite, …, etc.

The sorted verbal data was transferred onto a vector graph (concept network structures), based on the generated calculated weights of the detected stimulus words. The vector graph was used to display out-degree centrality scores (hereafter, 'ODC'), which indicate the number of connections one node possesses with other nodes (Friedkin, 1991). The centrality of the ODC scores detected all nodes that demonstrated the number of associated words connected with stimulus words (see Figure 1).

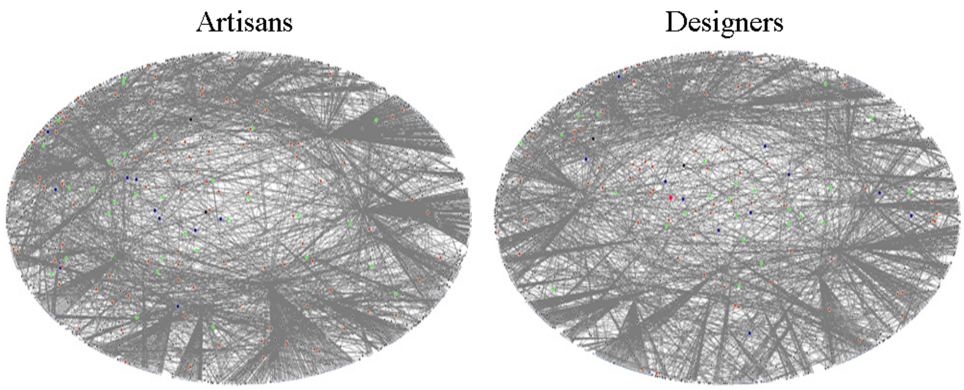
$$A = \left(a_{ij}\right)$$

$$\begin{bmatrix} a_{11} & \cdots & a_{1j} & \cdots & a_{1n} \\ \vdots & & \vdots & & \vdots \\ a_{i1} & \cdots & a_{ij} & \cdots & a_{in} \\ \vdots & & \vdots & & \vdots \\ a_{n1} & \cdots & a_{nj} & \cdots & a_{nn} \end{bmatrix} \quad a_{ij} = \begin{bmatrix} \text{associative word rate} & i \to j & \text{In} \\ 0 & i \to j & \textit{None} \end{bmatrix}$$

Out-degree centrality: $D_i = \dfrac{\sum_{i=1}^{n} a_{ij}}{n-1}$ (Note: n is the number of nodes).

Further, all generated associative words were visualised as graphs of the conceptual network (see Figure 3). Artisans generated 2,991 nodes/vertices (associative words) and designers generated 2,760 nodes/vertices (associative words).

Figure 3 Artisans' and designers' associative concept networks (prior to simplification) (see online version for colours)



Because the generated networks were too dense, it was necessary to simplify the created networks by the use of a reduction method. Systematic reduction was based on the consideration that not all words extracted from verbalised protocols contributed to in-depth cognitive levels. Surface-level cognition was overemphasised. Application of this simplified concept reduced the number of words with low number connections in the networks so that extraction of associative concepts located within in-depth cognitive levels were perceivable (see Figures 4 and 5). This reduction deleted more than 50% of words that received lower ODC scores and resulted in the creation of an observable network diameter (Leskovec, 2008). The reduction was applied independently to each group. Ultimately, artisans generated 278 associative words and designers generated 140 associative words.

A T-test was applied to determine whether the *two datasets* (artisans' and designers' associative concept networks) statistically differed from each other. We discovered that both datasets were statistically different. The absolute value of the t-Stat was greater than t and the critical two-tail and the probability revealed that the null hypothesis were smaller than alpha. T = $t_{5,741}$ = 3,494; p-value $0.0002 < 0.05$; therefore, we rejected Ho. Thus, a significant statistical difference existed between artisans' and designers' associative concept networks.

Table 2 T-test: two-sample assuming unequal variances

	Artisans	*Designers*
Mean	0.008793412	0.008287308
Variance	3.14298E-05	2.88755E-05
Observations	2,991	2,760
Hypothesised mean difference	0	
df	5,741	
t stat	*3.494923012*	
P(T <= t) one-tail	*0.00023889*	
t Critical one-tail	1.645119089	
P(T <= t) two-tail	0.00047778	
t critical two-tail	1.960377232	

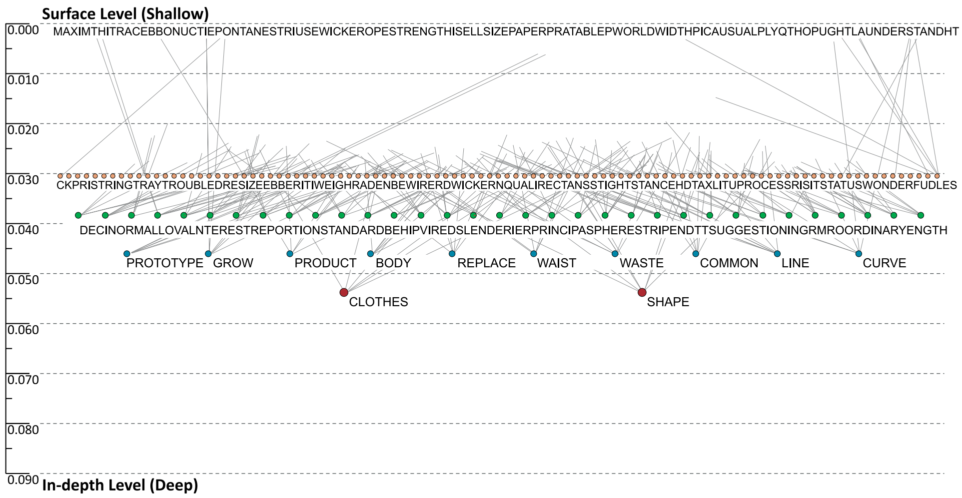
4.1 Artisans' associative concept network

Table 3 reveals that the artisans' highest score for ODC was 0.0530 with a total of two words. If we consider the range from 0.0500 up to 0.1000 as a representation of highly weighted associative words located within in-depth cognitive levels, we can see that artisans generated only two associative words, or 0.7% of the total number of associative words (indicated by a red-dotted square). These highly weighted associative words exemplified their in-depth cognitive levels during imaginative approaches (see Figure 4).

Table 3 Distribution of artisans' ODC scores (see online version for colours)

		Artisans		
No.	*Range*	*ODC scores*	*(n)*	*Associative words*
1	≤ 0.1000	-	-	-
2	≤ 0.0900	-	-	-
3	≤ 0.0800	-	-	-
4	≤ 0.0700	-	-	-
5	≤ 0.0600	0.0530	2	Clothes, shape
6	≤ 0.05000	0.0454	10	Body, common, curve, grow, line, product, stereo, etc.
7	≤ 0.0400	0.0378	33	Bond, chest, cloth, corner, creation, creativity, etc.
8	≤ 0.0300	0.0303	101	Advertisement, alike, amount, attitude, bag, basket, etc.
9	≤ 0.0200	-	-	-
10	≤ 0.0100	-	-	-
11	0.0000	0.0000	132	Add, apple, angle, artistic, Asia, ball, bamboo, base, etc.
Total			*278*	

Figure 4 Artisans' associative concept networks (see online version for colours)



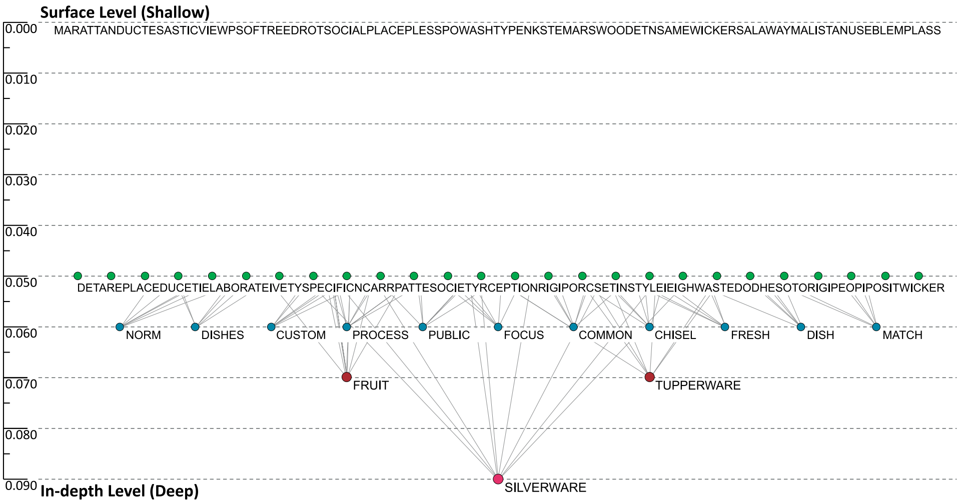
4.2 Designers' associative concept network

Table 4 reveals that the designers' highest score for ODC was 0.0900 with a total of one word. If we consider the range between 0.0500 and 0.1000 as a representation of highly weighted associative words, then we can see that designers generated 40 associative words, or 28.6% of the total number of associative words. This means that designers generated deeper in-depth cognitive levels during their imaginative approaches in comparison to artisans' in-depth cognitive levels (see Figures 4 and 5).

Table 4 Distribution of designers' ODC scores (see online version for colours)

Designers				
No.	*Range*	*ODC scores*	*(n)*	*Associative words*
1	≤ 0.1000	-	-	-
2	≤ 0.0900	0.0900	1	Silverware
3	≤ 0.0800	-	-	-
4	≤ 0.0700	0.0700	2	Fruit, Tupperware
5	≤ 0.0600	0.0600	11	Chisel, common, custom, dish, dishes, focus, fresh, etc.
6	≤ 0.05000	0.0500	26	Basket, booth, carrot, cloth, clothes, creativity, etc.
7	≤ 0.0400	-	-	-
8	≤ 0.0300	-	-	-
9	≤ 0.0200	-	-	-
10	≤ 0.0100	-	-	-
11	0.0000	0.0000	100	Apple, attention, bamboo, banana, basket, big, bowl, etc.
Total			*140*	

Figure 5 Designers' associative concept networks (see online version for colours)



4.3 *Comparison of the associated concepts*

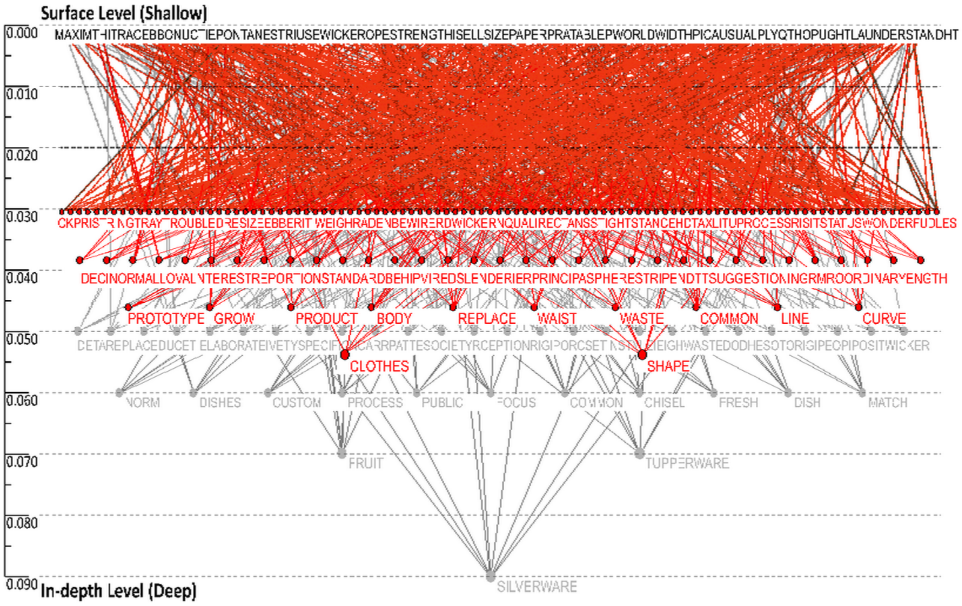
Figure 6 displays an image overlay that demonstrates the differences that existed between artisans' and designers' associative concept networks. The graph was organised in the Y-axis direction. The artisans' graph (red) has been placed over the designers' graph (grey). This overlay graph reveals that most of the associated words inhabited the surface level within the score category of 0.000. This surface cognitive level consisted of closely associated words or explicit words extracted from verbalised thoughts. The high score indicated that some nodes had more connections with other nodes that contained remotely associative words (polysemous). Thus, Figure 6 clearly depicts the significant differences that existed between the artisans' and designers in-depth cognitive levels. Artisans' highly weighted associative words were focused on technical or operationally related issues that resided on the designers' lower layer (i.e., the layer that was focused on presence of surroundings issues).

Table 5 Generated associative words following reduction

278 generated associative words	*140 generated associative words*
Artisans	*Designers*
Clothes, *shape*, body, common, curve, grow, line, product, replace, stereotype, waist, waste, around, balloon, basic, bond, chest, cloth, corner, creation, creativity, decision, fresh, growth, hip, idea, interest, intestine, length, norm, normal, ordinary, oval, pattern, population, portion, principal, reduce, round, sample, slender, sphere, standard, stripe, suggestion, advertisement, alike, amount, attitude, bag, basket,……, etc.	*Silverware*, *fruit*, *Tupperware*, *chisel*, *common*, *custom*, *dish*, *dishes*, *focus*, *fresh*, *match*, *norm*, *process*, *public*, *basket*, *booth*, *carrot*, *cloth*, *clothes*, *creativity*, *destroy*, *detail*, *elaborate*, *neighbourhood*, *original*, *originate*, *pattern*, *people*, *perception*, *plan*, *porcelain*, *position*, *produce*, *replace*, *set*, *society*, *specific*, *style*, *waste*, *wicker*, apple, attention, bamboo, banana, basket, big, bowl, box, bread, break, buy, ……, etc.

Note: Shown in part, ordered by the highest ODC scores, italic words represent in-depth cognitive levels.

Figure 6 Overlay of artisans' and designers' associative concept networks (see online version for colours)



4.4 *Identification of the characteristics of associative concepts*

Until this stage, data extraction based on associative networks revealed that artisans generated 0.7% words at the in-depth cognitive levels. Designers generated 28.6% words. This is a significant difference. To detect the distribution and tendency of these associative words, we initially identified artisans' and designers' collected generated associative words based on their qualitative characteristics. We discovered that *scene*, *appeal*, *operation*, and *shape* were the most closely identified characteristics of a number of selected words at the in-depth cognitive levels (see Table 6). These characteristics are listed below:

- *Scene*: A word that corresponded to the presence of surroundings (i.e., object, nature, customs, etc.)
- *Appeal*: A word that corresponded to the serving, preparation, or presentation (i.e., juice, style, etc.)
- *Operation*: A word that corresponded to processing, or other physical activity (i.e., reduce, bond, etc.)
- *Shape*: A word that corresponded to physical elements or units of measurement, (i.e., line, body, etc.).

Further, we intended that these identified characteristics would serve as variables that would be analysed in the factor analysis we would perform to obtain semantic relationships. The identified characteristics of artisans' and designers' associative concepts were selected on a proportional basis: 28 words were selected from the words collected for each group (10% of artisans' highly weighted associative concept/words; 20% of designers' highly weighted associative concept/words). A total of 56 words were selected out of 418 generated words. We decided we would identify only highly weighted associated concept/words to obtain characteristics (*scene*, *appeal*, *operation*, and *shape*). The range of highly weighted associated words had OCD scores of approximately 0.0500 or higher.

Table 6 Identified characteristics of associative concepts

List of identified characteristics
(Scene) silverware, Tupperware, basket, bowl, tray, dishes, norm, public, booth, etc., etc.
(Appeal) fresh, mint, cooked, rotten, food, raw, protein, dish, carrot, set, apple, etc.
(Operation) replace, bond, reduce,, process, elaborate, produce, break, clean, etc.
(Shape) shape, body, curve, waist, length, big, long, part, small, etc.

4.5 Analysis of semantic relationships

We distributed 56 associative words that corresponded to the identified characteristics of associative conceptual structures. ODC scores ranged between the highest to the low (see, Table 6). The identified characteristics consisted of *scene*, *appeal*, *operation*, and *shape*. We used these four variables in our factor analysis. Furthermore, the correlation among variables was extracted into two factors. The KMO score of 0.502 was appropriate. The factor matrix and corresponding names are listed in Tables 7 and 8.

Table 7 Rotated factor matrix

Adjectives (+)	*Adjectives (-)*	*F1*	*F2*
Appeal	Less scene	0.924	0.260
Scene	Less companion	0.922	0.004
Operation	Less operation	0.287	0.905
Shape	Less shape	–0.637	0.666
Eigenvalue (after rot):		2,19	1.33
KMO:			0.502

Table 8 Corresponding factor name

Factor	*Adjectives*	*Eigenvalue*	*Factor name*
F1	Appeal, scene	2.19	Surroundings
F2	Operation, shape	1.33	Object-oriented

For Factor 1, appeal and scene (hereafter referred to as 'surroundings') were associated with the presence of the fruit basket/container. For Factor 2, *operation and shape* (hereafter referred to as 'object-oriented') were associated with technical aspects of the fruit basket/container. Furthermore, factors were displayed on an orthogonal map to investigate the semantic relationships that existed between the identified characteristics of artisans' and designers' associative concepts (see Figure 7).

Figure 7 Semantic relationships map (see online version for colours)

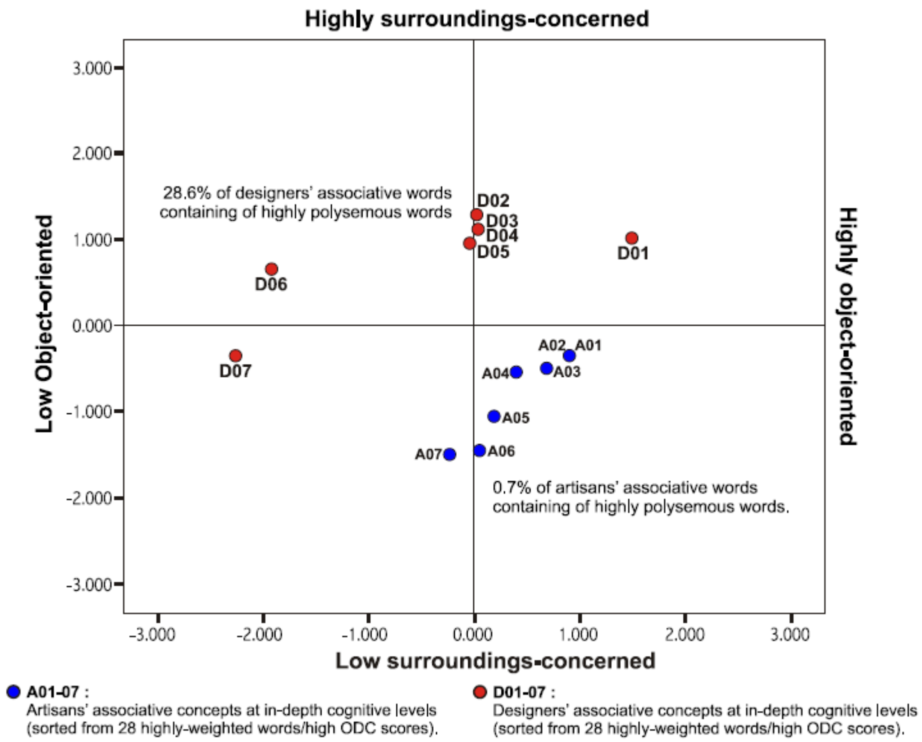
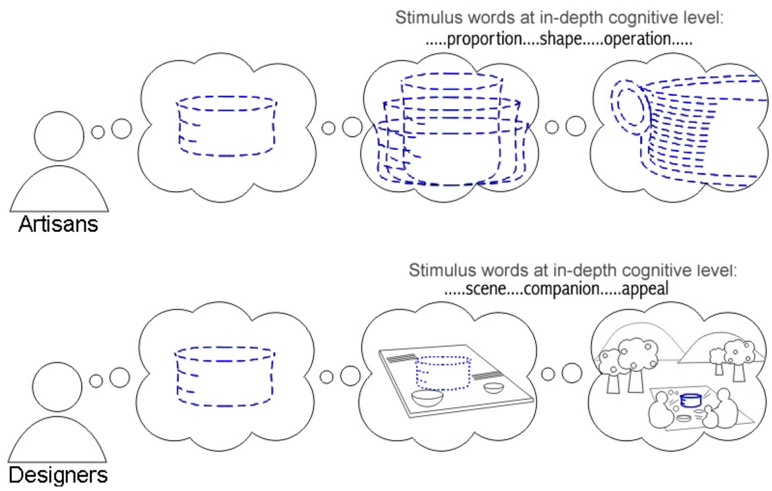


Figure 8 Artisans' and designers' imaginative approaches (see online version for colours)



The semantic map displays artisans' in-depth cognitive levels related to *operation* and *shape* issues, as they were positioned on the positive *object-oriented* factor. Their position was significantly negative on the *surroundings* factor. In contrast, designers' in-depth cognitive levels related to *appeal* and the presence of scenery, displayed a positive *surroundings* factor. In comparison with the associative network analysis, this indicated that artisans' in-depth cognitive levels during imaginative approaches tended to narrow. They were closely associated with physical appearance, as indicated by the stimulus words. In addition, designers' imaginative approaches revealed broader perspectives. Yet, the stimulus words were remotely associated with the current object (see Figure 8).

5 Discussion

Based on the identified extracted words revealed by the concept network analysis, we observed that artisans tended to focus more intently on the appearance and technical aspects of the fruit basket/container. They observed features such as shape, body, curve, waist, length, reduce, replace, and so on. We categorised these features as characteristics of *operation* and *shape*. The results also revealed that designers tended to place greater focus on the presence of the fruit basket/container. They offered the following associated words: silverware, Tupperware, dish, norm, public, booth, fresh, match, carrot, apple, and so on. We identified these features as characteristics of *scene* and *appeal*. These results were confirmed by Tables 3 and 4. We categorised approximately 10% of artisans' highly weighted associative concept/words as low *object-oriented*. We categorised 20% of designers' highly weighted associative concept/words as highly *surroundings*-concerned. Our results revealed that artisans generated 0.7% words at in-depth cognitive levels. In contrast, we discovered that designers generated 28.6% deeper in-depth levels of cognition during their imaginative approaches (0.0500–0.1000 ODC range).

As demonstrated by the highest ODC score achieved at the in-depth cognitive levels that corresponded to remote association, we discovered that designers tended to use more highly weighted associative concepts (polysemous words). We relied on the associative gradient theory to explore these results. This theory suggests that more closely associated or 'stereotypical' representations may lead to reduced creativity. Thus, if artisans and designers make greater numbers of associations, then they have a greater probability of achieving creative solutions, because remote associations (i.e., highly weighted associative concepts) are best suited for the creation of these solutions (Mednick et al., 1964; Baer, 1993; Eysenck, 1997; Martindale, 1995). Yamamoto et al. (2009) argued that the polysemy of a design idea could be significantly correlated with its originality. Therefore, we believe that designers' in-depth cognitive levels have greater probability of achieving creative solutions.

Based on our findings, we suggest that the roles of closely and remotely associated concepts at the in-depth cognitive levels during the early stage of idea generation differ for artisans and designers during their observations and definitions of design problems. Artisans' in-depth cognitive levels have fewer polysemous features. Therefore, they tend to express concerns related to more tangible issues, such as *shape* and *operation*. In comparison, designers' in-depth cognitive levels possess more polysemous features. For this reason, they may express concerns related to intangible issues, such as users' affective preferences (i.e., *scene* and *appeal*). The semantic relationship map confirms that artisans tended to focus on the artefact's physical properties, rather than on the surroundings or on users' affective preferences. In contrast, designers paid significantly more attention to issues related to the artefact's presence and less attention to its physical properties.

Most traditional craft artisans who reside in villages in developing countries possess limited formal education. Poor economic condition within the rural area has likely shaped their attitude towards mastering technical skills rather than taking a formal education that usually takes a long time to complete. Generally, most artisans dropped out of primary education, and seriously turned to learn and acquire traditional craftsmanship to make quick money for their family. For years, the artisans have devoted their entire life to mastering the craft. This seems to be one of the factors shaping their viewpoint to be mainly focused on technical issues and production chain, such as time, performance, quantity, object property, accuracy, delivery, and so forth.

The other factor that greatly shapes artisans' conservative viewpoint is the uniqueness of rural ecology as part of their culture (Canfield, 1973). In the rural communities, there are strong ties between livelihood and nature. Rural people feel blessed with their surrounding natural vegetation that provide daily resources. The rich natural vegetation creates a romance about an ideal livelihood. The welfare of village communities is tied up by the tranquillity and prosperity of the surrounding nature. Therefore, during the experiment to imagine designing a fruit bowl, we discovered that the artisans' stereotypical representation of an ideal fruit bowl was a romanticism of a prosperous surrounding vegetation. An ideal design of a fruit bowl was then associated with a sincere gratitude to the Mother Nature. Some of artisans' verbalised thoughts arosed from day-to-day events they were familiar with things they hear, things they deal with, and so forth. The artisans' conceptual process naturally involves a sense of gratitude towards nature as an integral part of their life and the objects they create, as demonstrated by their verbalised thoughts, such as material, nature, duck, leaves, fruit, and so forth. On the contrary, designers' viewpoint of an ideal fruit bowl design was highly associated to the future occurrences (e.g., users, appeal, appetising).

5.1 Evaluation of imaginative approaches observed during a design training

To develop effective methods to enhance artisans' creativity, we must evaluate the contents and methods used in design training programmes, because the use of typical or widely accepted design methods may lead to less than satisfactory results. These efforts may fail to address the real problem, even if we modify the design object to make it easily understandable to artisans during training. As our results demonstrated, artisans tended to respond and think in consistent ways. When they focused on an artefact, they tended to respond to tangible issues, such as the artefact's technical and physical aspects. Their thinking contrasted greatly with designers' considerations of the presence of users, *appeal*, and *scene*.

We believe these difficulties occurred because, during the design training programme, requests were made that the artisans focus solely on the *object* (i.e., the designed artefact). In fact, the systematic instructional materials required this type of focus. When the designers provided clear instructions about the potential design of an intended object during the training, they caused artisans to enter a *status quo* mental state. In this mental state, artisans' perceptual sets were tied to their tendency to make quick decisions and jump to familiar conclusions. The artisans were not asked to become flexible and discover alternatives. They were given clear guidelines to develop a craft object (a fruit basket/container). These guidelines were intended to enhance their creative processes. However, the guidelines failed to inspire the artisans to observe and explore in different, creative ways. Hence, designers must understand that artisans tend to execute these processes based on the heuristics required. Therefore, we suggest that designers offer looser and rather vague guidelines that may assist artisans to adopt broader perspectives. Instead of providing rigid or clear instructions for the design of a completely understandable object (e.g., 'a fruit basket/container'), we suggest that designers offer open-ended and rather vague instructions. For example, they could suggest that artisans design an object/artefact that would awaken appetites and inspire fresh feelings in family members.

It might be best that designers refrain from asking artisans to design concrete or obvious objects. Instead, they should free artisans from this rigid approach by suggesting vague or less-concrete design concepts. If designers permit artisans to enjoy experiences that inspire increased imagination, then designers will experience fewer difficulties when they direct artisans in the development of more concrete designs. We believe this approach will release artisans from perceptual barriers created by their former ways of thinking and responding. Thus, during training, artisans may begin to release themselves from their fixations with familiar concepts, including tangible or technical aspects (i.e., operation, shape, and proportion). Ultimately, training in creativity must focus on the enhancement of participants' cognitive resources. The development of teaching methods based on different characteristics of artisans' and designers' imaginative approaches designers may lead to increased creativity.

6 Conclusions

It is challenging to attempt to describe the nature of the creative cognition that inspires artisans' and designers' conceptual design processes. This research examined the differences that existed between in-depth cognitive levels discovered in artisans' and designers' imaginative approaches. Further, with additional development, these findings may serve as reference tools for the co-creation of educational programmes (design training programmes) aimed at the enhancement and development of artisans' creative cognition. Some scholars believe that creativity must be taught by instruction and training. However, we must not think that the imaginative approach that might release artisans from perceptual barriers in their ways of thinking can be developed instantaneously. Thus, we must strive to develop teaching methods that will enhance trainees' (artisans) creative cognitive abilities. We hope that this type of training will exert positive effects on their creative cognition. If this type of training is employed, rather than just thinking about beauty or attractive shapes, artisans will begin think more flexibly, broadly, and unconventionally. In the future, we hope to extend our research and apply this new approach to the development of an innovative design training programme. We will observe the ways that trainees' creative cognition might be affected by the imaginative approach and measure the results of our observations.

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