Chapter 33
A Blended Method for Generating Creative Product Concepts

Hung-Hsiang Wang

Abstract Concept generation during earlier conceptual stages is an important but unsystematic activity in product development processes. This paper aims to propose a design method integrating metaphor, conceptual blending, AEIOU framework, and three-level cognitive processing together for generating creative product concepts. The method consists of the six steps: (Eberle B. Help! In solving problems creatively at home and school. Good Apple, Inc, Carthage, 1984) define target using AEIOU; (Jones JC, Design methods: Seeds of human futures. John Wiley & Sons, New York, NY, 1980); search source based on similarity and dissimilarity mapping spaces at visceral, behavioral, and reflective levels; (Kelley T, Des Manag J 12(3):35–42, 2001) evaluate metaphor; (Fauconnier G & Turner M, Cognit Sci 22(2):133–187, 1998) construct input by transferring the target and source; (Wang HH, Int J Des Creativity Innov, doi:10.1080/21650349.2013.830352, 2013) construct blend in accord with blending principles; and (Lakoff G & Johnson M, Metaphors we live by. Univ. of Chicago Press, Chicago, 1980) evaluate blend. Application of the method to a creative lamp, "Dragon Dancing," is demonstrated and discussed. The final design using the blended results presents an impressive blend of a popular folk activity in Taiwanese culture with a good modern lighting and was recognized by the jury and participants as one of the most creative pleasurable designs at a design exhibition.

Keywords Industrial design • Creativity • Metaphor • Conceptual blending

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33.1 Introduction

Concept generation is vital to creative product development, especially in the earlier stages of the design process. A useful technique to generate original ideas in the earlier stages is to look for unusual combinations of other ideas. For example, creative design methods such as SCAMPER [1], morphological analysis [2], and prototyping [3] share a similar manipulation of such combinations. In many cases, they are rather unsystematic. One major reason is that their manipulation lacks theoretical explanation, though several theories related to creative thinking with combinations have potential for generating creative product concepts, especially conceptual blending theory [4, 5] and conceptual metaphor theory [6–8]. Thus, this paper aims to integrate these two theories and frameworks with other product design frameworks to develop a systematic design method.

33.2 Related Works

Concept Generation as Blending

Conceptual blending is a concept-synthesizing process to generate a new concept that is not included in the two input concepts but inherits some characteristics of the concepts from them [9]. A blend consists of four connected *mental spaces*: two partially matched input spaces, a generic space constituted by abstract structure common to the input spaces, and a new, blended space. Mental spaces refer to a description of how people's ideas about things are structured. A blend receives a partial structure, comprising of elements and topologies, from both input spaces but has an emergent structure of its own.

Blending starts with a cross-space mapping that connects elements and relations between two input spaces. The next step is to identify a generic space that reflects some more abstract structure shared by the two inputs and defines the core cross-space mapping between them. Meanwhile, another partial projection is from the input spaces onto the blend space. The blend is supposed to have a new emergent structure not provided by the inputs and can become the input space of another blending in a recursive way. To result in a good blend, there are three main principles of blending as described below [10]:

(a) Composition: The projection from the input spaces makes new relationships available that did not exist in the original inputs.
(b) Completion: Our background knowledge in the form of cognitive and cultural models allows the composite structure projected onto the blend to be viewed as part of a larger self-contained structure in the blend.
(c) Elaboration: The blend has its own emergent logic, and this can be elaborated to produce new ideas and insights.

Moreover, there are four types of conceptual integration networks: simplex, mirror, single scope, and double scope, in a sequence from plain blending through elaborative blending [11]. The classification is based on how the structures from various input spaces are integrated in the blend space. For simplicity, this study defines a structure as the set of elements and their topology; the latter is the structure of relationships between the elements of a mental space.

Figure 33.1 illustrates the classification based on various blends with elements and topologies. Each larger circle represents a mental space, within which smaller circles denote elements and solid lines linking elements denote relationships between the elements. Dashed lines link elements of different spaces and represent projections from generic space onto input spaces and from input spaces onto blend space, whereas double-arrowheaded lines represent the mapping between the two input spaces.

For each four-space integration network in Fig. 33.1, the two mental spaces at the middle level are input spaces, *I1* and *I2*. The bottom mental space is a blend space, *B*, while the top one is a generic space, *G*. Elements of each generic space are represented by blank circles, yet in the rest spaces, elements are represented by filled circles. In a simplex network, one input has a topology projected into the blend, whereas another input has no typology but elements are projected into the blend.

In a mirror network, all spaces share a typology. In a single-scope type of network, the topologies of the inputs are different; only either one is projected to structure the blend. In a double-scope type of network, the typologies for the blend are brought in from both inputs. In terms of manipulation, double-scope and single-scope types of integration networks are generally more creative than simplex and mirror types.

AEIOU as Mental Space

Industrial designers often use some frameworks to build mental spaces for understanding the design problem given. Among these frameworks, AEIOU is a frequently used one for guiding and structuring data acquired from ethnomethodology and conversation analysis [12, 13]. AEIOU stands for five interrelated and

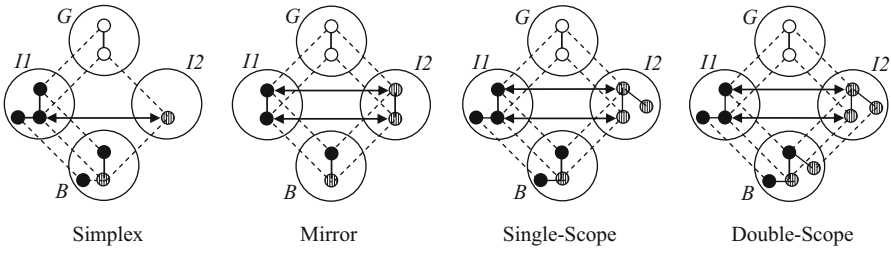

Fig. 33.1 Four types of conceptual integration network

interdependent components: Activity, Environment, Interaction, Object, and User. Activities are goal-directed actions, including the specific actions and processes that people use before, during, and after accomplishing their personal goals. Environments are the contexts in which an activity takes place. Interactions are between a person and other people or things in the environment. Objects are the individual elements of an environment, which may be put to simple or complex uses defining their function, meaning, and context within an activity. Users are the people whose behavior is being observed. When used to generate creative concepts with blends, this framework can be a basis for constructing the target domain and the first input space.

Three Levels of Cognitive Processing as Mapping

Starting with blending, designers often need metaphor sources that offer ready-made material of mappings between both input spaces. Three levels of cognitive processing (also called three-level emotional design framework) [14, 15] can help find the candidate metaphor in a systematic way. The visceral (reaction) level is the lowest level about sensory input, such as how things look, feel, and sound. The behavioral (routine) level is the middle level about use and usability concerning how things function and about the skilled and well-learned, largely routinized behavior. The behavior can be enhanced or inhibited by the reflective level and, in turn, enhance or inhibit the visceral level.

In addition, the bodily category, e.g., classifications based on human-scale interaction with objects such as chair or table lamp, is associated with the behavioral level. The reflective level is the highest level about meaning, dependent on the individual and influenced by knowledge, learning, and culture.

Once a target domain, *T*, has been specified, designers begin to search for source domains, *S*, as candidate to be used in blending process. One useful approach to exploring the source domain is based on similarity between objects and dissimilarity between categories [16, 17].

Accordingly, a good candidate is similar to the target domain at the visceral or behavioral levels (*V sim* and *B sim*) to create significant relevance but is dissimilar to the target domain at the reflective level (*R dis*) to create surprising effect, as the model shown in Fig. 33.2. In other words, the source's image (or meaning) is used to represent the target, though the images are different. The double-arrowhead lines between filled circles denote similarity or dissimilarity between properties of the two domains at various levels.

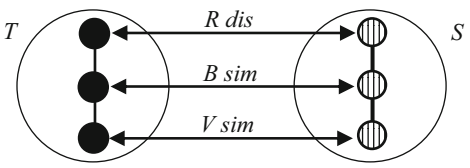

Fig. 33.2 Mapping with visceral and behavioral similarity and reflective dissimilarity

The above mapping can be extended by taking categories of the target and source into account, as depicted in Fig. 33.3. To create a surprising effect, the dissimilarity may be at the category level (*C dis*) or at the reflective level (*R dis*). When category dissimilarity is considered to generate a surprising effect, the similarity at the object level (i.e., visceral or behavioral and reflective levels) is thus measured to generate significant relevance.

As a result, a good candidate is similar to the target domain at object levels, including *V sim*, *B sim*, and *R sim* between the target object, *To*, and source object, *So*, respectively, but its categories, *Sc*, are dissimilar to the target domain's category, *Tc*. The dashed single-arrowhead lines start from the members to their categories.

33.3 The Blended Method

The extensive mapping in Fig. 33.3 for searching good metaphor sources and the conceptual integration network for blending creative concepts can be combined together to a design method. As illustrated in Fig. 33.4, the method comprises the following six step:

(a) Define Target: When a design problem is given, the designer transfers it to the target of metaphor. The problem is then constructed as a scenario, <*Activity, Environment, Interaction, Object, User*>, in which users interact with objects in contexts to perform activities, in order to build up the target domain.
(b) Search Source: The source domain is searched by mapping AEIOU at visceral, behavioral, reflective, and category levels. The cross-domain mapping from the target to the source as a starting point of blending is based on the similarity and dissimilarity, as described in Fig. 33.3. **A** useful category is largely of bodily level.
(c) Evaluate Metaphor: Alternatives are reviewed whether the similarity and dissimilarity are balanced. If one alternative is satisfactory, go to the next step. Otherwise, return to steps 1 or 2.

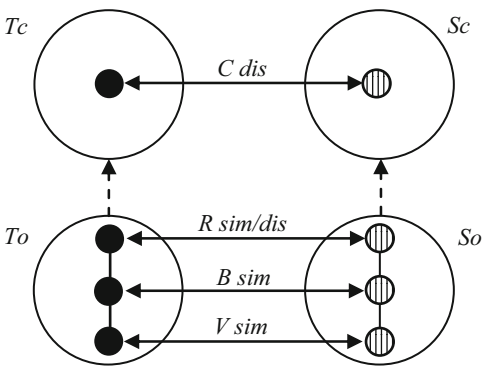

Fig. 33.3 Mapping with visceral, behavioral, and reflective similarity and category dissimilarity

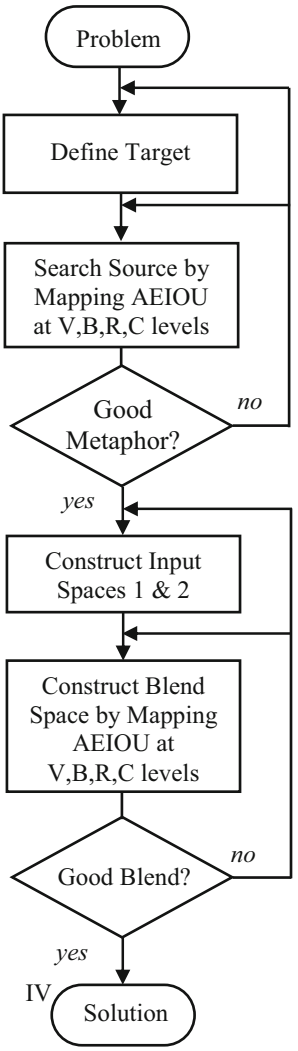

Fig. 33.4 Flowchart of concept generation using conceptual metaphor and conceptual blending

(d) Construct Input Spaces: AEIOU is the default structure of the generic space, in which the input spaces 1 and 2 are constructed based on the target and source obtained.
(e) Construct Blend: Blend the input spaces by cross-spaces mapping. The principles of composition, completion, and elaboration are applied to the blending process for pursuing a single-scope or double-scope blending.
(f) Evaluate Blend: Alternatives are reviewed whether the principles are met. If an alternative is satisfactory, view it as the solution and terminate the process. Otherwise, return to steps 4 or 5.

33.4 Example

Dragon Dancing Lamp, designed at the author's design studio, as shown in Fig. 33.5 and Fig. 33.6, is a floor lighting designed by mixing scenarios of modern lamps with dragon dancing in Taiwanese folk culture to deliver quality of creativity, esthetics, and meaning [8]. The design process is described as the following:

Define Target

At the beginning, the designers roughly chose lamp and Taiwanese traditional ceremony activities as the target domain and source domain, respectively. The target domain is represented by the AEIOD structure, <*lighting adjusting, at lounge, turn on/off, lamp, user*>, while a typical lamp's basic visual elements and topology are expressed as a lampshade on a tube with a base.

Searching Source

A collection of candidates, including night-market pinball and candy haws, aboriginal hunting and sun-shooting myth, as well as many other cultural aspects in Taiwan, are explored. Examining a number of candidates, the design team chose dragon dance as the source domain.

Fig. 33.5 A partial rendering of three lamps connecting together

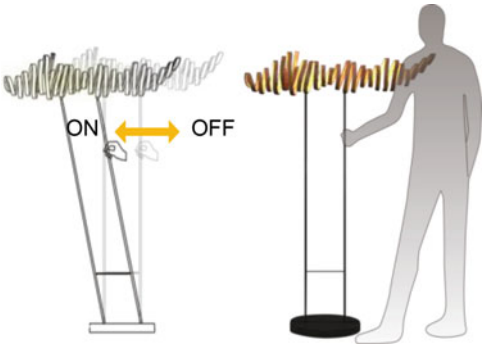

Fig. 33.6 Switching the parallel linkage to turn on/off lighting

Evaluate Metaphor

Dragon dance is evaluated as a good metaphor source, because the basic visual elements and topology of long dragon-shaped body on poles are very similar to that of the floor lamp, but the bodily categories as well as reflections of these two domains are different. By searching the source domain, the target domain is focused, in return, on the bodily category: floor lamp.

Construct Input Spaces

A typical floor lamp is constructed as input space 1, represented by AEIOU, <lighting adjusting, at lounge, turn on/off, floor lamp, user>, and its typology is represented by on(lamp shade, tube) and inserted_in(tube, base). Dragon dance is constructed as input space 2, represented by < dancing, outdoor, wield, dragon shaped object, player>, and the typology of the object used is represented by on(dragon shaped body, pole) and held_by(pole, hand).

Construct Blend

Constructing the blend space is essentially an iterative process. In brief, the process is divided into three rounds. First of all, the emphasis is put on the interaction with objects in the two scenarios at the visceral and behavioral levels. There is a sequence of three sub-blends, as illustrated in Fig. 33.7. In the first round of blend, the visual structures of the lamp and dragon-shaped artifact are mapped to each other in order to create a lamp with dragon-shaped shade on the poles. The team members' wielding of poles when performing dragon dance is projected onto the users switching the lamp by wielding the lamp tube.

This is an emergent property at the visceral and behavior levels, following the composition principle. Traditionally, dragons were constructed from wood, with bamboo hoops on the inside, though nowadays these materials have been replaced by lighter materials such as aluminum and plastics. Consequently, the bamboo hoop is projected onto the material of the lamp shade. The integration network in this round is of double-scope type.

Evaluate Blend

As described previously, outcomes of the first round meet the composition principle and reveal an emergent property at visceral and behavior level and a single-scope integration network. In the second and third rounds, the integration networks

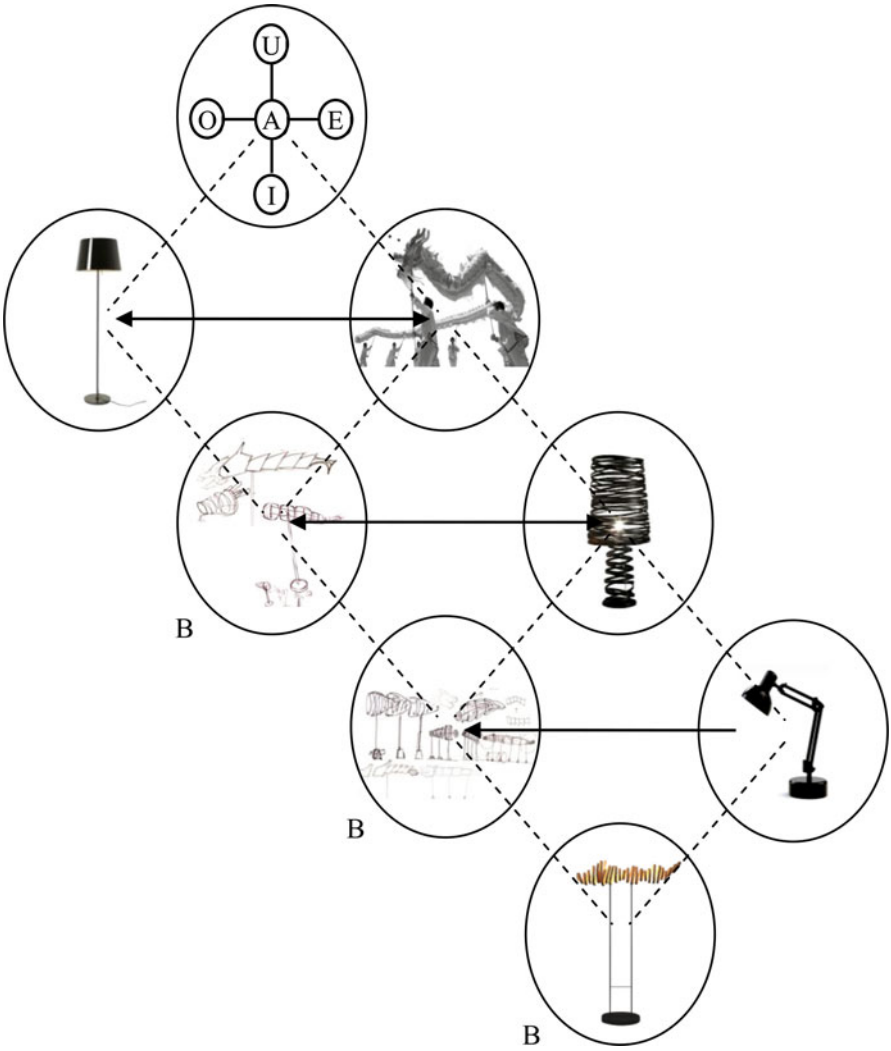

Fig. 33.7 Blending process of *Dragon Dancing Lamp*

are both single scope. The final prototype based on the third blend space is shown in Fig. 33.5 and was recognized by the jury and participants as one of the most creative pleasurable designs at the final presentation and exhibition of concept design of future products in 2011, funded by the National Science Council (NSC) of Taiwan [18].

The second round is to mediate the abstraction at visceral level in order to stress on behavioral similarity between floor lamp and dragon dancing. On the one hand, each several floor lamps can be put together as many sections are joined to assemble a long dragon-shaped body. On the other hand, a creative lamp, *Curl My Light*,

designed by Dima Loginoff [19], made of round sectional metal frame and diffuser is similar to the bamboo hoops of the dragon-shaped body. Thus, the form and assembly are blended with the first blend to generate new lampshades made of curl bamboo, to which LED strip is adhered.

In the third round, more details are refined, following the elaboration principle. The parallel linkage frequently used in desk lamps is projected onto the third blend to maintain the parallel movement of the lampshade when the user waves the lamp tube.

33.5 Conclusion

The design method proposed offers simple but useful guidelines that integrate frameworks of AEIOU and three-level emotional design framework, theories of conceptual metaphor, and conceptual blending to define the problem, search the source domain, and generate blends. Its application to the Dragon Dancing Lamp design demonstrates some new elements and topologies that are not included in the input spaces emerging from the iterative three-round blending process. The process is at large from a double-scope integration network through single-scope ones, generating highly creative concepts. In addition to culture creative product design, the method has potential for enhancing design innovation and emotional design in other product categories. More research is needed on developing blending principles by product design.

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