Economic competition is like auto racing

Building metaphorical schemas when reading text

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Even though our language is pervaded by metaphor, we do not necessarily think metaphorically. Knowing whether people make conceptual connections between a source and a target domain, and if so under which conditions, is of theoretical as well as practical interest, for example in text design. This paper experimentally investigates under which conditions people build their textual representations of a news article on a metaphorical schema. To disentangle the inconclusive output of recent reaction-time studies, we conduct a memory study. We probe the effect of signaling and conventionality on textual representations — two variables which have been ignored or conflated in previous studies. We find that people are more likely to metaphorically structure their representations of a news article to the extent that it contains novel metaphorical expressions. The inclusion of similes that explicitly signal extended mappings between source and target domains may also act as an aid to integration, although our evidence for this is more equivocal. These findings are discussed in relation to the career of metaphor theory and to the role of deliberateness in metaphor processing.

Keywords: conventional metaphor, novel metaphor, signaling, textual representation, metaphorical schema, recall study

1. Introduction

According to Lakoff and Johnson (1980), the human conceptual system is largely metaphorical. For instance, the following italicized expressions are seen as reflecting the conceptual metaphor IDEAS ARE FOOD (1980, p. 46):

- What he said left a bad *taste in my mouth*.
- All this paper has in it are *raw facts, half-baked ideas, and warmed-over theories*.
- There are too many facts here for me to *digest* them all.
- I just can't *swallow* that claim.

These expressions are all conventional but, according to Lakoff and Johnson's theory of conceptual metaphor, the metaphorical connections between ideas and food are essential for understanding the meaning of these expressions. Cognitive linguistic theories, however, "suffer from a lack of precision as to exactly how metaphorical thought is recruited during linguistic interpretation" (Tendahl & Gibbs, 2008, p. 1842). When we talk or write about economic competition, for example, we may use movement metaphors like *accelerating economy*. Does this mean that we actually think of cars or racing?

Conceptual metaphor theory has traditionally shown little interest in the role of context in understanding metaphors (Tendahl & Gibbs, 2008, p. 1840). This is reflected in many stimulus materials of psycholinguistic studies on metaphor, which frequently do not resemble natural language. Staying close to language as it is used in 'real life' is a general challenge for psycholinguistic studies, and online studies in particular, since experimental research requires maximum control of the stimulus material. The trade-off is that carefully crafted texts become far removed from actual language use. Graesser, Millis, and Zwaan (1997) call these unrealistic, choppy texts 'textoids' because they are presented out of any social context and are uninteresting or uninformative or both. They caution that "the study of textoids unveils unnatural representations and processing strategies" (Graesser, Millis, & Zwaan, 1997, p. 166).

The present study addresses the shortcomings of previous stimulus materials: the reading passages are among the first to do justice to the need for more natural texts (e.g., Boers, 1997; Pearson et al., 1981). As will be described in detail in Section 3.1.2, the stimulus material comprises a short passage based on an authentic news report on economic competition that is built upon an extended racing metaphor. Extended metaphors have been found to occur naturally in journalistic writing (Krennmayr, 2011). We examine under which conditions the racing metaphor becomes part of the mental model of the text. We hope that our findings about people's mental representation of metaphorical mappings reflect reality better than those derived from textoid-based studies.

Understanding whether people think metaphorically when reading 'real' text is not only theoretically interesting; there are also practical implications. Metaphor has the ability to highlight some aspects of a concept while at the same time hiding others (Lakoff & Johnson, 1980, p. 10). Metaphor has been shown to be a powerful tool for creating subtly persuasive messages serving ideological purposes (e.g.,

Charteris-Black, 2004; Chiang & Duann, 2007; Kitis & Milapides, 1997; Musolff, 2006; Santa Ana, 1999; Zinken, 2003). If metaphorical language can potentially influence people's views on topics, and consequently their actions, it is important to know under which conditions people are most likely to build representations of a text they read on a metaphorical schema. Knowing whether a metaphorically used word on the page is also a metaphor in people's minds may therefore have implications for journalistic writing practice, for example. As the media contribute to building and adapting knowledge and beliefs, journalists stand to benefit from knowing the factors that can cause a reader to adopt metaphorical thinking. Those involved in creating text for educational purposes would also benefit from such insight because employing metaphors can make difficult topics more accessible and easier to remember or, alternatively, may hinder understanding (Cameron, 2003). Thus metaphor can have powerful pedagogical potential (Semino, 2008). Knowing what kind of mental representations readers actually build when coming across different manifestations of metaphorical language in text would be helpful to anyone writing texts for an audience. Writers could then make more informed choices for their text design.

While this work focuses on written texts, its implications also extend to spoken text design when the text is prepared, such as in speeches or lectures (Beger, 2011; Charteris-Black, 2004; Low, Littlemore, & Köster, 2008). This also applies to situations where speakers such as therapists or teachers strategically employ metaphor for communicative purposes (see e.g., Cameron, 2003; Cameron & Low, 2004; Kopp, 1995; Kopp & Craw, 1998; Low, 2008; Wickman, Daniels, White, & Fesmire, 1999). Examining when people build metaphorical schemas when reading text consequently has great practical implications.

2.   Studying extended mappings in discourse

2.1   Reading time studies

Previous studies have tried to understand whether conceptual metaphors actually activate cross-domain mappings. Reading-time studies are a common means of testing the validity of cross-domain mappings in online processing of extended metaphors. In these studies, subjects are typically given a passage describing short scenarios, (e.g., a debate) using multiple metaphorical expressions from the same source domain (e.g., RACING or WAR) to describe the topic. They then read a metaphorical target sentence that is either consistent or inconsistent with the source domain (e.g., 'His skill left his opponent *far behind him* at the *finish line*' is consistent with the RACING scenario but not with the WAR scenario). Researchers

measure the time it takes subjects to read (in)consistent target sentences. The idea is that if cross-domain mappings are active, a matching target sentence speeds up reading time compared to mismatching ones.

Even though many of these studies (e.g., Boronat, 1990; Keysar, Shen, Glucksberg, & Horton, 2000; Thibodeau & Durgin, 2008) are very similar in set-up, they arrive at diverging results. While some research presents evidence that conceptual metaphors create schematic knowledge structures that affect a reader's text interpretation (Allbritton, McKoon, & Gerrig, 1995) and that conceptual metaphors are available even for conventional metaphorical expressions (e.g., Thibodeau & Durgin, 2008), others find that people rely on conceptual metaphors for novel expressions but not for conventional ones (e.g., Boronat, 1990; Keysar et al., 2000).

Straightforward comparison between the studies is difficult. For example, Boronat (1990) conducted a study in which reading passages contained conventional metaphorical expressions (italicized) (e.g., 'he *attacked* the opposition's arguments') and another in which the reading passages contained novel ones ('he *intensified the bombardment* as he made his last key points'). In the experiment testing novel expressions, the conceptual metaphor was introduced by a simile (e.g., '*Dan saw the big debate as a war*'). In the experiment testing conventional metaphorical expressions, by contrast, such a simile was lacking and the mapping was thus not explicitly stated. The fact that participants seemed to construct source-target mappings in the novel scenarios could thus (also) have been due to the opening simile drawing readers' attention to the novel metaphorical expressions.

A straightforward interpretation of results is similarly difficult for Keysar et al.'s (2000) reading-time studies, which measured the effect of conventionality as well as the effect of signaling the metaphorical mapping. In their paragraphs the underlying metaphor was made explicit at the beginning of the stimulus text either by a simile, by an A is B metaphor, or not at all. Their experiment compared a novel condition with explicit mapping to a conventional condition without explicit mapping, but not to a novel condition without explicit mapping. No statistical tests were carried out to check differences between the novel condition with explicit mapping and the conventional condition with explicit mapping.

It is difficult to compare the results of these studies to Thibodeau and Durgin (2008), who introduced changes to Keysar et al.'s (2000) stimulus materials. This is because Thibodeau and Durgin (2008) looked at two conditions without explicit mapping, one of which was novel and one of which was conventional — a combination of manipulations not found in the Keysar et al. study.

From these studies we can conclude that both the degree of conventionality of metaphorical expressions (novel or conventional)[1] and the signaling (or not) of the underlying conceptual mapping have a role to play in the construction of source-target mappings. The precise nature of their roles is less clear. In order to achieve better understanding, it is essential to consistently manipulate these variables, i.e. degree of conventionality and signaling, across conditions. This a major aim of the current experiment.

2.2 Memory studies

The bulk of reading-time studies point out that conceptual metaphors can provide schema-like structures to organize information in a text (e.g., Gibbs & O'Brian, 1990; Nayak & Gibbs, 1990), but readers' models of textual representation are not their primary focus of discussion (cf. Allbritton, 1995, and Allbritton et al., 1995 for exceptions). Yet these are crucial for the use of metaphor in discourse processing. Readers of a text add and integrate their prior knowledge about the language, the world and the communicative situation, as well as their personal experiences. This creates a so-called *situation model* (Kintsch, 1998, p. 103ff), which is schema-based. Elements not explicitly mentioned in a text can be elaborated on through the schema.

Experiments conducted by Bower et al. (1979) demonstrate how schemas function. Participants read and then recalled a text that instantiated a script, such as visiting the doctor or going to a restaurant. In immediate recall they remembered the actual statements of a story and activated the script. However, once memory faded, people needed to rely on the script in their recall, which led to 'intrusions', i.e. falsely recalled script actions that were not part of the text they had read. The script had become part of the mental model of the story.

Here we conduct a memory study in order to better understand the conditions under which readers form metaphorical schemas when reading text with an extended metaphor. Since the organizing function of metaphorical schemas can be related to the organizing function of other schematic knowledge such as scripts, we draw on memory studies on the construction of scripts (e.g., Bower et al., 1979), as well as van Dijk and Kintsch's (1983) model of text comprehension. A recall study allows us, like Bower et al. (1979), to look at intrusions. These may

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1. We do not claim that metaphorical expressions are always clearly conventional or clearly novel — metaphor is a gradable phenomenon after all. However, in our experiment one group of metaphorical expressions, which we termed 'novel' metaphors, are clearly less conventional than those we termed 'conventional.' The grouping into these two categories has been confirmed experimentally (see Section 3.1.2).

serve as an indicator that the metaphor has become part of the mental model. Similar to Allbritton et al. (1995), we assume that if a metaphorical schema can be used to help organize textual information about an abstract topic, it should be possible to show that it has an effect on the textual representation of that information in memory.

3. Study

The memory study we present here examines under which conditions an extended auto racing metaphor in a news text on economic competition becomes part of the actual mental model of the text. Potential influential factors on the representation are the degree of conventionality of the metaphorical expressions in the text (conventional versus novel), whether or not the underlying metaphorical mapping is explicitly stated by a simile (*Economic development is … like auto racing*), and the amount of time between reading and recalling the text (immediate or delayed recall). Table 1 summarizes the conditions.

Table 1. Experimental conditions

	immediate		delay	
conventional	no signal	signal	no signal	signal
novel	no signal	signal	no signal	signal

The degree of conventionality and signaling are expected to have an effect on the mental model readers build of the text for several reasons:

i.   According to the Career of Metaphor Theory (Bowdle & Gentner, 2005), novel metaphors are processed by comparison, i.e. alignments between target and base concepts. If a base term is consistently aligned with a range of different target terms from the same conceptual domain, the repeatedly-derived abstraction may become conventionally associated with the base term as a secondary meaning, thus making the term polysemous. Metaphor processing will thus shift from comparison to categorization. Moreover, in contrast to conventional metaphorical expressions, novel metaphorical expressions may invite the reader to activate the source domain of auto racing and map it onto the target domain of economic competition (see Steen, 2008). They may thus better aid readers in forming a metaphorical auto racing schema.

ii. According to the principle of grammatical concordance (Bowdle & Gentner, 2005), similes — which are grammatically identical to literal expressions of comparison — should invite explicit (albeit metaphoric) comparisons between

target and base domains. Since similes make the source domain of auto racing explicit they may therefore, like novel metaphorical expressions, be experienced as a deliberate rhetorical choice on part of the writer (Steen, 2008). This could aid integration of an auto racing schema into people's text representation. Moreover, signals emphasize certain aspects of the text content and/or clarify the organization of a text (see Meyer, 1975 as cited in Whitney, Budd, & Mio, 1996). They have been shown to have a positive effect on memory for text (Meyer, 1984, as cited in Whitney et al. 1996), since they encourage elaborate processing that would otherwise not occur.

iii. While people may remain largely unaware of the source domain of conventional expressions, an explicit statement may help them generate mappings. As claimed by the Career of Metaphor Theory, similes may serve to 'rejuvenate' highly conventional metaphoric mappings by shifting the mode of processing from categorization to comparison (Bowdle & Gentner, 2005). Even conventional metaphorical expressions may thus be experienced as deliberately used and hence draw attention to the source domain (Steen, 2008, 2010). Assuming that similes may function as a signal for deliberate metaphor use, we expect a signal to have a greater effect in the conventional scenario than in the novel scenario, where the metaphorical expressions may be more likely to be perceived as deliberate, even without a signal.

Summary of predictions:

Analogous to script and schema recall studies, we assume that if people build a metaphorical schema of auto racing, they will not only remember elements from that schema, but will also use elements in their recall protocols that are consistent with that schema but that were not part of the stimulus text. An active metaphorical mapping should activate domain-specific terms from the domain of auto-racing, whereas the text is about the economy.

The experiment tests if people's text recall is influenced by the manipulations such that they use more racing metaphors in the experimental conditions than in a control condition without an extended mapping. We also expect that the number of auto racing terms used will not be the same across the experimental conditions, since novelty and/or signaling of metaphor is expected to aid people in constructing a text representation built on a metaphorical schema. More specifically, we predict the following four effects:

1. *effect of conventionality:* People will produce more auto racing expressions in the novel condition than in the conventional condition.
2. *effect of signaling:* People will use more auto racing expressions in the simile condition than in the no-simile condition.

3. *effect of time of recall:* People will reproduce more auto racing expressions in immediate recall than in delayed recall as readers will find it more difficult to separate knowledge of the text and pre-knowledge and will have to rely on a topic-driven schema to recall the passage.
4. *interaction effect of conventionality and signaling:* The difference in number of auto racing expressions between cases with and without signaling will be larger for the conventional condition than for the novel condition.

In order to test these predictions, we created a short, believable news report on economic competition that more closely resembles natural language than the experimental materials used in previous studies. We endeavored to keep artificiality to a minimum by modeling the sample texts on an actual text from a magazine (Hunt, 2004). This should provide a better picture of what happens in 'the social world' and distinguishes this study from its predecessors.

Besides carefully controlling the degree of conventionality of the metaphorical expressions in the texts (for details see Section 3.1.2), we took particular care in keeping a clear distinction between different forms of figurative language use. This has not always been achieved in previous studies, where, for example, reading passages included both similes and metaphors, whereas conclusions were drawn about metaphor in general, without discussing differences between these two forms of figurative language use (e.g., Pearson et al., 1981). We also made sure that all conditions contained the same number of metaphorical expressions. In the past, this has not been a priority. There, scenarios in different studies did not each contain the same number of metaphorical expressions. Nor was the number of metaphorical words always consistent within one set of stimuli. This uncontrolled variable may have contributed to the diverging results.

In sum, our study improves on previous work in the following ways:

1. the number of source domain terms has been held constant across conditions.
2. novel test items only occurred in the novel condition and conventional ones only in the conventional condition.
3. metaphor and simile were not mixed.
4. both degree of conventionality (conventional metaphorical expressions versus novel expressions) and signaling (making a source-target mapping explicit through the use of a simile at the beginning of a reading passage) were consistently manipulated across all experimental conditions.
5. a believable news article was modeled on an existing text from a business magazine.

3.1 Method

3.1.1 *Subjects*

120 undergraduate students from Grand Valley State University (Michigan, USA: henceforth GVSU), all native speakers of English, participated in the study. All were given course credit for their involvement, and none had participated in similar studies.

3.1.2 *Materials and design*

The material consisted of short news passages on economic development. There were five versions of the passage with the same storyline — four experimental conditions and one control condition. Each of the four passages in the experimental conditions contained seven metaphorical items that belong to the extended mapping of auto racing. Two passages contained novel metaphorical expressions and two contained conventional ones. For both the novel and the conventional passage, there was one text version with and one text version without an introductory simile signaling the underlying metaphor. The control condition did not contain an extended mapping. Each passage was approximately 190 words (they can be found in the Appendix).

The metaphorical expressions used differed in their degree of conventionality. In order to select the seven conventional and seven novel expressions, we used the following sources to guide our intuitions: the thesaurus function of the "Macmillan English Dictionary for Advanced Learners", "Longman English Dictionary Online" and the "Merriam-Webster Online Dictionary", "Roget's Thesaurus" (Kipfer & Chapman, 2003) and WordNet (Princeton University, 2010). We first selected racing expressions that could conventionally be applied to economic development and could be used interchangeably with literal expressions in the control condition. Then we looked for terms that could function as novel metaphoric synonyms.

In order to make sure that the novel condition only contained novel metaphorical expressions and the conventional condition only conventional ones, the categorization of expressions into these two groups was checked behaviorally by administering a forced-choice task. 22 GVSU undergraduate students (who did not participate in the main study) participated for course credit. They received descriptions of seven economic situations from the test passage. Each situation was followed by two statements describing the situation. One of the statements contained a metaphorical item from the reading passage that was categorized as conventional. The other one contained its corresponding novel item. For example, the situation 'One country is not as economically successful as other countries' was followed by the conventional example '*the country has been left miles behind*' and the novel example '*the country has been left several laps behind*.' The subjects

had to "circle the expression that seems like a more familiar or conventional way of describing the economic situation." The order of items was random and was counterbalanced across subjects.

A binominal test shows that overall agreement across items was 0.92. Participants overwhelmingly chose the conventional term. The overall proportion was tested against the expected value of 0.50. This is the expected proportion when the expressions are equally likely to be conventional ($t(21) = 17.31$, $p < .001$). The same was done for each item separately with a binominal test for each item. The observed proportion (ranging from 0.82 to 1.00 was significantly higher than 0.50 (all p values $< .005$). These results support the item selection. The novel items were perceived as much less conventional than the conventional ones.

Following Mannes and Kintsch (1987), both immediate and delayed recall tests were administered. For both times of recall a control group was created where the stimulus text did not contain an extended auto racing metaphor. The remainder followed a 2 (recall interval: immediate versus two-day delay) ×2 (signaling: simile versus no simile) ×2 (conventionality: conventional versus novel) factorial design with recall interval, signaling and conventionality as between-subject factors. For instance, in the conventional condition, a subject would read '(…) *China and India have pulled ahead economically (…)*' while subjects in the novel condition would read '(…) *China and India have turbocharged ahead economically (…)*' In the condition with signal, the source domain was made explicit by a simile ('*Economic development is (…) like auto racing*'), while subjects in the unsignaled condition did not receive such a cue. The dependent measure was the number of metaphorically-used words in the recall protocol that belonged to the auto racing schema.

3.1.3   Procedure

The experiment was run in small groups with each subject seated at a separate table. They received a text on economic development as well as task instructions. The subjects were instructed to read the passage carefully because they would be tested on the material later. They were given three minutes to view the passage. No mention of metaphorical language was made in the instructions.

Half of the subjects recalled the passage 15 minutes after reading it (immediate recall condition). After reading the passage, they completed a 15-minute distractor task. Then they received instructions to recall the passage on economic development they had read earlier. The subjects were told to recall the exact wording of the passage, but whenever they could not remember the exact wording they could use their own words to convey the ideas that they did recall. Recall was cued by the headline of the passage (*Economic Development*). The students recalled the passage using pen or pencil below the headline. There was a twelve-minute time limit

for this task. The other half of the subjects recalled the text two days later (delayed recall condition).

3.2 Analysis and results

If the manipulated variables (simile, conventionality, and time of recall) influence the kind of representation of the text people build, we should observe differences in the number of auto racing expressions between the experimental conditions and the control condition and between the experimental conditions themselves. If people have integrated an auto racing model into their textual representations, they are also expected to use auto racing terms that were not in the reading passage but that are nevertheless consistent with an auto racing schema. Since such intrusions are a strong indication of the operation of schemas, we need to look at both correctly recalled auto racing terms from the stimulus text and intrusions.

3.2.1 *Data coding*

Two of the authors served as judges using an explicit coding scheme described below. All expressions that were consistent with an auto racing schema were counted and then labeled as either intrusions or correct recalls from the text. For example, one subject wrote "*America seems to be <u>stalled</u>, even <u>stuck in a lower gear</u>*." While *stalled* was part of the test passage, *stuck in a lower gear* was not. The second expression is, however, also consistent with the domain of auto racing. It was counted as an intrusion.

As a first step, decisions were made on whether or not an expression was part of an auto racing schema and whether it consisted of one or more words (e.g., is *win the race* one unit or should it be broken up into the two units *win* and *race*? For this example, both judges agreed on one unit.) The texts were coded and notes about item disagreements (whether an expression is part of an auto racing schema or not) and unit disagreements (one or more units) were made. Disagreements were solved in ensuing discussion. As a second step, a consistency check was performed to ensure that expressions were consistently included or excluded across conditions.

ECONOMIC DEVELOPMENT IS AUTO RACING is a complex metaphor. The auto racing schema is thus related to a number of other schemas such as movement, competition, driving or racing in general. It is therefore not simple to delineate the schema and to describe exact cut-off points. Some expressions in the recall protocols are clearly related to an auto racing schema (e.g., *checkered flag*), while others are more general (e.g., *pull ahead*) and thus only peripherally related. Particularly for the more general expressions, there may be alternative mappings (Krennmayr, 2011). This becomes clear if we look at the terms in isolation (e.g., *accelerating*:

driving in general; *fall off track*: racing in general etc.) Nevertheless they are all loosely connected. Because they are surrounded by other metaphorical expressions evoking an auto racing scenario, they are made coherent by context and are thus drawn into the auto racing schema. Cameron and Low (2004, p. 367) describe this phenomenon as a metaphor 'attracting' other, only loosely related terms. Since the main interest here is neither the depth nor level of processing, but merely the existence of any metaphorical auto racing-, racing- or movement-related schema, the degree of match for the auto racing metaphor is not a concern. Despite the fuzzy boundaries of the auto-racing schema, analyst agreement was high (20 disagreements versus 258 agreements).

In order to separate intrusions from recalled expressions, a coding schema was developed. The reliability of the coding scheme was confirmed by having an independent coder examine 20 randomly selected recall protocols according to the instructions. Out of 140 cases, there was disagreement on only three items.

3.2.2   *Results*

Experimental versus control passages. Before analyzing the impact of both conventionality and signaling on the types of auto-racing expressions recalled by subjects, we first needed to confirm our assumption that news stories about economic development and competition would not automatically be comprehended in terms of an auto-racing schema in the absence of expressions invoking that schema. That is, we expected that the recall protocols of the control passage, which contained neither extended racing terms nor suggestive similes, would contain relatively few (if any) auto-racing terms in comparison to the recall protocols of the experimental passages. Table 2 shows the mean number of auto-racing terms recalled by subjects for all five passage types in each of the recall conditions. (For the four experimental passages, the means include both correct recalls of metaphorical expressions from the texts and intrusions. For the control passage, the means indicate intrusions only, as this version of the text did not contain any auto-racing terms.) As predicted, fewer racing metaphors appeared in the recall protocols of the control passage than in the recall protocols of the other passage types (Table 2). Indeed, fewer than half of the subjects receiving the control passage included even a single racing metaphor in their protocols. Moreover, the metaphorical expressions that appeared in the control protocols tended to be isolated and fairly conventional.

A 5 (passage type: control, conventional/no-simile, conventional/simile, novel/no-simile, novel/simile) ×2 (recall time: immediate, delayed) analysis of covariance (ANCOVA) was conducted on the subject means, with protocol length included

Table 2. Total auto racing terms in relation to metaphor condition, presence of simile, and time of recall (scores are means; standard deviation in parentheses)

	no metaphor	conventional			novel		
		no simile	simile	AVERAGE	no simile	simile	AVERAGE
immediate	0.50 (0.67)	1.92 (1.24)	2.83 (1.90)	2.37 (1.64)	3.91 (2.78)	4.00 (1.86)	3.96 (2.31)
delayed	0.50 (0.80)	0.58 (0.80)	1.67 (1.97)	1.13 (1.57)	1.50 (1.83)	4.67 (5.53)	3.08 (4.34)
AVERAGE	0.50 (0.72)	1.25 (1.23)	2.25 (1.98)	1.75 (1.71)	2.71 (2.61)	4.33 (4.05)	3.52 (3.70)

as a covariate.[2] The predicted effect of passage type was confirmed, $F(4, 109) = 11.28$, $p < .001$, r = .54. Post hoc analyses revealed that significantly more racing metaphors were recalled in both of the novel conditions (no simile and simile) than in the control condition (both p's < .01), and significantly more racing metaphors were recalled in the novel/simile condition than in the novel/no simile condition as well as both of the conventional conditions (all p's < .05). There was also a main effect of the protocol length covariate, $F(1, 109) = 26.17$, $p < .001$, r = .44. There was no main effect of recall time, and there were no significant interactions.

Having answered the initial question about how economic competition is conceptualized in the absence of racing metaphors, we now turn to analyze the recall protocols for the experimental (metaphoric) passages in greater depth.

Recalls of auto-racing terms. Table 3 shows the mean number of auto-racing terms correctly recalled from the original passages. A 2 (conventionality: conventional, novel) ×2 (signaling: no-simile, simile) ×2 (recall time: immediate, delayed) ANCOVA was conducted on the subject means, with protocol length included as a covariate. As predicted, there was a main effect of conventionality: More racing metaphors were used when subjects read a novel passage ($M = 1.71$) than when they read a conventional passage ($M = .91$), $F(1, 87) = 12.25$, $p < .001$, r = .35. The anticipated effect of recall time was also obtained: More racing metaphors were correctly recalled immediately following exposure to the passages ($M = 1.90$) than after a two-day delay ($M = .72$), $F(1, 87) = 8.87$, $p < .01$, r = .30. Finally, there was

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2. The length of each recall protocol was recorded by using the Word Count function of the Microsoft Word application. The reason for including protocol length in the statistical analysis is as follows: the expected number of auto racing terms increases as the length of a protocol increases. For instance, if the probability of a word being an auto racing term is 1%, we expect one auto racing term in a 100-word protocol and ten in a 1000-word protocol. Therefore, a difference between conditions may be due to a difference in protocol length and not due to the effect of the condition. Including protocol length as a covariate has the appropriate effect of correcting differences between conditions for differences in protocol length.

Table 3. Recalls from text in relation to conventionality, presence of simile, and time of recall (scores are means; standard deviation in parentheses)

	conventional			novel		
	no simile	simile	AVERAGE	no simile	simile	AVERAGE
immediate	1.17 (0.83)	1.50 (1.00)	1.33 (0.92)	2.33 (1.30)	2.58 (1.73)	2.46 (1.50)
delayed	0.25 (0.45)	0.75 (0.87)	0.50 (0.72)	1.33 (1.67)	0.58 (0.90)	0.96 (1.37)
AVERAGE	0.71 (0.81)	1.13 (0.99)	0.92 (0.92)	1.83 (1.55)	1.58 (1.69)	1.71 (1.61)

a main effect of the protocol length covariate, $F(1, 87) = 7.27$, $p < .01$, r = .28. The main effect of signaling and none of the interactions were significant.

In sum, the predicted effects of conventionality and recall time on correct recalls were found. The effect of signaling and the anticipated interaction between conventionality and signaling did not materialize — although the data trended in the predicted directions. We will discuss these results in greater depth shortly.

Schema-consistent metaphor intrusions. Table 4 shows the mean number of racing metaphor intrusions in the recall protocols. A 2 (conventionality: conventional, novel) ×2 (signaling: no-simile, simile) ×2 (recall time: immediate, delayed) ANCOVA was conducted on the subject means, with protocol length included as a covariate. As predicted, there was a main effect of conventionality: There were more racing metaphor intrusions for the novel passages ($M = 1.81$) than for the conventional passages ($M = .83$), $F(1, 87) = 6.77$, $p < .025$, r = .27. The predicted effect of signaling was also confirmed: There were more racing metaphor intrusions for the simile passages ($M = 1.94$) than for the no-simile passages ($M = .71$), $F(1, 87) = 9.32$, $p < .01$, r = .31. There was also a main effect of recall time, although the direction of this effect was the reverse of what was found for correct recalls. That is, more racing metaphor intrusions appeared in the delayed recall protocols ($M = 1.38$) than in the immediate recall protocols ($M = 1.27$), $F(1, 87) = 6.03$, $p < .025$, r = .25. And there was a main effect of the protocol length covariate, $F(1, 87) = 19.11$, $p < .001$, r = .42.

In addition to the above effects, there were two unanticipated interactions. First, there was an interaction between conventionality and signaling, $F(1, 87) = 4.31$, $p < .05$, r = .22.

Table 4. Number of intrusion in relation to conventionality, presence of simile, and time of recall (scores are means; standard deviation in parentheses)

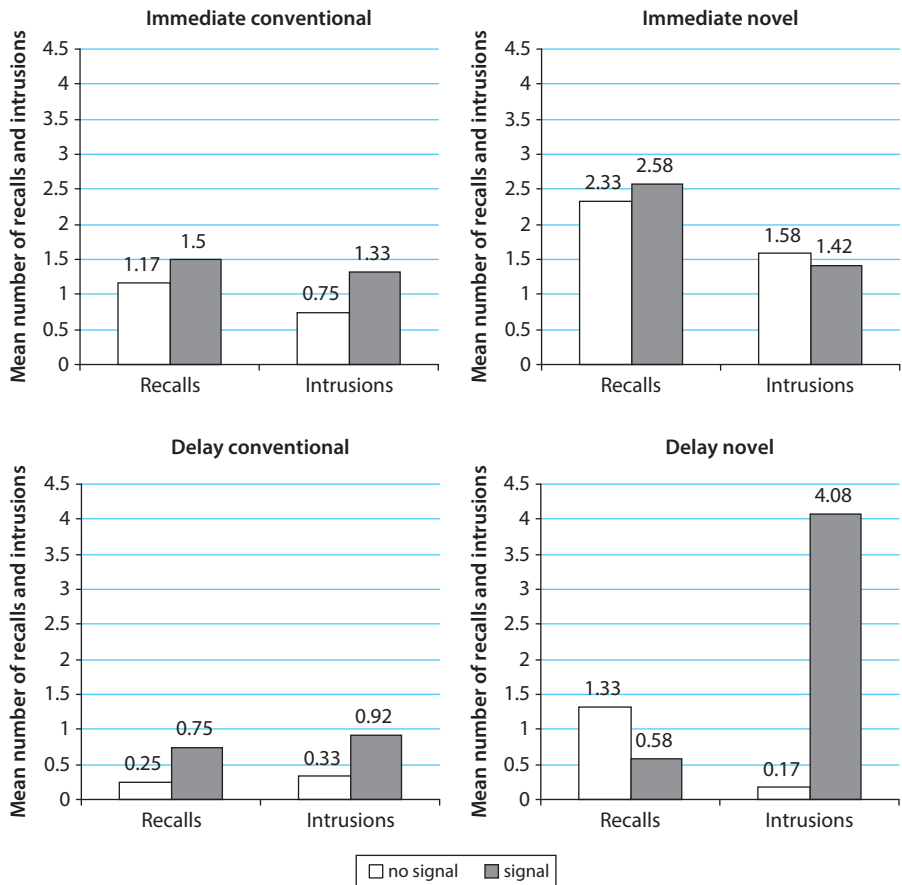|	conventional			novel		
	no simile	simile	AVERAGE	no simile	simile	AVERAGE
immediate	0.75 (0.62)	1.33 (1.37)	1.04 (1.08)	1.58 (1.62)	1.42 (1.16)	1.50 (1.38)
delayed	0.33 (0.49)	0.92 (1.68)	0.62 (1.25)	0.17 (0.39)	4.08 (5.12)	2.12 (4.08)
AVERAGE	0.54 (0.59)	1.13 (1.51)	0.83 (1.17)	0.88 (1.36)	2.75 (3.88)	1.81 (3.03)

Figure 1. Mean number of recalls and intrusions per condition

Although we had predicted that signaling would have a bigger impact on the recall of the conventional passage than the novel passage, the reverse was found: Similes led to a larger jump in racing metaphor intrusions in the novel condition. (The mean of 4.08 shown in Table 4, looks unusually high. This may be due to outliers that have an undue influence on the statistical model. However, inspection of influence statistics did not point to outlying values that were cases of concern.)[3]

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3. We looked at Cook's distance and the leverage values, two common measures for investigating the influence of particular observations on the model parameters. None of the values of Cook's distance were higher than 1.0 and none of the leverage values were higher than the average leverage (Field, 2009). Still, when we removed two of the highest values, the significance of two of the effects changed: the main effect of time of recall was no longer significant. The interaction between conventionality and signaling was also no longer significant. The last result

Second, there was an interaction between signaling and recall time, $F(1, 87)$ = 6.49, p <.025, r = .26, such that similes boosted the number of racing metaphor intrusions in the delayed condition more than in the immediate condition. These unexpected results are further discussed in the next section. There were no other significant interactions in the intrusion data.

3.3 Discussion

As predicted, an extended auto racing metaphor in a text on economic competition is likely to become part of the mental model of the text when the metaphorical expressions are novel. These results do not wholly align with Thibodeau and Durgin (2008), who showed that (non-signaled) conventional and novel expressions both trigger source-target mappings. We, however, found that auto racing terms were used significantly less often in the conventional condition than in the novel condition. The implication is that a subject's textual representation is more likely to be based on the source domain when metaphorical expressions are novel rather than conventional. It is of course true that, given the methods used here, it remains possible that conceptual metaphor played a role during online comprehension. However, compared with novel expressions, its use is not prominent in people's textual representations. Novel metaphorical expressions may be experienced as a rhetorical choice and thus make the reader map the source domain of auto racing onto the target domain of economic competition. These results are compatible with the Career of Metaphor Theory (Bowdle & Gentner, 2005), which suggests that mappings between novel metaphors are typically processed by comparison, whereas conventional metaphors are processed by categorization.

Subjects used significantly more metaphorical expressions from the text in immediate recall than after a delay, as predicted. After a time-delay, they used significantly more intrusions than in the immediate recall condition. This is in line with earlier memory studies (e.g., Bower et al., 1979; Johnson, Bransford, & Solomon, 1973), which suggest that after a time-delay people have to rely on their situation model (van Dijk & Kintsch, 1983), and thus they fall back on a schema to recall the passage.

While we did not observe the predicted effect of signaling for recalls from the text, subjects did use significantly more intrusions when a simile set up the conceptual mapping than when the metaphorical schema was left implicit. This is consistent with early studies on script and schema recall (Bower et al., 1979; Brewer & Treyens, 1981); a high proportion of intrusions from the domain of auto

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seems to indicate that the unexpected pattern may not be a systematic effect. The critical main effects of conventionality and signaling, however, were still obtained.

racing indicates that an auto racing schema has become part of the readers' mental representation when they read a simile. In other words, readers may not remember the actual wording of the text, but they do remember the metaphorical theme.

The expected interaction effect between conventionality and signaling for all auto racing expressions was not observed for recalls from the text, but there was an interaction effect for the intrusions. We predicted that signaling would have a bigger impact on the recall of the conventional passage than the novel passage, but the opposite was found: Similes led to a larger jump in racing metaphor intrusions in the novel condition than in the conventional condition. In the conventional condition, signaling did not significantly increase the number of intrusions, which is consistent with Keysar et al.'s (2000) findings. We had expected that signaling conventional metaphors more strongly boosts a reader's awareness of the underlying mapping, relative to the novel case, and that subjects would recognize the mapping for novel metaphors even without signaling. A possible explanation for this unexpected result may be that the function of the simile was not the same across the two levels of conventionality. The novel metaphors may have been eye-catching to such a degree that they made the reader pay less attention to the overall meaning of the passage. It is possible that the simile made the metaphorical schema more salient for the reader, giving the passage a better structure and making it more coherent (see Meyer, 1975). As has been shown in many psycholinguistic studies, the more coherent a passage is, the easier it is to comprehend and remember (e.g., Myers, O'Brian, Balota, & Toyofuku, 1984; Thorndyke, 1977).

In contrast, the conventional metaphorical expressions may have attracted less attention — they may have seemed more coherent and easier to comprehend to begin with. This needs investigation in follow-up experiments. The results have important consequences for the interpretation of the results in Boronat (1990), where the potential effect of signaling was not addressed. Our experiment suggests that signaling does matter.

There was another unpredicted effect. For the intrusions, we observed an interaction effect between time of recall and signaling. While in immediate recall there was no significant difference in the number of intrusions between signaled and unsignaled conditions, a signal led to a significantly higher number of intrusions when recall was delayed. Again, this finding can be related to the decay of the textbase. After a two-day delay compared to an immediate recall, readers rely on their situation model to recall the text. The expectation was that when people cannot rely on the textbase, they will make plausible but incorrect guesses. This means that the guesses are not random, but are consistent with the schema (Kintsch & van Dijk, 1978, p. 375). Readers may not remember the surface expressions, even when the metaphor is signaled, but they do remember the underlying conceptual

metaphor and hence, in the delayed condition, they produce significantly more intrusions when the metaphor was signaled than when it was not.

Thus, our data suggests that integration of an auto racing schema is most complete when the auto racing expressions are novel *and* when the mapping is signaled. This is supported by the relatively large number of intrusions compared to recalls from the text in the novel, signaled, delayed recall condition. These observations again strongly support the idea that memory of the metaphorical auto racing theme persists after memory of the text's actual wording fades, and that memory of the metaphorical theme is stronger when that theme is novel and is made explicit to the reader.

Steen (2008) argues that metaphor is processed by comparison when a language user is deliberately invited to perform a cross-domain mapping. He suggests that extended metaphors are likely experienced as deliberate. However, the present research has shown that a more differentiated picture is required: one must distinguish between extended mappings for conventional and novel metaphors. The latter resulted in more auto racing expressions in the recall protocols and generated a particularly high number of intrusions in delayed recall when coupled with a simile. Novel metaphorical expressions may be more readily recognized and remembered as a rhetorical device or play on words than conventional ones, and as a consequence, the metaphorical schema becomes integrated in the textual representation.

We can try to understand this finding in the following way: if a writer's goal is to make the reader think of the topic in terms of a source domain, it may not be enough to indicate a mapping by playing on words through extended conventional mappings — the data indicate that integration of metaphor in the reader's model of the text is most effectively achieved with signaled *novel* metaphors. It may also be possible, however, that the conventional expressions in the stimulus text are perceived as metaphorical, but not as particularly interesting. They may thus trigger fewer thoughts in the construction of the schema than the novel expressions do.

The overall higher usage rate of auto racing terms in the novel condition still does not mean that every novel metaphor is always processed by comparison, even — or particularly — in the context of an extended mapping. It may be the case that once the mapping has been integrated into the story schema, any other auto racing expressions are only superficially processed (see also Cameron, 2003, p. 188). Steen (2008) cautiously states that "(…) all metaphor that is experienced as deliberate is presumably processed metaphorically (…)" (p. 238). If we assume that an extended metaphor is deliberate, however, these results cast some doubt on that idea.

Like Allbritton et al. (1995), the present experiment has shown that metaphorical schemas can affect people's text representation. While their study found that people used metaphorical schemas to connect text elements without elaborate processing,

our results show that people can benefit from an explicit invitation to form source-target mappings. Similes and novel metaphors can function as such aids.

Since the variables metaphor conventionality and signaling influence the readers' textual interpretations, it is important to manipulate them carefully when designing experimental material. This study thus addresses the limitations of earlier studies such as Boronat (1990), Keysar et al. (2000) and Thibodeau and Durgin (2008), which did not pay sufficient attention to manipulating these factors consistently.

3.4 Suggestions for future research

Counter to our predictions, similes led to a larger jump in the number of racing metaphor intrusions in the novel than in the conventional condition. To understand the unexpected direction of this effect, follow-up experiments are in order. They need to test whether the simile in the novel condition made the text more coherent than the simile in the conventional condition did. Another, related interpretation is that it may have functioned as a useful and memorable peg on which to hang the assorted novel metaphorical expressions, a conceptual tool that was less needed in the conventional condition.

Future research on recalling text with an underlying extended metaphor also needs to investigate how far pre-knowledge of the target domain and of the source domain correlate with the recall scores (see Pearson et al., 1981; Meyer, 1987). Reading skills are another point of future investigation, since they can have an impact on memory ability. Weaker readers may need the extra aid of simile to build a metaphorical model, while good readers may not (e.g., Blasko, 1999; Whitney et al., 1996). This question is particularly relevant for educational contexts.

While our research has shown that readers are likely to generate a metaphorical schema under certain conditions, we do not know at which level of abstraction this schema operates (see also Bower et al., 1979). A more detailed fine-grained coding procedure in which each racing term is coded for its level of abstraction could shed light on the level at which the auto racing schema operates. Finally, since metaphors can add to the coherence of a text when they span several statements in discourse and thereby facilitate discourse cohesion (Graesser, Mio, & Millis, 1989, p. 134), future research may manipulate the number of metaphorical expressions as well as the spacing between expressions to provide a more differentiated picture of the cohesive function of metaphors.

4.   Conclusion

This study has addressed three major gaps in metaphor comprehension research. First of all, the test material is more realistic and believable than the 'textoids' used in previous studies. Second, it is the only experiment to date that has kept the number of source domain terms constant across conditions, has placed novel test items only into the novel condition and conventional ones only into the conventional condition, and has not mixed metaphor and simile forms. Furthermore, both signaling and conventionality have been manipulated across all conditions. Though there have been a number of studies examining the effect of conventionality on the activation of conceptual domains (e.g., Boronat, 1990) and the effect of making a mapping explicit (Keysar et al., 2000), the present study is the first to have tested for interaction between these two variables.

Results suggest that source-target domains can be psychologically real to varying degrees. Connections between source and target domains tend to be integrated into readers' mental models when they are explicitly invited to do so. Novel metaphors and signaling of the mappings can function as such invitations. The unexpected jump in the use of auto racing intrusions in the novel condition (and not in the conventional one) when the metaphorical schema was signaled calls for further research into the role of signaling a metaphor and the consequences for textual representations.

Since memory studies and reaction-time studies tap into different stages of processing, we cannot directly link their results. Although recall tasks do not offer the precision of online comprehension tasks and their results tend to be 'messier,' they have the potential to offer a more complete picture of the products of figurative processing. The study has thus laid the ground for a range of possible ensuing research projects on extended metaphors and the circumstances under which they are likely to become part of readers' mental representations of a text. For example, knowing under which conditions people build their mental representation of a text on a metaphorical schema has practical implications for text design. Obtaining a better picture of the consequences of using one kind of metaphor (form) over another is vital since metaphor has been shown to influence people's understanding of complex topics, their attitude on public issues, and consequently their actions.

Acknowledgement

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Appendix

Text passages

Auto racing terms are printed in bold for reference. In the experiment, auto racing terms were not marked.

conventional; no simile:
Economic Development
Economic development is a challenging and competitive process. Consider, for example, Mexico's developing economy. While other newly industrialized countries like China and India have **pulled ahead** economically, Mexico has been **left miles behind.** A number of reasons can be cited for Mexico's underperformance relative to these other **accelerating** economies. For one thing, Mexico is extremely dependent upon the United States. But our country is struggling with its own **stalled** economy. And both Mexico and the United States will be losing more and more manufacturing jobs to Asia in the future.

Of course, the financial integrity of the United States is also somewhat dependent upon Mexico. The state of Texas, for instance, is deeply concerned about Mexico's economic development, because Mexico's role in the global economy has consequences for Texas real estate markets. In fact, our country's entire economy could wind up **veering off course** if the situation in Mexico does not improve. If the United States wants to retain its **leading position** in the world marketplace, then we should consider doing more to help Mexico's economic development. Otherwise, Asia might **take the prize** in the global economy.

conventional; simile:

Economic Development

Economic development is a challenging and competitive process, very much like auto racing. Consider, for example, Mexico's developing economy. While other newly industrialized countries like China and India have **pulled ahead** economically, Mexico has been left **miles behind.** A number of reasons can be cited for Mexico's underperformance relative to these other **accelerating** economies. For one thing, Mexico is extremely dependent upon the United States. But our country is struggling with its own **stalled** economy. And both Mexico and the United States will be losing more and more manufacturing jobs to Asia in the future.

Of course, the financial integrity of the United States is also somewhat dependent upon Mexico. The state of Texas, for instance, is deeply concerned about Mexico's economic development, because Mexico's role in the global economy has consequences for Texas real estate markets. In fact, our country's entire economy could wind up **veering off course** if the situation in Mexico does not improve. If the United States wants to retain its **leading position** in the world marketplace, then we should consider doing more to help Mexico's economic development. Otherwise, Asia might **take the prize** in the global economy.

novel; no simile:

Economic Development

Economic development is a challenging and competitive process. Consider, for example, Mexico's developing economy. While other newly industrialized countries like China and India have **turbocharged ahead** economically, Mexico has been left **several laps behind.** A number of reasons can be cited for Mexico's underperformance relative to these other **revved-up** economies. For one thing, Mexico is extremely dependent upon the United States. But our country is struggling with its own **sputtering** economic **engine.** And both Mexico and the United States will be losing more and more manufacturing jobs to Asia in the future.

Of course, the financial integrity of the United States is also somewhat dependent upon Mexico. The state of Texas, for instance, is deeply concerned about Mexico's economic development, because Mexico's role in the global economy has consequences for Texas real estate markets. In fact, our country's entire economy could wind up **fishtailing** if the situation in Mexico does not improve. If the United States wants to remain on the **inside track** in the world marketplace, then we should consider doing more to help Mexico's economic development. Otherwise, Asia might **take the checkered flag** in the global economy.

novel; simile:

Economic Development

Economic development is a challenging and competitive process, very much like auto racing. Consider, for example, Mexico's developing economy. While other newly industrialized countries like China and India have **turbocharged ahead** economically, Mexico has been left **several laps behind.** A number of reasons can be cited for Mexico's underperformance relative to these other **revved-up** economies. For one thing, Mexico is extremely dependent upon the United States. But our country is struggling with its own **sputtering** economic **engine.** And both Mexico and the United States will be losing more and more manufacturing jobs to Asia in the future.

Of course, the financial integrity of the United States is also somewhat dependent upon Mexico. The state of Texas, for instance, is deeply concerned about Mexico's economic development, because Mexico's role in the global economy has consequences for Texas real estate markets. In fact, our country's entire economy could wind up **fishtailing** if the situation in Mexico does not improve. If the United States wants to remain on the **inside track** in the world marketplace, then

we should consider doing more to help Mexico's economic development. Otherwise, Asia might **take the checkered flag** in the global economy.

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