

# The Goldilocks Scenario: Is Noun-noun Compounding Compositional?

*George Dunbar*

The psychological literature on concept combination has taken as its main focus the study of noun-noun (NN) combinations. Other types of combination, such as adjective-noun, or verb-argument combination, have been less frequently studied, though by no means ignored (e.g. Smith et al., 1988; Levin & Pinker, 1991). Nevertheless, NN combinations have often been taken as the paradigm of combination.

Existing models of the cognitive processes involved when a hearer interprets a novel NN combination emphasise the construction of an interpretation from the concepts associated with the constituent nouns. That approach offers the promise of a compositional account. In contrast, this paper shows that novel NN combinations cannot be interpreted reliably from the constituent nouns without contextual support. More than that, the paper argues that it is important to understand NN combinations from the speaker's perspective. The successful production of a novel, or just unfamiliar, NN combination requires the speaker to allow for the addressee's current knowledge.

Wisniewski (1997) provides one of the most precise cognitive models of the interpretation of NN combinations. Wisniewski classifies three types of NN combination in English: relational, property and hybrid. He claims that relational combinations are understood by an augmented version of the schema modification process described in Cohen and Murphy (1984). In this process, the modifier (the noun in the first position in the combination) occupies a slot in a scenario, with the scenario typically being part of the conceptual representation of the other noun. Both other types of compounding involve a two-stage process. First, comparison notes areas of similarity, and consequently difference. The differences provide candidates for the property to be provided by the modifier, the areas of similarity provide a potential aspect of the second noun upon which the property can be applied. The actual property transferred is elaborated or instantiated by context in a second processing stage. Central to

---

*Address for correspondence:* University of Warwick, Coventry, CV4 7AL, United Kingdom.

*E-mail:* G.L.Dunbar@warwick.ac.uk.

Wisniewski's theory seems to be the view that NN combinations are largely self-contained, a function largely of "knowledge in the constituent concepts themselves" (1997, p. 174), and, although he acknowledges that discourse context may influence the process, its role is not elaborated. The self-contained view is held also by Shoben and Gagne (1997), who conclude that relational interpretations of NN combinations, the type they argue is most normal, are constructed by the hearer using knowledge of the kinds of relationship a noun has tended to contract with other nouns in the past to bias the interpretation of an innovative combination towards one employing the most frequent of those relationships again.

Much of Wisniewski's evidence comes from the definitions participants give to novel combinations presented in isolation. He shows, for example, that they can provide property mapping as well as thematic interpretations (Wisniewski, 1996, Experiment 1), that this is more likely when the Ns are more similar (Wisniewski, 1996, Experiment 2), and that it can occur even when plausible thematic interpretations are potentially available for a particular NN combination (Wisniewski, 1998). The choice of novel combinations is important, because there are difficulties with using established combinations experimentally (Hampton, 1997; Rips, 1995; Wisniewski, 1996). For example, established combinations may be interpreted simply by retrieval, having been learned. However, there are also difficulties in using null contexts to study combinations. First, the assumption that "listeners have little trouble comprehending them" (Wisniewski, 1998, p. 177) is not always borne out for innovative language in other settings. For example, Gerrig (1989) found high error rates on meaning paraphrase judgements in a study of lexical innovations in which each innovation was preceded by a context-setting paragraph designed by the experimenter to make the interpretation determinate. Second, although the very notion of a null context is, of course, theoretically dubious (Crain & Steedman, 1985), there is evidence that processing innovative language without explicit context is qualitatively different from processing it with context (Gerrig & Healy, 1983). Third, a crucial difference between laboratory studies of novel NN combinations presented in isolation and real-world lexical innovation is that in the latter case there is an intended meaning.

The conjecture explored in this paper is that the need to convey an intended meaning, rather than only the ability to construct a plausible interpretation, is key to understanding NN combination in English. NN combination is primarily something the speaker does with the hearer in mind, rather than the converse.

Pragmatic approaches to language understanding contrast with the self-containment view in key respects. Relevance theory (Sperber & Wilson, 1986) develops a pragmatic account of communication which emphasises the role of the speaker in selecting the linguistic stimuli that will lead the hearer to the

intended meaning readily. The key to this is what is termed the Principle of Relevance (p. 158): the presumption that acts of ostensive communication are optimally relevant. This principle plays roughly the role that the Cooperative Principle and maxims play in Grice (1975) – indeed, one of Grice’s maxims, the Maxim of Relation, was “be relevant”.

Optimal relevance has two components. First, for a stimulus, such as a phrase, to be optimally relevant, the level of contextual effect achievable is never less than enough to make the stimulus worthwhile for the hearer to process. Contextual effects, implications and changes in the strengths of beliefs (termed assumptions), are effects deduced from the union of the new information in the stimulus and the context, but not deducible from either alone. The second component of optimal relevance is that the level of effort required is never more than needed to achieve these effects. Sperber and Wilson (1986) argue that from optimal relevance it follows that the stimulus chosen to communicate will be the one that requires the least processing effort to make the speaker’s particular informative intention mutually manifest. They further argue that as a consequence of this, the first interpretation recovered by the hearer that is consistent with the belief that the speaker intended this interpretation will be the intended interpretation. This follows because speaker and hearer share the presumption that such stimuli will be optimally relevant, the Principle of Relevance. The implication is that a speaker, taking into account his understanding of his interlocuter’s beliefs, should select a stimulus that leads to the correct interpretation first – if the first interpretation reached were not the correct one, then he should have chosen a different stimulus, for example by adding explicit information.

Clark and Clark (1979) describe a general theory of innovative language, illustrated with a detailed empirical study of denominal verbs. Their theory is essentially a pragmatic one. They analyse denominal verbs as “contextuals”, expressions whose sense is dependent upon context, in an analogous way to the dependence of indexicals upon context for their reference. Just as the reference of a deictic expression like *now* varies infinitely, according to the time of utterance, they claim the sense of a denominal verb like *Houdini*, as in “Tom can houdini his way out of almost any scrape”, will vary infinitely according to the mutual knowledge of the speaker and hearer (the knowledge speaker and hearer know they share), especially their knowledge of the original nominal – in this case the proper noun *Houdini*, a well-known escapologist. Any mutually known property of *Houdini* could be the basis for the denominal verb, as long as the speaker “... has good reason to believe... that on this occasion the listener can readily compute... uniquely... on the basis of their mutual knowledge...” the intended denotation (Clark & Clark, 1979, p. 787). They explicitly relate this convention to the Cooperative Principle (Grice, 1975).

Elements of category knowledge with high cue validity, termed predominant

features, play a special role, for Clark and Clark, in denominal verbs that move beyond the status of transient innovation to become established in the language. When a predominant feature is its basis, then a new term will be interpretable by the whole linguistic community, since this is knowledge they all share. This is, however, just a special case. In different contexts, features which are not predominant, or indeed knowledge which is not generic, may be more salient, and “the listener must decide which of the possible senses is most salient” (ibid., p. 795). Clark and Clark suggest that the main reason for denominal verbs is economy of expression, although they also cite, as rhetorical advantages derived from economy, precision, vividness, and surprise, surprise being useful for example in humour.

Clark and Clark’s approach is similar in spirit to Relevance theory, although there are some differences, and both contrast with the self-containment theories in their emphasis on the role of cooperative and coordinated activity by both speaker and hearer. The self-containment approach emphasises NN combination as a problem for the listener.

It is clear that, on the pragmatic account, the notion of an interpretation in isolation from any context is defective. We would predict from this that readers presented with novel stimuli in isolation will experience difficulty both because they cannot make the presumption of optimal relevance, since they have no evidence of intentionality, and because they therefore have no basis for differentiating the intended interpretation from any conceivable interpretation. As Sperber and Wilson (1986) point out, the number of possible interpretations is uncountably infinite.

The studies which will be described in the paper were designed to investigate these questions. The first was a case study of a particular innovative combination, Goldilocks economy, examining the way it is used, and the ways usage changed longitudinally. The second study was a simple experiment to see whether this innovative combination could be interpreted in isolation by participants who had not yet encountered it, even if they were familiar with its constituent nouns. It was found that (a) when used, the phrase was often explicitly defined by the speaker; and (b) participants in the experiment were typically unable to provide the correct interpretation given the phrase in isolation. The results are discussed in relation to their implications for the view that noun-noun compounding is compositional, and in terms of the communicative function of innovative compounds.

## **1 The Corpus Study**

A corpus was constructed consisting of the text of two daily financial newspapers (the Wall Street Journal (WSJ), Jan 1991 – July 1998, and the Finan-

cial Times (FT), Jan 1992 – July 1998). A search located 192 occurrences of *Goldilocks* in 137 economics articles in the WSJ and FT.

The earliest use observed, *Goldilocks syndrome*, occurs in the first half of 1992 in the WSJ. There is then a gap of 18 months before the next, *Goldilocks economy*. Most articles provided an explicit definition of the term, where the meaning of the phrase was amplified paratactically. It is not obvious why that should be necessary if the meaning of a compound can be reconstructed from its component nouns. More specific evidence that the motivation for giving definitions was pragmatic comes from a change in the pattern over time. Definitions were much more common in the early period, and were less frequent later. Prior to July 1997, 86% of uses in the FT carried an explicit definition, but after that date only 63% did. The difference was statistically significant. Again, this would be expected on a pragmatic account. As time passed, more people would have become familiar with the term, and could be relied upon to know what it meant on the basis of prior knowledge. As time went by, then, the person producing the term could have greater confidence that it would be understood without recourse to a definition.

To examine the relationship between individual writers and definitions, FT articles where a single reporter was credited as author were identified (a column called “Lex” was also included). There were 30 such writers. They were divided according to the date of publication of their first *Goldilocks* article – 15 publishing it before 1.7.97, 15 after. Of those in the earlier group, 87% included a definition in this debut article, compared to 40% in the later group, a statistically significant difference. These results provide evidence consistent with the hypothesis that definitions are provided when it seems more likely to the writer that the term will be new or unfamiliar to the reader. As the term becomes established in a community, definitions are less likely to be provided. Cogent additional evidence comes from six readers’ letters published in the FT which used the term. None provided an explicit definition. In each case, the letter was a response to an article in which the term had been used. Understanding of the meaning of the term can therefore be taken by the letter writer to be part of the common ground or mutual understanding upon which interpretation of the letter is to be based (Clark & Marshall, 1981). This is evidence that the motivation for giving definitions is indeed pragmatic.

The definitions can be considered as falling into two groups, which I will term hints and explanations. Hints were variations on the “not too hot and not too cold, but just right” slogan, the phrase *Goldilocks* is fabled to have uttered upon finding a bowl of porridge that she liked, including substitutions of fast, slow, weak or strong, and order variations. Hints were common, constituting 68% of definitions in the WSJ and 30% in the FT.

Hints indicate that the meaning relates to an optimal configuration of some

parameter, but do not provide a mapping from the vehicle (the heat of porridge) to the topic. Implicitly, the mapping is to the economy considered holistically, and this is not difficult for a reader because it is conventional among people who live in market economies to apply metaphors of heat, speed, and strength to the economy (Lakoff & Johnson, 1980). In a sense, the hint is just indicating which of Goldilocks' stereotypical properties is to be transferred, with mapping and instantiation left as the beholder's share (cf. Wisniewski, 1997). However, although the interpretation achieved from a hint by simply instantiating the heat, or strength, of (a token of) the economy with an optimal middling value may be sufficient for many purposes, it is conceptually vague. As we shall see shortly, a more specific understanding is possible.

Explanations provide a more explicit mapping onto features of an economy. A particularly frequent type is illustrated by the phrase "modest growth but not enough to fuel inflation" (WSJ, 5.8.96). One of the curious things about this dataset, however, was the wide variation in the features identified in explanations.

Example explanations of *Goldilocks economy* found in the corpus:

1. low inflation and steady growth
2. low inflation, low unemployment and a soaring stockmarket
3. one in which the bears are kept at bay
4. not too cold for the unemployed, not too hot to cause inflationary pressures
5. the miracle combination of negligible inflation and very high levels of capacity and manpower utilization
6. a 'just right' combination of stable interest rates and healthy economic growth

One more aspect of the corpus data poses a difficulty for accounts that rely on composing the meaning of a compound from component nominal concepts. Although clearly the same concept is being referred to, across usages the actual head noun used varies. Head nouns included: *Goldilocks economy*, *scenario*, *recovery*, *vision*, *growth*, *era*, *story*, *phase*, *period*, *expansion*, and *spin*. The first two were by far the most common manifestations, and some of the others appeared only once in the corpus. Nevertheless, if the calculation of the meaning of the compound rests primarily on a process of construction from the conceptual elements of the constituent nouns, how can it work to vary the constituent nouns and still have the same result?

## 2 The Experiment

One implication of the pragmatic account is that the expression *Goldilocks economy* will not be interpretable by an intelligent reader in isolation. Or, rather, an intelligent reader could not be expected to alight upon the intended interpretation reliably. Experiment 2 tests this by asking participants to define the term. We predict that although participants may be consistent among themselves, as Wisniewski has reported in a number of studies with other NN combinations, they will not reliably pick the “correct” interpretation. In addition, they will not be confident about their definition because they will realise that they have insufficient information.

Seventeen undergraduate students participated for course credit. They were asked to evaluate both familiar and novel combinations, and afterwards the individual constituent words. They indicated their familiarity with each term on a scale from zero to five. The endpoints were labeled “Completely new to me” and “Very familiar”, respectively. Second, they were asked to write down what they believed the expression meant. Third, they were asked to rate their confidence in their definition on a scale with endpoints, zero and five, labeled “Just guessing” and “Absolutely certain – that’s definitely what it means”. The task typically took around 15 minutes.

Confidence and familiarity were both low for novel combinations such as *Goldilocks economy*, see Table 1. In contrast, high ratings were returned for the constituent words, and for familiar combinations, such as *fire drill*.

## 3 Conclusion

The two studies briefly described generated a number of results not predicted by traditional approaches to NN compounding that construct the meaning of the combination from the component nominals. In the experiment, consistent with predictions of the pragmatic approach, participants could not construct accurate interpretations of an unfamiliar NN compound out of context. Moreover, as predicted, participants were not confident about the interpretations they did make. The corpus study found that writers commonly provided definitions when using a novel NN compound, but were less likely to include a definition once it became increasingly likely that the reader would be familiar with the compound. Indeed, when the novel compound was used in a letter responding to an article in which the compound had been used, definitions were never given. Moreover, the constituents of the compound varied through the corpus, though obviously the same concept was being denoted. These findings challenge the notion that the meaning of NN compounds can be reliably composed from the meanings of

<b>Familiarity</b>	<b>Definition given</b>	<b>Confidence</b>
0	The ideal state for an economy to be in.	0
0	Economy where people are all taking advantage of each other.	0
0	A type of economy, sounds like a positive term.	0
0	Blonde blue collar workers.	0
0	An economy where people's valuables are shared.	0
0	Uncertainty or lies in economy.	0
0	An economy which is careful in its approach to money matters.	0
0	An economy which has become 'just right' through trial and error.	2
0	An economy heavily dependent upon others.	0
0	A not very stable economy.	0
0	The economy is impatient and eager / greedy (as in the story).	0
3	An economy which is 'just right' after experimenting with others.	2
2	Take what you want.	0
0	An economy in which people can use others' possessions for free.	0
0	An economy which borrows or takes money from other sources.	0
0	[no definition offered]	0
0	Where people in business prosper due to relying / taking ideas etc. off other people.	0

Table 1: Participant responses to *Goldilocks economy* out of context.

the constituent concepts. The results are more readily understood in pragmatic terms.

Earlier laboratory research has found that people are able to interpret unfamiliar compounds. However, those studies have used completely novel compounds, with target meanings determined without reference to an external standard. There was then no true normative standard to which results could be compared. The experiment presented here has the advantage that the “correct” meaning is known, it is simply not known to participants. With this essential addition, we can now see that whatever constructive cognitive operations participants apply in the laboratory tasks, they are not sufficient to guarantee accurate communication. Participants certainly could construct an interpretation. Indeed, I would go further and say that several constructed quite similar interpretations to one another. For example, several interpretations described the *Goldilocks economy* as one that appropriated goods, perhaps unfairly. This interpretation is entirely reasonable, and could well have been the intended interpretation. To this extent, the data is consistent with previous laboratory research. However, it just was not the intended interpretation. What has been shown, then, is that, even when participants can construct an interpretation consistently, out of context, it may not be the intended interpretation.

The earlier laboratory studies, because they did not emphasise pragmatic aspects of communication as strongly, neglected a phenomenological aspect of NN interpretation to which this experiment has also drawn attention. When someone understands language, there is an associated feeling of confidence. This experiment has shown that that feeling is almost completely absent when participants attempt to understand an unfamiliar NN compound out of context. Not only were participants not in a position to know what the intended interpretation was, they knew that they didn’t know.

Two further features of the definitions given in the newspaper corpus are important because they cast new light on the functional properties of NN compounds. The first striking observation is that writers would use both an NN compound and a definition. From a pragmatic perspective this is quite surprising, because it appears to go against principles of economy of expression. Why did the writer not simply give the definition? For example, instead of saying “... you’ve got a Goldilocks economy – not too heated or too weak” (J. Manahan, quoted in WSJ, 11.3.98), why not say “you’ve got an economy that is not too heated or too weak”? It appears that the NN combination serves to label a new phenomenon, a new phenomenon that needed a new name. By providing a label, the speaker identifies to the addressee that there is something to be labeled afresh. The new label makes a claim for the attention of the addressee of a particular kind. It invites the addressee to begin to form a new, (crucially) shared, concept. This is different from the usual way of analysing the meaning

of novel NN compounds. Novel NN compounds are usually analysed as denoting a meaning, in the same way that a noun does. Here we are arguing that novel NN compounds in some cases can be understood as naming a concept.

The second feature is the variety of different explanations of the *Goldilocks economy*. These explanations draw attention to different features of an economy in this state, including specific relationships between employment, inflation, stock-market investment, growth, productivity and international capital flows. On the one hand, these different explanations illustrate the way that a complex concept such as this can be approached from different perspectives. In the context of personal investment advice, some aspects will be relevant, and from another perspective, such as interest rate policy, a different, perhaps intersecting, subset of aspects will be most relevant to mention. However, it is also clear that there is more to it than that. The phenomenon of the benign equilibrium of the US economy in the 1990s was not conclusively and definitively characterised. Different people mentioned different features sometimes because they understood the economic basis for the phenomenon in different ways. It was the work of economic theory, lay and professional, to try to work out the concept, to explain what was happening. In short, the concept to which the phrase *Goldilocks economy* pointed was not fully worked out, and the variety of explanation occurred as part of the process of working out the shared concept over time. In analyses of NN compounds, it is easy to assume that the target concept can be defined fully, and to develop models to construct this target. In contrast, the data from this study suggest that the concept initially generated may be relatively underspecified, and yet be communicatively complete. Conceptual flesh is added from background knowledge of the world, and this knowledge can be a work in progress.

One view of NN combinations is that hearers can interpret them if they know the concepts associated with each of the component nouns. On that view, the associated concepts provide all that is needed to construct the combined meaning, a compositional analysis. Two strands of evidence were advanced against that view in this paper. The experiment showed that participants could not reliably construct the intended interpretation of an NN combination even if they understood the component concepts. Moreover, they realised that they did not have sufficient information, given just the combination out of context, and this was shown by their confidence ratings. No compositional account predicts either of these things. The other strand of evidence came from the corpus. Speakers, or writers, clearly did not expect two nouns to stand on their own. Typically, they provided a more or less explicit definition. Only when the addressee could be expected to already possess the novel concept through previous encounter was this provision relaxed. This shows that the person using an NN combination does not believe that the nouns on their own provide sufficient information for a

hearer to reconstruct the intended meaning. The speaker calibrates the utterance to take account of the addressee's current knowledge.

The studies reported here suggest a new picture of novel NN compounds, and imply that NN compounds are best understood in terms of what the speaker does. Novel NN compounds are not, at least not all, interpretatively compositional in any strict or narrow sense.

## References

- Clark, E. V., & Clark, H. H. (1979). When nouns surface as verbs. *Language*, 57, 767–811.
- Clark, H. H., & Marshall, C. R. (1981). Definite reference and mutual knowledge. In A. K. Joshi, B. L. Webber, & I. A. Sag (Eds.), *Elements of discourse understanding* (pp. 10–63). Cambridge, MA: Cambridge University Press.
- Cohen, B., & Murphy, G. L. (1984). Models of concepts. *Cognitive Science*, 8, 27–58.
- Crain, S., & Steedman, M. J. (1985). On not being led up the garden path: the use of context by the psychological parser. In D. Dowty, L. Karttunen, & A. Zwicky (Eds.), *Natural language parsing: Psychological, computational, and theoretical perspectives*. Cambridge, MA: Cambridge University Press.
- Gagne, C. L., & Shoben, E. J. (1997). Influence of thematic relations on the comprehension of modifier-noun combinations. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 23, 71–87.
- Gerrig, R. J. (1989). The time course of sense creation. *Memory & Cognition*, 17, 194–207.
- Gerrig, R. J., & Healy, A. F. (1983). Dual processes in metaphor understanding: Comprehension and appreciation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 9, 667–675.
- Grice, H. P. (1975). Logic and conversation. In P. Cole & J. L. Morgan (Eds.), *Speech acts* (pp. 41–58). New York: Academic Press.
- Hampton, J. (1997). Conceptual combination. In K. Lamberts & D. Shanks (Eds.), *Knowledge, concepts, and categories*. Hove: Psychology Press.
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: University of Chicago Press.

- Levin, B., & Pinker, S. (Eds.). (1992). *Lexical and conceptual semantics*. Cambridge, MA: MIT Press.
- Rips, L. J. (1995). The current status of research on concept combination. *Mind and Language*, *10*, 72–104.
- Smith, E. E., Osherson, D. N., Rips, L. J., & Keane, M. (1988). Combining prototypes: A selective modification model. *Cognitive Science*, *12*, 485–527.
- Sperber, D., & Wilson, D. (1986). *Relevance: Communication and cognition*. Cambridge, MA: Harvard University Press.
- Wisniewski, E. J. (1996). Construal and similarity in conceptual combination. *Journal of Memory and Language*, *35*, 434–453.
- Wisniewski, E. J. (1997). When concepts combine. *Psychonomic Bulletin and Review*, *4*(2), 167–183.