The Time course of Metaphor Processing: Effects of Subjective Familiarity and Aptness

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Abstract

A cross-modal priming paradigm was used to investigate the time course of figurative activation for metaphors which varied in familiarity. In Experiment 1 the target was presented immediately at the offset of the vehicle. For high familiar metaphors, both literal and figurative interpretations showed evidence of immediate availability. For low familiar metaphors, the literal interpretation was available but the figurative target showed inhibition. Experiment 2 delayed presentation of the target 300 ms. and similar results were found, although inhibition of the figurative target decreased. Together, Experiments 1 and 2 showed the figurative meaning is more readily available in highly familiar metaphors. The results of Experiment 3 suggest metaphor aptness is especially important for low familiar metaphors. The implications of these findings for models of non-literal language are discussed.

Introduction

A comprehensive theory of language processing must be capable of explaining how individuals comprehend the meaning of utterances that differ in their literal and non-literal interpretations. Non-literal language is an extremely pervasive component of natural language, therefore, the understanding of metaphors and other non-literal language is a critical theoretical problem.

The purpose of this paper is to address two questions concerning the processing of one form of non-literal language, namely metaphors. First, what is the time course of metaphorical activation? Is the figurative interpretation of a metaphor processed directly, or is it necessary for a literal interpretation to be computed prior to the metaphorical interpretation? Secondly, what are the factors that influence this time course? Two specific factors, subjective familiarity and aptness were investigated.

One approach to the comprehension of metaphors that makes clear predictions about the time course of metaphorical activation is Searle's (1979) three stage model. According to the three-stage model all metaphors are comprehended in a series of three stages. In stage 1 an attempt is made to interpret the metaphor literally. In stage 2 the utterance is found to be in some way defective when taken literally. This, in turn, triggers stage 3, which is a search for a non-literal interpretation (Searle, 1979). One prediction of the three-stage model is that a statement should take longer to comprehend when intended metaphorically than when it is intended literally. This is because the process of metaphorical interpretation can only begin after the literal interpretation has been computed and rejected. However, a number of researchers (Ortony, Schallert, Reynolds, and Antos, 1978; Inhoff, Lima and Carroll, 1984) found that this was not the case if a metaphor is presented in a context sufficient to specify both its component parts (eg. the appropriate topic) and its metaphoricity (the fact that it was not meant literally). Other experiments, (Glucksberg, Gildea, and Bookin, 1982) have demonstrated that under some conditions metaphor processing is obligatory. Subjects were asked to decide if a sentence was literally true or false. For example, the sentence SOME JOBS ARE JAILS is literally false, but metaphorically true. The automatic comprehension of the non-literal truth of a metaphor interfered with judgments of literal falseness, slowing responses.

These studies suggest that metaphor comprehension may not require an initial literal interpretation. However, Janus and Bever (1985) have suggested that this conclusion may be premature. They argued that the total sentence reading times used by Ortony et al. (1978) were not sensitive enough to detect differences in metaphorical and literal processing. When Janus and Bever (1985) replicated Ortony et al. (1978)

using phrase by phrase reading times, they found slowing of the critical metaphorical phrase as predicted by the three-stage model. Although the controversy is by no means settled, this study does point out the need for on-line measures of metaphor processing.

One factor which may well influence the efficiency of metaphor comprehension is subjective familiarity. The role of subjective familiarity has not been previously examined, however, it is likely that experience with a particular metaphor should facilitate subsequent comprehension. A second factor, metaphor goodness or aptness, has been investigated (eg., Trick and Katz, 1986). It appears that a highly apt metaphor is one in which the domains of the topic and vehicle are relatively distant but the within domain features are relatively close in semantic space (Trick and Katz, 1986). The between domain distance must be fairly large for the metaphor to be effective because close distances provide little interaction or surprise. For example, A SQUIRREL IS A CHIPMUNK carries little or no metaphorical meaning because SQUIRREL and CHIPMUNK are both from the same domain (small furry mammals) and therefore share most features. This suggests that a certain degree of aptness is likely to be critical to metaphor comprehension.

There are two major questions to be addressed in the present paper. First, what are the temporal parameters of a metaphorical interpretation? Is the figurative meaning of the metaphor available immediately along with the literal interpretation of the vehicle or is the literal interpretation available earlier as suggested by the three-stage model. Second, does the subjective familiarity and aptness of a metaphor influence the availability of the metaphorical interpretation?

Method

Materials and Procedures

In three cross-modal priming experiments a metaphorical phrase embedded in a neutral sentence context was presented auditorily and the subject's task was to make a lexical decision (word or non-word) about a letter string (Target) presented visually for 250 ms. To assure that the sentences were being attended to, a comprehension test was built into the experiment. On each trial, an individual subject had a 50% chance of receiving a word vs. a non-word target, and 50% chance of hearing a metaphorical vs. a literal sentence. Three visual target conditions included a word related to the metaphorical meaning of the vehicle (FIGURATIVE TARGET), a word related to the vehicles literal meaning (LITERAL TARGET) and an unrelated word (CONTROL TARGET). Targets were selected in 3 individual norming studies. Target words were matched to unrelated control targets that were approximately equated for word frequency, word complexity and length. Metaphors were selected from a corpus of 260 non-literary metaphors compiled by Katz, Paivio, Marschark and Clark (1988) and had a consistent X is Y structure. The topic and vehicle were explicitly stated and no literal reading of the statement was plausible. For example:

Jerry first knew that LONELINESS WAS A DESERT when he was still very young.
Figurative Target: ISOLATE
Literal Target: SAND
Control Target: MUSTACHE

Faster lexical decisions in comparison to the control targets are assumed to indicate on-line activation. In Experiments 1 and 2, 12 high familiar metaphors (mean familiarity 4.16 - 5.28) and 12 low familiar metaphors (mean ratings 2.29 3.39) were chosen according to independent ratings completed by 44 subjects.

Subjects

The subjects for all three experiments were undergraduate students enrolled in psychology classes at the State University of New York at Binghamton who received class credit or monetary payment.

Experiment 1

In Experiment 1, the visual target was presented immediately at the offset of the metaphorical vehicle. The three stage model predicts faster reaction times to literal targets than to controls, whereas, the figurative targets should not differ from the controls. This would indicate the literal interpretation was available prior to the figurative interpretation. If the metaphorical interpretation is available along with the literal interpretation, both literal and figurative targets should be faster than the controls. Also if subjective familiarity influences the availability of a metaphorical interpretation then facilitation for figurative targets should be primarily for highly familiar metaphors.

Results. The overall correct lexical decision rates for experiment 1 was 98% correct,

experiment 2 was 97% correct and experiment 3 was 99% correct. Reaction times less than 250 ms and greater than 1750 ms were excluded from all analysis.

The results shown in Table 1 differ depending on familiarity. In the high familiar condition, facilitation is seen for both literal and figurative targets in comparison to the controls. This indicates that both the literal and metaphorical interpretation of the vehicle was available. In contrast, the low familiar condition showed facilitation for the literal target, but the figurative target is slower than it's control.

Table 1
Experiment 1: Means and SDs of correct responses

	Low Familiar			High Familiar		
	MEAN	SD	DIF*	MEAN	SD	DIF*
FIGUR.	983	208	-54	887	173	157
LIT.	881	194	48	880	181	164
CONT.	929	189		1044	180	

* difference from control

The analysis of variance was conducted for both subjects (F1) and items (F2). A two way ANOVA (Familiarity: high vs. low X Target: literal, figurative, control) showed a significant main effect of target ($F1(2,160) = 24.82$, $p < .0001$; $F2(2,22) = 3.44$, $p < .05$,). The effects of familiarity were seen in the interaction between familiarity and target ($F1(2,160) = 28.42$, $p < .0001$; $F2(2,22) = 6.13$, $p < .01$.). In the high familiar condition both the literal and figurative targets were significantly faster than their control indicating activation of the metaphorical interpretation simultaneous with literal activation of the vehicle. Planned comparisons using Bonferroni t-tests to control for familywise error ($p < .05$) support this conclusion (figurative vs. control $t(80) = 7.58$, $p < .0001$; literal vs. control ($t(80) = 8.33$), $p < .0001$).

In the low familiar case the findings are quite different. The literal target is faster than its control, whereas, the figurative target appears to show a pattern of inhibition (literal target vs. control, $t(80) = 2.67$, $p < .01$); figurative target vs. control.($t(80) = 2.78$, $p < .01$).

Experiment 2

In Experiment 2 the target was presented 300 ms downstream of the vehicle. Results for the high familiar condition should replicate Experiment 1 with both literal and figurative targets showing patterns of facilitation. If additional time is needed for the comprehension of low familiar metaphors, the figurative targets should show facilitation.

Results. The results of Experiment 2 were quite similar to Experiment 1 (see Table 2). It is clear that the pattern of reaction times differs based on familiarity. The high familiar condition continues to show faster lexical decisions to the literal and figurative targets in comparison to their unrelated controls. In contrast, in the low familiar condition only the literal target is facilitated whereas the figurative target is once again slower than it's control. A two way ANOVA (Familiarity: high vs. low X Target: literal, figurative, control) showed a main effect of target in the subject analysis that narrowly misses significance in the items analysis ($F1(2,70) = 17.59$, $p < .0001$; $F2(2,22) = 3.15$, $p < .06$). Once again, the effects of familiarity can be seen in the interaction between familiarity and target ($F1(2,70) = 18.88$, $p < .0001$; $F2(2,22) = 4.43$, $p < .05$).

The results of Experiment 2 appear to be similar to those found in Experiment 1, however, closer comparison of the means (see Table 2) does show one important difference. With the additional time the figurative targets in the low familiar condition show less inhibition. Unlike Experiment 1, there is no longer a significant difference between the figurative and control targets in the low familiar condition ($t(35) = .72$). However, there is significant facilitation of the literal target ($t(35) = 3.43$, $p < .002$) that is almost twice the size of the facilitation found for the literal target in the low familiar case in Experiment 1. It is possible that the greater facilitation with additional time may reflect the continued search process for features of the vehicle's domain that are necessary for comprehension of the figurative interpretation.

Table 2
Experiment 2: Means and SDs of correct responses

	Low Familiar			High Familiar		
	MEAN	SD	DIF*	MEAN	SD	DIF*
FIGUR.	926	210	-24	795	129	172
LIT.	811	141	91	820	141	147
CONT.	902	221		967	136	

*difference from control

In the high familiar condition, facilitation is strong for both the figurative ($t(35) = 9.45$, $p < .0001$) and literal targets ($t(35) = 8.01$, $p < .0001$). There is now a 25 ms advantage for the figurative over the literal target. Although the difference is small,

it may indicate that the literal meaning is beginning to fade as comprehension of the metaphorical phrase is completed.

The continued lack of availability of the low familiar figurative interpretation prompted a closer look at the item means in terms of their aptness. In the high familiar case the pattern is consistent. All high familiar metaphors showed activation regardless of their aptness. On the other hand, for the low familiar metaphors the high apt group showed facilitation, whereas the moderate apt group showed inhibition. This suggests that aptness may play an especially important role in low familiar metaphors.

Experiment 3

Experiment 3 was designed to investigate whether the processing of low familiar metaphors may depend on aptness. Twelve additional metaphors were selected to create high and moderate apt groups of low familiar metaphors (12 in each of the aptness categories). As in Experiment 1, the visual target was presented immediately at the offset of the metaphor vehicle. If the post hoc observations of Experiments 1 and 2 are viable, then the moderately apt metaphors should exhibit inhibition of the figurative targets and the high apt metaphors should show evidence of facilitation.

Results. Overall the results of Experiment 3 were consistent with predictions (Table 3). A two way ANOVA (Aptness: high vs. moderate X Target: literal, figurative, control) shows a marginally significant main effect of aptness attributable to faster times overall for the high apt targets ($F1(1,38) = 3.13$, $p < .08$; $F2(1,11) = 4.22$, $p < .06$. There is also a main effect of target ($F1(2,76) = 18.96$, $p < .0001$; $F2(2,22) = 9.78$, $p < .001$). The predicted interaction between aptness and target is significant in the analysis by subjects ($F1(2,76) = 3.64$, $p < .05$ and marginally significant in the items analysis ($F2(2,22) = 2.66$, $p < .09$).

As seen in Table 3, in the moderate apt low familiar condition the figurative target is slower than the control target although the difference does not reach significance in Bonferroni t-tests ($t(38) = 1.45$, $p < .16$. In contrast, the literal target ($M = 780$) is clearly faster than the control ($M = 855$), $t(38) = 4.07$) demonstrating activation of the vehicles' literal meaning.

Table 3
Experiment 3: Means and SDs of correct responses

	Moderate Apt			High Apt		
	MEAN	SD	DIF*	MEAN	SD	DIF*
FIGUR.	889	145	-34	816	117	50
LIT.	780	121	75	779	123	87
CONT.	855	130		866	144	

*difference from control

The overall pattern of the high apt low familiar condition is also consistent with predictions. Both the literal target and the figurative target are faster than the control but the figurative difference is only marginally significance by Bonferroni criteria (literal vs. control $t(38) = 3.46$, $p < .001$; figurative vs. control $t(38) = 2.14$, $p < .039$).

The results of Experiment 3 suggest immediate availability of both literal and figurative interpretations of a low familiar metaphor if the metaphor is highly apt. When a person encounters a metaphor with which they are not familiar, the aptness of the metaphor may be especially critical to comprehension.

General Discussion

The three experiments presented here suggest that it is possible for the metaphorical interpretation of a phrase to be processed as rapidly as the literal meaning of one of its elements. There are two important qualifications to this statement. First, rapid processing seems to depend on previous experience with the metaphor, shown by high ratings of subjective familiarity. Highly familiar metaphors seem to be more easily and rapidly comprehended than relatively novel, low familiar metaphors. Second, even if the metaphor is less familiar, it's figurative interpretation may still be available relatively early if it has been judged to be highly apt.

If all metaphors are comprehended using a stage-like process in which an attempt at a literal meaning must first be made in order for a non-literal meaning to be computed (Searle, 1979), then we would expect only the literal interpretation to be available in the 0-delay condition. This is clearly not the case. The results of Experiment 1 and 2 show that when metaphors are high in subjective familiarity they can be processed as rapidly as the literal meaning of one of their components. These findings can not be readily explained by the three-stage model.

One alternative to the three-stage model is the Categorization model of metaphor processing (Glucksberg & Keysar, 1990). In this approach the literal and metaphorical interpretations of an X is a Y assertion are both comprehended as simple class-inclusion statements. For example, the metaphor MY HUSBAND IS A BABY is understood by assigning the metaphor's topic, HUSBAND, to the class exemplified by the metaphor's vehicle BABY, as well as infants and other dependent creatures. In contrast, if the contextual environment favored a literal interpretation of the word BABY then the class would include a different membership, restricted to those of a very young age. Consistent with the data presented here, the categorization approach suggests direct processing of the metaphorical interpretation without the need to first compute and reject a literal interpretation.

It is also possible to view the roles of aptness and familiarity within the categorization approach. Aptness has been shown to be reflected, in part, within the structure of the metaphor itself. An apt metaphor is one in which the domains of the topic and vehicle are relatively distant while the within domain features are relatively close in semantic space (Trick & Katz, 1986). Subjective familiarity, on the other hand, is a measure of how familiar the subject is with the metaphor. A highly familiar metaphor may be one in which considerable experience with the individual domains of the topic and vehicle has made the appropriate features of the vehicle more salient and therefore, more quickly and easily activated. As experience with the metaphorical usage of the vehicle increases, the relevant features may become more and more central to the domain, therefore requiring less time and effort for comprehension. In direct contrast, less familiar metaphors, which are also less apt, may have vehicles in which the critical features needed to define the category, are not highly salient. This may account for the pattern of inhibition found for the low familiar moderate apt metaphors. When embedded in discourse, contextual information probably highlights the features critical for comprehension.

In conclusion, in order to explain the comprehension of metaphors it may not be necessary to postulate either separate metaphorical stages or separate mechanisms. However, this does not imply that metaphors are unimportant or uninteresting. Quite the contrary, the study of non-literal language may be crucial to the understanding of a constantly evolving natural language system. Throughout the ordinary evolution of any natural language, novel usages that are capable of expressing a great deal of information powerfully and succinctly will be invented, and if used frequently, may eventually become part of the literal usage.

Acknowledgements

This research was supported by the Center for Cognitive and Psycholinguistic Sciences and NINCDS Grant R29 26587 and NIH BRSG Grant SO7RR07149-17 to the second author.

References

Glucksberg, S., and Keysar, B. 1990. Understanding Metaphorical Comparisons: Beyond Similarity. *Psychological Review* 97:3-18.

Glucksberg, S., Gildea, P., and Bookin, H. 1982. On Understanding Nonliteral Speech: Can People Ignore Metaphors? *Journal of Verbal Learning and Verbal Behavior* 13:512-521.

Inhoff, A.W., Lima, S.D., and Carroll, P.J. 1984. Contextual Effects On Metaphor Comprehension in Reading. *Memory & Cognition* 12:558-567

Janus, R.A. and Bever, T.G. 1985. Processing of Metaphoric Language: An Investigation of the Three-Stage Model of Metaphor Comprehension. *Journal of Psycholinguistic Research* 14:473-487.

Katz A.N., Paivio A., Marschark, M. and Clark J. 1988. Norms for 204 Literary and 260 Nonliterary Metaphors on Psychological Dimensions. *Metaphor and Symbolic Activity* 3:191-214.

Ortony, A., Schallert, D., Reynolds, R.B., and Antos, S.J. 1978. Interpreting Metaphors and Idioms: Some Effects of Context on Comprehension. *Journal of Verbal Learning and Verbal Behavior* 17:465-477.

Trick, L., and Katz, A.N. 1986. The Domain Interaction Approach to Metaphor Processing: Relating Individual Differences and Metaphor Characteristics. *Metaphor and Symbolic Activity* 1: 185-213.

Searle, J. 1979. Metaphor. In A. Ortony (Ed.), *Metaphor and Thought*. Cambridge, England: Cambridge University Press.