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The psycholinguistics of metaphor

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Can lawyers be sharks, can jobs literally be jails, and can dogs fly across lawns? Such metaphors create novel categories that enable us to characterize the topic of interest. These novel metaphorical categories are special in that they are based on outstanding exemplars of those categories, and they borrow the exemplar's name for use as the category names. Thus 'shark' can be taken as a metaphor for any vicious and predatory being. Contemporary research reveals how people can create and understand such metaphors in ordinary conversation, and suggests that we understand metaphorical meanings as quickly and automatically as we understand literal meanings.

Neuroimaging has become a gold mine. Whether or not you agree with that statement, you had no trouble when reading it in understanding that neuroimaging is a rich source for discoveries in the cognitive sciences and not a hole in the ground. How do people arrive at such understandings? As is usually the case for questions about cognition, we need to understand both representation and process. For the neuroimaging example, what is the mental representation of the words 'gold mine' in the context of the metaphorical assertion? Does it, for example, include an initial representation of the literal gold mine that is replaced by a contextually appropriate representation? Given a particular representation, what processes do people apply to generate a contextually appropriate interpretation? Do we, for example, initially derive a literal interpretation of the sentence, then reject that interpretation because it makes no sense?

As awkward as this process might seem, it is exactly what the standard pragmatic model of metaphor comprehension posits [1–6]. This model, which has held sway since Aristotle [7], holds that metaphor requires a discrete three-stage process. For nominal metaphors such as '*neuroimaging is a gold mine*', the first step is to derive the literal meaning of the sentence. This yields the nonsensical interpretation that neuroimaging is a hole in the ground. The second step assesses this interpretation against the context of utterance. Because it does not make sense in context, we must then take the third step: a search for a non-literal meaning that does make sense. As Searle put it, 'Where an utterance is *defective* if taken literally, look for an utterance meaning that differs from sentence meaning' (Ref. [4], p. 114, emphasis added).

Literal meaning is defective whenever a rule of conversation appears to be violated. [8]. One conversational rule is to be truthful, and nominal metaphors like the one above are literally false. Under the three-stage pragmatic model, when false assertions do not make sense in context they are defective. What can be done to repair the damage? According to the model, metaphors are initially recognized as false categorical assertions. The literal false meaning must therefore be rejected, and an alternative non-literal interpretation found. One way to do this is to convert a false literal assertion, such as '*some roads are snakes*' or '*some jobs are jails*' into a true assertion, namely, a simile. Sentences such as '*some roads are like snakes*' and '*some jobs are like jails*' are literally true. Indeed, all comparison assertions are true because any two things must always be alike in innumerable ways [9]. 'False' metaphors are thus converted into 'true' similes, and then interpreted just as any literal comparison assertion would be interpreted.

This model poses two psycholinguistic issues. The first derives from the assumption that literal meanings have unconditional priority. If this is true, then literally intended language should be easier to understand than non-literal. Furthermore, non-literal interpretations should be optional; they should be generated *only* when literal interpretations are defective in one way or another. The second issue involves the comparison problem. As any two things can be alike in innumerable ways, how do we identify precisely those ways that are intended in any given context ?

Each of these issues–priority of the literal, and whether metaphors require a comparison process–yields testable hypotheses. To forecast my more detailed discussion, I have reached the following conclusions. With respect to the priority of the literal, there is a consensus in the field that literal meaning does not have unconditional priority [10–17]. Metaphor comprehension can be as easy as literal, and it is not optional. The second issue remains controversial [18,19], but I will argue that metaphors are not understood via a property-matching comparison process. Instead, they are generally understood directly as categorical assertions [20].

On the priority of the literal

Is literal language easier to understand?

Literal language processing is considered to be automatic: it is triggered by any linguistic input. Figurative language processing, by contrast, is presumably triggered by the failure of a literal interpretation to make sense. This entails that figurative interpretations must take more time than literal, because such interpretations are sought only after a literal interpretation has been

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Box 1. Understanding novel metaphors

Some elegant experiments carried out by Blasko And Connine [a] used a cross-modal priming paradigm that takes advantage of the phenomenon of semantic priming. One measure of the relative accessibility of a particular word's meaning is lexical decision time – the time taken to read that word and decide whether it is a word in the English language or not. When a target word appears immediately after a semantically related word, then lexical decisions are faster than when the target word appears after an unrelated word. For example, deciding that *nurse* is a word is faster when it is preceded by the word *doctor* than by the word *radio* [b,c].

The experimental participants listened to metaphors such as: 'Jerry first knew that *loneliness was a desert* * when he was very young'. While listening, a letter string target would appear on a computer screen immediately after the metaphor (where * appears, above). When the visual target appeared, the participants had to decide, as quickly and accurately as they could, whether it was an English word or not. There were three types of word targets, defined in terms of their relation to the metaphorical phrase: metaphorical, literal and control. For the '*loneliness is a desert*' metaphor, the metaphorical, literal and control targets were, respectively, *ISOLATE*, *SAND* and *MUSTACHE*. Faster lexical decisions to metaphorical or literal targets relative to control targets would indicate immediate activation of metaphorical or literal meanings, respectively. Both metaphorical and literal targets were faster than controls. The metaphorical meanings of these apt metaphors were understood as quickly as the literal meanings, even when the metaphors were relatively unfamiliar. These results are consistent with other studies of metaphor comprehension that have found no differences in the time taken to understand metaphorically- and literally-intended expressions [d–h].

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generated and found wanting. A moment's reflection should convince you that this cannot always be true, and indeed, psycholinguistic research supports this intuition. Consider, first, idioms such as '*kick the bucket*'. This expression is virtually never intended in its literal sense. As a result, the first meaning that comes to mind is the idiomatic one, to die [21–23]

How important is expression familiarity?

One determinant of an expression's comprehensibility is its familiarity, but familiarity alone is insufficient to account for ease of idiom comprehension. Consider novel variants of familiar idioms such as 'he didn't spill a single bean'. Even without a supporting context, most people immediately interpret this expression idiomatically, meaning that he told no secrets whatsoever. We tested this intuition by having people interpret novel variants of familiar idioms and their literal counterparts. For example, given the context of interrogating a prisoner of war, people interpreted either the single-bean idiom or its literal counterpart, telling a single secret. There was no priority of the literal: people understood the novel variant idioms as quickly as their literal counterparts [23]. Even young children can handle, indeed produce, idiom variants. In a class exercise for my psycholinguistics course, one of my students explained to her three-year-old daughter, Stephanie, that '*spilling the beans*' meant telling a secret. Later that day, Stephanie cautioned her father: '*don't throw the beans to Allison, she's not supposed to know*!'.

Familiarity is also relatively unimportant when understanding well-constructed, apt metaphors. One demonstration that people can understand novel metaphors as quickly as comparable literal expressions was provided in an elegant experiment by Blasko and Connine [10] (see Box 1). Their results are consistent with other studies of metaphor comprehension that have found no differences in the time taken to understand metaphorically- and literally-intended expressions [15,16,24–26].

I turn now to a second implication of the view that literal meaning has unconditional priority. Fluent speakers of a language do not have the option of refusing to understand. The language processor is data-driven. Given a linguistic input, that input will be processed–phonologically, lexically and syntactically [27,28]. This implies that literal meanings are non-optional. They will always be generated, regardless of a person's intentions to understand or not. Are metaphorical meanings also automatically generated, or is metaphor comprehension optional, dependent on context? Counter to the standard three-stage model, metaphor comprehension is not dependent on a failure to find a context-appropriate literal meaning. Like any other kind of language comprehension, metaphor comprehension is non-optional. Instead it is mandatory and automatic [14,29–31] (see Box 2).

Beyond similarity: metaphors are understood directly

So far we have accepted the assumption that metaphors such as '*my lawyer is a shark*' are literally false, whereas in simile form – '*my lawyer is like a shark*' – they are true. But let us reconsider. The lawyer–shark class inclusion assertion is literally false, but only if we take the word 'shark' to refer to the marine creature, that is, at the basic level of abstraction. However, the word 'shark' can be understood at a higher level of abstraction to refer to the category of predatory creatures in general, not just to the fish with sharp teeth [32–34]. Metaphor vehicles such as 'shark' thus have dual reference. They

Box 2. On the optionality of figurative meanings: can people ignore metaphors?

People cannot ignore metaphors, even when literal meanings make perfect sense in context. We drew this conclusion from a series of experiments in which people would perform optimally if they attended exclusively to literal meanings but ignored metaphorical ones [a–c]. The experiments were modeled after Stroop's classic demonstration that people cannot ignore literal meanings [d]. In his well-known test, Stroop presented words printed in various colors and asked people to name the color of the ink, *not* to read the words themselves. When color words such as *red* were printed in any color other than red (e.g. in green) then people had difficulty saying 'green', indicating response competition from the word itself: *red*. This color/word interference effect was taken to mean that people could not inhibit reading words that are attended to, even when such inhibition would improve task performance.

We applied this logic to literally false but metaphorically true sentences such as 'some roads are snakes' and 'some offices are icebergs'. Our experimental participants were shown sentences one at a time on a screen and instructed to judge whether each sentence was literally true or false. We used four types of sentences: literally true, e.g. '*some fruits are apples*'; literally false, e.g. '*some fruits are tables*'; metaphors, e.g. '*some jobs are jails*', '*some surgeons are butchers*'; and scrambled metaphors, e.g. '*some jobs are butchers*', '*some roads are jails*'. The metaphors were literally false category-membership assertions, but they were readily interpretable if taken non-literally. The scrambled metaphors were also literally false, but not readily interpretable.

If people ignore metaphorical meanings, then the metaphors should take no longer to reject than the scrambled metaphors. If, on the other hand, people automatically register any metaphorical meanings that are available, then the metaphor sentences should take longer to judge as false than their scrambled counterparts because of the response competition between the 'true' non-literal meanings and the 'false' literal ones of the metaphor sentences.

Our results were clearcut: people had difficulty in rejecting metaphors as literally false (Fig. I). We interpreted this metaphor interference effect in the same way that Stroop interpreted his color/word interference effect: people could not inhibit their understanding of metaphorical meanings, even when literal meanings were acceptable in the context of our experiment.

There is, however, an alternative interpretation. It may well be that people were slow to judge metaphors as literally false because their topics and pics and vehicle terms were related, not because of a metaphorical interpretation conflicting with a literal one (e). To control for this possibility, we repeated the original experiment with metaphors that people rated as good ones when quantified by 'some', but as poor ones when quantified by 'all', e.g. 'some surgeons are butchers' versus 'all surgeons are butchers'. We also included all-quantified metaphors that were rated as good in both 'some' and 'all' form. The 'good' metaphors produced the metaphor interference effect regardless of quantifier. By contrast, the metaphors rated as poor in their all form did not, even thought in their 'some' form they did produce interference. We conclude that the metaphor interference effect reflects metaphor comprehension, not any adventitious relation between metaphor topic and vehicle (f).

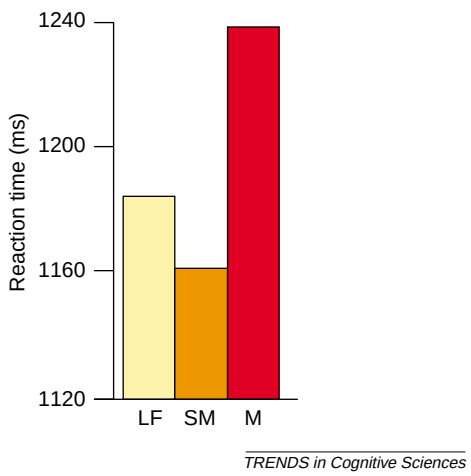

Fig. I. Reaction time of subjects making a 'literal-false' decision as a function of sentence type (LF, literal false; SM, scrambled metaphor; M, metaphor). Metaphorically true sentences are hard to judge as literally false.

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can refer either at a subordinate level or at a superordinate level.

In most metaphors, this dual reference function is implicit. In others, the dual reference is explicit, as in '*Cambodia was Vietnam's Vietnam*'. The first mention of *Vietnam* refers to the Asian nation of that name; the second to the superordinate category of disastrous military interventions that the American–Vietnam war has come to exemplify. More generally, when a category has no name of its own, the names of prototypical category members can be used as a name for that category [35–37]. Typical literal examples include brand names such as Xerox and Kleenex to refer to the categories of dry paper copiers and tissues, respectively. Typical metaphorical examples, now conventionalized, include *butcher* for anyone who should be skilled but is incompetent, *jail* for any unpleasant, confining situation, or *Enron* for any dramatic accounting scandal.

How are novel and conventional metaphors processed?

There is ample evidence that well-formed novel metaphors are understood as readily as familiar conventional ones [15,20,38], although they might be processed differently. Giora proposes that most words have multiple meanings that vary in their relative salience [13,24]. When a metaphorical meaning is highly salient, then that meaning will be accessed first and the metaphor will be rapidly understood. When it's meaning is relatively low in salience, then it will be understood more slowly. Aside from relative speed of comprehension, the comprehension process is the same in both cases.

For Gentner and Bowdle, novel and conventional metaphors are processed differently [39]. Novel metaphors are understood by structural alignment followed by comparison of topic and vehicle properties. In a second stage, property attributions are inferred. Consider the expression '*some of John's ideas are diamonds*'. Properties in common, such as 'valuable', are aligned. Further inferences can then be drawn, such as the property 'creative'. For conventional metaphors, the vehicle term (e.g. '*diamond*') can, through repeated use, acquire dual reference as described in our attributive categorization theory. The metaphor can then be understood directly as a categorical assertion. Gentner and her colleagues later modified this position [18,19] to argue that understanding conventional metaphors initially involves structural alignment before being processed as categorical assertions.

By contrast, Kintsch and Bowles point out that structural alignment is '…a controlled, resource-demanding process' [that is not required] …when sentences are understood automatically' (Ref. [40], p. 252). This conflicts with Wolff and Gentner's claim [19] that structural alignment/comparison is the first and automatic stage in metaphor comprehension. Kintsch developed a predication algorithm that, like our attributive categorization model, does not involve structural alignment [41]. It also, like ours, treats novel and conventional metaphors in the same way. The algorithm computes metaphor interpretations based on latent semantic analysis, and produces interpretations that closely match those that people produce. The algorithm also distinguishes between metaphors that are easy and those that are difficult to understand.

Whether or not structural alignment and comparison processes are used to understand either novel or conventional metaphor remains controversial. At the very least, such processes may not be necessary for either metaphor type, but may well be required for obscure metaphors such as 'her marriage was a filing cabinet'. For such metaphors, no immediate interpretation comes to mind, but people can usually find some interpretation that makes some sense.

Metaphors as attributive categorical assertions

Metaphors are thus attributive assertions, not mere comparisons [42]. They are understood more quickly in their paradigmatic class-inclusion form than in simile form [43], and have more force than do similes. They have more force because metaphors are interpreted somewhat differently than similes. We asked people to interpret metaphors and similes, such as '*some ideas (are/are like) diamonds*'. For similes, people tended to mention properties that were usually true of the metaphor vehicle, such as 'rare' and 'valuable'. However, for metaphors, a different kind of property was prominent, properties that were not usually true of the metaphor vehicle in isolation, such as 'insightful' and 'creative'. In other words, metaphors were interpreted more metaphorically than were similes [44–46].

Predicative metaphors, in which verbs are used figuratively, function similarly (L. Torreano, unpublished doctoral dissertation, Princeton University, 1997). The verb *to fly* literally entails movement in the air. Flying through the air epitomizes speed, and so expressions such as '*he hopped on his bike and flew home*' are readily understood via the same strategies that nominal metaphors, such as '*his bike was an arrow*', are understood. Arrows are prototypical members of the category of speeding things; flying is a prototypical member of the category of fast travel. On this view, not only bikes but anything that travels rapidly can fly, even ideas and, regrettably, rumors.

Dual reference and metaphors

The communicative strategy of dual reference – using prototypical category member names to name non-lexicalized categories – provides a natural explanation for the major metaphor phenomena. Because metaphors are categorical assertions, they are, unlike literal comparisons, non-reversible. The only circumstance under which a metaphor can be reversed is when the ground of the metaphor changes, as in '*my surgeon was a butcher*' (a negative comment) versus '*my butcher is a surgeon*' (a positive comment) [47].

Dual reference also accounts for the paraphrasability of metaphors as similes and vice-versa. In simile form, as in '*my lawyer was like a shark*', the word 'shark' refers to the literal predatory fish. In metaphor form, it refers to the superordinate category of predatory creatures that is exemplified by the literal shark (see Table 1). Literal comparisons cannot be paraphrased in this way; for example, '*coffee is like tea*' becomes false in categorical form: '*coffee is tea*'. Similarly, literal category assertions become anomalous in comparison form: '*robins are birds*' versus '*robins are like birds*'.

Because metaphor vehicles refer to abstract superordinate categories, calling attention to the basic-level literal meaning of a metaphor should make comprehension more difficult. We tested this notion by priming metaphors either with an irrelevant literal property of the topic or an irrelevant literal property of the vehicle. We asked college students to read metaphors such as '*my lawyer was a shark*', preceded by (a) neutral control sentences, such as '*some tables are made of wood*', (b) irrelevant topic-property sentences, such as '*some lawyers are married*', and (c) irrelevant vehicle-property sentences, such as '*sharks can swim*'. It took more time to understand the metaphor when it was preceded by the vehicle-property (*sharks–swim*) sentence than when it was preceded by

Table 1. Hypothetical representation of metaphorical and literal sharks

Metaphorical shark	Literal shark
Vicious	Vicious
Predatory	Predatory
Aggressive	Aggressive
Tenacious	Tenacious
Merciless	Merciless
etc.	Can swim
	Has fins
	Has sharp teeth
	Has leathery skin
	etc.

either the neutral control or the irrelevant topic-property sentences [47].

Conclusions

I draw two major conclusions about metaphor comprehension. First, there is no priority of the literal. We apprehend metaphorical meanings as quickly and as automatically as we apprehend literal meanings. Second, we understand metaphors exactly as they are intended, as categorical assertions. When I say that '*my job is a jail*', in a sense I mean it literally. I do not mean that my job is merely like a jail, but that it actually is a member of the category of situations that are extremely unpleasant, confining and difficult to escape from.

With continued use, once-novel metaphors become conventionalized, and their metaphorical senses enter into our dictionaries. Consider the term *butcher*: it can be used to refer to a meat purveyor, a bungler, or a vicious murderer. But just because the second and third senses of *butcher* are now in the dictionary [48], it does not mean that they are literal; they are metaphorical nonetheless, and are understood as such by fluent speakers of idiomatic English. The critical test is the ability to paraphrase assertions involving metaphorical butchers in either the categorical or simile form: '*X is like a butcher*' can be expressed as '*X is a butcher*' with no loss of meaning. Whether or not such conventionalized metaphors are understood via the same processes as are novel metaphors remains a controversial issue [18] to be resolved by future research.

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