

An Analysis on Metaphoricity of Design Competition Winners

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Abstract: Metaphor underlies many creative designs by juxtaposing target domain and source domain to generate a novel mapping between them. Among metaphor theories, Andrew Ortony's salience imbalance theory [4] is useful for determining the metaphoricity- the aesthetic pleasingness of a metaphor depending on maximizing the distance between the different domains involved and minimizing the difference between the features within each domain. This paper is to apply the imbalance model to the metaphor within design competition winners in the field of industrial design. Twenty-eight metaphorical designs chosen from winners of several international competitions were used as stimuli. Given the target and source of each stimulus in a questionnaire, nine subjects were asked to determine the degree of similarity between a target and its source, and the salience of the features of the target and source, respectively. Results reveal the metaphoricity of the stimuli largely depends on the salience imbalance of features, and the salience of common features in the source domain tends to be higher than that in the target domain. The empirical evidence of this study supports the application of imbalance model to product design.

Key words: *metaphor, industrial design, similarity, salience imbalance*

1. Introduction

Metaphoric designs are always creative because of its imaginative, surprising or amazing juxtaposition of two different existing things together to make sense in a certain context. This is very true for a number of award-winners of design competitions, such as winners of concept design categories at International Forum Design (iF) Award and "red dot" Award. Metaphor can help us understand the unfamiliar things from familiar things [5]. It is not only a way for everyday thinking but also a way to solve design problems. Since design can be seen as a process or product of problem solving, metaphor plays an important role in designers' conceptualization when designing a product, and in users' understanding about the product or their experiencing through the product when using it. Similarity is not only an important property for human perceiving and interpreting external things, but also the basis to construct metaphor by comparing the features (also called attributes) of two different things [1]. Amos Tversky's [7] feature-based contrast model is an effective method for similarity judgments, especially in linguistics domain. His researches support that metaphor contains more asymmetry of similarity than that of other genres, like literal and anomaly. The definition of asymmetry used in this paper is twofold. On one hand, it indicates the juxtaposition of the source and target of a metaphor is definite in order, not to be reversed. For

example, it may be amazing when Philippe Starck took Excalibur as the source to design a metaphoric toilet brush with their common features, but it is not the case if he adopts a toilet brush as the source to design a metaphoric Excalibur. On the other hand, asymmetry refers to the salience imbalance of features of two things. , Andrew Ortony et al. [4] argue that the essence of metaphoricity is salience imbalance. However, few empirical studies on the asymmetry in metaphor in the area of industrial design can be found. The major objective of this study is to apply Ortony’s imbalance model to the analysis of metaphoricity of design competition winners.

2. Imbalance model

Metaphorical language and metaphorical thought are based on statements and judgments of similarity [2]. According to Tversky’s contrast model, similarity judgment is a feature contrast task, where the degree of similarity of two entities is a linear combination of their common and distinctive features. Let a, b be two entities, and their respective feature sets A and B . The similarity judgment of a and b , denoted by $s(a, b)$, is as shown in Equation (1) [7] [8].

$$s(a, b) = \theta f(A \cap B) - \alpha f(A - B) - \beta f(B - A) \quad (1)$$

where

$\theta, \alpha,$ and $\beta \geq 0$,

$A \cap B$ is the set of features common to both entities a and b ,

$A - B$ is the set of distinctive features of a ,

$B - A$ is the set of distinctive features of b ,

f is an additive function (i.e., $f(A \cup B) = f(A) + f(B)$) as an indicator of the salience of entities,

$\theta, \alpha,$ and β are the weights assigned to $f(A \cap B), f(A - B),$ and $f(B - A),$ respectively.

Although Tversky’s contrast model theory deals with literal and non-literal similarity statements, Ortony et al. [4] extended it to salience imbalance model. Ortony [3] [6] claims contrast model posited salience of features of an object is an independent constant, and the intersection of $f(A \cap B)$ is hard to measure. Thus, the imbalance model considers the salience of common features of the b -term (i.e., the source) is the main factor while two entities are similar. In other words, the measure of the common features depends only on their salience for the b -term, as shown in Equation (2).

$$s(a, b) = \theta f^b(A \cap B) - \alpha f(A - B) - \beta f(B - A) \quad (2)$$

where

$\theta, \alpha,$ and $\beta \geq 0$.

In general, high salience of b -term is viewed as a necessary condition for a meaningful similarity statement. Four types of similarity statement are as shown in Figure1. First, (metaphorical) simile is a similarity statement in which the shared features tend to be of higher salience for the b -term but of relatively lower salience for the a -term (i.e., the target); the measure $f^b(A \cap B)$ should be high (see Figure1. (a)). Second, literal similarity statement is a statement in which two concepts denoted by the terms are likely to share many features; some of which are of relatively higher salience for both. The measure $f^b(A \cap B)$ is determined by the salience of the

shared features vis-à-vis the b-term (see Figure1. (b)). Third, the measure $f^b(A \cap B)$ is lower when metaphorical similarity statements are reversed. Metaphor cannot be reversed without radical changes in perceived similarity and meaningfulness because there is an inherent imbalance in the salience of the relevant features by the two terms(see Figure1. (c)). Finally, anomalous similarity statement is a statement in which no relatively higher salient features of source that are shared with the target; the measure $f^b(A \cap B)$ should be lower (see Figure1. (d)).

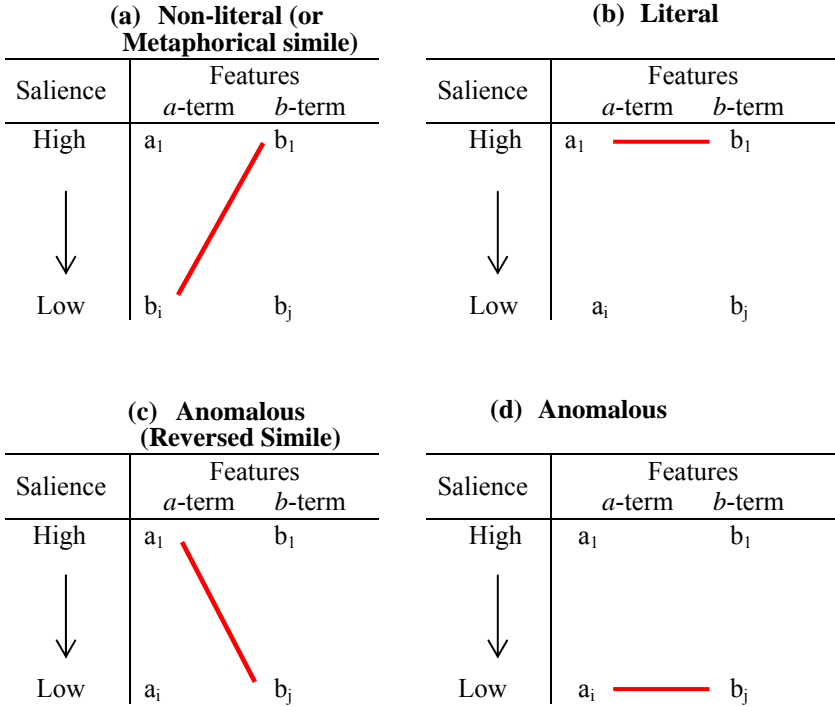


Figure1. Diagrams of four types of similarity statement

Saliency imbalance can be assessed by the degree of diagonality of common features from the source to the target. The imbalance, $I(a, b)$, in saliency levels of matching features of the target and source is a primary source of metaphoricity, as shown in Equation (3). According to the equation, the more literal a similarity statement is, the lower will be its degree of metaphoricity because the matching features have largely high degrees of saliency in both A and B.

$$I(a, b) = g(f^b(A \cap B) - f^a(A \cap B)) \tag{3}$$

where

g is some, probably additive, function,

$I(a, b)$ is a measure of the saliency of the common features set of the source and target respectively.

In sum, the objective of this study is to employ saliency imbalance model to determine the metaphoricity of design competition winners.

3. Methods

Twenty-eight stimuli with metaphor are chosen from 328 winners of concept product design of the International Forum Design Award (iF) in 2008 and 2009, and “red dot” Award in 2008. The choice is based on the design

intension described on the original design boards or reported in press. As illustrated in Table 1, each stimulus is represented in picture with texts and the arrangement of all the stimuli is randomly in a questionnaire that is designed to collect the subjects' opinions about similar between design work and source. Subjects of the questionnaire are nine experienced industrial designers (4 males and 5 females with average age of 26). They are asked to judge the similarity and salience of common features of each stimulus, and then to figure out the common features and salience of source and target, respectively, in order to classify the stimuli into four types. For each stimulus, a subject is asked to answer three well structured questions with 9-point Likert's scale and two open-ended questions (1 point for "Unacceptable"; 9 points for "Acceptable"). The average of time to fill out all questions is approximately 30 minutes.

The first question is "How do you think about the similar degree between this figure and its source (be given)". The mean score indicates "Similarity" in next section. The common feature of source and target is written down by subjects, and then they give a score to show the important degree of common feature for source and target respectively. The mean of the former scores indicates the salience of common feature of source, while the mean of latter indicates the salience of common feature of target. The imbalance value is calculated by common feature in the source subtracting common feature in the target, i.e. "Metaphoricity" in next section.

Table 1. Stimuli for imbalance model questionnaires

1  T: fire extinguisher S: gun	2  T: clinical thermometer S: lollipop	3  T: dustbin S: dolphin	4  T: cup S: plug	5  T: clothes hanger S: rabbit	6  T: clothes hanger S: branch	7  T: compression dustbin S: Armstrong step
8  T: earphone S: zipper	9  T: periscope S: fishing rod	10  T: rescue system S: net	11  T: powerline inspection robot S: monkey	12  T: speaker S: zipper	13  T: A.V. projector S: maestro	14  T: digital camera S: USB
15  T: clock nail S: time	16  T: alarm clock S: tumbler	17  T: boarding pass S: watch	18  T: tack S: flower	19  T: pot stand S: crab	20  T: fan S: bricks	21  T: dog's feces collector S: pot
22  T: soap S: pill	23  T: wireless speakers S: cube	24  T: umbrella S: rose	25  T: air purifier S: pod	26  T: slippers S: yin and yang	27  T: air projection system S: balloon	28  T: clock S: annual eclipse

T: target; S: source (adopted from:

http://www.ifdesign.de/awards_exhibition_index_d?award_name=iF+concept+award&list_awards=1&award_id=0&kategorie_id=-1&sprache=0; <http://www.red-dot.de/>)

4. Results

4.1 Similarity

Similarity means the similar degree. The results of the questionnaire are described in Table 2. The means of half of the stimuli are more than 5 points, and one-of-three stimuli are scored over 7 points. This shows most of subjects considered the target is alike source and they can also indicate the similar feature. Standard deviation (SD) values can show the dispersion of agreement. If SD value is lower, that means the opinion of subjects is more correspondent. In general, the subjects connect the similar of two entities by using the whole or part of visual form of source to represent the appearance of target when he or she creates a product. A stimulus cannot be regarded as metaphorical one if the perceived similarity is too low. The reason might be that the source has been transformed by the designer too much so that the subjects cannot identify. The degree of similarity between most stimuli and its source is rather high (mean = 5.63). That means the degree of similarity is an important way to judge whether a design is metaphorical or not. However, there is no agreement on the cognition of the degree of similarity by different subjects. In the next section we focus on metaphoricity with the salience imbalance.

Table 2. Similarity and salience imbalance of stimuli

No.	Similarity		Salience of Target		Salience of Source		Salience Imbalance
	Mean	SD	Mean	SD	Mean	SD	
1	4.00	1.69	2.50	2.33	6.75	1.49	4.25
2	5.25	1.83	2.38	2.45	7.63	1.68	5.25
3	1.75	1.17	1.13	1.25	4.75	3.58	3.62
4	3.50	2.78	2.25	2.71	6.38	3.70	4.13
5	5.50	2.62	3.13	1.64	7.75	1.03	4.62
6	6.88	1.13	4.25	2.25	7.50	1.60	3.25
7	5.50	2.20	2.25	1.58	7.75	1.16	5.50
8	7.75	0.89	4.625	3.07	8.375	0.74	3.75
9	2.25	1.49	1.75	1.28	4.63	2.61	2.88
10	7.38	1.51	4.63	2.72	7.63	1.30	3.00
11	6.75	1.83	3.38	1.88	7.63	1.99	4.25
12	7.38	1.19	2.25	1.98	8.00	0.93	5.75
13	1.57	0.98	1.00	0.82	6.00	3.16	5.00
14	6.38	1.68	2.63	3.20	8.13	0.64	5.50
15	6.13	2.47	1.50	1.19	7.00	1.41	5.50
16	6.50	1.31	1.50	1.41	7.50	1.31	6.00
17	7.63	0.74	1.88	0.83	8.13	0.64	6.25
18	6.25	1.98	2.38	1.68	7.75	1.16	5.37
19	4.88	2.80	3.62	2.13	6.62	2.56	3.00
20	4.38	2.13	2.00	1.07	6.38	1.30	4.38
21	2.75	1.58	4.13	2.47	6.50	2.50	2.37
22	8.25	1.04	2.75	1.49	7.50	1.93	4.75
23	7.88	0.99	4.00	2.20	7.38	2.45	3.38
24	8.50	0.54	2.75	1.91	8.38	0.92	5.63
25	2.13	2.10	1.25	1.39	2.13	3.09	0.88
26	4.88	2.64	3.63	2.26	7.25	2.05	3.62
27	7.63	1.06	1.87	1.88	8.00	1.19	6.13
28	8.00	0.93	2.50	2.00	8.13	0.83	5.63

4.2 Metaphoricity

As the degree of metaphoricity can be equated with the degree of salience imbalance, we assume that metaphoricity increases with the salience imbalance. Table 2 tells us the salience of features in source a-term is higher than that in target b-term in 28 stimuli. This is coherent with Ortony's assertion. For example, the degree of metaphoricity of stimuli No. 17 is very high because the common feature "wearing on wrist" is more salient

for watch than for boarding card. In contrast, since most subjects cannot identify the similarity between stimuli No. 25 and a pod, most of them think the feature is not salient for both terms. The metaphority of a design is dependent on the extent to which the user can identify the source and the similarity between the target and source. Results show the degree of salience is quite different; we may further define a range of the score so that we can judge whether a design is a metaphorical one.

The similarity and metaphority of design have positive correlation (correlative coefficient = 0.508, significant level = 0.01). Figure 2 depict the mapping of similarity and metaphority. This is corresponding to Ortony's imbalance model, which highlights the relationship between similarity and the salience of intersecting features especially in source term, i.e. $f^b(A \cap B)$. If the set of common features is larger, and the salience is higher in source, the similarity ratings should be higher. As well, salience value of common features in source is higher than in target, the imbalance value is higher. To summarize, both similarity and metaphority are determined by the value of $f^b(A \cap B)$, derived from the salience value of the feature of b-term. According to high/low level of similarity and metaphority, all the stimuli can be located are distinguished into 4 types as shown in Figure 2.

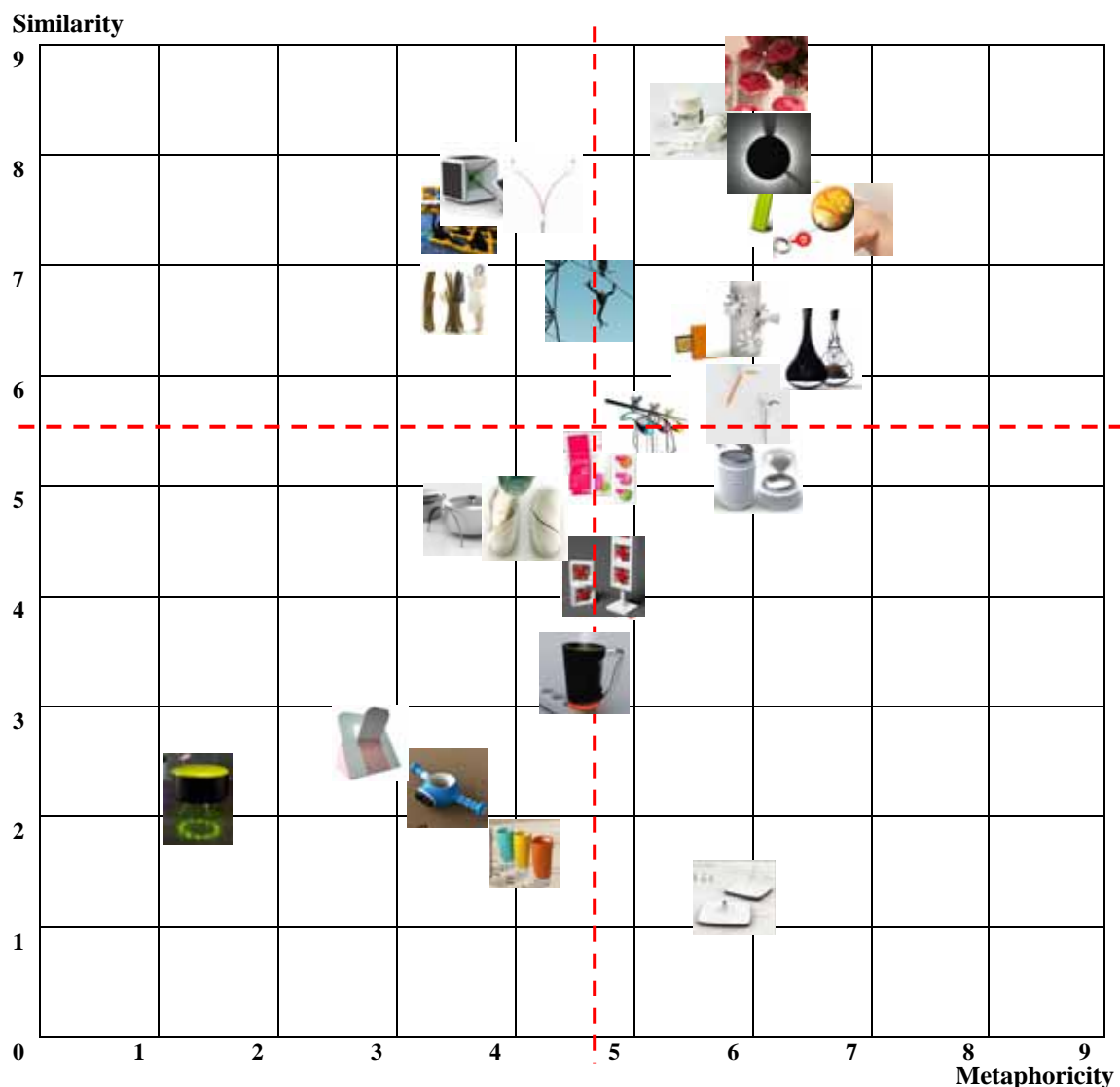


Figure 2. Mapping similarity and metaphority of the stimuli

In this section we discuss how imbalance model can be used for analyzing content of metaphor. Take stimuli No. 12 for example. It is a speaker with a source of zipper. Table 3 shows the common and distinctive features and salience of source and target. The common feature is “opening and closing”, others are distinctive features. For simplicity reason, let the weights θ be 1, while both α and β be the multiplicative inverse of sum of salience of all features ($=1/((6.2+5.3+3.75+3+2.5+2.2+1.7)+(6.4+4.7+4.25+3.4+3+2.3+1.5))$). Hence, the values of measurement of similarity and imbalance of source and target are 5.56 and 4.7, respectively, as shown in Equations (3) and (4).

$$s(\text{speaker, zipper}) = 1 * (6.4) - 0.02 * (6.2+5.3+3.75+3+2.5+2.2) - 0.02 * (4.7+4.25+3.4+3+2.3+1.5) = 5.56 \quad (3)$$

$$I(\text{speaker, zipper}) = 6.4 - 1.7 = 4.7 \quad (4)$$

Table 3. Features and salience of Speaker & Zipper

	Target: Speaker	Source: Zipper
ranking	Features of Target	Features of Source
1	Broadcasting music (6.2)	*Opening and closing (6.4)
2	Controlling volume (5.3)	Moving up and down (4.7)
3	Square box (3.75)	Linear track (4.25)
4	Covering with cloth (3)	Ring-pull (3.4)
5	a rotate-button(2.5)	Sawtooth (3)
6	Hard and solid form(2.2)	Protection (2.3)
7	*Opening and closing (1.7)	Color (1.5)

Note: * represents common feature; values in () represent salience of that features

That result is not corresponding with the degree of similarity described in last section. The reason is that subjects give grades of similarity directly by looking picture and source last section; it is easy to judge similarity by shape or appearance. Furthermore, as the range of scale is larger (the highest grade is nine) than that in last section, the result in this section is certainly higher. In principle, two entities are more similar if they have more common features and fewer distinctive features. Although the salience of the common feature in source is much higher than in target, yet the similarity is inevitable low because there is only one common feature in this case.

5. Conclusions

Metaphor is a method which has been used widely by industrial designers to creatively juxtapose two different things to generate innovative products, from which the users can understand and experience. This paper presents an analysis of metaphoricity of twenty-eight designs awarded in two international competitions. The results of the questionnaire support that the winners of design competitions are always characterized by good metaphoricity. This analysis is not only consistent with Ortony’s imbalance theory, but also demonstrates how similarity and metaphoricity interact in judging metaphor. Implications include that for designers who want to do metaphorical designs and tips for participating in international competitions.

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