Motion Events in Language and Cognition

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1. Motion and the Language-Cognition Interface

The relation between language and thought has held a constant fascination for students of human cognition. In recent years, the question of whether language shapes or is shaped by cognitive categories has been at the center of debates on language and thought. One position, commonly referred to as 'linguistic determinism' (or 'linguistic relativity'), has been particularly forcefully argued for by Benjamin Whorf. According to Whorf (1956: 212),

> Formulation of ideas is not an independent process, strictly rational in the old sense, but is part of a particular grammar, and differs, from slightly to greatly, between different grammars…

The opposite, 'universalist', view has been strongly associated with Noam Chomsky. Chomsky (1975: 4) writes:

> Language is a mirror of mind in a deep and significant sense. It is a product of human intelligence… By studying the properties of natural languages, their structure, organization, and use, we may hope to learn something about human nature; something significant, if it is true that human cognitive capacity is the truly distinctive and most remarkable characteristic of the species.

These two positions on the psychology of language and thought could not be more different. On the relativistic view, language causally affects the kinds of concepts humans can and do construct and use; on the universalist position, language reflects previously available concepts and can therefore be a window onto cognitive capacities unique to humans.

The studies we report in this paper represent an attempt to contribute to this debate by investigating whether linguistic representations guide and constrain nonlinguistic cognition. We have chosen to concentrate on motion as a testbed for the two competing positions on the language-cognition interface. There are two main reasons for this choice. Firstly, motion and location have been the focus of intensive investigation in lexical semantics and psycholinguistics (Levin 1985, Talmy 1985, Jackendoff 1990, Choi and Bowerman 1991, Slobin 1991, 1996, Bloom et al. 1996); secondly, several researchers now seem to agree that motion

and space provide both an empirically rich and a tractable domain to investigate language-thought relations (see Levinson 1996, Gentner and Boroditsky 2001).

Our paper is organized as follows. We begin by introducing those dimensions of the cross-linguistic expression of motion which will be the focus of our investigations (Section 2.1). After discussing previous experimental work, we set up a number of hypotheses concerning the relation between the linguistic encoding of motion scenes and the nonlinguistic conceptualization of the same events (2.2). In the main part of the paper, we present the results of two experiments which tested these hypotheses in English and Modern Greek (Sections 3 and 4). Towards the end, we return to the broader issues raised by the language-thought debate and draw some conclusions.

2. The Kinematics of Motion
2.1 Path and Manner in Cross-Linguistic Motion Descriptions

Imagine a simple motion event: a golf ball is rolling across a golf field. Human languages possess the means to parse this scene into a number of distinct encodable parts. For instance, language after language offers the means to refer to the ball separately from the background (the field), to follow its trajectory or path (across the field), to comment on its manner of moving (rolling or bouncing), to note whether the movement was caused by an agent (a golf player) or not, and so on. The fact that these and similar features are consistently singled out in the cross-linguistic packaging of motion events has led to the assumption that there is a corresponding inventory of natural (and possibly universal) motion 'primitives' that the linguistic encoding reflects.

Interestingly, these broad cross-linguistic similarities are accompanied by deep and pervasive differences among individual languages, both in terms of the available motion predicates and in the ways these predicates are configured in the clause. A striking difference, first pointed out by Talmy (1985), concerns the encoding of path and manner of motion information. In what we will call *Manner languages* (e.g. English, German, Russian, Swedish, Chinese), manner of motion is typically encoded in the verb, while path information appears in nonverbal elements such as prepositional phrases. In other *Path* languages (e.g. Modern Greek, Spanish, Japanese, Turkish, Hindi), the verb usually encodes the direction of motion, while the manner information is encoded in gerunds or prepositional phrases, or omitted altogether. Here are the typical renditions of the scene we described above in the two languages we will investigate:

(1) English
    The ball rolled   across the field.
      FIGURE MOTION+MANNER   PATH   GROUND

(2) Modern Greek
    I bala   diesxise   to gipedo.
    'the ball crossed   the field'
    FIGURE MOTION+PATH   GROUND

Even though Manner languages have path verbs and Path languages have manner verbs, the *preferred* lexicalization of motion events differs in the two language groups. In some cases, the use of manner verbs in Path languages is structurally disallowed (Aske 1989, Jackendoff 1990, Slobin and Hoiting 1994). Compare the pairs of English and Greek utterances in (3) and (4):

(3) a.   The ball rolled towards the hole.

     b.   I bala   kilise pros   tin tripa.
           'the ball rolled towards   the hole'

(4) a.   The ball rolled into the hole.

     b.   *I bala kilise stin tripa.
           'the ball rolled into.the hole'

In (3), a manner-of-motion verb is combined with a path PP denoting an unbound trajectory with a specific directionality. In (4), the same motion verb appears with a PP denoting a bound trajectory. Both structures are acceptable in English, while Greek only licenses the first one. More generally, Greek (and probably all Path languages) canonically disallows the co-occurrence of a manner-of-motion verb with a path modifier when the motion event involves some sort of bound path. The preferred lexicalization of this type of motion event involves simply the expression of direction (i.e. a path verb).

2.2 Experimental Prospectus

The linguistic facts illustrated in the previous section have caught the attention of many psycholinguists. Slobin (1991, 1996), Berman and Slobin (1994), and Naigles, Eisenberg, Kako, Highter and McGraw (1998) have conducted a series of experimental studies which have mainly confirmed the differences in encoding path and manner of motion across several languages. Given these facts, a natural question arises: is it possible for learners and speakers to pay differential attention to path and manner details of motion as a result of these language differences? Could it be that what one typically attends to for purposes of speaking affects what one attends to for purposes of thinking?

In the studies presented in this paper, we set out to investigate experimentally whether such effects of language on nonlinguistic cognition actually exist in the motion domain. Specifically, we asked whether the strongly differing preferences between English and Greek in expressing paths and

manners affect the way speakers remember and classify motion events. Furthermore, we investigated whether nonlinguistic performance is affected by degree of exposure to the target language. We did so by comparing the behavior of children and adult speakers of the two languages - who have been infected, so to speak, with their native tongues for varying lengths of time.

The hypotheses we set out to test are organized in two sets, which can be summarized as follows:

I. Linguistic hypotheses:
a. Greek and English speakers express path and manner differently in tasks that require them to describe motion events. Specifically, English speakers encode manner information more consistently, while Greek speakers encode path information.
b. Manner/path expressions will diverge more strongly with age, with children looking more alike than adults across the two languages.

II. Nonlinguistic hypotheses:
a. Memory and/or categorization performance for motion depictions will vary for speakers of the two languages. For instance, English speakers will pay more attention to manner information, while Greek speakers will pay more attention to path information.
b. Memory and/or categorization performance will diverge progressively over age.

(I) simply replicates assumptions from previous typological and experimental work. (II) is the linguistic-relativistic prediction, which builds on the cross-linguistic variability in grammar and language use. It is fairly easy to see that, on a Whorfian view, (IIa) and (IIb) follow straightforwardly from (Ia) and (Ib) respectively. We expected to confirm the hypotheses in (I) with our own materials and method; we were more skeptical about the projected conclusions in (II).

3. Experiment 1: Memory
3.1 Method
3.1.1 Participants

Participants were monolingual native speakers of either English or Modern Greek grouped into three age groups. The Young group included 38 English-speaking children between 4 and 6 years and 38 Greek-speaking children between 4 and 7 years. The Middle group included 39 English-speaking children between 10 and 12 years and 39 Greek-speaking children between 9 and 12 years. Finally, the Adult group included 20 English-speaking and 21 Greek-speaking adults.

3.1.2 Materials

The stimuli for Experiment 1 consisted of a set of 6 drawings adapted from Mayer's (1969) well-known frog stories for children. We also created variations of each scene by systematically altering either the path or the manner of the original motion. For example, to create a path variation, one of the original pictures showing a frog hopping into a room was altered to depict the frog hopping out of the room. To create a manner variation, a picture showing a boy jumping over a log was changed to show the boy tripping over the log.

3.1.3 Procedure

Participants were tested individually by a single experimenter in two sessions two days apart. All sessions were conducted in the participants' native language. During Session 1, subjects were presented with the set of target pictures (one at a time) and asked to describe them. In Session 2, subjects were presented with a second set of pictures (again one at a time). Each of the pictures in Session 2 could be identical to the original, or a path/manner variation. The experimenter told the subjects that these pictures could be either the same as the ones they had seen in the previous session or something could have been changed on them; participants were then asked to judge for each picture whether it was the same or different.

3.2 Results and Discussion

To see whether Greek and English speakers do, in fact, differ in their linguistic descriptions of the pictures they viewed during the first session, we coded the main verb in each description as either a Manner verb, a Path verb, or another type of verb. English speakers were much more likely to use a manner verb as the main verb than Greek speakers (even though both groups predominantly preferred manner verbs). Correspondingly, Greek speakers were much more likely to use a path verb as the main verb.

In the recognition task, although the youngest age group scored somewhat closer to chance, there was no difference between the two language groups in their ability to detect whether or not the path or manner depicted in the pictures had been changed. The results of the memory experiment lend no support to the Whorfian hypothesis: path and manner details of motion scenes are not treated differently by speakers of Path and Manner languages. Furthermore, no difference was detected between adult and child populations that could support language-specific pressures on memory.

We wanted to extend the findings of the memory experiment using a different nonlinguistic measure. We also wanted to use a more dynamic way of conveying movement. In Experiment 1, the static pictorial format made the recovery of path information somewhat harder than that of manner information, since monitoring paths requires tracing movement along a trajectory. As a result,

both language groups seemed to focus on manner more than any other dimension of motion in describing what took place in these scenes. Our second experiment addressed these concerns.

4. Experiment 2: Categorization
4.1 Method
4.1.1 Subjects

Participants in this study were again monolingual native speakers of English and Greek who fell into two age groups. One group included 22 Greek-speaking and 14 English-speaking children between 7 and 10. These children had not participated in the previous experiment. The second group consisted of 21 Greek-speaking and 20 English-speaking adults. This was the same group of adults who participated in Experiment 1; they completed the categorization experiment immediately after Session 2 of the memory experiment (and before the debriefing session).

4.1.2 Materials

Materials for this experiment consisted of a picture-book containing 8 sets of motion scenes. Each set consisted of three motion scenes in a match-to-sample format with one sample and two choices. The choices had the following property: one of them preserved the path given in the sample while changing the manner of motion (the 'same-path variant'); the other preserved the manner of the sample while changing the path (the 'same-manner variant'). For instance, one of the sample scenes depicted a man walking down the stairs; the same-path variant showed the same man slide down the stairs, while the same-manner variant presented the man walking to a bookcase. Each of the samples and variants was presented as a series of three digital color photographs depicting the beginning, middle and end of the action.

4.1.3 Procedure

Participants were tested individually by a single experimenter. All sessions were conducted in the participants' native language. After a practice trial, subjects were presented with the test trials and were asked to select the choice in which the participant was 'doing the same thing' as in the sample. After all trials were completed, participants were asked to describe each scene verbally.

4.2 Results and Discussion

We analyzed the linguistic descriptions of the Sample photographs in order to check what speakers paid attention to in their verbal encoding of the target event. The main verb in each linguistic description of the sample pictures was coded as Manner, Path, or Other. English speakers used manner verbs on many

more items than Greek speakers. Moreover, adults used more manner verbs in describing the sample photographs than children did. Generally, the overall shape of findings shows that, for the set of items used in this study, speakers' linguistic descriptions parallel the familiar patterns of Manner and Path languages.

A developmental effect on language preference was obtained only for the English speakers, with the English children showing a less differentiated pattern. The Path linguistic pattern already appears to be well-established in the Greek children. Nevertheless, the Whorfian hypothesis might still predict that a path bias in nonlinguistic categorization will be stronger for Greek adults than children due to extended exposure to the language pattern.

As far as the nonlinguistic results are concerned, both Greek and English speakers chose the Manner Variant on approximately half of the trials. There was no difference in categorization preferences between children and adults.

5. General Discussion and Conclusions

We started out the research reported here with two related sets of hypotheses. We hypothesized, first, that speakers of English and Greek will make use of different linguistic resources in packaging motion information. Indeed, as we suspected, when describing motion events, both English and Greek speakers exploited the structural and lexical options presented to them by their language. According to the corollary relativistic hypothesis, memory and categorization of motion scenes are affected by differences in the linguistic encoding. As we also suspected, this second hypothesis was not supported by our results. Furthermore, even though the cross-linguistic differences are more manifest in adult than in child language across the two language groups, we found that performance in these tasks across ages is not legislated by linguistic patterns (for a fuller analysis, see Papafragou, Massey and Gleitman 2001).

Having tested the predictions of linguistic determinism using different materials, tasks and age groups across two languages, we are now confident that these predictions are not supported as far as the path/manner distinction is concerned. But supporters of the relativistic hypothesis may still be skeptical. One possible objection to our findings is that they concern a perceptual domain in which linguistic effects are highly unlikely. Notice, however, that dynamic occurrences of motion engage mental organization much more complex than low-level perception, since they require the isolation and identification of motion sequences. This task, in turn, relies on complex aspects of event cognition which involve intentionality, agency, etc. In that respect, motion cognition goes beyond geometric-configurational information necessary for handling static scenes and involves some higher-order cognitive organization. It could therefore be argued that motion cognition might be affected by the linguistic segmentation and conflation of events. As we have shown, this view does not find empirical support.

Naturally, experimental investigation of the sort we undertook here is of necessity empirically limited. Thus one may insist that a cognitive domain other

than motion (or some different aspect thereof) will prove more conducive to linguistic effects. Nevertheless, it should be noted that, until now, failure to find empirical support for the linguistic relativity hypothesis has been more spectacular than success at confirming its predictions. We expect that, as new data from a number of ongoing projects are coming in, discussion of the language-thought topic will continue to provide fascination and controversy in the study of human psychology.

Endnotes

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Abstract

Languages differ widely with respect to the ways in which they encode motion events. In some languages (e.g. English, German), manner of motion is typically encoded in the verb, while direction of motion information appears in prepositional phrases. In other languages (e.g. Spanish, Greek), the verb usually encodes the direction of motion, while the manner information is encoded in gerunds or prepositional phrases. Two studies were designed to investigate whether these language-specific patterns affect speakers' reasoning about motion events. They compared the performance of English and Greek children and adults (a) in non-linguistic (memory and categorization) tasks involving motion events, and (b) in their linguistic descriptions of these same motion events. Even though the two linguistic groups differed significantly in terms of their encoding (linguistic) preferences, their performance in the non-linguistic tasks was identical. The results are inconsistent, with respect to this cognitive function, with the neo-Whorfian view that language necessarily plays a causal role in both the time-course and the end product of cognitive development.