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Metaphor Processing

Kathleen Ahrens

Department of English, The Hong Kong Polytechnic University, Hong Kong

Kathleen Ahrens, Department of English, The Hong Kong Polytechnic University, Hong Kong, 11 Yuk Choi Road, Hung Hom, Kowloon, Hong Kong SAR. Email: kathleen.ahrens@polyu.edu.hk

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1. Overview

Conceptual metaphors establish a relationship between two concepts, X and Y, which activates a figurative meaning of Y that is different from its literal meaning. For example, in (1) below, although the word *gēnjī* 根基 literally means ‘base/foundation’, here it refers metaphorically to ‘basis’. Thus, the metaphor has created a relationship between the concepts of IDEAS and BUILDINGS, in that an idea may (or may not) have a valid basis, just as a building may or may not have a strong foundation.

1. 你的論點根基是什麼？

Nǐ de lùndiǎn gēnjī shì shénme?

2SG sub argument base be what

‘What is the basis of your argument?’

(Ahrens 2002, 2010)

Much of the psycholinguistic research on metaphors has examined how quickly metaphorical meaning is processed compared with literal meaning, because metaphors are argued to be a special type of language that is used only for rhetorical or decorative purposes (Grice 1975; Searle 1979). This has led researchers to postulate that metaphorical meanings may be processed more slowly than literal meanings. Related issues include whether metaphor processing is facilitated by the systematicity of conceptual mappings and whether additional areas of activation in the brain are required when metaphors are processed. Studies in Mandarin have shed light on these issues using psycholinguistic and neurolinguistic methodologies.

1.1 *Speed of lexical access of metaphorical meaning*

One ongoing issue in metaphor research is the speed of accessing metaphorical meaning. This research is part of a broader field that explores accessing lexical meaning in general, in which researchers attempt to determine whether the ambiguity associated with a word facilitates or hinders lexical access. While some researchers have found that the more meanings a word has, the more quickly it is accessed (Hino *et al.* 2006; Millis and Button 1989), others have observed that the more meanings a word has, the more slowly it is accessed (Rodd *et al.* 2002), or there is simply a null effect (Gernsbacher 1984).

The above studies were all run on English stimuli, but Lin and Ahrens (2010) ran a reaction-time study on Chinese nouns. First, they decided on what was meant by lexical ambiguity, as ‘ambiguity’ has been used as an overarching term for any orthographic or phonological form that is associated with more than one meaning. However, as Lin and Ahrens (2010) point out, the lexical semantic literature (e.g., Allan 1986; Lyons 1995; Saeed 1997; Ullman 1957) has long noted that homonymy and polysemy are distinct types of lexical ambiguity, with homonymy referring to different words that are identical in orthography or sound (i.e., *bank*, which refers to either ‘the slope along a river’ or ‘a financial institution’), while polysemy refers to a word that is associated with multiple, related meanings, as in the case of *bank*, where the meaning of

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financial institution can be extended to refer to a building where physical objects may be safely stored (i.e., sperm bank) (→ Ambiguity, Homonymy, and Polysemy).

This distinction between homonymy and polysemy has been extended to the distinction between metaphor and metonymy (Ahrens *et al.* 1998; Lakoff 1987; Lakoff and Johnson 1980; Pustejovsky 1991). Like homonymy, metaphorical meaning extensions cross conceptual domains as in (1) above, where *gēnjī* (base) jumps from the source domain of BUILDING to the target domain of IDEAS. Moreover, metonymy is similar to polysemy because it extends a word's meaning within the same conceptual domain and is characterized by systematicity in how senses may be derived (Ahrens *et al.* 1998; CKIP 1993). Behavioral studies (Klepousniotou 2002), computational semantic theories (Ahrens *et al.* 1998; Pustejovsky 1991), and linguistic analysis (Lakoff 1987) all suggest that this distinction between metaphor and metonymy is valid.

Thus, Lin and Ahrens (2010) decided to classify Chinese words into two categories: words that had either multiple homonymic senses or multiple metaphorical senses (ambiguous word category), and words that had one or more metonymic meanings but no additional homonymic or metaphorical senses (unambiguous word category). They found that nouns with multiple meanings were accessed faster than nouns with only one meaning. These results suggest that homonymic and metaphorical meanings are actively represented in the mental lexicon and points to a random-access model of lexical access, whereby words with more meanings have a greater chance of being activated.

In addition, Lu and Zhang (2012) ran two event-related potential studies in Chinese to examine the speed of lexical access of words with literal and metaphorical meanings. They found that when literal meanings were less prominent than metaphorical meanings, the literal meanings were activated early on, indicating that both meanings were equally available when primed in lexical decision-type tasks. This finding is in line with what Ahrens (1998, 2001, 2002, 2006) found in cross-modal reaction time studies on lexical ambiguity resolution in Chinese. In these studies, participants heard sentences over headphones and saw a bi-syllabic word flash on the computer monitor, and then they decided whether those two characters made up a word in Chinese. Ahrens (1998, 2001, 2002, 2006) found that both primary and secondary meanings were accessed in contextually biased sentences when the visual target was presented for 750 milliseconds (ms) or less. This contrasts with studies in Cantonese (Li and Yip 1996, 1998) and Italian (Tabossi and Zardon 1993), which found that only the contextually appropriate meaning was available. As Ahrens (2006) points out, when immediacy and automaticity are allowed to occur (i.e., when the sentence is presented auditorally), the task becomes a lexical decision or lexical naming task. If the presentation point of the visual target occurs no later than the end of the syllable of the ambiguity, the position of the ambiguity is sentence-medial, and the length of the visual target presentation is less than 750 ms, then both meanings are accessed, as these task conditions allow the participants to process the language heard and seen immediately and automatically, without any pauses or guessing to interfere with the automaticity of the language processor.

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1.2 Systematicity of conceptual mappings

Over the past several decades, researchers have followed two different approaches to understanding metaphors: the attributive categorization approach (e.g., Glucksberg and McGlone 1999; Glucksberg *et al.* 1997; Keysar *et al.* 2000; McGlone 1996, 2007) and the conceptual metaphor approach (e.g., Ahrens 2002, 2006, 2010; Gibbs 1994; Lakoff and Johnson 1980). The attributive categorization approach has so far focused exclusively on English data and postulates that there are no pre-existing mappings between source and target domains. Metaphors are instead understood through class-inclusion statements in the form of ‘X is a Y’, in which a metaphorical category is assigned to the source domain, and the assignment entails some property of that category. For example, when the target domain of “marriage” (X) is compared to the source domain of “rollercoaster” (Y), the concept of “danger” is assigned to “rollercoaster”, which is then mapped to the target domain of “marriage”. Models based on the categorization approach emphasize the lack of systematicity in metaphorical mappings. One problem with the stimuli used in these studies is that no differentiation is made between novel metaphors and conventional metaphors—all metaphorical meanings are processed on the fly. Moreover, while this type of model may take frequency into account, it cannot account for differences within novel metaphors.

The conceptual metaphor approach postulates that metaphors are cognitive phenomena that are instantiated in language via mappings between source/concrete domains and target/abstract domains. Models based on this theory, such as the Conceptual Mapping Model proposed in Ahrens (2002, 2010) and Gong and Ahrens (2007), emphasize the systematicity involved in processing meaning and argue that this model has the advantage of allowing not only the processing of differences found for conceptual and novel metaphors but also the processing of differences found within novel metaphors.

The Conceptual Mapping Model hypothesizes that there are underlying reasons for the source-target domain pairings in conceptual metaphors. These reasons, called Mapping Principles, can be determined using a six-step paradigm discussed in Ahrens (2010), which presents four experimental studies in Chinese. These principles can also be extracted from Chinese corpus data (see Chung 2009; Gong *et al.* 2008). For example, when examining the target domain of IDEA, one can look at what concepts are associated with this target domain, including theory, argument, idea, framework, etc., and then examine what metaphors can be found to co-occur with this target domain. IDEAS is a productive target domain in Chinese, meaning it has several different source domains associated with it, including BUILDING, FOOD, COMMODITY, and BABY. Each time the target domain pairs with a source domain, it does so for a different reason (see discussion on the Mapping Principle Constraint in Ahrens 2002, 2010). For example, the mapping principle for the metaphor IDEA IS A BUILDING is: Ideas are understood as buildings in that buildings involve a (physical) structure and ideas involve an (abstract) organization (Ahrens 2010).

Understanding the reason for source-target domain mappings has the advantage of allowing for the prediction of the processing speed of different types of metaphors, as conceptual metaphors can be categorized as follows:

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- I. Conventional conceptual metaphors (i.e., example (1) above);
- II. Novel metaphors that follow mapping principles (i.e., the source-target domain pairing is conventional, and the mapping principle is followed, but with a novel lexical item that is not usually used in this way);
- III. Novel metaphors that do not follow mapping principles (i.e., the source-target domain pairing is conventional, but the mapping principle is not followed, so a concept that is not relevant to the mapping principle is being used); and
- IV. Novel metaphors that have an uncommon source-target domain pairing (i.e., one that is not usually seen in the language, such as IDEAS ARE CLOTHING).

Ahrens (2010) created stimuli that consist of the first three types of metaphors above. A series of four studies on native Mandarin speakers demonstrated that novel metaphors that followed Mapping Principles received significantly lower acceptability and interpretability ratings compared with conventional metaphors, as well as longer listening times when making acceptability and interpretability judgments. In addition, novel metaphors that did not follow Mapping Principles received significantly lower acceptability and interpretability ratings compared with novel metaphors that did, as well as longer listening times. Moreover, conventional metaphors were read equally quickly and were judged to be equally interpretable and acceptable when compared with their literal control conditions. This study supports the hypothesis that underlying mapping principles for conceptual metaphors may be analyzed and determined based on linguistic data.

A related issue is whether the systematicity postulated as underlying conventional conceptual metaphors is immediately and automatically activated when speakers read a passage. Gong and Ahrens (2007) found that when participants read entire paragraphs, the conceptual representations related to metaphors were built and then accessed, although this did not happen when a line-by-line presentation of the paragraph was provided, as this latter type of presentation creates an expectation for new information.

1.3 Area of activation

In a functional magnetic resonance imaging study, Ahrens *et al.* (2007) examined whether sentences with conventional (i.e., type I above) and highly novel metaphors (type IV) were processed in different locations in the brain when read compared with literal sentences. They found that the conventional metaphors had a slight increase in activation in the right inferior temporal gyrus compared with the literal condition, even though reaction times were comparable. In addition, when the highly novel metaphor condition was compared with the literal condition, there was increased activation bilaterally in the frontal and temporal gyri, and greatly increased reaction times. This indicates that metaphors are not homogeneous; they vary in their degree of conventionality, and when they are highly unconventional additional processing resources come into play.

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