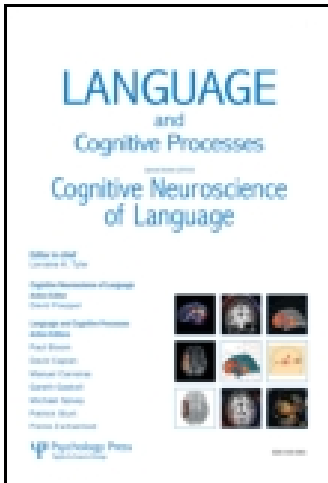


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### Associative and inferential processes in pragmatic enrichment: The case of emergent properties

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## Associative and inferential processes in pragmatic enrichment: The case of emergent properties

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Experimental research on word processing has generally focused on properties that are associated to a concept in long-term memory (e.g., *basketball—round*). The present study addresses a related issue: the accessibility of “emergent properties” or conceptual properties that have to be inferred in a given context (e.g., *basketball—floats*). This investigation sheds light on a current debate in cognitive pragmatics about the number of pragmatic systems that are there (Carston, 2002a, 2007; Recanati, 2004, 2007). Two experiments using a self-paced reading task suggest that inferential processes are fully integrated in the processing system. Emergent properties are accessed early on in processing, without delaying later discourse integration processes. I conclude that the theoretical distinction between explicit and implicit meaning is not paralleled by that between associative and inferential processes.

**Keywords:** Lexical pragmatics; Associative and inferential processes; Spreading activation; World-knowledge schemas or scenarios; Emergent properties.

### EMERGENT PROPERTIES

One of the best documented effects in psycholinguistics since the late 1970s is that of lexical priming. In processing a given word, related words become more readily accessible. As a result, a word such as *nurse*, for example, will be recognised faster after processing the word *doctor* than after the word *table* (Greenspan, 1986; Swinney, 1979; Whitney, McKay, Kellas, & Emerson, 1985). Spreading activation theories explain lexical priming effects as the result of automatic spreading activation of associates in a semantic memory network (Anderson, 1983; for a review of semantic priming theories, see Neely, 1991).

Lexical semantic information is associated with the word for a concept at the level of meaning instead of (or in addition to) the level of form representation (Moss, Ostrin, Tyler, & Marslen-Wilson, 1995). The accessibility of lexical semantic information is a common element in pragmatic models of word interpretation (e.g.,

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Carston, 2002a; Giora, 1997; Recanati, 2004). Lexical semantic information becomes active when processing a word and remains active depending on its relevance for interpretation as well as on the strength of the conceptual association (Rubio-Fernández, 2007, 2008). In contrast to associative processes, local inferential processes are often required when word interpretation relies on information that is not associated to a given concept.

One of the first researchers to draw a distinction between associative and inferential processes in word processing was Barsalou (1982), who distinguished between context-independent and context-dependent information in concepts. Context-independent information is accessed automatically every time the corresponding word is processed, whereas context-dependent information is only activated in contexts where it is relevant for interpretation. For example, the property **ROUND** would be part of the mental representation of **BASKETBALL** across contexts, whereas **FLOATS** would be activated only when contextually relevant. Rather than gaining accessibility by an automatic process of spreading activation of associates, context-dependent information or “emergent properties” are accessed through local inferential processes (Barsalou, 1982, 1983, 1987).<sup>1</sup> Consider the following example:

1. John didn't know how to swim, so when he fell into the water, his best friend threw him a basketball.

In interpreting (1), the reader infers that John's friend was trying to save him from drowning. This inference is derived on the basis that basketballs have the property of floating and can potentially be used as a life-preserver.

In two experiments, Barsalou (1982) tested the hypothesis that context-independent properties are always activated by their respective words whereas context-dependent properties need relevant contexts for activation. In the first experiment, the results of a property-verification task showed that context-independent properties (e.g., **HAS A SMELL** for **SKUNK**) were equally primed in neutral sentence contexts (*The skunk was under a large willow*) as in biasing contexts (*The skunk stunk up the entire neighbourhood*). However, the verification of context-dependent properties (**CAN BE WALKED UPON** for **ROOF**) was faster after reading a biasing sentence (*The roof cracked under the weight of the repairman*) than after reading a neutral sentence (*The roof had been renovated prior to the rainy season*). In the second experiment, the results of a similarity-judgement task revealed that the similarity ratings for pairs of words (e.g., **SOFA-DESK** or **RACCOON-SNAKE**) were affected by the prior presentation of the category name (**FURNITURE** and **CAN BE A PET** for the examples above) only when the property shared by the two concepts was context dependent. This confirmed the prediction that the properties shared by instances of a common category (e.g., **FURNITURE**) are usually context independent, whereas the properties shared by instances of an ad hoc category (**CAN BE A PET**) are often context dependent.

As illuminating as these experiments may be for the distinction between context-dependent and context-independent properties, Barsalou (1982) acknowledges that his results provide only a functional account of property availability, since the procedure did not address the time course of activation. In this respect, the time course of inferential processes in word interpretation has not been a focus of psycholinguistic

<sup>1</sup> I adopt the term “emergent properties” from the literature on metaphor interpretation and conceptual combination. However, Barsalou (1983) used the term “ad hoc categories” to refer to concepts constructed impromptu to achieve goals (e.g., **CAN BE USED TO STAY AFLOAT**).

research compared with associative processes. This gap in the experimental literature has become more obvious since lexical pragmatics was consolidated as a strong research area in recent years (e.g., Carston, 1997, 2002a; Recanati, 2004; Wilson, 2003; Wilson & Carston, 2006).

The study reported in this paper investigated two independent albeit related questions that should be relevant for pragmatic models of word interpretation. The first aim of the study is to establish the extent to which the initial unavailability of emergent properties—relative to associated properties—might disrupt the normal flow of interpretation. This question is relevant to the current debate in the cognitive pragmatics literature on the number of pragmatic systems that are there (Carston, 2002a, 2007; Recanati, 2004, 2007). The second question is whether pragmatic processes of enrichment based on world knowledge (e.g., the inference that John's best friend was throwing him a life-preserver) might facilitate lexical access of an unexpected word (*basketball* in the above example). This question touches on recent psycholinguistic research on the role of utterance interpretation in semantic activation (Norris, Cutler, McQueen, & Butterfield, 2006).

## EMERGENT PROPERTIES IN PRAGMATIC ENRICHMENT

According to Barsalou (1982), context-independent properties of concepts are accessed through automatic associative processes, whereas context-dependent properties are accessed through local inferential processes. In the study reported in this paper, I investigated the role of associative and inferential processes in instances of pragmatic enrichment where the reader goes beyond the message linguistically encoded and derives a more specific interpretation as to *why* or *how* a certain action is performed.

Consider the following examples of pragmatic enrichment:

- 2a. John didn't know how to swim, so when he fell into the water, his best friend threw him a lifebuoy.
- 2b. John didn't know how to swim, so when he fell into the water, his best friend threw him a basketball.

In both of these examples, we understand that John's best friend threw him a lifebuoy or a basketball *to save him from drowning*. However, whereas our world-knowledge schema for a situation where somebody is drowning would include a slot for LIFEBOUY, it would not include one for BASKETBALL. Thus, the implicated premise that John's best friend was throwing him a life-preserver would be accessed automatically in (2a), whereas it would have to be accessed through inferential processing in (2b). In other words, the property CAN BE USED TO STAY AFLOAT would be context-independent for *lifebuoy*—and so automatically accessed in processing the word—but context-dependent for *basketball*—and so accessed through local inferential processes.

According to Recanati (2004), pragmatic enrichment is a local pragmatic process that is derived through automatic, purely associative processes that operate in a blind mechanical fashion. However, whereas this is likely to be the case in examples such as (2a) above, this description is less likely to characterise instances of pragmatic enrichment such as the one in (2b), which do not entirely rely on our world-knowledge schemata for a certain situation but also involve local inferential processes.

In Recanati's account, inferential processes normally operate at the global level of the proposition expressed. For example, if (2b) was uttered by John's mother in a cynical tone of voice, her comment could be taken to imply that John's best friend had not been helpful enough when John was in danger. According to Recanati, the derivation of this type of implicit meanings is done through inferential processing. However, when inferential processes need to operate at the local lexical level rather than at the global level of the utterance, they disrupt the normal language flow (Recanati, 2004, p. 38). For example, in order to access the emergent property of basketballs CAN BE USED TO STAY AFLOAT in (2b), the reader would have to resort to an inferential mode of processing when automatic associative processes fail to deliver a plausible interpretation based on world knowledge.

An earlier proposal for a similar distinction between primary and secondary processing was made by Sanford and Garrod (1981) from a psycholinguistic rather than a philosophical perspective. Even though Sanford and Garrod focused their analysis on anaphora, emergent properties could be analyzed in a similar way. The same prediction could therefore be argued to follow from Sanford and Garrod's and Recanati's models regarding emergent properties in pragmatic enrichment: whereas accessing associated conceptual information is the result of a fast, automatic process, emergent properties would be accessed in a second stage of processing, only after mandatory associative processes have failed to deliver a satisfactory interpretation.

Recanati (2004) also shares with Sanford and Garrod the view that world-knowledge structures or "scenarios" play a crucial role in language comprehension. However, there seems to be an important difference between the functions that world-knowledge structures can perform in language interpretation according to Sanford and Garrod and to Recanati. In Sanford and Garrod's model of written language interpretation, scenarios work in the standard way that is generally accepted in psycholinguistics; that is, as cognitive structures or "templates" that represent a person's knowledge about objects, people, or situations, and whose activation in the interpretation of a certain passage would automatically give access to general information about that type of object, person or situation (e.g., when reading that someone is drowning in a public swimming pool, the corresponding scenario might automatically activate concepts such as LIFEBUOY or LIFEGUARD).

In contrast, Recanati (2004) assumes that on the basis of world knowledge structures alone—and therefore through purely automatic associative processes—hearers and readers are also able to derive more elaborate interpretations. In particular, Recanati (2004) argues that metaphors and metonymies are generally interpreted in a blind, mechanical fashion by accessing the corresponding world-knowledge structures. Thus, whereas the figurative meaning of a word might not be the most accessible one at first, during the interpretation process the contextually relevant meaning would gain the greatest level of activation and be integrated as part of the interpretation of the utterance. For example, in interpreting Nunberg's metonymy *The ham sandwich is getting restless*, according to Recanati, activation would shift from the concept HAM SANDWICH to the concept HAM SANDWICH ORDERER.

This model of word interpretation seems plausible in the case of conventional metaphors and metonymies where the figurative meaning of the word might be stored in the mental lexicon or be easily accessible (e.g., *My neighbour is a pig; John ate half of his plate*). However, it is unclear how this could be possible in the case of more creative uses that involve not just accessing an associated concept but generating emergent properties that require inferential processing. For example, in interpreting the

metaphor *Mary is a block of ice*, we would normally understand that Mary is a cold, insensitive, and unsympathetic person (Wilson & Carston, 2006). However, those properties are not associated with the standard concept BLOCK OF ICE (or to any of the concepts associated to that concept) and therefore will not be automatically activated in processing this expression. Since inferential processes would need to operate at the local level in order to derive the intended emergent properties, it seems fair to argue that in Recanati's account, the "normal flow of processing" based on purely associative processes would also be disrupted in instances of creative metaphor and metonymy (for a discussion of emergent properties in metaphor interpretation see Bowdle & Gentner, 2005; Glucksberg & Haught, 2006; Jones & Estes, 2005; Wilson & Carston, 2006).

Even though in Recanati's model hearers and readers are able to derive elaborate interpretations through primary pragmatic processing, the examples that he discusses are always based on world knowledge structures and as such, their interpretation could indeed be derived through purely associative processes and shifts in accessibility between various possible meanings (see Recanati, 2004). However, I argue that emergent properties pose a problem for this view of lexical pragmatics since the type of mechanical associative processes that usually drive word interpretation would not be enough to derive a satisfactory interpretation based exclusively on world knowledge.

For example, no matter how vast our knowledge of blocks of ice might be, by simple associative processing we could not come to understand what type of block of ice Mary is—for she is not a block of ice as we know them. Likewise, in learning that John's best friend threw him a basketball when John fell into the water, we would need to elucidate whether he threw him the basketball as a life-preserver or perhaps he was jokingly inviting him to play water polo.<sup>2</sup> Given that in order to understand these expressions and go beyond the meaning lexically encoded, hearers and readers would need to bear in mind the speaker's intentions, inferential pragmatic processing would have to operate at the local lexical level, thus disrupting the normal flow of interpretation based on primary associative processing (Recanati, 2004, p. 38).

The key argument against Recanati's model of lexical pragmatics is that emergent properties, by definition, do not receive automatic activation in processing the word for the concept and moreover, they may not be activated as part of the current scenario. For example, the activation of the swimming pool scenario may automatically activate the concepts SWIM and LIFEBUOY, which in turn would activate the property FLOATS. However, this associate alone would not allow the pragmatic enrichment of *John's best friend threw him a basketball*—to save him from drowning. If it did, it should be possible to interpret along similar lines the example *John's best friend threw him a tennis ball*. The fact that the relevant property CAN BE USED TO STAY AFLOAT is an emergent property of the concept BASKETBALL—which by definition would not get automatically activated in processing the word (Barsalou, 1982)—and would not be accessed as part of the swimming pool scenario makes Recanati's associative account inadequate to explain the interpretation of this type of examples of pragmatic enrichment.

Rather than making a distinction between two types of pragmatic processes, local associative processes and global inferential processes, Relevance Theory (Carston,

<sup>2</sup>When I presented this study as part of a talk at UCL, Ira Noveck commented that in first interpreting the example about John and the basketball, he had thought that John's friend was teasing him, not helping him. It seems clear from this misunderstanding that this type of examples cannot be understood without reference to the speaker's intentions.

2002a, 2004, 2007; Sperber & Wilson, 1986/1995; Wilson & Sperber, 2004) proposes a unitary on-line pragmatic processing system in which all pragmatic processes are uniformly inferential. In this framework, the distinction between the explicit and the implicit meaning of an expression—which is the basis for the distinction between local associative processes and global inferential processes in Recanati's account—does not entail any important difference between the kinds of pragmatic processes or systems involved (Carston, 2007).

Regarding the accessibility of emergent properties, Relevance Theory would recognise that these conceptual properties may not become available to the processor as fast as those properties associated to the concept in semantic memory. However, because in the relevance-theoretic framework our on-line processing system is understood as being primarily inferential, deriving emergent properties would not involve the breakdown of a more basic form of processing or even a switch from associative to inferential modes of processing.

The study reported in this paper examined the extent to which inferring emergent properties as part of a local process of pragmatic enrichment might slow down interpretation relative to associated conceptual information that would be automatically activated.

## THE ROLE OF PRAGMATIC PROCESSES IN LEXICAL ACCESS

Pragmatic models of word interpretation generally adopt the “standard position” regarding priming; namely the view that processing a word immediately, automatically, and context-independently activates a rather unspecific semantic representation, which in turn facilitates recognition of related words (Williams, 1988, p. 67). This view has been supported by a large number of cross-modal lexical priming studies since David Swinney's seminal paper of 1979. Nonetheless, many other studies have found evidence of selective, context-specific activation in word processing [see Tabossi (1996) and Norris et al. (2006) for a review].

Recent research by Norris et al. (2006) offers robust evidence that lexical access need not lead automatically to unconstrained semantic activation. In a battery of 11 lexical priming experiments, Norris et al. found that primes that would facilitate recognition of their associates when presented in isolation, would not necessarily prime these associates when presented in a neutral sentential context. Norris et al. adopt the same position as Williams (1988; see also Foss & Ross, 1983) and argue that associative relations are not automatically activated by lexical access of a certain word. Instead, they are available only in the “effective context” for priming; namely, the propositional representation of the utterance (Norris et al., 2006, p. 151). In their view, the association between a prime and a target will only be primed if this association is relevant to the interpretation of the utterance, or if the interpreter is encouraged to process the meaning of the prime word more deeply (e.g., by use of syntactic and/or prosodic cues). When associated words appear in isolation, they provide the only effective context, hence the resulting priming.

Similar results to those observed by Williams (1988) and Norris et al. (2006) have been observed with silent reading tasks (e.g., Morris, 1994). This is an important generalisation since cross-modal priming studies measure facilitation through secondary tasks such as word recognition or naming, which necessarily adds an unnatural dimension to the primary task of language interpretation. Myers, Cook, Kambe, Mason, and O'Brien (2000) conclude from their eye-tracking study that

spreading activation is not only driven by elements in the discourse representation but also by knowledge that the reader brings to the text.

The conclusions of these studies, in particular those of Norris et al. (2006) are highly relevant to pragmatic models of language interpretation:

Lexical activation does not automatically produce semantic priming. Semantic priming is a consequence of the activation of representations of utterance meaning. The construction or activation of utterance meaning is not an automatic consequence of lexical activation; it appears to depend on the demands of the listening situation, that is, on the kind of interpretation that the listener is attempting to build (Norris et al., 2006, p. 184).

Norris et al. do not specify how pragmatically rich the interpretation of an utterance needs to be in order to affect semantic priming. For instance, various cross-modal lexical priming studies have shown that as early as 200 ms from the offset of a homonymous word, only the contextually relevant meaning remains active (Swinney, 1979; Tanenhaus, Leiman, & Seidenberg, 1979). Even initial selective activation of the appropriate meaning of an ambiguous prime has been observed in highly constraining contexts (Simpson, 1981; Tabossi, 1988). These studies therefore suggest that the obligatory pragmatic process of disambiguation can effectively modulate word meaning activation during processing.

Do other local pragmatic processes such as free enrichment also result in selective priming? For example, in processing sentence (1) above, the interpreter would derive the implicated conclusion that John's best friend threw him a basketball *to save him from drowning*. To the extent that this inference is based on the hearer's world knowledge of this kind of situation, it is possible that associated information about throwing life-preservers might become activated in processing the utterance. It would therefore be interesting to see whether a pragmatically enriched interpretation of (1)—resulting from the early activation of world-knowledge schemata—might facilitate the processing of *basketball*. This would be particularly revealing since BASKETBALL is not part of the current scenario and priming would therefore be the result of early inferential processes rather than purely associative ones.

## AN ON-LINE STUDY ON EMERGENT PROPERTIES

### Experiment 1A

The first experiment was a pre-test of the materials used in the study. Given that emergent properties are context dependent, the first step was to determine whether the comprehension of the critical contexts involved accessing the intended emergent properties. For this purpose, the self-paced reading task used in the study was combined with a property verification task similar to the one used in Barsalou (1982; Experiment 1).

Participants were presented with a series of short passages one segment at a time. In the first experiment, participants had to answer a world-knowledge question at the end of each passage. Response times to these questions were recorded in two conditions: a critical condition where the question followed a relevant passage and a control condition where the question followed a neutral passage that included the target word but did not make the corresponding emergent property salient. The following are examples of the two conditions and the corresponding world-knowledge question:



4a. John went to the public swimming pool every afternoon. He spent most of his time there reading the papers. He didn't know how to swim, so when he fell into the water, his best friend threw him a **basketball** and then just waited by the side of the pool. John was expecting a bit more help.

4b. Tom was wondering what to spend his birthday money on. He always ended up getting sports equipment but he decided to get something else this year. He had first thought of getting a **basketball** to join the local team, but maybe he could get a new computer game instead.

4c. Can a basketball be used to stay afloat?

I was interested in participants' response times to the world-knowledge questions in both the critical and the control conditions. As context-dependent properties, emergent properties should only be accessed in interpreting the critical passages. Therefore, participants should take longer to verify these properties in the control condition than in the critical condition (Barsalou, 1982; Experiment 1). In other words, if an emergent property was accessed during the interpretation of a critical passage but not during the interpretation of a control passage, it would be more highly accessible when participants had to answer the world-knowledge question at the end of the critical passage, facilitating their response compared to the control condition.

If participants were equally fast at verifying the emergent properties in both types of contexts, it could be argued that emergent properties were accessed through an automatic chain of associations regardless of their contextual relevance. That is, even if BASKETBALL might not be directly associated to the property CAN BE USED TO STAY AFLOAT (the way LIFEBOY would be, for example), it might be the case that the concept BASKETBALL is associated to a property such as FILLED WITH AIR, which in turn might be associated to FLOATS and that to CAN BE USED TO STAY AFLOAT. Therefore, if participants verified that a basketball can be used to stay afloat equally fast regardless of the relevance of the property in the preceding context, this might suggest that the sophistication of an inferential system can be implemented in a blind associative system (Recanati, 2007).<sup>3</sup> In contrast, if participants verified the properties faster after they had read the critical passages, the results would suggest that emergent properties are accessible through an inferential process that is not automatically triggered across contexts but only in those instances where the emergent property is relevant for interpretation.

### *Method*

*Participants.* Thirty-eight undergraduate students at Princeton University took part in the experiment, either for monetary compensation or for course credit. All participants were native speakers of English.

*Materials and design.* Eight critical passages were constructed which included a target that was unfamiliar (i.e., that was not primed by other words in the passage) but appropriate (i.e., that was useful in the situation described). Critical passages made salient an emergent property of the target word that was relevant for interpretation. Another eight control passages were constructed including the critical targets but in a neutral context where the emergent property was not relevant for interpretation.

<sup>3</sup>Even though it is worth investigating the possibility that various properties might be automatically activated through a chain of associations, it is unlikely that this process would work in such a simple manner as described above. A concept such as RUBBER DUCK, for example, is probably associated to FLOATS, but this property should not automatically activate CAN BE USED TO STAY AFLOAT in that instance.

Targets in the control passages were familiar and appropriate so that word interpretation would depend on context-independent properties. Eighteen filler passages were also constructed including familiar and appropriate targets. Some filler passages included more complex syntactic constructions as a manipulation of writing style (which was supposed to be the point of the experiment for the participants).

All passages were divided in 12 segments of 2–11 words each. Target phrases or segments including the target words were composed of 2–4 words, with the target being the head noun in each segment. The materials were split into two lists so that the critical targets would appear only once in each list: List A included four critical passages and four control passages plus the 18 fillers. List B included the other four critical passages and the other four control passages plus the 18 fillers.

Each passage was followed by a world-knowledge question. All questions were formulated as general world-knowledge questions and not as specific comprehension questions. Overall, the correct response was “yes” in half the trials. In the critical and control trials, the question was about an emergent property of the target, which was only relevant in the critical passages (see Appendix 1 for a list of the world-knowledge questions used in these conditions). In the filler trials, the questions were standard world-knowledge questions that referred to a property of the target word in the passage (e.g., *Is it possible to eat ice-cream in winter?*). Filler questions were contextually relevant in half of the trials. Question Relevance was manipulated within subjects, with half the questions being contextually relevant and the other half being contextually irrelevant in both lists.

*Procedure.* The experiment was presented to the participants as an investigation of the effects that different writing styles have on reading. In order to minimise the likelihood that participants might answer “yes” or “no” to the questions depending on whether or not they were relevant to the passage, the instructions emphasised that the questions were general world-knowledge ones that were intended to test whether participants were paying attention to the task rather than their comprehension of the passages.

Participants were randomly allocated to one of the two lists of materials so each participant saw four critical and four control passages plus the fillers. Participants were evenly distributed between the two lists.

Participants read the passages one segment at a time on a computer screen. The text appeared in the centre of the screen on a white background. Participants were instructed to read at a normal pace and press the space bar to move to the next segment. At the end of each passage a row of asterisks appeared on the screen, which prepared participants for the world-knowledge question that came next. When the row of asterisks appeared, participants had to press the space bar to move to the world-knowledge question. Participants responded yes/no to the questions by using two designated keys on the keyboard. Responses and response times were recorded.

The first 10 passages of the exercise consisted of fillers, which were presented in the same order to all participants and served as practice. The following 16 passages were randomised individually and included critical, control, and filler passages.

### *Results and discussion*

Participants responded “yes” to the world-knowledge questions only 55.3% of the time in the control condition versus 96.7% in the critical condition where emergent properties were relevant for interpretation. The percentage of participants who responded affirmatively to the questions in the control condition was surprisingly

low, given that participants were supposed to verify these properties in both conditions. A reviewer suggested that participants might have been responding according to the relevance of the question to the preceding context, contrary to what had been emphasised in the instructions.

Of the 38 participants who took part in the experiment, 13 had indeed responded positively only when the question was relevant in the context. The remaining 25 participants responded “yes” 81% of the time in the control condition versus 97% in the critical condition. This difference was significant,  $z = 3.39$ ,  $p < .001$ . No significant difference was observed for the percentage of positive responses in the two List groups; 93% and 84%,  $z = 0.067$ ,  $p = .96$ . More importantly, for the “yes” responses of the 25 participants, response times were faster in the critical than in the control condition, with averages of 2,458 ms ( $SD$ : 1,128) and 3,963 ms ( $SD$ : 1,918), respectively.  $T$ -tests by participants ( $t_1$ ) and items ( $t_2$ ) revealed that this difference is significant,  $t_1(24) = 4.32$ ,  $p < .001$ ,  $t_2(7) = 4.55$ ,  $p < .004$ .

Reading times for the target phrases were similar in the critical and control conditions, with averages of 575 ms ( $SD$ : 172) and 559 ms ( $SD$ : 183), respectively. No facilitation of the target phrases was therefore observed in the critical passages relative to the control passages,  $t_1(37) = .803$ ,  $p = .427$ ,  $t_2(7) = .840$ ,  $p = .429$ .

The results of Experiment 1A suggest that the emergent properties used in this study were effectively accessed in interpreting the critical contexts, facilitating the response of the corresponding world-knowledge questions. The significantly different response times observed in the critical and control conditions also support the hypothesis that emergent properties are not accessed context-independently through a chain of automatic associations, but rather through a context-sensitive inferential process.

Regarding reading times for the target phrases, no facilitation was observed in the critical passages relative to the control passages. However, the control condition in Experiment 1A may not have been an appropriate baseline for the self-paced reading task given that the target words were familiar in the control passages. It is therefore possible that if targets are unfamiliar in both critical and control passages, they might show facilitation in the critical condition resulting from a process of backwards inference. This question was investigated in the second experiment.

### *Posttest of Experiment 1A*

Given that emergent properties are context dependent, the longer response times observed in the control condition would confirm that participants had to consider a suitable context in order to be able to verify the given property. Notice that this is clearly different from verifying associated or context-independent properties (e.g., *Is a basketball round?*). The fact that participants would have had to find a suitable context in order to be able to verify emergent properties may also explain why participants verified these properties less often in the control condition since they might not have considered the right type of context (e.g., *Is it possible to stand on a suitcase to change a light bulb?*). A possible concern with the negative responses in the control condition, however, is that even those 25 participants who did not systematically respond “no” to all the items in the control condition might have nonetheless been sensitive to the fact that those questions were unrelated to the preceding contexts. In order to test these two possibilities, the materials used in Experiment 1A were tested in a follow-up questionnaire.

Fifteen Princeton undergraduates took part in the posttest for monetary compensation. Participants were asked to rate on a 1–5 scale how feasible a series of 26 events were (e.g., *How feasible it is to stand on a suitcase to change a light bulb?*), with 1 being *Not feasible* and 5 being *Highly feasible*. Like the questions in the control condition of Experiment 1A, the 26 events were presented out of context. If participants in Experiment 1A had shown a general tendency to respond negatively to these questions because they were unrelated to the previous context, there should be no correlation between their responses and the feasibility scores. However, if as I hypothesise, participants might have had difficulties coming up with an appropriate context in order to verify the unrelated questions in Experiment 1A, there should be a positive correlation between their responses and the feasibility scores.

Participants in the posttest questionnaire responded *Not feasible* 17% of the time, which is comparable to the 19% of negative responses given in the control condition of Experiment 1A,  $z = .391$ ,  $p = .348$ . Moreover, there was a significant correlation between the number of positive responses that each critical item received in the control condition of Experiment 1A and the average feasibility score for each critical item in the posttest questionnaire,  $r(8) = .826$ , one-tailed  $p < .006$ .

The results of the posttest therefore confirm that those 25 participants who responded negatively to some of the unrelated questions in the control condition of Experiment 1A (e.g., *Is it possible to stand on a suitcase to change a light bulb?*) were sensitive to the relatively low feasibility of those events, which would in turn affect their ability to generate a viable context that would allow them to respond positively. This is contrary to the possibility that those participants were simply responding to the questions of Experiment 1A according to their relation to the preceding context.

## Experiment 1B

The second experiment included three versions of each passage, although each participant was presented with only one of the three. The following is an example of a critical passage (for a full list of the materials, see Appendix 1):

5. John went to the public swimming pool every afternoon. He spent most of his time there reading the papers. He didn't know how to swim, so when he fell into the water, his best friend threw him a **lifebuoy/a basketball/a newspaper** and then just waited by the side of the pool. John was expecting a bit more help.

The three types of targets were familiar and appropriate (*lifebuoy*), unfamiliar but appropriate (*basketball*), and familiar but inappropriate (*newspaper*). Familiar targets were part of the setting described. For example, lifebuoys are commonly found in public swimming pools, unlike basketballs. Appropriate targets were useful in the situation described. In the passage above, it would make more sense to throw John a basketball as a life-preserver than a newspaper, even if a newspaper could be found in the scene.

The interpretation of the critical passages involved a pragmatic process of free enrichment, by which the reader goes beyond the encoded message and derives a more specific interpretation as to why or how a certain action takes places in the situation described. Consider again (5) above: the interpreter of this passage understands that John's best friend threw him a lifebuoy or a basketball *to save him from drowning*. Because a newspaper cannot be used to this end, it should be difficult to integrate this concept in the mental representation of the discourse. Other passages involved a

pragmatic process of free enrichment as to how a certain action was performed (e.g., in one of the passages an empty bottle was used *like a rolling pin* to work a bread dough).<sup>4</sup>

Following previous self-paced reading and eye-tracking studies on various types of pragmatic inferences (Calvo & Castillo, 1998; Calvo & Meseguer, 2002; Garrod & Terras, 2000; Myers et al., 2000; Traxler, Pickering, & McElree, 2002), two measures of word processing were used in the study, an early and a late measure. Early word processing measures are typically understood to reveal initial lexical-access processes (Calvo & Meseguer, 2002; Calvo, Meseguer, & Carreiras, 2001). In the present study, the early measure corresponded with reading latencies for the critical target phrases [e.g., *a lifebuoy* in (5)]. Late eye-tracking measures are taken to reveal late text integration processes and, in some instances, a reanalysis of the target word (Calvo & Meseguer, 2002; Calvo et al., 2001). The late measure in this study corresponded with reading times for the segment following the critical targets [e.g., *and then just waited* in (5)]. The rationale for this self-paced reading measure is that, if participants were presented with the entire passage and had problems integrating a certain word in their on-line mental representation of the discourse [e.g., *newspaper* in (5)], their eye-movements would reveal regressions toward the difficult item. However, because in this version of the self-paced reading task one segment disappears from the screen when the next one appears, any delay in late discourse integration processes would be reflected in increased reading latencies for the following segment (Calvo et al., 2001; Traxler et al., 2002).

The design of the second experiment allowed addressing various research questions. First, the critical passages in this study included semantic associates of the familiar targets (e.g., *swim* would be a weak associate of *lifebuoy*). However, because these associates were separated by an average of eight intervening words in the passage, it is more likely that priming reflects global context priming (see Garrod & Terras, 2000). Therefore, if the early processing measure revealed priming of familiar targets (*lifebuoy* and *newspaper*), this result would confirm that not only relevant word associates but also world-knowledge structures can elicit priming of target words (Morris, 1994; Myers et al., 2000; Williams, 1988).

Regarding unfamiliar but appropriate targets (*basketball*), the active scenario would not prime these words. However, it is possible that, if a pragmatically richer interpretation of the utterance had already been constructed at the point where these targets are presented, the target words could be facilitated by a process of “backwards inference” (Carston, 2002b; Wilson & Carston, 2006; Wilson & Sperber, 2002). For example, it is likely that, at the point in processing where the segment *a basketball* is presented in passage (5), the reader has already understood that John’s best friend was throwing him a life-preserver. This would explain why words such as *lifebuoy* or *rope* would have a high cloze probability in this context (i.e., would be given as likely continuations for the sentence). If this enrichment was activated automatically as part of the current DROWNING scenario, this information could facilitate the backwards

<sup>4</sup>Previous psycholinguistics research has investigated the question of how elaborative inferences are derived during processing (e.g., Lucas, Tanenhaus, & Carlson, 1990; McKoon & Ratcliff, 1981). Notice, however, that the focus of the present study is not the pragmatic process of free enrichment *per se* (e.g., inferring in (5) that John’s best friend was trying to save him). Rather, this paper investigates the accessibility of the implicated premises involved in this pragmatic process (i.e., accessing the information that a lifebuoy or a basketball can be used to stay afloat).

inference that a basketball can be used to stay afloat. This pragmatic process of backwards inference would result in facilitation of unfamiliar but appropriate targets.<sup>5</sup>

World-knowledge plays an important role in Recanati's model of language interpretation. An active scenario could thus drive a pragmatic process of free enrichment in an automatic fashion (Recanati, 2004). However, because Recanati argues that only associative processes operate at the local lexical level, only the relevance-theoretic account could explain the facilitation of unfamiliar but appropriate targets by a process of backwards inference (Carston, 2002b; Wilson & Carston, 2006; Wilson & Sperber, 2002).

Regarding the late word processing measure, for those supporting the view that language interpretation is driven by world knowledge on the basis of associative mechanical processes (Recanati, 2004; Sanford & Garrod, 1981), integrating unfamiliar but appropriate targets (*basketball*) in the discourse representation would be, if not as disruptive as familiar but inappropriate targets (*newspaper*), at least more difficult than familiar and appropriate targets (*lifebuoy*). In other words, the same process of free enrichment that would be done fast and automatically in the familiar and appropriate condition (e.g., John's friend threw him a lifebuoy *to save him from drowning*) would disrupt the normal flow of processing in the unfamiliar but appropriate condition because inferential processes would have to operate at the local lexical level (e.g., in accessing the information that a basketball can be used to stay afloat). Because this process of free enrichment is pragmatically infelicitous in the familiar but inappropriate condition (e.g., a newspaper cannot be used to stay afloat) interpretation will also be disrupted in this condition, making a comparison viable with the latter two conditions.

According to the relevance-theoretic account, even though unfamiliar and appropriate targets might be primed to a lesser degree than familiar and appropriate targets in the early processing measure, the results of the late processing measure should reveal that integrating unfamiliar but appropriate targets is comparable to integrating familiar and appropriate ones. This would be the case because language interpretation is fundamentally inferential (Carston, 2002a, 2007; Wilson & Sperber, 2004): just as unfamiliar but appropriate targets may be primed through a process of backwards inference—even though they were not lexically primed—these targets should be integrated in the discourse representation without disrupting the interpretation process.

## Method

**Participants.** Seventy-three undergraduate students at Princeton University took part in the experiment, either for monetary compensation or for course credit. All participants were native speakers of English.

**Materials and design.** An extra passage was added to the eight critical passages that had been tested in Experiment 1A. These nine passages included an unfamiliar but appropriate target (*basketball*). Two new versions were made of each of the original passages, one including a familiar and appropriate target (*lifebuoy*), and the

<sup>5</sup>It is possible that a process of analogy between the type of standard life-preservers that would be expected in the situation (e.g., a lifebuoy) and a basketball might underlie the process of backwards inference that would result in the priming of *basketball*. It is important to note that a process of analogy is not the type of blind automatic associative process that could fall under Recanati's primary pragmatic processing.

other a familiar but inappropriate target (*newspaper*). An uninformed person rated the targets in terms of familiarity and appropriateness in the contexts. The results were as expected so no changes needed to be made to the materials. A set of 27 control passages were also constructed, one for each of the critical targets (for a full list of the control passages, see Appendix 2). In order to serve as an accurate baseline for facilitation, the target words in the control passages were unfamiliar (i.e., not lexically primed) and neutral with respect to the appropriateness manipulation. Finally, 10 filler passages were also constructed including a familiar and appropriate target. Some filler passages included more complex syntactic constructions as a manipulation of writing style. All passages were divided in 12 segments of 2–11 words each. Target phrases included 2–5 words, with the target being the head noun. The segments following the target phrases included 3–6 words, one of which was a verb.

The critical materials and the fillers were divided into three lists, each list including nine critical passages (three for each target type), plus the 10 fillers. A control list was also constructed, which included the 27 control passages, plus the filler set. Each target word appeared only once in each list. The control list was used only in the early processing measure. If all three targets had been of the same length and frequency in each passage, it would have been possible to make a direct comparison of their levels of activation for the early processing measure. However, because the targets differed along these dimensions, priming had to be established relative to a control condition where the targets appeared in a neutral context. Regarding the late processing measure, reading times for the segment following the critical targets could be compared directly since it was the same in each version of the passage.

Given that the control condition was only necessary for the early processing measure and the materials included a small number of critical passages (nine in total), Passage Type (i.e., Critical/Control) was manipulated between participants so that each participant would see as many critical passages as possible. In contrast, Target Type (i.e., Familiar and Appropriate/Unfamiliar but Appropriate/Familiar but Inappropriate) was manipulated within subjects.

*Procedure.* The set-up and the task in Experiment 1B were the same as in Experiment 1A. The only difference was that, instead of having to answer a world-knowledge question at the end of each passage, participants had to do a memory test at the end of the self-paced reading task. The memory test consisted of four passages, two of which had appeared in the previous test. Participants had to recognise those passages that they had read before. Participants were told about this memory test in the instructions to ensure that they would read the passages carefully.

Reading times for the target phrases and the following segment were recorded in the critical lists in order to establish an early processing measure and a late processing measure, respectively. In the control list used for the early processing measure, only the reading times for the actual target phrases were recorded. The onset for reading times was the presentation of the critical segment and the offset was the participant's response (i.e., pressing the space bar to see the next segment).

Participants were randomly allocated to one of the four lists of materials and evenly distributed between the critical and control lists, so that 36 participants were tested in the three critical lists (12 participants in each list) and 37 in the control list. It must be noted that because of the different lengths of the critical and control lists, the average RT for each participant and condition included a different number of items (three in the critical lists and nine in the control lists). Across lists, the first five passages consisted of fillers, which were presented in the same order to all participants and

served as practice. The rest of the passages were randomised individually and included critical and filler passages in the critical lists, and control and filler passages in the control list.

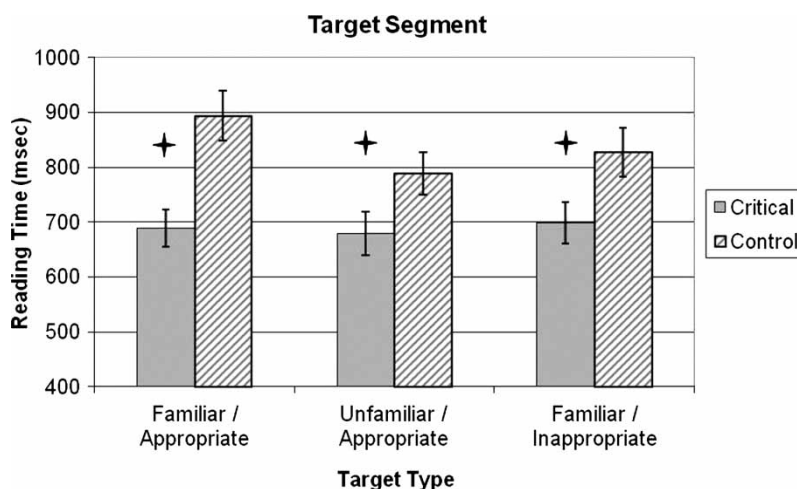
### Results and discussion

All participants performed satisfactorily in the memory test.

*Early processing measure.* Data points that were 2.5 Standard Deviations above a participant's average reading time for the critical segments were discarded as outliers (1.2% of data). Average reading times for the three target types in the critical and control passages, as well as the significance level of the facilitation (i.e., the difference between the critical and the control condition) are shown in Figure 1.

Familiar targets showed significant priming in the critical contexts (Familiar and Appropriate,  $t_1(71) = 3.59$ ,  $p < .002$ ,  $t_2(8) = 7.86$ ,  $p < .001$ ; Familiar but Inappropriate,  $t_1(71) = 2.19$ ,  $p < .04$ ,  $t_2(8) = 2.83$ ,  $p < .03$ ). Interestingly, unfamiliar targets were also processed faster in the critical than in the control contexts, with their level of priming being also significant [ $t_1(71) = 1.98$ ,  $p = .05$ ,  $t_2(8) = 3.56$ ,  $p < .008$ ]. A mixed Analysis of Variance (ANOVA) with participants ( $F_1$ ) and items ( $F_2$ ) as random variables revealed a significant main effect of Target Type by subjects,  $F_1(2, 142) = 4.38$ ,  $p < .02$ ;  $F_2(2, 24) = .595$ ,  $p = .56$ , and a significant main effect of Passage Type,  $F_1(1, 71) = 7.91$ ,  $p < .007$ ;  $F_2(1, 24) = 56.28$ ,  $p < .001$ . The corresponding  $3 \times 2$  interaction was significant by participants and marginally significant by items,  $F_1(2, 142) = 3.41$ ,  $p < .04$ ;  $F_2(2, 24) = 2.97$ ,  $p = .07$ .

Given their high cloze probability in the critical passages, familiar and appropriate targets could be seen as a sort of control for the other two target types. For familiar but inappropriate targets, a  $2 \times 2$  ANOVA revealed a significant main effect of Passage Type,  $F_1(1, 71) = 9.43$ ,  $p < .004$ ;  $F_2(1, 16) = 43.67$ ,  $p < .001$ . The Target Type  $\times$  Passage Type interaction was marginally significant,  $F_1(1, 71) = 3.68$ ,  $p = .06$ ;  $F_2(1, 16) = 3.34$ ,  $p = .09$ . For unfamiliar but appropriate targets, a  $2 \times 2$  ANOVA showed a significant main effect of Target Type by subjects,  $F_1(1, 71) = 8.12$ ,  $p < .007$ ;  $F_2(1, 16) = 1.13$ ,  $p = .30$ , and a significant main effect of Passage Type,  $F_1(1, 71) = 8.95$ ,  $p < .005$ ;



**Figure 1.** Average reading times ( $\pm$ SE) for the target segments and significance level of the facilitation ( $p \leq .05$ ).



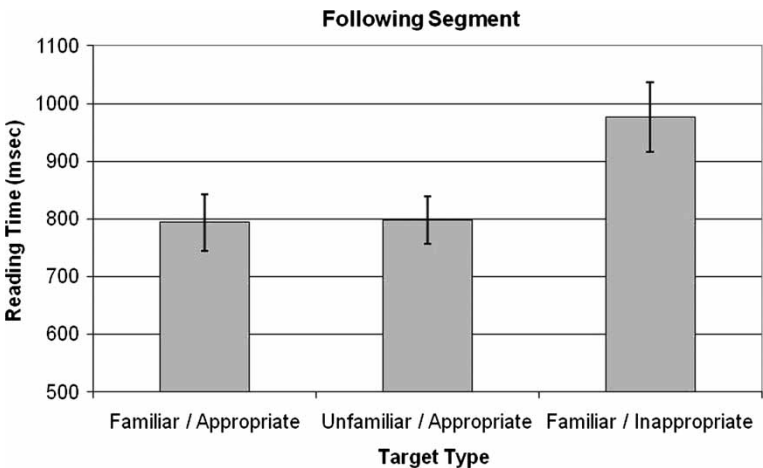
$F_2(1, 16) = 62.94, p < .001$ . The corresponding Target Type  $\times$  Passage Type interaction was significant both by participants and by items,  $F_1(1, 71) = 5.63, p < .03$ ;  $F_2(1, 16) = 7.19, p < .02$ .

The results of the second experiment confirmed the various experimental hypotheses that were investigated with the early processing measure. Both types of familiar targets (*lifebuoy* and *newspaper*) showed significant facilitation in the critical passages compared to the neutral control condition. Given that this priming was more likely to result from the activation of relevant world-knowledge structures than from intra-lexical priming, this result supports the view that schemata (and not only semantic associations) can affect spreading activation (Morris, 1994; Myers et al., 2000; Recanati, 2004; Sanford & Garrod, 1981; Williams, 1988).

Regarding unfamiliar but appropriate targets (*basketball*), the early processing measure also revealed a significant priming effect. Given that these targets were not part of the current scenario and therefore would not have been primed by an automatic process of spreading activation, this pattern of results supports the view that early inferential processes operate in parallel with associative processes. As with the priming of the other target types, the role of relevant world-knowledge would have been vital in allowing the readers to enrich their interpretation of the passages (e.g., *John's friend was throwing him a life-preserver*) fast enough to facilitate an early process of backwards inference. It is through this latter process that emergent properties (e.g., CAN BE USED TO STAY AFLOAT for *basketball*) would have been accessed, thus facilitating unfamiliar but appropriate targets. This pattern of results is most consistent with the Relevance Theory view of a unitary inferential pragmatic processing system (Carston, 2007), even though it highlights the importance of world-knowledge structures in language interpretation (Recanati, 2004).

*Late processing measure.* Average reading times for the segment following the three target types are shown in Figure 2.

The results clearly show that participants continued reading the stories at a similar pace after they encountered appropriate targets, whether familiar or unfamiliar. In contrast, participants slowed down when they had to integrate an inappropriate target in the discourse representation. A one-way ANOVA revealed a significant main effect of Target Type,  $F_1(2, 70) = 6.08, p < .005$ ;  $F_2(2, 16) = 4.23, p < .04$ . Using again the



**Figure 2.** Average reading times ( $\pm$ SE) for the segment following each target type.

Familiar and Appropriate condition as a control, pairwise comparisons reveal a significant difference with the Familiar but Inappropriate condition,  $t_1(35) = 2.60$ ,  $p < .02$ ,  $t_2(8) = 3.32$ ,  $p < .02$ ; but no significant difference with the Unfamiliar but Appropriate condition,  $t_1(35) = .110$ ,  $p = .91$ ,  $t_2(8) = .065$ ,  $p = .95$ .

The results of the late processing measure offer even stronger support to the relevance-theoretic account, with the integration of unfamiliar but appropriate targets in the discourse representation not disrupting the normal flow of interpretation. Processing the segment following the critical targets was comparable in the two appropriate conditions, with only inappropriate targets showing longer reading latencies. The results of the late processing measure are particularly remarkable if we take into account that the initial level of activation of familiar and appropriate targets (*lifebuoy*) was significantly higher than that of unfamiliar but appropriate targets (*basketball*).

Regarding the validity of these results, eye-tracking studies offer a wider range of reading measures than self-paced reading tasks, with potentially more accurate and generalisable results. However, there is evidence that self-paced reading tasks can produce similar results to eye-tracking experiments, with these techniques being often combined (see Calvo & Castillo, 1998; Calvo et al., 2001; Traxler et al., 2002). Rayner (1998) argues that eye-tracking and self-paced reading studies are more likely to show similar results if processing is disrupted during reading (e.g., in resolving syntactic ambiguity). Given the potential disruption of normal processing by both unfamiliar and inappropriate targets, the materials used in this study should offer accurate results with a self-paced reading technique. A pattern of results that supports this view is the significant difference between familiar and appropriate targets (*lifebuoy*) and familiar but inappropriate targets (*newspaper*) in the late processing measure. If the self-paced reading technique was sensitive enough to pick up this difference, it should have also detected any significant difference with unfamiliar but appropriate targets (*basketball*).

## GENERAL DISCUSSION

The results of the present study support the view that the effective context for priming is the propositional representation of the utterance (Foss & Ross, 1983; Norris et al., 2006; Williams, 1988). Target words were facilitated when they were part of the current scenario accessed in interpretation, supporting the view that world-knowledge structures play a fundamental role in language processing and interpretation (Recanati, 2004; Sanford & Garrod, 1981). However, the activation of schemata did not result in exhaustive, uniform priming of the targets, with contextual relevance modulating their accessibility from early on in processing.

Emergent properties were not generally derived through a blind chain of automatic associations, but rather through inferential processes that operate in a context-sensitive manner. These inferential processes, combined with automatic associative processes, resulted in the facilitation of the corresponding targets, even if to a lesser degree than more familiar targets. I therefore conclude that inferential processes are fully integrated in the processing system, operating not only at the global level of the utterance but also at the local lexical level (Carston, 2002a).

The fast activation of emergent properties observed here in instances of pragmatic enrichment should be relevant for research on two other areas of lexical pragmatics; namely, metaphor interpretation and conceptual combination. The accessibility of emergent properties is a crucial question for models of metaphor interpretation since

the properties predicated of the metaphor topic are often not directly associated to the metaphor vehicle (e.g., *Mary is a block of ice*; see Bowdle & Gentner, 2005; Jones & Estes, 2005; Glucksberg & Haught, 2006; Wilson & Carston, 2006). Likewise, in conceptual combination, emergent properties that apply to the combined phrase are often not activated by either of the two concepts alone (e.g., WHITE for *peeled apples*). Previous research in this area has found that emergent properties are also activated very rapidly in conceptual combination (Glucksberg & Estes, 2000; Springer & Murphy, 1992; Swinney, Love, Walenski, & Smith, 2007).

The results of this study strongly suggest that the language interpretation process is uniformly inferential, rather than it being divided into two distinct modes of processing. Integrating unfamiliar but appropriate targets in the discourse representation did not interrupt or delay processing, with comparable late processing measures being observed for all appropriate targets, whether familiar or unfamiliar. The results of this study therefore support the Relevance Theory view of a unitary processing system that treats all pragmatic processes as uniformly inferential (Carston, 2004, 2007; Wilson & Sperber, 2004), rather than a distinction between primary and secondary processing (e.g., Recanati, 2004; Sanford & Garrod, 1981).

Recanati (2007) adopts a somewhat more moderate position in that local processes such as pragmatic enrichment may involve consideration of speaker's intentions in some cases, although not necessarily [see Carston (2007) for an in-depth discussion of the sort of problems that Recanati's original account faced]. What the present investigation of emergent properties adds to this view of local pragmatic processes is that, even in those cases when they do involve inferential processing, local pragmatic processes do not disrupt the normal flow of interpretation. In this respect, given the speed and efficiency of these inferential processes, it is likely that they are the norm rather than the exception. It seems therefore legitimate to question whether it is informative to describe local pragmatic processes as purely associative, when they may still operate in an inferential manner without overloading the interpretation process.

One way in which Recanati's model might be able to accommodate the present results is if associative and inferential processes did not operate sequentially at the local lexical level but rather in parallel; that is, if associative processes did not have to fail in order for inferential processes to be triggered. The mutual parallel adjustment of explicit and implicit meaning (a notion that Recanati adopts from Relevance Theory; see Wilson & Sperber, 2004) would indeed allow interpreters to understand passages such as the ones that were used in this study. Thus, participants seemed to have no trouble understanding why John's best friend threw him a basketball when he was drowning but were puzzled when he threw him a newspaper; even when it had been mentioned that there was a newspaper in the scene. It therefore seems that the global implication that John's friend was trying to save him to some extent drives the search for relevant properties at the local conceptual level.

It seems plausible, especially in view of the present results that associative and inferential processes do operate in parallel at the lexical level, in an interactive way analogous to the mutual parallel adjustment of explicit and implicit meaning. However, this view seems to be more akin to the Relevance Theory account than to Recanati's, given that, in the former, associative processes do the groundwork for inferential processes, whereas in the latter, associative processes are supposed to do the very job that Relevance Theory posits inferential processes to do—at least at the local level. In this sense, Recanati argues that “the smartness of an inferential system can be implemented in a dumb associative system” (2007, p. 52).

It is unclear how associative and inferential processes could operate in parallel at the lexical level if the dominant mode of processing was the associative one. If a local pragmatic process of free enrichment, for example, is usually derived by mechanical associative processes (as when John's friend throws him a lifebuoy *to save him from drowning*), but it may also be derived inferentially (as when John's friend throws him a basketball), it is unclear how these two processes could systematically operate in parallel if one is the norm and the other is the exception. On the other hand, if they operate in parallel rather than sequentially but only in certain contexts where inferential processes are required at the local level, then it remains to be explained what triggers the operation of inferential processes in such contexts (assuming, again, that it is not the failure of mandatory associative processes to derive a satisfactory interpretation). In contrast, in the relevance-theoretic framework, associative processes feed into and interact with inferential processes in all instances of language interpretation.

In conclusion, the results of the present study suggest that associative and inferential processes are integrated in a unitary system rather than reflecting a division of labour corresponding with two different levels of meaning, the explicit and the implicit.

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# APPENDIX 1: CRITICAL PASSAGES INCLUDING THE DIFFERENT TARGET PHRASES IN BOLD (FAMILIAR AND APPROPRIATE/ UNFAMILIAR BUT APPROPRIATE/FAMILIAR BUT INAPPROPRIATE) FROM EXPERIMENT 1B AND WORLD-KNOWLEDGE QUESTIONS FROM EXPERIMENT 1A (RELATIVE TO THE UNFAMILIAR BUT APPROPRIATE TARGETS)

- John went to the public swimming pool every afternoon. He spent most of his time there reading the papers. He didn't know how to swim, so when he fell into the water, his best friend threw him **a lifebuoy/a basketball/a newspaper** and then just waited by the side of the pool. John was expecting a bit more help.

Can a basketball be used to stay afloat?

- Peter woke up early and decided to go down to the kitchen to have some cereals before going to school. Unfortunately, he spilled milk all over the kitchen table. He didn't want his mother to know, so he cleaned up the mess **with a dishcloth/with his scarf/with his bowl** and left for school. He wasn't surprised when his mother asked him about the episode.

Is it possible to use a scarf to wipe up milk?

- Mary went to a new hairdresser on Monday. They gave her a nice haircut, but it was very expensive. When she was paying, it started raining heavily. Once out on the street, she opened **her umbrella/her magazine/her purse** and ran to her car. Unfortunately, she was soaked by the time she got into the car.

Is it possible to use a magazine to protect oneself from the rain?

- Lucy's grandmother was giving a big party tonight. She was cooking several dishes and baking bread. Now she was taking a break sitting at the kitchen counter. Lucy wanted to help, so she started working the bread dough **with a rolling pin/with an empty bottle/with an empty stool** and preheated the oven. She was full of ideas when it came to cooking.

Can an empty bottle be used as a rolling pin?

- Linda needed to buy some make-up, so she went shopping during her coffee break. When she came back to her office, she wanted to put on her new mascara but she realized she had left the window open and there was a strong draft. To prevent the letters on her desk from flying around, she tried to use **a paperweight/a banana/a lipstick** as fast as she could, but it was too late.

Can a banana be used as a paperweight?

- Lee was renting a small room without a window. There was almost no space for all his technical drawing equipment, but the house was very close to the company where he was working as a draftsman. Whenever he wanted to air the room, he would prop the door open **with a doorstopper/with a dictionary/with a compass** even though it was noisy outside.

Is it possible to use a dictionary as a doorstopper?

- Claire was redecorating her apartment. She wanted to change the lighting and put a few more plants around the place. She started by putting brighter spot lights over the kitchen table. She wasn't very tall, so she had to use **a chair/a suitcase/a cactus pot** and try to keep her balance. Changing the light bulbs in the living room was even more difficult.

Is it possible to stand on a suitcase to change a light bulb?

- It was so hot and humid that summer, that Fred spent most nights awake. He had to drink water regularly and change into a dry t-shirt every so often. There were lots of insects in the room, so he would spend his waking hours trying to get rid of the mosquitoes **with a fly spray/with a comic book/with a glass of water** and concentrate on ignoring the heat. Nights felt very long that summer.

Can a comic book be used as a fly swatter?

- Emily was travelling around Asia as a backpacker. Her budget was low, but now she was running out of money, so she had to stay in the cheapest possible places. The bathrooms were always very basic, sometimes they wouldn't even have a shower. Whenever she wanted to fill up the sink, she would have to use **her drain stopper/her own raincoat/her dollar bills** and sponge wash. Anything, as long as she could freshen up after a long day of hiking.

## APPENDIX 2: PASSAGES IN THE CONTROL LIST OF EXPERIMENT 1B WITH TARGET PHRASES IN BOLD

1. John and his wife loved their house. They had a large garden and in summer they would often throw garden parties for their friends. It was two years ago when John and his wife finally got **a life-preserver** for their swimming pool. Now they couldn't find it anywhere.
2. Peter and his parents had moved to a new city last year. It had been hard at the beginning, but Peter was getting used to all the changes by now. Since he made new friends three months ago, Peter had been trying to get **a basketball** so they could all play together. His father wouldn't listen to him.
3. Since she lost her job, Beth's life had become very boring, although she was desperately trying to stick to a routine. On Tuesday mornings, for example, Beth would usually go out to buy **a newspaper** to look at the job listings. She had been looking for a job for six months.
4. Tom had started to have problems with his memory. This worried him since his father had suffered from dementia in his old age. Tom could remember how his father had also started to forget things at some point. Yesterday evening Tom entered the living room **with a dishcloth** in his hand. He couldn't remember what he was going to do with it.
5. Jeff was reading for his exams but he had started too late so he was trying to wake up early every morning and do some work before school. Jeff was running late this morning, so he arrived at school **with his scarf** and his gloves inside his bag. Now he was afraid he might have caught a cold.
6. On Friday evenings the whole family would have dinner together. They would often have home-made pizza since that was a family favourite. One Friday night, when everybody had finished eating, little Harry went up to his mother **with his bowl** and asked her for some porridge. He was a really good eater.
7. It had been a long day at work. It was as if all the deadlines were coming up at the same time. As soon as she came out of the lift, Mary realized that she had lent **her umbrella** to one of her colleagues, so she would have to buy a new one tomorrow. It had been raining for two days.
8. Diana was sharing an apartment with three other students. They all had their lectures in the morning, apart from Diana. One Monday morning, while she was having breakfast alone, Diana was having a look at **her magazine** and listening to the radio at the same time. She loved reading about fashion and hearing the news.
9. Fiona was terribly absent-minded. Her friends would often tease her about that, since they all had witnessed one episode or another. This week, when Fiona went to the dentist, she couldn't remember where she had put **her purse** so she had to borrow money from her husband. It was the second time this week.
10. Somebody had broken into Louise's apartment on Thursday night. The burglar had ran away when Louise came home. Before phoning the police, Louise had managed to hit the burglar in the head **with a rolling pin** that she found in the kitchen. Her neighbor was there as soon as he heard the noise.
11. Every time Pam travelled to Florida, all her memories from her childhood would come back to her. Pam was only a little girl that summer when she was playing on the beach and hurt herself **with an empty bottle** that somebody had left there. She remembers she rushed home to her mum.
12. Greg went out for dinner with Kate. He had suggested his favourite restaurant but forgot to make a reservation and now they were told they would have to wait for an hour. They even had to ask the waiter to come **with an empty stool** to the bar, since all the seats were taken.
13. Liz seemed to have a collection of everything. Rare editions of French novels, China bowls, old coins and stamps, book markers and African masks. They lived in a large apartment, but after the years, it started getting crowded with all her stuff. When they moved out of their apartment, the first thing that Liz packed was **a paperweight** from her desk. It took her a few days to put everything in boxes.
14. Phil had failed three modules last year and his parents were very disappointed. That is why he had tried to be more disciplined this year. The exams were now approaching and he felt he had succeeded in his resolution. Before he entered the examination room, Phil decided to have **a banana** so that he wouldn't be hungry for a while. It was going to be a pretty long exam.

15. Jane had been considering getting a divorce for some time now. She knew her husband was having an affair and she couldn't trust him anymore. He kept promising that things were going to change but they never did. One day, Jane was emptying the pockets of her husband's jacket when she found a **lipstick** and a set of keys. She was sure he would make up another one of his stories.
16. Fred and his little brother were the best of friends. They would always play together and would never fight. Their parents were happy to have such good kids. One day Fred was playing with his brother. They made a ramp for a toy car **with a doorstopper** and a little garage with a shoe box. Now they could play for hours.
17. Meg liked to study with her friends. At school, they were encouraged to study in groups so that they could help and motivate each other. When they were revising for their finals, Meg would always come **with a dictionary** in case they didn't understand some word in the textbook. It proved to be a very useful idea.
18. Luke was attending a new school this year. They had a very innovative curriculum and he felt that he was learning a lot. This semester he was learning how to play guitar. The following semester Luke would learn how to draw **with a compass** as part of his technical drawing course. He was looking forward to it.
19. Matthew had decided that over the next five years, he would refurbish his house. The project involved tearing down one of the walls in his bedroom and building a bathroom where the guest room was now. When the sales started, Matthew bought himself a **chair** and a leather foot rest. He had always wanted to have a quiet corner to study.
20. Laura had been busy trying to help her best friend organize her wedding. She had always thought that people exaggerated when they said that planning a wedding was a lot of work, but now she could see there was some truth in it. Laura didn't expect to get home to find a **suitcase** in the hallway. As always, her brother had arrived unannounced.
21. Shops these days are usually well stocked, but sometimes markets are still the best place to go if you are looking for something special. When he moved to London, Mark decided to go to the market when he couldn't find a **cactus pot** to put in his new balcony. Columbia Road was the oldest flower market in London, so it was also a landmark.
22. Paul had taken a risk when he got together some friends from two different groups one evening. Conversation had started to decay over dinner and every now and then there would be an uncomfortable silence. To entertain his friends, Paul started juggling **with a fly spray** and two cans of cat food. Nobody was too impressed.
23. Bob had always been envious of those people who could sleep on planes. His own brother could even sleep through bad turbulence and arrive at his destination as fresh as if he had slept in his own bed. Bob would always go on long distance flights **with a comic book** and a few crosswords. He usually didn't like the films they showed.
24. Having children was a full-time job for Martin. Just getting them ready for school took him almost two hours every morning. But he was very patient and never lost his temper. Before putting the children to bed, Martin would come to their room **with a glass of water** and a couple of books to read. He was a very good father.
25. Sylvia was a very organized person. She always planned everything well in advance and every time she had to organize something, she would go around with long to-do lists even though she had a very good memory. Whenever she went on holidays, Sylvia would always travel with **her drain stopper** because of that one time when she couldn't fill up the sink because it didn't have one.
26. Margaret had decided to spend her gap year working for an international NGO. They had to receive training before travelling abroad because they were going to be living in very hard conditions. The organizers had told the volunteers to try to be prepared, but when Margaret got to the Children's Village, she even wanted to donate **her own raincoat** and sunglasses. She was shocked by all the poverty.
27. Since she was the youngest of four sisters, Sam had always inherited all her clothes and toys from her sisters. Her bike was now too small for her but her mum had told her that she would have to wait for one more year until she could get another one. For the last three months, Sam had been keeping all **her dollar bills** in a small box hoping that she could save enough money to buy a new bike.