

Explaining the Time-Course of Literal and Nonliteral Comprehension

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Introduction

Over the last few decades, a considerable number of experimental studies have been made on the time-course of literal and nonliteral comprehension. These studies have been devoted to test two incompatible models of nonliteral processing: serial model and parallel (direct) model. The serial model states that literal interpretation is an obligatory process and nonliteral interpretation is triggered only when the literal interpretation is rejected as incongruous. Thus, it predicts longer processing times for nonliteral sentences as compared to literal sentences. On the other hand, the parallel/direct model claims that nonliteral interpretation is computed directly, without the rejection of the literal interpretation. As a result, it predicts no processing time difference between literal and nonliteral sentences. However, both models explain only a limited number of the time-course findings: some studies have shown equal (or shorter) processing times, while other studies have shown longer processing times for nonliteral interpretation. What these results indicate is that literal interpretation does not always have priority over nonliteral one and nonliteral interpretation is not always derived directly.

Recently, Giora (1997) proposes that the serial/parallel debate can be reconciled by *the graded salience hypothesis*: nonliteral and literal comprehension can be viewed as governed by a simple principle of salience that more salient meaning is processed first. The view underlying the model, which we agree with, is that no priority is assumed with respect to literality. However, Giora's (1997) explanation of the time-course findings by the graded salience hypothesis is inconsistent mainly because she takes a static view of salience which decides priorities for multiple interpretations. Her analysis of the findings is based on the salience of lexical meanings of a sentence, and assumes that the priorities decided by the lexical salience remain static during language comprehension.

The purpose of this paper is to consistently explain a variety of apparently incompatible psycholinguistic findings on the time-course of nonliteral comprehension. For this purpose, we argue that (a) three levels of language comprehension — i.e., lexical access, sentence meaning construction, discourse interpretation — should be separately considered, (b) a priority of one interpretation to an alternative interpretation at one level does not entail the same priority at higher levels because of a shift in salience caused by contextual support, and (c) this dynamic view of salience based on the multilevel analysis best accounts for the time-course findings of nonliteral versus literal comprehension.

A Multilevel Analysis and Dynamic Salience

To clarify the drawback of the graded salience hypothesis, let us first discuss some empirical findings. Ortony, Schallert, Reynolds, and Antos (1978) demonstrated that when paragraph-length long contexts were provided, metaphorical interpretations of target sentences such as (1) did

not take more time to read than literal interpretations of the same sentences.

(1) Regardless of the danger, the troops marched on.

However, when the target sentences were preceded by short contexts (one sentence long), metaphorical interpretations were processed slower than literal ones. They also found that idiomatic interpretations of idioms like “let the cat out of the bag” took faster to process than literal interpretations of the same idioms when long contexts were provided.

Against Ortony et al.'s findings, Janus and Bever (1985) argued that the equal reading times for literal and metaphorical interpretation in Ortony et al.'s (1978) experiment was not caused by a rich context, but rather, by their experimental method that the reading times were measured at the end of the target sentences. In other words, an extra processing required at the end of the sentences may mask the difference in processing times for literal versus metaphorical sentences. They also showed that metaphorical interpretation took longer to read even in rich context when reading times were measured at the end of the vehicle phrases (e.g., “the troops” in (1)).

Giora (1997) explains these findings as follows: the metaphorical interpretations of the sentences in the experiments are novel (i.e., unfamiliar). According to the graded salience hypothesis, the salience of an utterance is a function of its conventionality, familiarity, frequency, or contextual setting, and thereby the metaphorical interpretations are less salient than their literal interpretations. Hence, a novel metaphorical interpretation is derived after a literal interpretation is processed initially and rejected, and consequently, takes longer to process. The equal reading times obtained in the long-context condition is caused by the extra masking process, as contended by Janus and Bever (1985). However, her explanation is unconvincing because she does not explain, if a masking process exists, why such process does not equate the reading times in the short-context condition and why it does not mask the shorter reading times of idiomatic interpretations.

The reason for Giora's inconsistent explanation is that she underestimates the role of context: “context has a limited role. Though it may facilitate activation of a word's meaning, it does not inhibit activation of salient (e.g., frequent) meanings (*ibid.*, p.186).” Hence, according to the graded salience hypothesis, the fact that salient lexical meanings are processed first entails that the whole sentence meaning is constructed first from these lexical meanings. This static view of salience makes her explanation inconsistent.

To provide a consistent explanation of these findings, we take a dynamic view of salience that contextual setting can change the degrees of salience (i.e., priorities) of multiple interpretations in the comprehension process (for a similar view, see Récanati 1995). To consider the dynamic view of salience, we divide the process of language comprehension into the following three levels.

Lexical Access (LA) — A process in which lexical meanings of the constituent words of a target sentence are accessed and retrieved from the mental lexicon.

Sentence Meaning Construction (MC) — A process in which the whole meaning of the sentence is constructed from the constituent meanings.

Discourse Interpretation (DI) — A process in which the speaker's meaning (e.g., implicatures) of the sentence is inferentially derived from the sentence meaning and context.

From LA level through MC level, salience governs language comprehension, and a salience shift takes place because of the following different ways in which salience is affected by several factors:

- At LA level, all frequent, conventional or familiar word's meanings are activated. Context also facilitates activation of related meanings.

- At MC level, both intrasentential and extrasentential context has a crucial role. Contextually unrelated lexical meanings are inhibited and at the same time, related lexical meanings are activated so that the appropriate or well-formed sentence meaning is constructed first.

On the other hand, at DI level, relevance or coherence, rather than salience, comes into play: a more relevant meaning is comprehended faster, but an irrelevant meaning is rejected.

The claim about LA level is justified by a number of empirical findings on lexical access or lexical ambiguity resolution (e.g., Small, Cottrell, and Tanenhaus 1988). Furthermore, additional evidence for the claim is provided by experimental research on metaphor (Blasko and Connine 1993) and idiom (Cacciari and Tabossi 1988). These studies showed that salient meanings (i.e., literal meanings of metaphors and unpredictable idioms, metaphorical meanings of familiar metaphors, idiomatic meanings of predictable idioms) were activated immediately after stimulus onset, and remained activated after 300ms delay. On the other hand, less salient meanings (i.e., metaphorical meanings of unfamiliar metaphors, literal meanings of predictable idioms) were not activated even after 300ms delay.

The role of intrasentential context at MC level is also supported by some empirical findings. For example, Gerrig and Healy (1983) demonstrated that subjects took shorter time to read a metaphor when it followed the context (e.g., (2a)) than when it preceded the context (e.g., (2b)), but such ordering effect was not observed for the literal targets.

- (2) a. The night sky was filled with drops of molten silver.
b. Drops of molten silver filled the night sky.

What the finding suggests is that intrasentential context facilitates a contextually appropriate sentence meaning, and as a result, it is constructed first *without* a full sentential construction of the inappropriate, but more salient at LA level, interpretation being attempted. In such case the appropriate interpretation is not triggered by the rejection of the inappropriate (i.e., semantically ill-formed) interpretation; the inappropriate interpretation is only bypassed because of the salience shift. The longer comprehension times of similes than metaphors without extrasentential context found by Johnson (1996) can also be interpreted as justifying the role of intrasentential context. Similes mean pretty much the same thing as their paraphrased metaphors,

but there is no structural differences between similes and literal comparison sentences. Hence, intrasentential context of similes cannot inhibit literal-comparison meanings of similes, and they must be constructed and rejected before metaphorical meanings of similes is constructed. Note that Giora's (1997) graded salience hypothesis cannot account for these findings, since it assumes that intrasentential context does not affect the degree of salience.

Another empirical evidence for such on-line comprehension is provided by an event-related brain potential (ERP) study. In the ERP methodology, the N400 component, a negative-going wave that peaks at about 400ms after stimulus onset, is known to be elicited mainly by semantic or pragmatic inappropriateness. Pynte, Besson, Robichon, and Poli (1996) applied the ERP methodology to literally anomalous metaphor with one-sentence-length context and demonstrated that contextually unrelated metaphors elicited significantly larger N400 components than contextually related metaphors regardless of metaphor familiarity. As far as literal anomaly is concerned, there is no difference between related/unrelated conditions, and therefore, the finding implies that sentential construction of contextually appropriate metaphorical meanings are performed at the early stage of MC, without the literal meaning being rejected because of contextual inhibition of literal meanings. It is quite obvious that the graded salience hypothesis is inconsistent with the finding for the reason mentioned at the beginning of this section.

Explaining the Time-Course Findings

First of all, the findings by Ortony et al. (1978) and Janus and Bever (1985) can be explained consistently by the dynamic salience view. Paragraph-length rich context renders novel metaphorical meanings more salient than literal ones at MC level, and thus, the metaphorical sentence meanings are immediately constructed without the literal sentence meanings being constructed. Hence, Ortony et al.'s long-context condition yielded comparable reading times for literal and metaphorical interpretation. On the other hand, one-sentence-length context is not enough to make them more salient, resulting in the longer reading times in the short-context condition. What Janus and Bever's finding indeed shows is that the novel metaphorical meanings are not easier to process *only at LA level*, since people cannot construct the whole sentence meanings at the end of the vehicle phrase.

The explanation above is also consistent with other findings on metaphors. Since short context cannot provide sufficient support for immediate construction of metaphorical meanings of unfamiliar metaphors, familiar metaphors used figuratively are understood more rapidly than unfamiliar ones used figuratively within one-sentence-length contexts (Blasko and Briehl 1997). Although Gibbs's (1990) finding on the longer reading times for novel metaphorical referential expressions (e.g., (3a)) than literal equivalent references (e.g., (3b)) within a rich context appears to be incompatible with our explanation above, it may be caused by lack of contextual support.

- (3) a. "The creampuff didn't even show up."
b. "The fighter didn't even show up."

In Gibbs's experiment the same context was used for different targets, while in Ortony et al.'s study the same target

was preceded by different contexts. Indeed, the contexts in Gibbs's experiment do not facilitate metaphorical interpretations of the metaphorical references, though they facilitate literal interpretations of the literal references. For example, the context for (3a) and (3b) describes a weak boxer before a fight, but it does not give a hint how the weak boxer is similar to a creampuff.

Furthermore, Inhoff, Lima, and Carrol (1984) found that even in the short-context condition, literally anomalous metaphors (e.g., "the directors mercilessly *choked* smaller companies") did not require longer reading times than their literal counterpart sentences (e.g., "the directors mercilessly *outbid* smaller companies"). This finding can be explained as the effect of the intrasentential context: extrasentential one-sentence-length context cannot provide sufficient support for a salience shift, but literal ill-formedness of metaphors offsets insufficient contextual support. Thus, the metaphorical sentence meaning is immediately constructed, resulting in the equal reading times. This finding cannot be explained by the graded salience hypothesis. Note that intrasentential context (literal ill-formedness) alone cannot render metaphoric and literal interpretations equally fast to process: when no extrasentential context was given or when only one-word context was presented, metaphorical sentences were read more slowly than their literal paraphrase sentences (e.g., Shinjo and Myers 1987).

Empirical findings on interference effect of metaphors in the literal truth decision task can be explained along the same line. If metaphorical interpretations are readily available at MC level, they interfere with the decision and take slower to verify their literal truth than literally false sentences. Hence, sensible metaphors interfered the decision out of context (Glucksberg, Gildea, and Bookin 1982), and poor metaphors produced such effect when they followed short contexts (Gildea and Glucksberg 1983).

The shorter reading times for idiomatic interpretations obtained by Ortony et al. (1978) is caused by insufficient contextual support for literal interpretations of the idioms. Idioms generally have highly conventional meanings, and thus idiomatic meanings of idioms are much more salient than their literal meanings. Therefore, even when a paragraph-length context supports literal interpretation, an idiomatic meaning is processed first without literal construction at MC level. This explanation is consistent with other empirical findings on idiom: idiomatic interpretations of idioms took faster to process than literal uses of the same idioms without context (Gibbs 1980), and literal uses of idioms facilitated only idiomatic meanings even when paragraph-length contexts supported literal interpretation (Gibbs 1986b). Unconventional idioms, however, were read as fast as their literal paraphrases because they are equally salient (McGlone, Glucksberg, and Cacciari 1994).

The above explanation based on the dynamic view of salience is summarized as follows:

1. *When the intended interpretation is more salient than the unintended one at LA level, the intended interpretation is processed first from LA through MC level, whether contextual support is provided or not.*

2. *When the intended interpretation is less salient than the unintended one at LA level, but sufficient contextual support (e.g., paragraph-length extrasentential context, or one-sentence-length extrasentential context plus intrasentential context) for the intended interpretation is provided,*

the intended interpretation is processed first at MC level without the unintended meaning being rejected.

3. *When the intended interpretation is less salient than the unintended one at LA level and contextual support for the intended interpretation is not enough, the unintended salient meaning is processed first and rejected at MC or DI level so that the intended meaning is interpreted.*

When Case 1 or 2 applies to one interpretation but Case 3 applies to another interpretation (and they are equally relevant), the former interpretation is processed faster than the latter one.

Many other empirical findings can be accounted for by the analysis of comprehension at DI level. For example, Keysar (1989) examined reading times for ambiguous sentences (e.g., "Bob Jones is a magician") within four types of context — literally and metaphorically true (L+/M+), literally and metaphorically false (L-/M-), literally true and metaphorically false (L+/M-), and literally false and metaphorically true (L-/M+). The result was that the sentences were faster to read in the context of L+ than L-, and also faster to read in the context of M+ than M-. According to the multilevel analysis, the target sentences are relevant to the context of L+/M+, less relevant to the context of L+/M- or L-/M+ and least relevant to the context of L-/M-, because two compatible interpretations are computed simultaneously in L+/M+, but only one intended interpretation is computed in L+/M- or L-/M+ and the context of L-/M- triggers a search for other possible interpretations. This finding cannot be explained consistently by the graded salience hypothesis. Giora (1997) contends that the literal meanings are rejected before the metaphorical meanings are processed even in the context of L+ because they cannot provide an answer to the question presented at the last line of the context. However, her argument is inconsistent with the observed longer reading times for the target sentences in L-/M+ than in L+/M+. If metaphorical interpretation in both conditions is triggered by the rejection of the literal meanings, it predicts equal reading times. Moreover, the multilevel analysis is consistent with Keysar's (1994) finding that the target sentences are longer to read in the context of M+/M- than in the context of M+, or in the context of L+/L- than in the context of L+.

Onishi and Murphy (1993) examined whether Gibbs's (1990) finding is caused by referential use of metaphors by comparing predicative metaphors (e.g., (3c)) expressing the same information as Gibbs's metaphorical references with literal equivalent sentences (e.g., (3d)).

(3) c. He's such a creampuff that he didn't even show up.

d. He's such a loser that he didn't even show up.

The result was that metaphors did not take longer to read than literal sentences, and they concluded that referential use of metaphors caused the increased reading times. However, the literal sentences compared with predicative metaphors differ from original referential descriptions information-wise. They include additional information (e.g., "loser") that the literal references did not, and it may cause additional reading times at DI level, possibly because more implicatures can be derived from the additional information. Hence, such additional reading times might yield the equal reading times for the predicative metaphors and the literal sentences.

Ironic interpretation requires the literal sentence meaning of irony, and it is derived from the information pro-

vided by the literal meaning and context at DI level, as suggested by recent irony theories (e.g., Sperber and Wilson 1995; Giora 1995; Utsumi 1996). In other words, there is no “ironic sentence meaning” which should be constructed at MC level and substituted for the literal sentence meaning. In fact, Giora, Fein, and Schwartz (1998) showed that only the literal meaning of an ironic sentence was activated (150ms and 1000ms after the onset) and was not suppressed even when the ironic meaning was activated (2000ms). Hence, the multilevel analysis provides a consistent explanation of the seemingly incompatible findings on irony: ironic sentences did not take longer to interpret than their literal equivalent sentences when paragraph-length contexts were provided (Gibbs 1986a), but often took longer to interpret than the same sentences used literally (Giora 1995). When context makes ironic interpretation highly relevant (e.g., context is surrounded by ironic environment (Utsumi 1996)), ironic interpretation is processed as fast as, or faster than, relevant literal interpretation at DI level, but otherwise ironic interpretation is processed slower. Note that the graded salience hypothesis cannot explain these findings because Giora (1997) contends that ironic meanings have not been conventionalized and thus less salient than literal ones.

Proverbs are also highly context-dependent and their literal meanings play a necessary role in shaping proverbial interpretations. Thus, proverbs were interpreted figuratively more rapidly than literally when they followed paragraph-length contexts, but proverbial interpretations took more time than literal interpretations within only single-word contexts (Kemper 1981). Furthermore, since unfamiliar proverbs are less salient at LA and MC levels, even in rich contexts they took longer time to interpret figuratively than literally (Honeck, Welge, and Temple 1998).

Concluding Remarks

In this paper, we have argued the need of the multilevel dynamic model of salience for explaining the time-course findings, and showed that it provides a consistent explanation of the findings. Our analysis suggests that it is difficult and useless to assume one simple principle governing all the levels of language comprehension. Thus, we believe that future studies of the time-course of nonliteral comprehension should be done not for supporting or rejecting the simple models, but for discovering what factors affect nonliteral comprehension at each level and how they affect.

References

- Blasko, D. and Brihl, D. (1997). Reading and recall of metaphorical sentences: Effects of familiarity and context. *Metaphor and Symbol, 12*, 261–285.
- Blasko, D. and Connine, C. (1993). Effects of familiarity and aptness on metaphor understanding. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19*, 295–308.
- Cacciari, C. and Tabossi, P. (1988). The comprehension of idioms. *Journal of Memory and Language, 27*, 668–683.
- Gerrig, R. and Healy, A. (1983). Dual processing in metaphor understanding: Comprehension and appreciation. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 9*, 667–675.
- Gibbs, R. (1980). Spilling the bean on understanding and memory for idioms in conversation. *Memory and Cognition, 8*, 149–156.
- Gibbs, R. (1986a). On the psycholinguistics of sarcasm. *Journal of Experimental Psychology: General, 115*, 3–15.
- Gibbs, R. (1986b). Skating on thin ice: Literal meaning and understanding idioms in conversation. *Discourse Processes, 9*, 17–30.
- Gibbs, R. (1990). Comprehending figurative referring descriptions. *Journal of Experimental Psychology: Learning, Memory and Cognition, 16*, 56–66.
- Gildea, P. and Glucksberg, S. (1983). On understanding metaphor: The role of context. *Journal of Verbal Learning and Verbal Behavior, 22*, 577–590.
- Giora, R. (1995). On irony and negation. *Discourse Processes, 19*, 239–264.
- Giora, R. (1997). Understanding figurative and literal language: The graded salience hypothesis. *Cognitive Linguistics, 8*, 183–206.
- Giora, R., Fein, O., and Schwartz, T. (1998). Irony: Graded salience and indirect negation. *Metaphor and Symbol, 13*, 83–101.
- Glucksberg, S., Gildea, P., and Bookin, H. (1982). On understanding nonliteral speech: Can people ignore metaphors. *Journal of Verbal Learning and Verbal Behavior, 21*, 85–98.
- Honeck, R., Welge, J., and Temple, J. (1998). The symmetry control in tests of the standard pragmatic model: The case of proverb comprehension. *Metaphor and Symbol, 13*, 257–273.
- Inhoff, A., Lima, S., and Carrol, P. (1984). Contextual effects on metaphor comprehension in reading. *Memory and Cognition, 12*, 558–567.
- Janus, R. and Bever, T. (1985). Processing of metaphoric language: An investigation of the three stage model of metaphor comprehension. *Journal of Psycholinguistic Research, 14*, 473–487.
- Johnson, A. (1996). Comprehension of metaphors and similes: A reaction time study. *Metaphor and Symbolic Activity, 11*, 145–159.
- Kemper, S. (1981). Comprehension and the interpretation of proverbs. *Journal of Psycholinguistic Research, 10*, 179–198.
- Keysar, B. (1989). On the functional equivalence of literal and metaphorical interpretations in discourse. *Journal of Memory and Language, 28*, 375–385.
- Keysar, B. (1994). Discourse context effects: Metaphorical and literal interpretations. *Discourse Processes, 18*, 247–269.
- McGlone, M., Glucksberg, S., and Cacciari, C. (1994). Semantic productivity and idiom comprehension. *Discourse Processes, 17*, 167–190.
- Onishi, K. and Murphy, G. (1993). Metaphoric reference: When metaphors are not understood as easily as literal expressions. *Memory and Cognition, 21*, 763–772.
- Ortony, A., Schallert, D., Reynolds, R., and Antos, S. (1978). Interpreting metaphors and idioms: Some effects of context on comprehension. *Journal of Verbal Learning and Verbal Behavior, 17*, 465–477.
- Pynte, J., Besson, M., Robichon, F., and Poli, J. (1996). The time-course of metaphor comprehension: An event-related potential study. *Brain and Language, 55*, 293–316.
- Récanati, F. (1995). The alleged priority of literal interpretation. *Cognitive Science, 19*, 207–232.
- Shinjo, M. and Myers, J. (1987). The role of context in metaphor comprehension. *Journal of Memory and Language, 26*, 226–241.
- Small, S. I., Cottrell, G. W., and Tanenhaus, M. K. (1988). *Lexical Ambiguity Resolution: Perspective from Psycholinguistics, Neuropsychology and Artificial Intelligence*. Morgan Kaufmann Publishers.
- Sperber, D. and Wilson, D. (1995). *Relevance: Communication and Cognition, Second Edition*. Oxford, Basil Blackwell.
- Utsumi, A. (1996). Implicit display theory of verbal irony: Towards a computational model of irony. In *Proceedings of the International Workshop on Computational Humor (IWCH'96)*, pp. 29–38.