CHAPTER FOUR

DEPICTING FICTIVE MOTION IN DRAWINGS*

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1. Introduction

Motion verbs are pervasive. Found in all languages and all levels of discourse (Miller 1972; Miller & Johnson-Laird, 1976), they are highly polysemous, affording a range of interpretations and occurring in a wide variety of grammatical constructions. When interpreted literally, motion verbs express movement along a trajectory, as in *Bob goes down the walkway* and *The stray cat runs across the alley.* In such cases, the subject noun phrase referent (e.g., *Bob*) is animate and capable of traveling through space. When interpreted figuratively, motion verbs often express no physical perceivable movement, as in *Weekends go by fast* and *The tone went from morose to ecstatic*. In these cases, motion information metaphorically maps on to relatively abstract conceptual domains, such as change and time, and spatial information is transformed or backgrounded (see Boroditsky, 2000; Lakoff, 1987; Lakoff & Johnson, 1980, 1999; Radden, 1997, for discussion of CHANGE IS MOTION, TIME IS SPACE, and related conceptual metaphors).

Another pervasive figurative motion verb use is shown in (1a) and (1b). It too describes a static scene, but in this case, spatial information is highlighted, especially spatial information relating to the trajector (here, subject noun phrase).

(1) a. *The road goes along the coast*
b. *A lake runs between the golf course and the train tracks*

In (1a), the trajector (*road*) is close to and parallel with a landmark (*coastline*). In (1b), it extends between two landmarks (*golf course* and *train tracks*). In both, the trajector is linear, occupying a relatively long space.

Though the construction shown in (1a) and (1b) is ubiquitous in everyday language and has received considerable attention in cognitive linguistics, its conceptual structure is not yet well understood. This goal of this chapter is to gain a better understanding of the representation underlying these figurative uses of motion verbs. First, I provide an overview of relevant cognitive linguistic research, including discussion of fictive motion. Then, I discuss the results of three novel drawing tasks designed to investigate the way these constructions are conceptualized and in turn externally represented.

A commonly held assumption among cognitive linguists is that some linguistic forms and constructions tacitly include *fictive motion,* mentally simulated motion that transpires from one part of a scene to another (see Talmy, 1996, 2000).[1] On this view, upon hearing a spatial description such as *The road goes along the coast* the listener "moves" along some portion of a road, and upon hearing a sentence such as *The lake runs between the golf course and the train tracks* the listener "scans" a lake. Fictive motion is thought to be analogous in some respects to real motion in that it takes time to "go" from one imagined point in space and time to another. It is also believed to provide language users a way to compute information about the layout of the scene, especially the configuration of the trajector and its position relative to other entities (Matsumoto, 1996). For instance, *A table runs along the wall* immediately signals that a table is adjacent to the wall and not simply in the proximity of the wall. Fictive motion is also thought to be subjectively experienced in that the language user enacts "motion" in the absence of an explicitly coded animate agent (see Langacker, 1986).

Fictive motion is not limited to constructions with motion verbs. It is present in a broad range of spatial expressions, including sentences such as *There's a cottage every now and then in the woods,* evoking "movement" along a line of cottages (see Talmy, 2000), or *Ed is across the room from John*, which involves "scanning" from Ed to John. Fictive motion is subsumed under *virtual motion*, which covers a broad range dynamic construal, including temporal scanning, such as the "replay" of events in the historical present (see Langacker, 1999).

Linguistic observations provide some insights into the conceptual structure of fictive motion sentences (also referred to as *FM sentences*) such as (1a) and (1b). One observation concerns tense and aspect. FM sentences often appear in the simple present tense, as shown in (1a), but not in the progressive, as exemplified in ??*The road is running along the coast*. Because FM sentences "already" express an on-going situation with an implicit state change (scanning from one point on the road to another), there is no need to make them more "on-going" by imposing progressive aspect (see Langacker, 1987, 2000). (Note that this utterance would be fine with sufficient context. For instance, Person A asks Person B about the status of a new road, and Person B, who works on the road crew, responds with *The road is running along the coast*, highlighting the evolving, changing state of the road.) A second observation is that temporal modifiers often occur with FM sentences, as in *The road goes along the coast <u>for two hours</u>*. The same phrase could also indicate how long it took to actually move along the coast, as in *Bob drove along the coast <u>for two hours</u>*. A third observation is that directional phrases often occur with FM sentences, as in *The road goes <u>north</u>* or *The road goes <u>left</u>*. The same phrases describe direction of actual movement, as in *The train goes <u>north</u>* or *The taxi turned <u>left</u>*.

Such linguistic observations are informative and useful, but conducting experiments can lead to deeper insights into language representation, comprehension, and use (see Gibbs, 1991. Doing on-line experiments is one way to investigate conceptual structure, including that of FM sentences. In (Matlock, 2001, in press), I did a series of decision-time experiments that tested how long it took participants to read and make decisions about FM sentences in a variety of contexts. The rationale was that if people simulate motion or visual scanning while attempting to understand fictive motion language, it should be possible to manipulate that simulation by varying contextual information about motion, for instance, placing an FM sentence in the context of a story about fast motion versus slow motion. Overall, participants were quicker to process FM sentences after reading stories about fast travel versus slow travel, short-distance versus long-distance, and with easy terrains versus difficult terrains. Together, the results suggested that understanding an FM sentence required participants to tap into information about the actual motion they had read about and imagined while reading the story (for supporting arguments, see Barsalou, 1999 and Glenberg, 1999). Critically, control experiments showed that participants were no faster or slower when reading comparable spatial descriptions that did not include fictive motion, for instance, *The road is next to the coast*.

Doing experiments with drawings is another way to investigate conceptual structure. Drawings are external representations of people's conceptions of the world, and they provide insights into how they conceptualize objects, states, and actions (Tversky, 1999, 2001). They can also reveal aspects of conceptual understanding that may otherwise be impossible to express in words alone. This is evident in advertisements that use pictorial metaphor (see Forceville, 1997). It is also seen in the way illustrators draw lines trailing behind a figure or an elongated figure to depict motion (McCloud, 1993; Tversky, 1999), and in the way people use lines and arrows to specify direction and other motion information in maps (Tversky & Lee, 1998, 1999). Inferring motion from lines is so natural that even blind individuals "see" motion in raised curved lines and draw lines to indicate motion, for instance, lines emanating from a person (Kennedy, 1997).

In what follows, I discuss three drawing studies designed to get at the conceptual structure of fictive motion sentences. If mental simulation of movement or scanning is part of the conceptual structure of sentences with fictive motion, then that information may be observable in the way people externally represent salient spatial elements described by FM sentences. In particular, they may spatially extend or elongate trajectors in spatial depictions. If so, we might expect a long narrow rectangle to represent a carpet (trajector) in the FM spatial description *The carpet runs between the wall and the counter*, but not necessarily in the comparable non-FM (non-fictive motion) spatial description *The carpet is between the wall and the carpet*. In all three studies, participants read a sentence that described a spatial scene, and drew an image to represent their understanding of that sentence. In Study 1, they generated depictions of FM sentences, such as *The pond runs between the barn and the corral,* and non-FM sentences, such *The pond is between the barn and the corral* – sentences judged as having similar meanings and as having trajectors that may or may not be long in the world (e.g., pond). In Study 2, participants drew pictures of sentences such as *The trail goes along the road* and *The trail is next to the road* – sentences with inherently long trajectors. In Study 3, participants drew arrows to represent traversable trajectors in FM sentences that featured slow, neutral, or fast manner verbs (e.g., *race*, *go*, *crawl*), for instance, *The frontage races through the countryside* and *The road crawls from one vista point to another*.

2. Study 1

The goal of study 1 was to examine how people would depict sentences that did and did not include fictive motion. Of interest was how trajectors that may or may not be construed as long would be drawn. Would they be longer in depictions of FM sentences than in depictions of non-FM sentences? If the trajector (hereafter, TR) is generally longer in depictions of FM sentences than in depictions of non-FM sentences, it could suggest differences in conceptual structure due to motion simulation or some kind of elongation or linear extension.

Method

Participants

Fourteen UCSC undergraduates participated for credit in a psychology course. All were native speakers of English or learned the language before the age of 7.

Stimuli and Design

Stimuli included 128 English sentences. Each sentence described a spatial scene that was (a) outdoors (e.g., farm), (b) indoors (e.g., classroom), or (c) on the human body (e.g., leg). Primary stimuli included 32 sentence-pairs. Sentences in each pair were nearly identical. The FM sentence featured the motion verb *run*, and the non-FM sentence featured the copula verb *be*. In addition, half the pairs featured the prepositional phrase *between X and Y* (both FM and non-FM) (e.g., *A birthmark runs between her ankle and knee*, *A birthmark is between her ankle and knee*), and the other half featured *along X* (FM) and *next to X* (non-FM) (e.g., *The tattoo runs along his spine*, *The tattoo is next to his spine*). The sentences in each pair varied only minimally to lessen the influence of other factors.[2] Sample stimuli are shown in Appendix I.

All sentences had subject noun phrases that referred to objects of variable length in the real world. For instance, an object such as a table may or may not be long (e.g., small round coffee table or long rectangular dining room table). A norming study before the experiment ensured that experimental sentences would include only trajectors that were conceptually "flexible" in length. Twelve UCSC undergraduates rated 195 concrete (tangible, visible) nouns on how long they were. To make their judgments, participants used a scale of 1 to 7, in which "1" was "never long", and "7" was "always long". The list included a wide range of items, including *lake*, *tattoo*, *parking lot*, and *blackboard*. In the end, only the items with mean ratings in the middle range were recruited as TR's for sentential stimuli in the experiment (3 to 5). This was important to determining whether TR's that are neutral to length would be linearly extended when they appeared in depictions of FM sentences.

Prior to the experiment it was also important to establish that the two types of stimuli – FM sentences and non-FM sentences – would be as semantically similar as possible. In a separate norming study, 10 UCSC undergraduates rated sentences in every pair on semantic equivalence. Participants were told to think about the meaning of each sentence in a pair and provide a similarity rating. Using a scale where "1" indicated "not at all the same meaning" and "7", "the same meaning", participants rated 50 pairs, including items such as *A birthmark runs between her ankle and knee* and *A birthmark is between her ankle and knee*. Only the pairs with mean ratings of 5 or higher were retained as stimuli for the experiment. Finally, it was important to ensure that all sentences in the experiment were semantically sensible. Using a scale of 1 to 7, in which "1" was "makes no sense" and "7" was "makes perfect sense," 15 UCSC undergraduates judged all sentences as on semantic sensibility. All sentences in this study had mean ratings of 5 or higher.

The stimuli also included 32 filler pairs of spatial sentences, such as *The rocking chair sits on the back porch* and *The rocking chair is on the back porch*. All sentence pairs, including fillers, were put into two lists so no participant would see both sentences in a pair. One contained 16 FM sentences, 16 non-FM sentences, and 32 filler sentences, and the other, the remaining 16 FM sentences, 16 non-FM sentences, and 32 fillers. Sentences in each list were randomly ordered and put in a booklet. In both booklets, each sentence appeared at the top of an otherwise blank, vertically oriented 8.5 by 11 inch page.

Procedure

After filling out a survey about language background and visual impairments, each participant was given a booklet and instructed to (1) read each sentence carefully, (2) imagine what it meant, and (3) quickly sketch the image below the sentence. The participant was told not to be overly concerned with detail because no sketch would be analyzed on artistic merit.

Results and Discussion

Only the drawings for the non-filler sentences were analyzed. Length scores were calculated by first measuring the length and width of every TR (e.g., *birthmark*) in centimeters, and then dividing length by width. (Two coders, who were blind to the study, measured the scores here and in Study 2 and agreed 92 percent of the time.) The length scores were averaged across all drawings for FM sentences and non-FM sentences. Overall, TR's were longer in depictions of FM sentences (M = 2.73) than in depictions of non-FM sentences (M = 1.84), $t_{(12)}$ = 4.91, $p < .001$. See Appendix II for examples of drawings.

To see whether the overall difference in TR length was primarily driven by any one sentence type, two additional t-tests were run. One compared only the FM and non-FM sentences with the preposition *between*, yielding a reliable difference, $t_{(12)} = 3.05$, $p < .01$ (FM = 2.44, non-FM = 1.94). The other compared only the FM and non-FM sentences with the preposition *along/next to*, showing a reliable difference, $t_{(12)} = 5.10$, $p < .001$ (FM = 2.99, non-FM = 1.75). Thus, the difference in TR length was not driven by differences in prepositions.

The results suggest the TR is conceptualized differently for FM sentences than it is for non-FM sentences, even though the two types of sentences are judged to be highly similar in semantic content. One possibility for greater TR length in depictions of FM sentences is that people naturally simulate motion or tap into motion information when processing fictive motion language. If so, this could encourage them to conceptually elongate the TR – either through scanning along it and later representing it in static form, or through spatially extending it and building it up over time. Another possibility, however, is that the mere presence of the motion verb in the FM sentence led to differences in TR length.

3. Study 2

The second study further investigated the conceptual structure of fictive motion using the drawing task from Experiment 1. Here participants were given only FM and non-FM sentences that contained inherently long TR's (e.g., *road* in *A road goes along a mountain range* and *The road is next to the mountain range*). Of interest again was how the two types of sentences would be depicted in drawings. Specifically, would inherently long TR's be even longer in depictions of sentences with fictive motion?

Method

Participants

Nineteen UCSC undergraduates participated for credit in a psychology course. All were native speakers of English or learned the language before the 7 years of age.

Stimuli and Design

Primary stimuli included 16 pairs of sentences that described outdoor settings. Each pair contained an FM sentence and a non-FM sentence. The FM sentence featured a motion verb (*go*, *run*), and the non-FM sentence featured a copula verb (*be*). The FM sentence also included the preposition *along*, as in *A road goes along a mountain range*, and the non-FM sentence included the prepositional phrase *next to*, as in *A road is next to a mountain range*.[3] Sample stimuli are shown in Appendix I.

A norming study ensured all FM and non-FM were highly semantically similar. Using a scale where "1" indicated "not at all the same" and "7" indicated "the same", 10 UCSC undergraduates rated sentence pairs such as *A sidewalk goes along a canal* and *A sidewalk is next to a canal*. In the end, only highly similar pairs (mean rating of 5 or higher) were used in the study. Those same sentences had also been rated as semantically sensible (mean rating of 5 or higher) by 21 UCSC undergraduates. They also included TR's judged as relatively long (mean rating of 5 or higher) in the norming study mentioned in Study 1.

All pairs of sentences, including the 16 filler pairs, were put into two booklets. One set contained 16 FM sentences, 16 non-FM sentences, and 32 filler sentences, and the other, the remaining 16 FM sentences, 16 non-FM sentences, and 32 filler sentences. Sentences in both booklets were randomly ordered and each sentence appeared at the top of an otherwise blank horizontal 8.5 by 11 inch page.

Procedure

Each participant followed the same procedure used in Experiment 1.

Results and Discussion

Only the depictions of non-filler items were coded and analyzed. Length scores were measured using the method in Study 1. Overall, people drew longer TR's when drawing of FM sentences (M = 10.13) than when drawing non-FM sentences (M = 6.79), $t_{(18)} = 3.51$, $p < .01$. See Appendix II for examples.

The results, consistent with those of Study 1, show differences in the way people conceptualized the TR in understanding and drawing FM and non-FM sentences. One explanation for longer TR's in depictions of FM sentences is that people simulated motion or tapped into conceptual structure about actual motion in making sense of the sentence and forming a mental image. If so, this may have led them to conceptually elongate the TR and draw a longer object in the picture. Another possibility is that the motion verb alone led to longer TR's.

4. Study 3

The third study further investigated the conceptual structure of fictive motion. In this case, a slightly different task was used, one with more attention on the trajector and one that used only FM sentences. Participants were given FM sentences with manner verbs that expressed varying rates of speed in their literal uses, such as *race* (fast), *creep* (slow), and *go* (neutral). For each sentence, participants drew an arrow to represent the TR (e.g., *road* in *The road jets from one vista point to another*). Of interest was whether manner of movement alone would lead to difference in how arrows were drawn, especially length, thickness, and crookedness. If FM sentences include motion as part of their conceptual structure, and if this is reflected in a spatial depiction, we would expect TR's to be longer, thinner, and less crooked for FM sentences with fast motion verbs, even though nothing is actually moving in the description.

Method

Participants

Sixteen UCSC undergraduates participated for credit in a psychology course. All were native speakers of English or had learned the language before 7 years of age.

Stimuli and Design

The stimuli included 24 FM sentences and 48 fillers that described spatial scenes. Every FM sentence featured an underlined TR that represented a travel route (e.g., *road*, *highway*) and a motion verb that expressed (in its literal interpretation) a fast, slow, or neutral travel rate. The 6 slow verbs were *jog*, *crawl*, *creep*, *plod*, *meander*, and *ramble.* The 4 fast verbs (some used twice) were *jet*, *fly*, *race*, and *speed*, and the neutral verb was *go*. Verbs were categorized on rate of speed determined by a survey in which 18 UCSC undergraduates rated 45 action words (e.g., *slide*, *run*, *race*, *creep*, *jump*) on how fast they imagined doing the action and how long the actions took (see Matlock, 2001). See Appendix I for stimuli.

All sentences were randomly ordered and put into a booklet. Under every sentence there was a space for drawing the arrow. The space was 2 inches high and 8.5 inches wide.

Procedure

Every participant was instructed to (1) read each sentence, (2) focus on the underlined word in the sentence, (3) quickly draw an arrow to represent it, and (4) not erase.

Results and Discussion

Three research assistants who were blind to the experimental manipulation rated all arrows on length, crookedness, and thickness. A high degree of inter-rater reliability was obtained (95 to 98 percent). (All p-values are < .05 unless specified otherwise.)

Length

To calibrate themselves, the coders first examined all arrows produced by a single individual. Then they rated every arrow on how it compared to all others drawn by that individual. A length rating of "1" specified "very short", and a rating of "7" specified "very long". All scores were then averaged according to the rate of speed expressed by the verb (fast, neutral, slow). The mean length rating for fast verbs (FV) was 4.95, for slow verbs (SV), 4.07, and for the neutral verb (NV), 3.99. A within-subjects analysis of variance showed a main effect for verb, $F_{(2,45)} = 11.1$, $p < .001$, suggesting that manner influenced arrow length. Closer inspection showed a reliable difference between FV and SV, $t_{(30)} = 4.26$, and between FV and NV, $t_{(30)} = 4.04$, but not between NV and SV.

Crookedness.

Coders surveyed all arrows for a single participant, and later rated every arrow on how crooked it was compared to all other arrows drawn by that individual. A rating of "1" meant "not at all crooked", and a rating of "7" meant "very crooked". Average crookedness scores were 1.59 for FV, 2.37 for SV, and 2.63 for NV, respectively. A within-subjects ANOVA then revealed a main effect of verb, $F_{(2,45)} = 9.51$, $p < .001$, indicating that arrow crookedness was affected by the information expressed by the verb.[4] Closer inspection yielded a reliable difference between FV and SV, $t_{(30)} = 2.88$, and FV and NV, $t_{(30)} = 4.8$, but not between NV and SV.

Thickness

Coders first examined all arrows per individual. Then they obtained a thickness score for every arrow by comparing it to all other arrows drawn by that individual. A rating of "1" meant "not at all thick", and "7" meant "very thick". The average ratings were 1.04 for FV, 1.2 for NV, and 1.41 for SV. A within-subjects ANOVA showed a main effect for verb, $F_{(2,45)} = 5.65$, indicating that manner information in the verb influenced arrow thickness. Closer analysis showed a reliable difference between FV and SV, $t_{(30)} = 2.67$, and between NV and SV, $t_{(30)} = 2.19$, but no difference was observed between FV and NV.

Together, the results show that arrows that depict TR's in FM sentences with fast motion verbs (e.g., *race*) are longer, thinner, and less crooked than arrows that are depictive of TR's in FM sentences with slow motion verbs (e.g., *creep*). One possibility is that people mentally simulated motion or tapped into motion information when thinking about and forming an image of fictive motion sentences. This would mean that fast verbs caused people to simulate movement quickly and slow verbs caused people to simulate movement slowly. If so, these conceptual differences could have led to differences in how drawings were executed, for instance, slower pen stroke and shorter arrow for slow manner verbs. Another possibility is that nothing more than type of manner that was specified in the motion verb drove the results.

5. General Discussion

Three studies investigated the comprehension of sentences such as *The road runs along the coast*, believed by cognitive linguists to evoke mentally simulated traversal or scanning. Study 1 and Study 2 used free-style drawing tasks to investigate how trajectors would be drawn in depictions of FM sentences and depictions of non-FM sentences. The results revealed that depictions of trajectors were longer for FM sentences than for non-FM sentences even though the sentences were judged as being similar in meaning. Study 3 used a drawing task to investigate how trajectors would be depicted by arrows in FM sentences. Of interest was whether manner information (slow, fast, or neutral verb) would influence the way arrows were drawn. The results showed that arrows were longer, thinner, and straighter with fast verbs than with slow verbs.

The results of the studies reported here lend support cognitive linguists' claims about fictive motion and its role in the understanding of FM sentences. As shown in Study 1, objects that are not necessarily long, such as birthmarks, are longer in depictions of FM sentences, such as *The birthmark runs between her knee to her ankle,* than in depictions of non-FM sentences, such as *The birthmark is between her knee to her ankle*. Because drawings reflect people's conceptions about space (Tversky, 1999), it is not unreasonable to assume that longer trajectors in depictions of FM sentences are the end result of (a greater degree of) simulated motion or scanning. The thinking is that conceptually elongating or scanning along a linear entity takes time and that in a static depiction, time maps onto space. The same explanation applies to the results of Study 2. In that case, trajectors that were already long (e.g., *road*) became longer in depictions of FM sentences than they were in depictions of non-FM sentences.

Study 3 offers further support, as depictions of trajectors were longest with fast verbs and shortest with slow or neutral verbs, suggesting that the speed of the verb interacts with and structures the construal of the noun phrase. One explanation is that the semantic velocity expressed by the verb mapped onto the velocity of the hand during drawing. Support for this comes from recent work on haptic perception and visual memory. Kerzel (2001), for instance, found a connection between hand speed and perceived velocity of moving objects. Participants in his study first watched a fast- or slow-moving visual stimulus. After that, they moved their hands either slowly or quickly (as per verbal or non-verbal instruction). Next they were asked to specify how quickly or slowly the visual stimulus moved. The results, that participants' velocity of hand movement influenced their retention of visual velocity, suggested that visual perception and somatosensory perception are tightly coupled. Thus, based on Kerzel's findings, it is reasonable to entertain the idea that in drawing a sentence such as *The road jets from one vista point to another*, participants in the studies presented here mapped verb velocity onto hand manual, that is, faster hand movement for drawing trajectors associated with fast verbs. Future research that measures velocity of hand movements could be informative.

The idea that figurative uses of motion verbs include mental simulation may seem odd to language theorists who do not appeal to dynamic representations. However, scores of psychological studies have shown that mental imagery figures into all sorts of reasoning and problem solving. For instance, people are able to generate and mentally rotate three-dimensional images (e.g., Cooper & Shepard, 1984; Shepherd & Metzler, 1971). What's more, people are able to imagine moving through an imagined environment and to shift position in the environment with non visual input (see Denis, 1996; Denis & Cocude, 1989; Kosslyn, 1994). People are so good at imagining motion that the time taken to mentally "move" across an imaginary region mirrors the times one would expect from actual movement through an actual region in space (see Kosslyn, Ball, & Reiser, 1978). Thus, it is plausible that people mentally simulate motion or scanning along a trajector when understanding FM sentences. For instance, it is not unreasonable to assume that in Study 1, participants elongated items such as *lake* in drawings because they mentally scanned the lake during the processing of sentences such as *A lake runs between the golf course and the train tracks*.

What is most intriguing about the results reported in this chapter is that none of the stimuli conveyed actual motion through physical space. In all three studies, only figurative interpretations of motion verbs were available. If the sentences *had* expressed explicit motion through physical space, the results would be less interesting. For instance, if Study 3 had used literal uses of motion verbs, we would expect long arrows for a sentence such as *John races through the park* and short arrows for *John crawls through the park*. That differences arise even though there is no physical motion conveyed in the figurative uses of motion verbs provides compelling evidence to support cognitive linguists' claims that FM sentences involve simulation or scanning of movement along a trajectory.

These results challenge standard psycholinguistic accounts for how words are represented and processed. Regardless of how motion or scanning was simulated while people did the task, there was a strong interdependence of verb and subject noun phrase. In every study, the depiction of the subject noun phrase varied according to a difference in the verb: a motion verb or copula verb in Studies 1 and 2, and a slow verb or fast verb in Study 3. That the same noun phrase was depicted differently lends support to the idea that lexical meaning is emergent and interactive (e.g., Elman, Bates, Johnson, Karmiloff-Smith, Parisi, & Plunkett, 1996; MacWhinney, 1999; Tomasello, 1998). The results are also problematic for the view that comprehending polysemous verbs involves a dictionary look-up (for discussion, see Gibbs & Matlock, 1999). That would not explain how a verb such as *go* would influence the way another constituent in the sentence was depicted in the end. The results also call into question approaches that assume a hard and fast distinction between figurative and literal language (for discussion, see Coulson & Matlock; Gibbs, 1994). In some respects, the meaning evoked with fictive motion language is not unlike that of actual motion, even though nothing is described as moving. This is especially clear in Study 3 (e.g., long arrow with fast verb).

The possibility that simulated motion figures into the use and understanding of language, including of sentences, such as *The road runs along the coast*, is not all that mysterious. Thinking about motion and space during language comprehension is natural, and involves tapping into and assimilating knowledge acquired from direct embodied experience and interaction with the world (Clark, 1973; Lakoff, 1987; Glenberg, 1999). Understanding FM sentences involves knowing things like how long movement generally takes and knowing that it occurs along a trajector "contained" by a spatial region (Matlock, in press). Much of this knowledge is probably tacit and structured by basic image schemata, such as SOURCE-PATH-GOAL and CONTAINER (see Gibbs & Colston, 1995; Johnson, 1987; Mandler, 1992; 1996). Although some of it may be conscious, for instance, remembering the lake you used to swim in or your local golf course upon hearing *The lake runs between the golf course and the train tracks*.

The precise mechanisms underlying fictive motion need to be mapped out before we can fully understand how people process figurative uses of motion verbs in sentences such as *The road runs along the coast*. But for now, we can say that figurative uses of motion verbs appear to evoke conceptual structure that is dynamic and reflective of the way we perceive and enact motion in the world.

Acknowledgments

Thanks to Frank Brisard, Ravid Aisenmann, Raymond Gibbs, Jr., and an anonymous reviewer for comments on an early draft. Thanks also to Herbert Clark, Rachel Giora, Art Glenberg, Paul Lee, Leonard Talmy, and Barbara Tversky for sharing insights related to this work, and to Nicole Albert, Jeremy Elman, Kat Firme, Sydney Gould, Krysta Hays, and John Nolte for collecting and coding data.

Endnotes:

* Some of the work in this paper was presented at RAAM-4 (Research and Applying Metaphor), Tunis, Tunisia, April, 2001.
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1 Talmy (1983) originally used the term *virtual motion* to refer to this phenomenon. Fictive motion is akin to Langacker's (1986) *abstract motion* and Matsumoto's (1996) *subjective motion*. Here I address only one type of fictive motion, Talmy's (2000) *co-extension path* fictive motion.

2 *Along* could not be used for both FM and non-FM sentences because it could have resulted in a few semantically odd non-FM sentences, for instance, ?*The city park is along the financial district*.

3 See footnote 3.

4 This result is statistically reliable even when the verbs *meander* and *ramble* (inherently crooked or curved) are excluded from the analysis.

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Appendix - I

Experiment 1 Sample Stimuli

The military base runs between the two mountain ranges
The military base is between the two mountain ranges
A lake runs between the golf course and the train tracks
A lake is between the golf course and the train tracks
The pond runs between the barn and the corral
The pond is between the barn and the corral
The swimming pool runs between the patio and the garage
The swimming pool is between the patio and the garage
The blackboard runs between the water fountain and the door
The blackboard is between the water fountain and the door
The birthmark runs between her knee and ankle
The birthmark is between her knee and ankle
The university parking lot runs along the edge of the lagoon
The university parking lot is next to the edge of the lagoon
The city park runs along the financial district
The city park is next to the financial district
The pig pen runs along the side of the barn
The pig pen is next to the side of the barn
The lake runs along the golf course
The lake is next to the golf course
The tattoo runs along his spine
The tattoo is next to his spine

Experiment 2 Sample Stimuli

The highway runs along the coast
The highway is next to the coast
A toll road runs along the coastline
A toll road is next to the coastline
The bike path runs along the railroad tracks
The bike path is next to the railroad tracks
The trail runs along a road
The trail is next to the road
A road runs along a mountain range
A road is next to a mountain range
The trail goes along the road
The trail is next to the road
A freeway goes along the mountain range
A freeway is next to the mountain range
A frontage road goes along the freeway
A frontage road is next to the freeway
The footpath goes along the creek
The footpath is next to the creek
The sidewalk goes along the canal

The sidewalk is next to the canal
Some huts run along the edge of the lake
Some huts are next to the edge of the lake
Some trees runs along the river
Some trees are near the river

Experiment 3 Sample Stimuli

Fast-manner verbs
The frontage road speeds alongside the freeway
The road jets from one vista point to another
The toll road races through the countryside
The highway races through the grasslands
The road flies through the countryside
Neutral-manner verbs
The road goes through the desert
The footpath goes through the hills
The trail goes through the valley
The street goes through farmland
The freeway goes through the forest
Slow-manner verbs
The toll road meanders through the countryside
The road crawls from one vista point to another
The highway crawls through the grasslands
The sidewalk jogs from one house to another
The road plods through the countryside

Appendix – II

Examples of drawings from Experiment 1

Figure 1: The birthmark <u>is</u> between her knee and her ankle (non-FM)

Figure 2: The birthmark <u>runs</u> between her knee and her ankle (FM)

Appendix – II

Examples of drawings from Experiment 2

Figure 3: A road is next to a mountain range (non-FM)

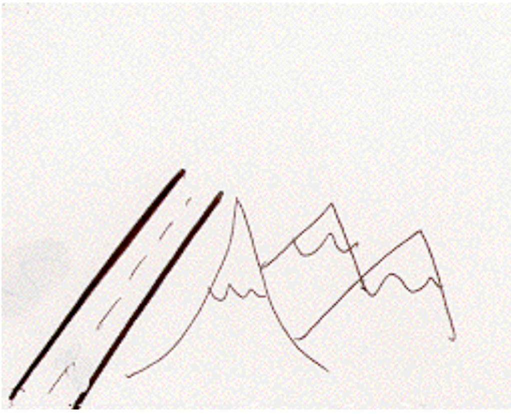

Figure 4: A road runs along a mountain range (FM)