Interpreting Visual Metaphors: Asymmetry and Reversibility

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Abstract In a verbal metaphor, the target and the source domains can usually be distinguished clearly, and some features of the source domain are mapped to the target domain, and not vice versa. This asymmetry of metaphor has been acknowledged in conceptual metaphor theory, as well as in interaction theory. However, the asymmetry of visual metaphor, in which concepts are depicted in images, is debated in the existing literature. The authors argue that the main reason behind this is that images lack an explicit copula ("X is Y"); so it is not always clear what a visual metaphor is about (what its target is). The authors explore the asymmetry of visual metaphors by considering a number of examples, and also by using the results of an empirical study they conducted with forty-four participants. Their study shows that, although the source and the target of visual metaphors are reversible more often than in their verbal counterparts, the transferred features usually change drastically by the reversal. This essay argues that the visual metaphors can appear to be symmetric more often than the verbal metaphors because the lack of copula can turn the focus on the comparison between the source and the target, instead of the target itself. The examples demonstrate that context plays a major role in this process by identifying the source and the target of a visual metaphor.

Keywords visual metaphor, asymmetry, context, interaction, juxtaposition

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Verbal metaphors are known to be asymmetric: to say "Surgeons are butchers" is not the same thing as saying "Butchers are surgeons." Generally, features are transferred from the source to the target and not from the target to the source. Reversing the source and the target of a metaphor produces quite a different meaning. For example, "Billboards are warts" conveys the impression that billboards are ugly blemishes on the landscapes. If we reverse the source and the target, however, as in "Warts are billboards," we obtain a somewhat incomprehensible metaphor, with a possible interpretation that warts convey something about the health of the person.

In contrast, in a literal comparison statement like "Billboards are placards," reversing the terms ("Placards are billboards") produces a meaning similar to the original one. This obliteration of asymmetry becomes even more pronounced if we introduce the term *like* as in "Billboards are like placards," which communicates a meaning quite similar to "Placards are like billboards." At the other extreme, we can make a completely symmetrical statement by focusing on the similarities instead of the source or the target, as in "Billboards and placards are similar" or "Warts and billboards are similar."

This observation provides the key to the asymmetry of metaphors. A metaphor essentially makes a statement about the target, which is the focus. So, if we reverse the source and the target, even if the reversal is meaningful, the meaning is different. On the other hand, a comparison statement focuses on the shared properties and differences between two objects or situations—we cannot even apply the terms *source* and *target* there, as both are merely objects of comparison. Along this continuum, similes lie more toward the metaphor end and literal similarity comparisons more toward the comparison end (figure 1).

Our goal in this article is to explore whether this phenomenon can be observed in visual metaphors as well. The problem with visual metaphors is that because there is no explicit copula, or a word such as *like*, one essentially has to rely on the context to figure out what the metaphor is about and what message it is trying to convey. To this end, we carried out an empirical study in which we asked the participants to interpret a number of visual metaphors. Using the results of this study, we analyze how the target is determined in a visual metaphor, how the direction of feature transfer is determined, and whether visual metaphors are more symmetric than verbal metaphors.

This article is organized as follows. First, we briefly summarize existing models to explain the asymmetry of verbal metaphors. Then we introduce visual metaphors and summarize the existing research on directionality in visual metaphors. Subsequently, we present our empirical study on interpreting visual metaphors and address the issues of asymmetry and revers-

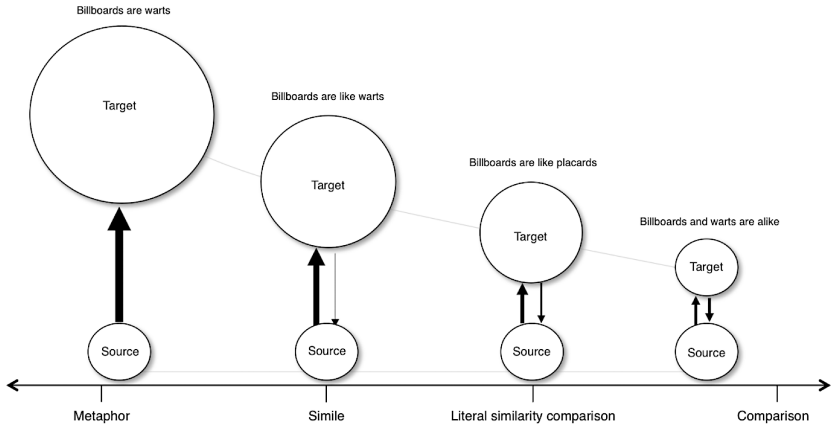


Figure 1 The continuum showing metaphor and comparisons on the extreme ends

ibility therein. We articulate a model of the interaction between the perceptual and conceptual features of the two concepts present in the visual metaphor, or implicitly referred to by it. Finally, we summarize our conclusions and point out future directions for research.

Asymmetry in Verbal Metaphor

Studies suggest that verbal metaphors tend to be strongly directional. Amos Tversky (1977) explains this strong directionality of metaphors in terms of salience imbalance. According to him, the meaning of a metaphor depends on a match of high-salient features of the source with low-salient features of the target; therefore, swapping the two terms, in general, changes the meaning. Andrew Ortony (1979) extended Tversky's model by defining the salience of a feature relative to the particular object of which it is an attribute: the same features may have different salience in two different objects. He suggested that the difference between metaphor and literal similarity is largely due to a difference in the relative salience of the features shared between the source and the target. In a metaphor such as "Billboards are warts," the shared features (such as ugly) are of high salience in the source (warts) and of low salience in the target (billboards). In a literal comparison such as "Billboards are like placards," the shared features (namely, that both are surfaces for displaying information) are of high salience in both target and source domains. He suggests that an imbalance in the salience levels of the shared attributes of the two terms is what characterizes a metaphor (as opposed to literal similarity; Ortony 1979: 164).

It is sometimes argued that the interaction theory of metaphor, proposed by Max Black (1962, 1979), endorses a symmetric view of metaphor (Hausman 1989; Lakoff and Turner 1989). This argument is based, however, on what we see as a basic misunderstanding of interaction theory (Indurkhya 1992: 68–73; see also Forceville 1995). The root of this misunderstanding can be traced to somewhat inconsistent remarks made by Black in both his essays. For example, in one place Black (1962) argued that while the metaphor "Man is a wolf" makes men seem more predatory, at the same time it also makes wolves seem more humane. This, in a way, is the gist of bidirectionality in metaphors. Although a metaphorical statement is generally about the target, does it say something about the source as well in passing? Does it affect our perception of the source as a side effect?

A careful reading of Black, however, reveals that the interaction theory of metaphor clearly holds that the primary and the secondary subjects cannot be reversed without creating a different metaphor altogether. In the same 1962 essay, Black used an analogy of looking at the starry sky through a smoked glass on which a pattern of lines are etched, to explain how interaction works in a metaphor. The pattern of stars seen in the sky through the smoked glass results from an interaction between the pattern of etched lines (the source or the secondary system) and the arrangement of stars in the sky (the target or the primary system). Notice that both the source and the target influence the seen structure. The pattern of etched lines determines the pattern, but the stars have to be in the appropriate place to be seen through the etched lines. In fact, there are a myriad of potential patterns in the starry sky, so one cannot say that we are comparing some preexisting pattern in the starry sky with the pattern of etched lines. So the structure seen in the sky truly emerges from an interaction between these two systems. This is the essence of interaction theory.

This account is clearly asymmetric, for it is difficult to consider looking at the smoked glass through a starry sky. If we imagine a large black screen with several pinpoint holes (one for each star), and consider looking through this screen at the smoked glass, a very different pattern will emerge. This is what happens when we swap the source and the target of a metaphor, as from "Surgeons are butchers" to "Butchers are surgeons."

This same insight is reiterated in Black's later essay (1979), in which he uses the geometric figure of the Star of David to explain how metaphors can create new perspectives and new similarities. The figure of the Star of David can be described as two equilateral triangles, as a hexagon with an equilateral triangle on each side, as three overlapping parallelograms, and so on (figure 2). The description in terms of parallelograms is harder to see, but given the right context it jumps out: this is similar to what happens in processing metaphors.

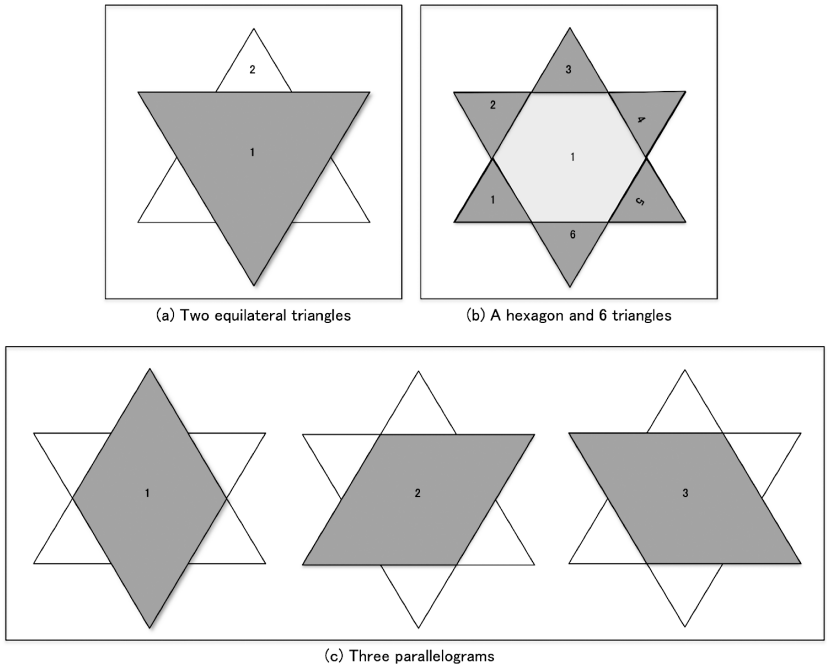


Figure 2 Black's illustration for "Thinking in Metaphors." The figure of the Star of David can be described in terms of two equilateral triangles (a), a hexagon and six triangles (b), and three parallelograms (c).

However, in seeing the Star of David in terms of parallelograms, one cannot say that parallelograms are made to look like the Star of David.

In our earlier work (Indurkhya 1992, 2006), we formalized this insight of interaction theory by articulating a multilayer model of cognition, with the interaction happening between the concepts of the source and the perceptual imagery of the target. This account is inherently asymmetrical. The question we would like to examine here is whether this account can be applied to visual metaphors as well.

Introducing Visual Metaphor

A visual metaphor (also called "pictorial metaphor") occurs when the source and/or the target of a metaphor are rendered as images, or, in other words, when something (the target) is presented visually as something else (the source). Examples of visual metaphors are often found in advertising, political cartoons, films, and art (Forceville 1996; Fox 1982; Kaplan 1990, 1992; Nikolakouli 2012; Reffaie 2003; Whittock 1990). Figure 3 provides one such

Source: http://adsoftheworld.com/

Figure 3 An example of a visual metaphor

example. This image shows some people waiting at an airport lounge. There is, however, something unusual about this picture: all but one of the people have a loudspeaker for their heads. The loudspeaker heads make the image seem incongruous and anomalous at first, but upon reflection, we can arrive at a metaphorical interpretation: people talk very loudly in airports, as if their "heads were loudspeakers." Images that can be interpreted like this are called visual metaphors.

Although visual metaphor has not been at the forefront of research on metaphor, there have been several theoretical and empirical studies exploring the nature and structure of such metaphors (Carroll 1994; Durand 1987; Forceville 1996, 2002; Indurkhya and Ojha 2013; Kaplan 1990, 1992; Kennedy 1982; Moura 2006). In particular, researchers have asked how visual metaphors are different from their verbal counterparts, what cognitive processes are involved in visual metaphor processing, as well as how features are selected and transferred in a visual metaphor.

Asymmetry and Directionality in Visual Metaphor

Although there is a general consensus that verbal metaphors are asymmetric, this issue is debated in visual metaphors. Noël Carroll (1994) suggested that visual metaphors are assembled as composite, nonsequential images using superimposition or composite construction and must meet the requirements of "homospatiality" or "noncompossibility." In homospatiality, different images corresponding to distant domains are fused into a single spatial slot. In noncompossibility, unrelated images are juxtaposed, and the spectator is forced to find a way to assimilate the juxtaposed images as the rep-

resentation of something particular, thereby engaging him or her in a search that is similar to the quest for meaning in a verbal metaphor. In other words, the viewer is moved from the perception of that particular image to an "abstract thought about the interaction of categories" (Carroll 1994: 201). In this characterization of visual metaphor, there is no directionality—as both images play a symmetric role—so reversibility emerges as one of its inherent features.

Charles Forceville (2002), however, has argued against requiring homospatiality and noncompossibility as necessary ingredients of visual metaphors. He criticized the selection of examples chosen by Carroll, pointing out that they are all taken from the surrealist art movement, which favors reversibility, thereby leading Carroll to assume that reversibility is a typical feature of visual metaphor. Adding to this debate, Vitor Moura (2006) has argued that, according to Carroll, a significant portion of any visual metaphor's heuristic value resides in the way it prompts its viewer to "test" whether the metaphor can be reversed. This view is not exactly the same as claiming that visual metaphors are more prone to reversibility than the linguistic ones, but that the reversibility in visual metaphors can be tested more straightforwardly (Kosslyn 2003).

We would like to point out that the difference between the verbal and visual metaphors with respect to asymmetry stems from the difference in their modalities and structures. Verbal and visual metaphors use different representation and processing modes, as text and images are processed differently in the brain (Paivio 1986; Paivio and Begg 1981; Schnotz 2002; Schnotz and Bannert 1999). Moreover, verbal metaphors follow a linguistic structure (syntax), which helps the reader to identify the source and the target of a metaphor. For example, often the term before the copula is the target, and the term after the copula is the source. On the other hand, there is no such accepted syntax in images. It is not always clear what the image is about, so it is difficult to discern what is the target and what is the source in a visual metaphor. One could say that verbal metaphors are linear, whereas visual metaphors are holistic, although some researchers have argued that images also have a structure that can correspond to syntax of languages (Cohn 2003, 2007, 2013; Kress and Van Leeuwen 2006).

The asymmetry of a metaphor is closely tied to the problem of identifying the target of a metaphor. If the target is clearly identifiable, then the metaphor is likely to be asymmetric because swapping the target with the source will lead to a different metaphor. In verbal metaphors, most prevailing accounts are based on a one-stage or a two-stage model. In a two-stage model, first an anomaly is detected, and then an attempt is made to transfer features of the source to the target. Reaction-time studies have provided

evidence against this two-stage model (see, for instance, Gerrig 1989) because a metaphor does not take any longer to be understood than a literal statement of similar complexity. In a one-stage model, the context and the word meanings interact to produce an overall meaning, which can be literal or metaphorical (Indurkhya 2016).

In visual metaphors, however, a three-stage model has been proposed (Forceville 1996).[1] First we have to identify two different images; second, we need to decide which image is the target and which is the source; and finally, we need to ascertain which features of the source are transferred to the target. To understand the cognitive processes underlying these steps, we conducted an empirical study in which we asked the participants to interpret various kinds of visual metaphors, which we describe below.

An Empirical Study on Interpretation of Visual Metaphors

Participants

Forty-four participants (average age of 21.5) took part in this study. The participants were undergraduate or graduate students at Kyungpook National University but from different countries. The native languages of the participants were as follows: Hindi for twenty-five, Korean for eleven, Telugu for three, Persian for two, Bengali for two, and Tamil for one. All the participants, however, were fluent in English, as ascertained by their TOEIC scores.[2]

Material

Visual metaphors appear in different genres such as print ads, movies, cartoons, and the arts. For our study, we chose examples from the genre of print advertisement for the following reasons. First, visual metaphors in print ads have been studied extensively in recent years, and there are many examples available in today's digital world. Secondly, while print ads are creative, they also have a very clear message to convey to the viewer. Generally, advertisements carry a message, which they aim to communicate effectively in a focused way. Thirdly, compared to cartoons, which provide another source of visual metaphors, the messages carried by print ads are usually simpler; they require less social and political information to understand their message because if the ad is complicated, it may fail to convey the intended meaning.

1. To contrast, the second stage is almost always implicit in verbal metaphors, except possibly when interpreting whole works of literature like *Moby Dick* or *The Wizard of Oz*.
2. Test of English for International Communication. For more information on the TOEIC, see Educational Testing Service.

Visual metaphors in advertisements can be classified in various ways. They can be monomodal, where only the visual modality is used, or multimodal, where both verbal and visual modalities are used. Moreover, there are different ways in which concepts can be depicted in a visual metaphor (Durand 1987; Forceville 1996; Kennedy 1982; Wollheim 1987). For our study, we focused on the following two classes of visual metaphors: (1) both concepts of the visual metaphor are explicitly depicted; and (2) one concept of the visual metaphor is explicitly shown and the other is implicit.

Task and Methodology

Prior to the experiment, participants were shown five examples to familiarize them with the experimental procedure. The examples included visual metaphors and the corresponding verbal metaphors with the preferred target and source in the given corresponding verbal metaphor. Then in the experiment, the participants were shown a total of sixteen images. The images were visual metaphors appearing in ads and were collected from a publicly available database on the Internet, Ads of the World. Out of these sixteen images, six images had both concepts explicitly present (case 1), and the remaining ten images had one concept explicitly present and the other implied (case 2). Images were presented randomly in the experiment. The procedure (see figure 4) was as follows. First, the participants were shown an image and were asked if the image could be interpreted metaphorically. They were given four options. The first option was the metaphor in the "X is Y" format. The second was in the "Y is X" format. The preferred understanding of the corresponding verbal metaphor for the given image was decided on the basis of a seven-year study on two hundred participants who provided verbal interpretation for visual metaphors (Ojha and Indurkhya 2009; Ojha 2013). The third option was to provide a different metaphorical interpretation for the image. The fourth option was to say that the image is not metaphorical. If they chose any of the first three options, they were asked to state the reasons

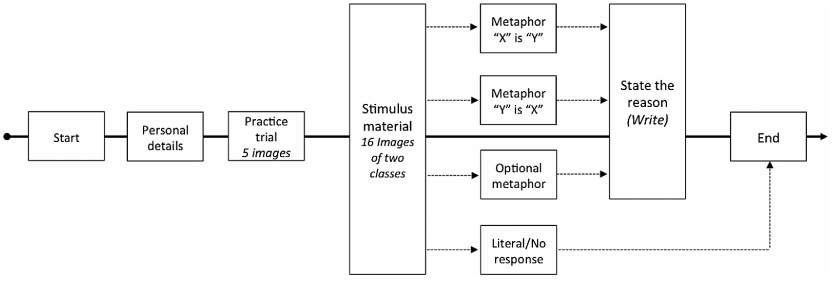


Figure 4 Experimental procedure for the study

for their choice of metaphor to elaborate on their interpretation. The survey was conducted on an online portal specifically designed for this study. The average time to finish the experiment was 14.2 minutes (SD = 4.7 minutes).

Results and Discussion

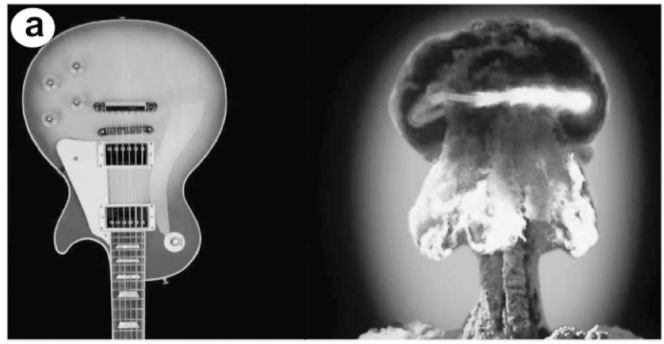
First we discuss, in turn, the results for examples in each of the two classes of metaphors: when both concepts are explicitly depicted, and when only one is explicit and the other is implied. Then we present a summary of our results in a table for all the images used in the study.

Case 1: Both Concepts Are Explicitly Depicted

When two concepts are depicted explicitly, we can distinguish among three subcategories, depending on their mode of presentation: the two concepts can be shown juxtaposed together with no other concepts present, the two concepts can be presented together with several other concepts that provide a context, or the two concepts can be fused together in a composite image. In the first case, it is not clear if the image is a metaphor at all, for the juxtaposition can be seen simply as juxtaposition without connecting the two images. In the second case, the context provides some clues as to how to meaningfully connect the two images, and it may also suggest which image is considered to be the target. The third possibility, which corresponds to "homospatiality" in the terminology of Carroll (1994), seems more ambiguous for determining which of the two partially depicted concepts is the target. We will now consider examples of each of these three subcategories below. Of the six images used in this case, in one of them the two concepts were juxtaposed, in two of them the two concepts were presented in a context, and in three of them the two concepts were fused in a composite image.

Two Concepts Depicted in Juxtaposition Figure 5 illustrates an example of this kind of visual metaphor, in which the images of a nuclear explosion and a guitar are shown in juxtaposition, with the shape of the nuclear blast matching the shape of the guitar.

These two images are not merged, and there is no other visible sign (except the similarity of shape) to connect these two concepts other than the fact that they are presented in a single frame. We conducted the study with two versions of the image by swapping the left and right images as shown in figure 5. Each version was shown to different participants. The first version was shown to forty-four participants, and the second version was shown to thirty-six participants. Our results demonstrated that the placement of the images had no effect on the interpretation: 80 percent of the participants (and 76 percent for those exposed to the reversed order) interpreted this as the met-



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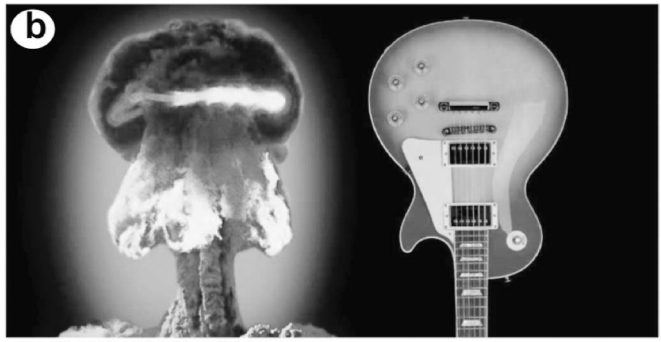

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Figure 5 A visual metaphor in which both concepts are depicted pictorially.

aphor "A guitar is a nuclear explosion," while sixteen (18 percent) of them interpreted it as "A nuclear explosion is a guitar." The remaining four (6 percent) of the participants did not find the juxtaposition metaphorically meaningful and explained it literally (e.g., "It is a picture of a guitar and a nuclear explosion").

Those who considered the guitar to be the target focused on the sensation of the sound of the guitar and its excitement by transferring the corresponding attributes from the domain of a nuclear blast. On the other hand, those who chose to go with "A nuclear explosion is a guitar" compared *the perfection of guitar music* to *the perfect execution of a nuclear explosion*. This shows that when the source and the target are reversed in a visual metaphor, we obtain a different meaning, similarly to the case with verbal metaphor.

Two Concepts Depicted in a Context Sometimes the image is such that a context is provided by the other objects in the image or by the structural arrangement of the image, which helps to connect the two images, as shown in figure 6. Here a row of bullets is shown, in which one bullet is replaced by a

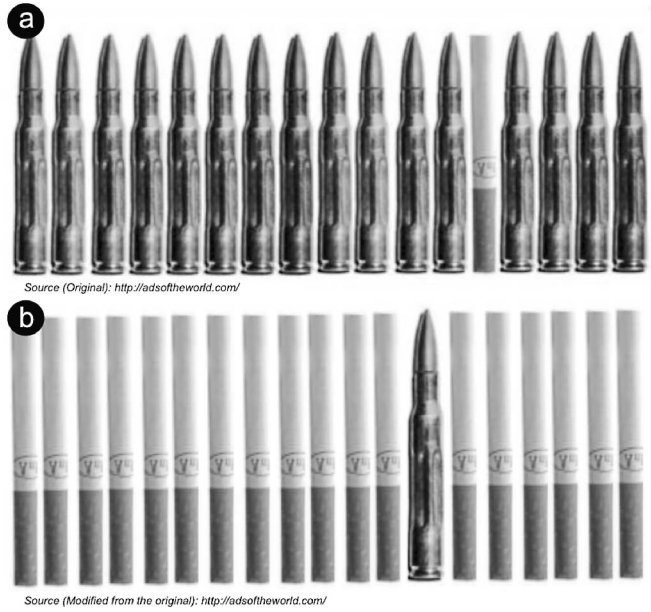


Figure 6 A visual metaphor in which both concepts are depicted but in a context.

cigarette. Thus, the row of bullets sets the context for interpreting the cigarette image. (If this example were presented in the mode discussed earlier, then only a single bullet image would be juxtaposed with the cigarette image.) This could be considered to be a case of "partial homospatiality," to modify the terminology of Carroll.

For this example (figure 6a), 92 percent of the participants interpreted it as "Cigarettes are bullets," and 8 percent considered it to be "Bullets are cigarettes." Most participants, however, suggested that the feature transferred, in either case, is that they kill, but more of them felt "Cigarettes are bullets" conveys a stronger message than "Bullets are cigarettes." One participant noted that the image suggests that cigarettes are deadlier than bullets because it looks like one cigarette is equal to sixteen bullets.

This example reveals an instance of symmetry in visual metaphors, for even when the source and the target are reversed, the feature transferred is the same. This may be because in the context of an antismoking campaign, the life-threatening feature of cigarettes is emphasized. Nevertheless, one participant suggested that "Bullets are cigarettes" conveys fun, for smoking a cigarette can be fun and joyful. It should be noted here that cigarette smoking might be seen as positive or negative. Cigarette ads emphasize the fun aspect, but the antismoking ad emphasizes the deadly aspect. Thus it seems that the overall message dominates the interpretation, which in turn

Source: http://adsoftheworld.com/

Figure 7 Another visual metaphor in which both concepts are depicted in a context.

determines which features are transferred regardless of the source and the target distinction.

As to why the cigarette is the preferred target for this visual metaphor (figure 6a), we conjectured that it might be because the bullets are more numerous. To verify this, we ran another experiment in which there was a row of cigarettes, with one of them replaced by a bullet (figure 6b).[3] The results showed no significant difference in the response: 84 percent of the participants preferred "Cigarettes are bullets" as the interpretation. We suggest that the cigarette is the preferred target because of the cultural context, in which antismoking campaigns are more common, and people are used to seeing cigarettes as the target.[4]

Another example of a visual metaphor in this category is shown in figure 7, which is an advertisement for a beer. The odd placement of a hand grenade inside a beer bottle provides the context for interpreting the image metaphorically. The text in the red stripe says "strong," suggesting the feature to be transferred. When showed to our participants, 80 percent of them interpreted it as "Beer is a hand grenade," in which the feature "explosion" or "strong" was transferred. Those participants who interpreted the image as "The hand grenade is beer" suggested that "smoothness" and "fluidity" of beer is transferred to the hand grenade.

Comparing the above two examples of homospatial metaphors, in which both concepts are explicitly depicted, we can see an effect of verbal cues. In the first example (figure 6), no verbal cues are used, and it shows more symmetry with respect to the feature transferred. In the second example

3. The experiment was conducted with thirty-six participants (average age = twenty years). All the participants were fluent in English as assessed by their TOEIC score. Out of thirty-six participants, nineteen were from Korea, three from Iran, nine from India, two from Pakistan, one from China, one from Brazil, and one from Japan. The experiment followed the same procedure.

4. It may be interesting to do another study pertaining to an antigun campaign and related ads in the United States.

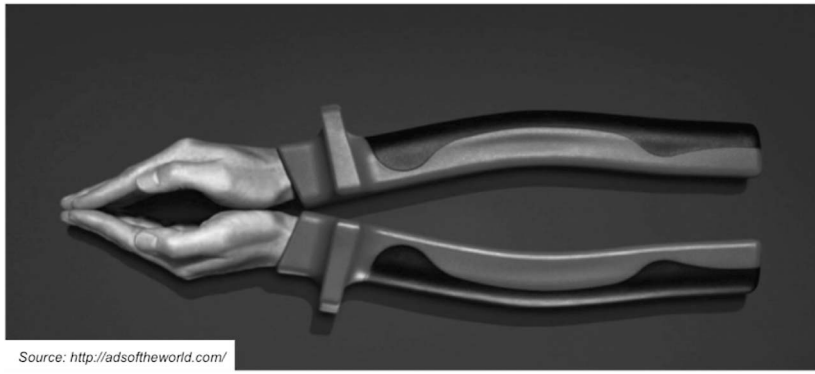


Figure 8 A visual metaphor in which both concepts are depicted homospatially.

(figure 7), placing the verbal cue "strong" primes the viewer in selecting the features to be transferred, which also seems to affect their choice of the target.

Two Concepts Are Fused in One Image Some visual metaphors depict a merged composite image in which the two concepts are fused into a single image. An example is shown in figure 8, which depicts a composite of pliers and folded hands. This incongruity invites the viewer to understand the image metaphorically. When showed to our participants, 60 percent of them interpreted it as "Hands are tools," and 40 percent as "Tools are hands." Thus, this example illustrates symmetry with respect to the choice of target, as there was no strong preference. In the case of "Hands are tools," however, efficiency or perfection was transferred to the target, but for "Tools are hands," care was the transferred feature.

So it seems that for this class of visual metaphors, the choice of target is not so unequivocal, although the features transferred are different, depending on which concept is chosen as the target.

Case 2: One Concept Is Explicitly Depicted and the Other Is Implicit

In several instances of visual metaphor, one concept of the metaphor is pictorially depicted, but the other is only implied by the context. The explicitly depicted concept can be the source or the target. We will consider examples of each situation in turn.

Source Is Explicitly Depicted but the Target Is Implied Consider the image shown in figure 9. We see a hand about to touch a cactus plant. Notice that there is no incongruity in this image, for it is quite natural for such a cactus to be on the bedside table. The posture of the person in the bed, however, and of the hand suggests an alarm clock. The name of the advertiser, and a little

Figure 9 A visual metaphor with the source explicitly depicted and the target implied

picture of an alarm clock on the bottom right-hand corner, further reinforce this suggestion. Still, the image could be interpreted literally as a kind of prank, in which someone has replaced the alarm clock with a cactus plant while the person was asleep in the bed. The posture of the hand, however, suggests someone about to hit the snooze button after the alarm has just rung. This steers the viewer toward the intended message, which is that this alarm clock will surely wake you up, for turning it off is like touching a prickly cactus plant, which is bound to rouse anyone from a deep sleep. This influence of context and explicit hints is obvious, leading 90 percent of the participants to choose the interpretation "An alarm clock is a cactus" rather than the other way around, although no alarm clock is shown in the main part of the image. (The remaining 10 percent of the participants found this image anomalous.)

Two other similar examples are shown in figure 10. In the left image, we see a fish coming out of a mouth, and in the right image a dirty sock. The position of the sock or the fish is where the tongue would normally be, suggesting "Tongue is a fish (or a dirty sock)." At the bottom right corner of each image is a picture of a Clorets chewing gum packet with the message "Eliminate bad breath." This suggests that the fish or the sock is somehow connected with bad breath, and that is the feature transferred to the tongue.

Indeed, when the image was shown to the participants, 60 percent suggested that it should be interpreted as "Tongue is a fish/sock," 16 percent as "Fish/sock is tongue," while 24 percent did not respond and considered the

Figure 10 Two visual metaphors with explicit sources and implicit targets

image to be literal and funny. For "Tongue is a fish/sock," the transferred feature was the foul smell of the fish or the dirty sock. For "Fish/sock is tongue" the transferred feature was the "rough" texture of the sock and the "smooth" texture of the fish's skin. When they interpreted the images literally, the participants suggested that a sock is being worn on the tongue or a fish is being eaten.

Both these examples therefore illustrate how strongly context influences the choice of the target of the metaphor, even when the target is not explicitly shown. Moreover, the information that this is an advertisement for a particular product constrains the feature that is transferred from the source, which in turn determines the message communicated by the metaphor. The end result is a highly asymmetrical process.

We now consider some examples in which the target is explicitly shown and the source is implied.

Target Is Explicitly Depicted but the Source Is Implied Figure 11 shows the image of a shoe with a strand of hair functioning as a shoelace. On the bottom-right corner, the image of a shampoo bottle is shown. Shampoo suggests strong hair; so the image seems to convey the message that (using this shampoo) hair will be as strong as shoelaces. Thus, the target "hair" is explicitly shown, and the source "shoelace" is implied by the context.

Indeed, when shown to the participants, 95 percent of them interpreted it as "Hair is a shoelace" (transferring the strength of shoelace to the hair), and

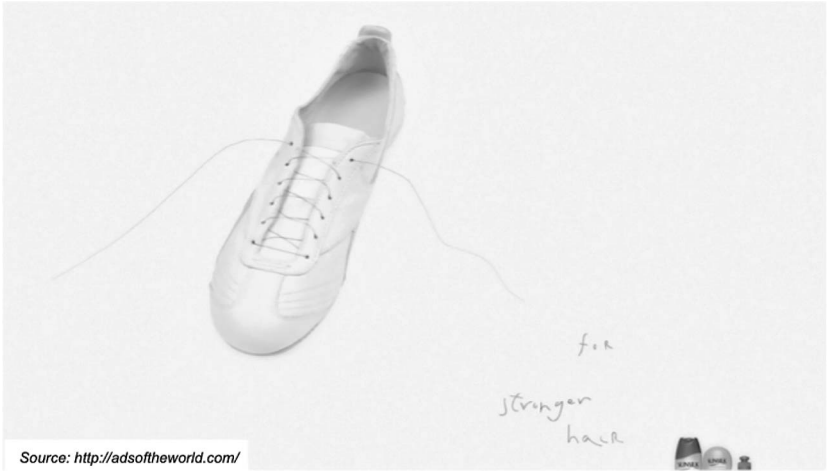


Figure 11 A visual metaphor with the target explicitly depicted but the source implied

only 5 percent of the participants interpreted it as "Shoelace is hair" (transferring the length of the hair to the shoelace).

In the above example, the context provided by the shoe and the way the hair was laced through it provided a strong clue to the source of the metaphor, which was missing from the picture. Sometimes, the source is hinted at by the shape or color of the depicted image. For example, figure 12 shows an ad for a certain brand of bottled water. Here the shape of the curled up bottle suggests a tube of toothpaste. Once the source is identified, the viewer can generally work out the transferred feature, which could be "freshness" in this case. In our study, 75 percent of the participants interpreted this image as "Water is toothpaste," with the transferred feature being "freshness" or "cleanliness"; but 25 percent did not find any meaningful metaphor in this image. Thus, we see that, as the hint about the missing source of the metaphor becomes subtler, the possibility of missing the metaphor altogether becomes stronger. At the same time, however, the chance of confusion between the source and the target of the metaphor becomes much smaller: if the source cannot be identified at all, then it cannot be mistaken for the target of the metaphor.

Comparing these examples with those when the target is not explicitly depicted but implied by the context, we can say that it is the context and the message of the advertiser (and not an explicit depiction) that largely determines what will be the source of the metaphor and what will be the target. Between these two factors, the context seems to play a more dominant role. For the examples shown in figures 9 and 10, we cannot think of an advertising

Figure 12 Another example in which the source of the metaphor is implied by the shape of the target object.

message that will make the cactus (or the fish or the dirty sock in figure 10) the preferred target. However, for the example of figure 12, if the message is something like "freshness" accompanied by a picture of a toothpaste tube, the target could be construed as toothpaste.

What is more, the viewer's cultural background can also play a key role in determining the target of a visual metaphor. Consider, for example, the image shown in figure 13, which was used for an environmental campaign. At first glance, the picture looks normal: women moving in a procession around an electric pole, with barren land around them. However, for people familiar with Indian culture, this picture takes on a religious connotation: it reminds them of shrines constructed by raising a platform around a tree, which women circle in a ritual of worship. This connotation invites the viewer to construct the metaphor "An electric pole is a tree," with the missing tree being the source, similarly to the above two examples. The text above the

Figure 13 A visual metaphor in which culture plays a key role.

image, "Plant more trees," further strengthens this metaphor. Other possible interpretations of this image might emphasize the issue of deforestation, appealing to the spiritual needs of humans: deforestation will leave no trees to worship.

When the image was shown to our participants, 70 percent interpreted it as "The electric pole is a tree," in which the features of a tree such as "life giver" and "absence of shade" were transferred to the electric pole. Although some of the participants answered that they interpreted this image as "The tree is an electric pole," when they elaborated their interpretation, the electric pole was taken to represent "technology," and the women were seen as worshipping technology as if it were a kind of god. This makes it seem like a "Technology is God" metaphor, which is an abstraction of the interpretation "Electric pole (representing technology) is a tree (representing God)."

Another interesting aspect of this example was that 22 percent of the participants (nine with Korean as their native language and one with Iranian) could not find any interpretation for this image. This suggests that cultural background knowledge is necessary to interpret some visual metaphors. This issue requires further empirical studies. In our earlier experiments, we have used images from antismoking ads that show cigarettes in the form of a coffin, for example, but we have not studied the effect of cultural background on the interpretation of such images.

Summary of Results

We provide below a summary of the responses for all the stimuli presented in the experiment (Table 1). The table shows the image, the target preferences for each of the two main objects in the image, and a measure of asymmetry for that image. The asymmetry is calculated using a statistical measure of skewness proposed by H. L. MacGillivray (1986). A skewness value close to zero indicates that the data are symmetrical, whereas a value far from zero indicates asymmetry.

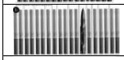
Modeling Interaction in Visual Metaphors

We now articulate a model to capture how different perceptual and conceptual components of the concepts depicted in the image, or implied by it, interact together to generate a metaphorical interpretation. This is an elaboration of a model we outlined (Ojha and Indurkhya 2016), and it is based on the model proposed by Wolfgang Schnotz and Maria Bannert (2003) to explain how people integrate information from text and pictures. Using this model, we explain how asymmetry results (or does not result) from the interaction.

We illustrate three different situations with respect to asymmetry by considering some of the examples used in our experiments. Figure 14 shows interaction sequences for two situations: one shown in figure 3 (corresponding to "Heads are loudspeakers"), and the other shown in figure 8, which is a composite of pliers and hands. The terms used in the model are as follows. *Perceptual space* is where visual and imagistic information is processed. *Conceptual space* is where verbal and abstract information is processed. *Interaction* refers to the process by which perceptual and conceptual features compete and cooperate together to generate different interpretations. *Incongruity* refers to conceptual dissonance between the objects in the image. *Anchor* refers to the concept or the object that provides some hint or cue about the intended message of the image, which helps in resolving the incongruity.

For the "Heads are loudspeakers" situation, after the two concepts are identified, and an incongruity between them is detected (stage 3), the target needs to be imagined based on the context, for the heads that are replaced by the loudspeakers are not shown in the image. The context here indicates that the message is about the heads (and not the loudspeakers), so that it is the features of the loudspeakers that are projected onto the perceptual and con-

Table 1 Summary of results

Image	Depiction mode			Response			Asymmetry (skewedness value)	Directionality
	Target 1	Target 2	Fusion*	Target 1	Target 2	NR/L		
	Guitar	Nuclear explosion	No	80	16	4	0.763	Guitar
	Guitar	Nuclear explosion	No	76	18	6	0.693	Guitar
	Bullets	Cigarettes	No	8	92	0	(-) 0.794	Cigarettes
	Bullets	Cigarettes	No	16	84	0	(-) 0.740	Cigarettes
	Beer	Hand grenade	No	80	12	8	0.766	Beer
	Hands	Tools	Yes	60	40	00	0.130	Hands/tools
	Hands	Tools	Yes	56	40	4	0.196	Hands/tools
	Alarm clock	Cactus	Yes	90	0	10	0.986	Alarm clock
	Tongue	Fish	Yes	60	16	24	0.433	Tongue
	Tongue	Sock	Yes	60	16	24	0.446	Tongue
	Hair	Shoelace	Yes	95	5	0	0.871	Hair
	Water	Toothpaste	Yes	75	0	25	0.967	Water
	Electric pole	Tree	Yes	69	9	22	0.553	Electric pole
	Nail	Screw driver	No	54	46	0	0.065	Nail/screw driver
	Medicine	Weapons	Yes	24	30	46	(-) 0.122	Undecided
	Cigarettes	Pyre	Yes	56	20	24	0.344	Cigarettes
	Shoe	Limousine	Yes	62	32	6	0.312	Shoe
	Heads	Loud speakers	Yes	76	15	9	0.722	Heads

*Yes = two concepts are merged, No = two concepts are not merged.

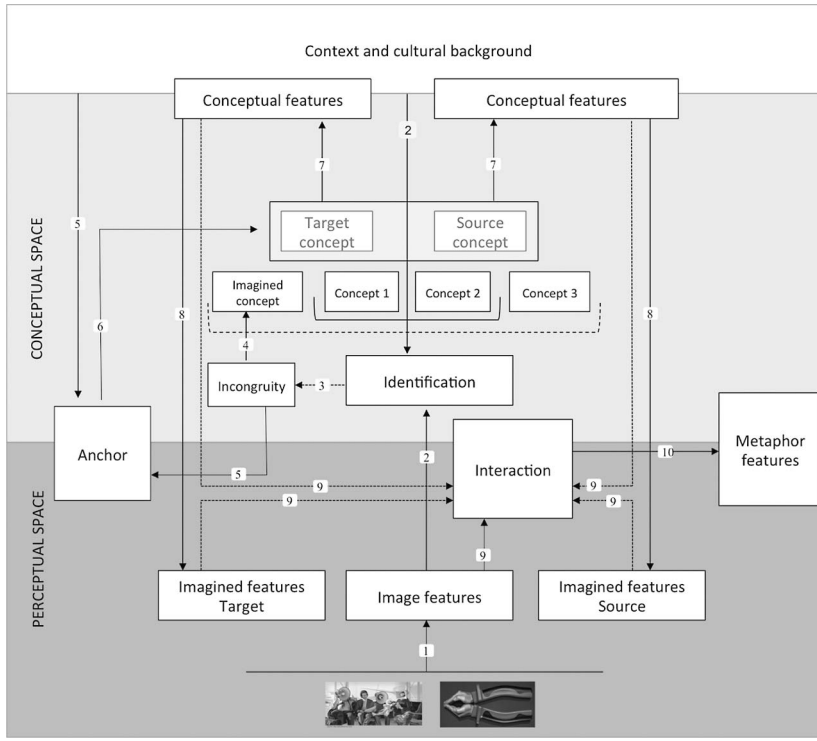


Figure 14 An interaction model to show the processing of visual metaphor when the concepts are partially depicted.

ceptual features of the head. This results in an obvious asymmetry. A stepwise description of this process is as follows:

Step 1: Perceptual features of the image are extracted and processed in the perceptual space.
Step 2: Perceptual features of the image are integrated into objects or concepts. In this example, loudspeakers and human bodies, and so forth, are identified. (This identification of concepts is highly influenced by the previous knowledge, context, and cultural background of the viewer.)
Step 3: Incongruity between the concepts/objects is detected in the conceptual space. (The incongruity could be in the objects themselves or it could be in their arrangement.) In this example, we detect that human bodies do not have loudspeakers for heads.
Step 4: Detection of incongruity triggers imagining missing concepts or possible congruous extensions of the images. In this example, heads are imagined, and their perceptual and conceptual features are brought into the interaction space.
Step 5: Some object or concept in the image is identified that hints at the intended message of the image. This serves as the "anchor." The anchor could be a per-

ceptual feature such as shape or a conceptual feature such as cultural icons, and so on. It could also be a logo to clearly mark the target of the image. In this example, one notices that this is an ad about headphones because one normal person is seen wearing a pair of headphones.
Step 6: Identification of the anchor leads to determining the target of the metaphor. In our example, heads become the target and loudspeakers the source.
Step 7: Conceptual features of the target and the source are evoked. In this example, we become aware that loudspeakers are loud, and people can be loud talking heads.
Step 8: Associated perceptual features of the source and target are evoked from imagination based on prior perceptual experiences.
Step 9: Conceptual features, imagined features, and image features interact in both conceptual and perceptual spaces.
Step 10: This interaction leads to the generation of metaphor features. Some of these features are source features, some are target features, and some are emergent features.

For the pliers-hands composite, both concepts are partially depicted and are combined into a single image. After the two concepts are separated, and an incongruity is detected, it is not clear which is the target concept: it could be hands, or it could be pliers. But the context, this being an ad for an automobile, indicates that workmanship is the feature being highlighted. Nonetheless, if we consider the two depicted concepts, namely, the hands or the tool, either can be the target more or less with the same message. Thus, this becomes more like a comparison statement—"Tools are like hands" or "Hands and tools are alike"—without a clear preference for the target. Therefore, we see more symmetry in the participants' interpretations. A stepwise description of the process is described below:

Step 1: Perceptual features of the image are extracted and processed in the perceptual space.
Step 2: Perceptual features of the image are integrated into objects or concepts. In this example, hands and the handles of the pliers are identified.
Step 3: Incongruity between the concepts/objects is detected in the conceptual space. In this example, we detect that hands do not form the grippers of pliers.
Step 4: Detection of incongruity triggers imagining missing concepts or possible congruous extensions of the images. In this example, grippers of the pliers are imagined, and their perceptual and conceptual features are brought into the interaction space.
Step 5: Identifying anchor: in this example, one notices that this is an ad about cars. Cars need to be designed with care, so this becomes the anchor.
Step 6: Identification of the anchor leads to determining the target of the metaphor. However, in this example, "Hands are tools" and "Tools are hands" seem to communicate more or less the same meaning, namely, that care is being exercised.

Step 7: Conceptual features of hand and tools are evoked.
Step 8: Associated perceptual features of the source and target are evoked from imagination based on prior perceptual experiences.
Step 9: Conceptual features, imagined features, and image features interact in both conceptual and perceptual spaces.
Step 10: This interaction leads to the generation of metaphor features.

The third situation covers the cases in which both images are fully shown and are juxtaposed (figure 5). In this situation, the absence of copula has the most pronounced effect, for there is no incongruity. Figure 5, for example, could just be an image of a guitar with an image of an atomic explosion next to it. The verbal equivalent of it is putting the word *billboards* next to the word *warts*. In the absence of an intervening copula, the reader's interpretative freedom is considerable. In figure 5, there is not even contextual pressure for the figures to interact. In principle, then, one would expect a symmetric comparison (if there is any comparison at all), something like "Guitars and atomic explosions are alike." However, our experiments show otherwise. Our participants clearly preferred the direction of transfer from the atomic explosion to the guitar, and this was independent of which image was on the left and which on the right. We suggest that this is because the cultural background leads one to prefer the guitar as the target rather than the other way around. In other words, it is more meaningful to consider a guitar as explosive than to consider an atomic explosion as musical. This interaction is shown in figure 15. Thus, in such situations, the target is identified *after* the metaphor is meaningfully assimilated (if it is assimilated at all). Or perhaps it would be more accurate to say that the process of understanding the meaning of the target goes hand in hand with its identification. In these situations, the content of the images and the viewer's background knowledge determine whether the metaphor is symmetric or asymmetric, and it does not so much depend on the form of presentation.

A detailed stepwise description of this process is as follows:

Step 1: Perceptual features of the image are extracted and processed in the perceptual space.
Step 2: Perceptual features of the image are integrated into objects or concepts. In this example, guitar and atomic explosion are identified.
Step 3: Conceptual features associated with guitar and atomic explosion are evoked.
Step 4: Newly evoked conceptual features further evoke associated perceptual features. These features come from imagination based on prior experience. In this example, an atomic explosion might evoke a loud booming sound.
Step 5: Conceptual features, imagined perceptual features, and image features interact in both conceptual and perceptual spaces.

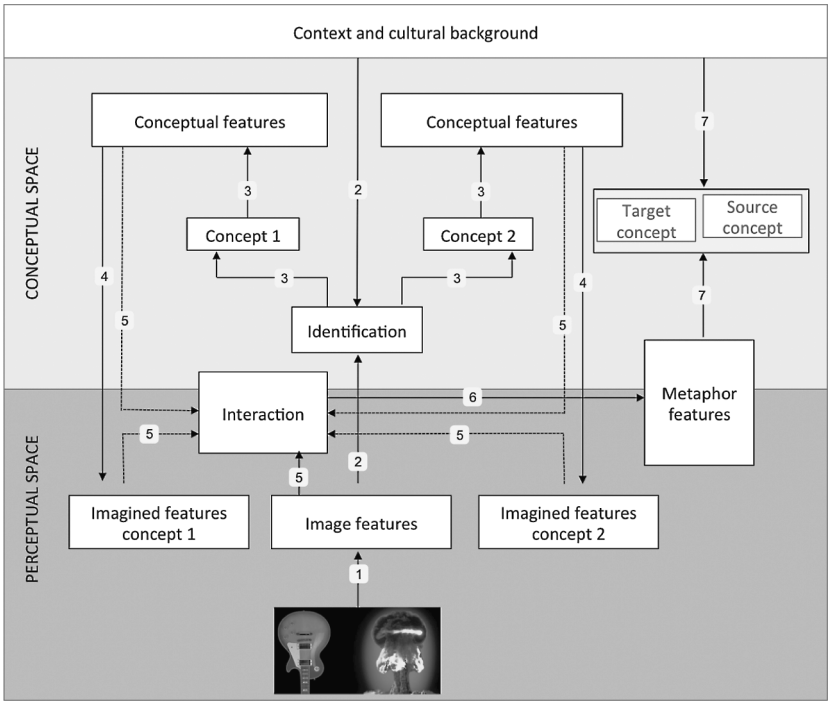


Figure 15 An interaction model to show the processing of visual metaphor in which two concepts are juxtaposed.

Step 6: This interaction leads to the generation of metaphor features.
Step 7: The target and the source of the metaphor are now determined, based on the context and the cultural background of the viewer.

Conclusions and Future Research

As the discussion above shows, one major characteristic of visual metaphors that distinguishes them from their verbal counterparts is the lack of any clear identification of source and target. In a verbal metaphor, as in "Juliet is the sun," the linguistic structure clearly indicates that the statement is about Juliet, who is the target of the metaphor. However, in a visual metaphor, this is not the case. The image shown in figure 6 could be saying something about bullets, about cigarettes, or about both. This introduces an ambiguity with respect to the source and the target of a visual metaphor, which makes it more likely to be reversible, but the message communicated by the reversed metaphor is generally different, so in this sense, the visual metaphor remains asymmetric.

Such ambiguity with respect to the intended target can also be evidenced in verbal metaphors, if we go beyond the sentence level. For instance, "His pipes need cleaning" (Binkley 1974) can both refer to the plumbing in someone's house (literal), or to clogging in his arteries (metaphorical). It is the context that determines whether a metaphorical interpretation is indicated, and what is the intended target of the metaphor. This effect is even starker when an entire literary work is interpreted metaphorically. For example, L. Frank Baum's *The Wizard of Oz* is considered by some to be a satire of the political situation in the United States at the turn of the twentieth century: the Wicked Witch of the East stands for the industrialists and the bankers of the northeastern United States, the Emerald City stands for Washington, DC, the Tin Man represents the demoralized industrial workers, and the Scarecrow represents the wise but naive midwestern farmers (Littlefield 1964). Similar interpretations have been suggested for Herman Melville's *Moby Dick* and many other works of literature. In such examples, the metaphor works at a holistic level.

The examples presented in this article demonstrate that visual metaphors also work at a holistic level. In these examples, context plays a dominant role in determining what will be the target of the metaphor, and which features are transferred from the source to the target. In many of these examples, the source ends up reconceptualizing the target by creating a new ontology and structure therein (Indurkhya 1992, 2006). For instance, in the heads-as-loudspeakers example presented above, the human head is conceptualized as a noise-making object. The role of context in interpreting visual metaphors therefore needs to be explored much further beyond this preliminary study. What happens when we change the message in figure 12 so that it is an ad about a certain brand of toothpaste? How do people from different cultures interpret the image of figure 13? We hope that future research will be able to generate more empirical data, which can then become the basis of a more comprehensive theory of visual metaphors.

Another direction of future research is to study asymmetry and reversibility in other modalities. For example, Trevor Whittock (1990) provides many instances of metaphor in films that parallel the cases of visual metaphors discussed in this article. In one famous scene from Charlie Chaplin's movie *The Gold Rush*, a starving gold prospector (played by Chaplin) is seen boiling a boot for his meal, then eating it. The scene depicts the misery of the poor (the target) by recalling (by means of visual comparison) the components of a rich man's dinner (the source): the boot is like a fish, nails are like bones, and bootlaces are like spaghetti. Here the target is explicitly depicted, but the source is implied. On other hand, in David Lean's movie *Doctor Zhivago*, the mystical connection between Yuri (Omar Sharif) and Lara (Julie Christie) is

signaled by a spark from the trolley's overhead wires. Here the source is explicitly shown, but the target is implied. Akin to homospatiality, there are examples when a carefully matched movement in temporal juxtaposition of images invites the viewer to a metaphorical interpretation, as in the cut from the movement of the bone thrown in the air by the ape-man to the movement of the spaceship in Stanley Kubrick's *2001: A Space Odyssey*, or in Charlie Chaplin's cut from a flock of sheep to a crowd descending into the underground station in *Modern Times*. Examining such examples to see whether the temporal dimension introduces any new aspects of asymmetry and reversibility in metaphor might provide valuable insights. For instance, in moving images, the temporal dimension introduces an inherent asymmetry (see also Fahlenbrach 2016 for recent studies of metaphor in moving images).

Similarly, the mode of gestural communication, which has been receiving more attention in recent years (Goldin-Meadow and Brentari 2015), is another unexplored area with respect to metaphors. We believe that the exploration of asymmetry and reversibility in all these modalities will lead us toward a deeper understanding of the cognitive processes underlying metaphor that transcend its verbal manifestations.

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