Path & Manner Verbs in Action: Effects of "Skipping" or "Exiting" on Event Memory

Dorrit Billman (dorrit.billman@psuch.gatech.edu)
School of Psychology; Georgia Institute of Technology, 274 5th Street
Atlanta, GA 30332 USA

Meredyth Krych (krych@psych.stanford.edu)
Department Psychology; Jordan Hall; Stanford University
Stanford, CA 94305 USA

Abstract

The question of how and whether language influences thought is an important one in many of the cognitive sciences. Our work integrates linguistic analysis on lexical semantics with psychological work on memory. It is motivated by neoWhorfian question whether differences in language use will produce corresponding differences in nonlingusitic cognition. The research reported here asks how memory for familiar, unambiguous, "verb-sized" events presented on video might be influenced by an accompanying verb. Our verb choices of Path versus Manner Verbs were guided by cross-linguistic variation in which aspects of an event are highlighted by the verb. We find a predicted interaction: the verb altered recognition memory of familiar, unambiguous events

Effects of Language on Event Memory

The information in language and in perception, while organized so differently, is nevertheless tightly coupled to allow meaningful interplay: we can talk about what we see and visualize what we hear described. This constrains representation (Jackendoff, 1987) and processing. How is this information linked? Does language influence the information provided by perception, or is the encoding and use of perceptual information relatively immune from the influence of language? The research reported here asks how memory for familiar, unambiguous, "verb-sized" events presented on video might be influenced by an accompanying verb. Our verb choices are guided by cross-linguistic variation in which event aspects are highlighted in the verb.

This hypothesis that language might influence perceptual memory is a version of the neoWhorfian hypothesis: does language influence thought? This question can be asked at two very different, yet related levels: the level of language system and the level of language use.

At the level of the language system, linguists, anthropologists, and developmentalists have asked whether a person's (native) language influences how that person does some cognitive task. This research tradition emphasizes careful analysis of the language system but does not give much attention to identifying what or how cognitive processes produce any effect. While research in the '70's produced little evidence of Whorfian effects, recent research has, including effects on clearly nonlinguistic tasks: on visual memory (Levinson, 1996), on information selected to include in narrative (Berman & Slobin, 1994), on social inference (Hoffman, Lau, & Johnson, 1986), and on cognitive and semantic development (Shatz,Martinez, Diesendruck & Akar, 1995; Gopnik&Choi, 1990).

At the level of language use, cognitive psychologists ask what the effect on cognition might be of choosing one versus another language form from within the same language system. This research tradition emphasizes careful analysis of cognitive processing, particularly memory (schema effects and eyewitness studies), but does not give much attention to the structure of language. Words are typically treated simply as pointers to a schema or concept without reference to their role in the broader language system. These studies have provided evidence that language accompanying a visual stimulus does affect the remembering of it. Effects of label or description are often found when stimuli are ambiguous (Carmichael, Hogan, & Walter, 1932; Bower, Karlin, & Dweck, 1975) or hard to describe (Schooler &Engstler-Schooler,1990) and when tasks invite reconstructive inference (e.g. Loftus & Palmer, 1974) and recall. Occasionally effects of language (for memory of drawings, Gentner & Loftus, 1979) are found with recognition tests and familiar, unambiguous stimuli. However, visual memory is quite good, and effects of description on recognition tests for meaningful material are relatively hard to find (e.g. McCloskey& Zaragoza, 1985; Bekerian & Bowers, 1983). With recognition tasks, effects of language on visual memory are obtained by "slipping by" the verbal information in the form of presuppositions in misleading post-event descriptions and disappears if the information is presented directly or close to the time of encoding (Hall, Loftus, & Tousignant, 1984).

Our work contributes to understanding the influence of language forms on visual memory in two ways. First, we investigate memory for video tapes of simple, familiar, everyday events. Rather than looking at how language might fill in missing information when the perception is ambiguous or already attenuated over the passage of time, we look at how alternative, appropriate descriptions for the same, familiar event affect its memory. Perceptual memory for dynamic, event information might be particularly influenced by language. Unlike static pictures, events are fleeting and do not normally bear reexamination.

Second, our variations in the language describing the events come from linguistic analysis of verbs. We seek to preserve the cognitive psychologist's precise investigation of process but also preserve the insights from lingusitic analysis and consideration of a verb in the context of a

whole system. Our experiments vary language forms within English, but our within-English choices are motivated by contrasts which are important cross-linguistically. We wish to lay a foundation for linking within-language effects to between-language differences. Cross-linguistic differences may be the cumulative result of repeated use of the forms available in and preferred by one language rather than another. Indeed, Kay (1996) suggests that any between-speaker differences resulting from use of different languages might be cut from the same cloth as within-speaker differences in use of one or another form within a single language. While Kay's emphasis was to down-play cross-linguistic differences, this comparison equally suggests the importance of investigating within language effects to understand cross-linguistic differences.

Our study varied the type of verb used to describe a simple motion event. Languages differ in what aspects of the event are encoded in the verb, and what aspects in optional "satellite" constructions such as prepositional and adverbial phrases (Talmy, 1985). Two of these aspects are Path and Manner. Path verbs specify the path over which a moving object travels, while manner verbs specify the manner in which the movement takes place. English is a path-satellite language with manner encoded in the verb, and information about path in prepositional phrases, e.g. "the bottle FLOATED into the cave". English has a highly elaborated verb lexicon for manner, e.g. with over 40 verbs for different ways of walking, from amble to waddle (counted from Levin, 1993). English does have some verbs that specify the path of the moving object rather than manner of movement: "leave", "enter", "ascend", and so forth, but these are few, low frequency, and borrowed from Romance languages. In contrast to English, Romance languages such as Spanish and French typically encode path information in the verb, and manner information in an optional adverbial phrase.

We designed video events which could clearly be described by a manner or path verb. For example, a video clip showed a woman climbing a set of stairs on tiptoe and this was described either as "Tiptoeing" or "Ascending." We asked whether recognition memory would be affected by choice of Path versus Manner verb describing the scene at encoding.

We predict a disordinal interaction so that foils which change Manner on a recognition test will be easier to detect for subjects who hear Manner rather than Path verbs at encoding. Likewise, changes in Path on a recognition test will be easier to detect for subjects who have heard Path rather than Manner verbs at the time of encoding.

Method Design

Encoding Condition (Manner Verb/ Path Verb/ NoLanguage), a between-subject variable was crossed with Recognition Item Type (Path Foil/ Manner Foil/ Old], a within-subject factor.

Subjects

Thirty self-reported, monolingual native English-speaking Stanford students received course credit for participation.

Stimuli

At both encoding and test subjects saw video clips of common, everyday events which lasted 3-20 seconds with 5 seconds of black in between scenes. For subjects in the Path and Manner encoding conditions, the videotaped events were accompanied by a verb at encoding. No language accompanied any scene during recognition.

Encoding Stimuli

There were 24 encoding events, 8 targets and 16 fillers. Target scenarios were designed in sets of three events: one original event and two foils. The target event was designed to be good example of both a path and a manner verb, for example, a child **skipping** through a living room to **exit** through the front door, or a woman **crossing** a road, **jogging**. The 8 target events were skip/exit, jog/cross, pedal/pass, tiptoe/ ascend, stroll/leave, float/rise, hop/enter, and fly/descend. Fillers were other common events including both motion events and explicitly social events.

Recognition Stimuli

For each target scene (e.g. the scene that was labeled either as "Exiting" or as "Skipping"), subjects saw the original clip (as seen at the encoding session) and two foils which were variations of the original. The Path Foil changed the Path of the action in the event so that the foil event did NOT exemplify the original PATH verb. All other aspects, including manner of motion were kept as identical to the original event as possible. Likewise, the Manner Foil changed the manner in the event so that the foil event did NOT exemplify the original MANNER verb. See Table 1. Filler old items and close foils were included .

Table 1. Design of Target and Foils for Recognition Test

Target	Exit	Skip
Path foil	*Approach (not exit)*	Skip
Mannerfoil	Exit	*Gallop (not skip)*

Ideally, both path and manner foils would be of equal difficulty in the control, No Language condition. This is not critical because each item is judged by subjects in both conditions, but it would reduce questions of scaling in interpreting an interaction. We were concerned that we would be forced to use "larger" or "more salient" changes for path rather than manner. Relatively subtle changes in manner may be sufficient to produce a change in manner--from jog to dash, or from skip to gallop. On the other hand, it seems like a larger difference to change from entering to approaching, or from exiting to heading to the door. English has many manner verbs and so their meanings may be "close together" compared to differences in event meaning needed to make a novel event no longer an example of the initial path verb.

Procedure

Encoding Session

Participants were instructed that they would be doing a couple of tasks on everyday activities on that day and the next day. First they would watch short video clips of everyday events. Subjects were told they would preview the video clip events now and "rate them later". Also, they were told that they would hear verbs accompanying each scene but that their task was to watch the clips.

After watching the 7 minute tape of 24 video clips, they performed a filler task to prevent the subjects from rehearsing the video clips and from knowing why they would return. The filler task was writing a instructions for building a Lego model.

Recognition Session

The next day, subjects took a recognition memory test on the video clips with no accompanying language. They viewed clips concerning scenarios they had seen the day before and judged whether each video clip was "identical" to the original clip. Subjects indicated whether the clip was identical to the original event (old) or not identical (new) on a scale from 1-6 confidence scale where 1= Very sure the clip was NEW; 6= Very Sure the clip was old. To help the subjects look for subtle differences between the variations and the original scenes, items 1 and 3 of the recognition list were the old and new clips for a filler scenario.

Subjects saw 24 target-related items (as well as 16 fillers). Of the target related items, 8 were the old, original clips; 8 varied the manner (Manner Foils) and 8 varied the path (Path Foils. No language accompanied any recognition test event.

Subsequently subjects wrote down a general description of what caused them to judge an item as new. They also 1) viewed the original scenes again and generated descriptions and 2) recalled the original words heard at the encoding session.

Scoring

Responses were scored for errors and as rated correctness. A recognition judgment was scored as an error if the rated response was on the incorrect half of the rating scale. For each subject, the percent of errors for the 8 items of each type was totaled, contributing 3 data points.

Rated Correctness scores were generated for every response, 24 data points/subject. High ratings indicate good performance. Scores of 6 mean a subject was very sure then they correctly rated an old item as certainly old (rating of 6) or a new item as certainly new (rating of 1). Scores of 1 mean that a subject was very sure when they *incorrectly* rated an old item as new or a new item as old.

Results

Overall Analysis of Data

Two large analyses, on the Percent Errors and on Recognition Certainty, provided a general model of the data. Figure 1 illustrates the pattern for Recognition Certainty. The 3x3(x10) Percent Errors analysis included Encoding Verb condition (Manner/ Path/ No Language), Recognition Item Type (Manner Foil/ Path Foil/ Old), and their interaction (as well as Subjects nested in condition). The 3x3(x10)x8 Recognition Certainty analysis included these factors plus EventSet(8 different scenarios) and its interactions. See Tables 1&2.

A main effect of Item Type was significant in both analyses (recognition certainty $F(2, 621) = 37.79$, $p < .001$; errors $F(2, 54)$ 23.52=, $p < .001$). Changed Manner foils were more difficult to reject than Path foils. Performance was best on Old Items; subjects seemed biased to accept an item as old unless they had a reason for rejecting it. There was no effect of Encoding Condition, on either measure. The Recognition Certainty analysis also found effects of EventSet, of Subject, and of the EventSetXItemType interaction ($p<.05$).

Encoding Label x Foil Type Interaction

Four analyses found the predicted disordinal interaction. The interaction term on Recognition Certainty and on Errors from the 3x3 analyses reported above were significant ($F(4,621]= 9.93$ Certainty; $F[4,89]=5.92$ Errors; p's $< .001$).

Table 2. Recognition Certainty (SD) for each Encoding Condition and Foil Type

		FOILS		
		Path Foil	Manner Foil	Old
LABEL	Path	**5.28** (.46)	3.35 (.76)	5.24 (.39)
	Manner	4.65 (.69)	**4.51** (.48)	5.1 (.56)
	NL	4.4 (.80)	4.10 (.44)	4.96 (.79)

In addition, two 2x2 analyses provided the most specific test of the hypothesized interaction of Path vs Manner encoding and Path vs Manner foil type. These four key cells are shaded in Tables 2&3; column differences are the critical comparison. Subjects showed the predicted interaction: Path Foils (e.g., not exiting but still skipping) are better rejected by subjects with Path Labels at encoding than by subjects with Manner Labels; and Manner Foils (e.g., not skipping but still exiting) are better rejected by subjects Manner Labels. at encoding than by subjects with Path Labels (Errors $F(1, 18) = 14.11$; Certainty $F(1, 302) = 22.51$; p's $< .001$). The fact that the interaction is significant for Errors as well as the more sensitive rating measure of Certainty shows that the effect is not due to subtle changes in confidence.

The critical pattern is the reversal of performance by the two subject groups for the two Foil Types. While path foils are easiest for all, the relative performance of Path and Manner Encoding groups reverses for path and manner foils.

Table 3. Percent Errors (SD) for each Encoding Condition and Foil Type

LABEL	FOIL: Path Foil	Manner Foil	Old
Path	**.125** (.12)	.525 (.20)	.075 (.09)
Manner	.238 (.14)	**.288** (.10)	.138 (.12)
NoLang	.350 (.19)	.363 (.15)	.188 (.21)

Thus the effect with the more sensitive ratings measure is not simply reflecting subtle shifts in confidence but changes in whether an item is judged old or new.

Linear contrasts on errors showed that most of the 2x2 interaction effect was produced by subjects in the Path Label (Item effect for Path Encoding subjects: $F(1, 54) = 14.21$, $p<.001$; for Manner subjects $F(1, 54) = 0.58$, p=ns). Path

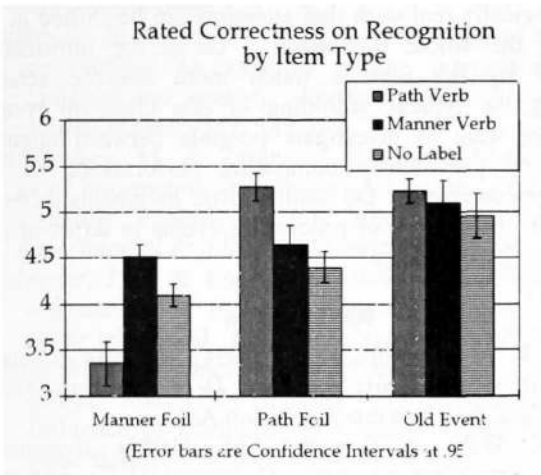

Figure 1: Rated Correctness on Recognition

Label subjects' errors on Manner Foils are drastically higher than on Path Foils [40% higher], while Manner Label subjects have only slightly more errors [5% higher) on Path than on Manner Foils. Further, subjects in the control (No Language) group had equal errors (about 35%) both for Manner and for Path Foils. Thus, giving English speakers Path Labels produces a greater difference between error types and a greater change from No Language than does providing Manner Labels.

Scenario Comparisons

To look for item effects, we looked at the error patterns to foils for the 8 scenarios. For the 8 manner foils, performance on 1 item was at floor and 1 item at ceiling, leaving 6 informative items. On all six of these informative manner foils, subjects in the Manner Label condition made fewer errors than did subjects in the Path Label condition. For the 8 path foils, performance on 3 was at floor, leaving 5 informative items. On 4 of the five informative items, subjects in the Path Label Condition made fewer errors than did subjects in the Manner Label condition. In sum, while we have some nondiagnostic items, 10 of the 11 informative foils follow the predicted pattern.

Discussion

The primary purpose of the experiment was to seek a phenomena: is there an effect of manner or path verb on visual recognition of meaningful, familiar, visually presented events? We did indeed find the predicted disordinal interaction effect of encoding verb on recognition memory. Path foils were easier to reject when an appropriate path rather than manner verb was heard at encoding; manner foils were easier to reject when an appropriate manner rather than path verb was heard at encoding. This held whether responses were scored as number correct or average certainty of correct judgment.

This experiment is a first step in integrating the representational analysis from linguistics with the process methods of cognitive psychology in the domain of motion events. However, this experiment alone says little definitive either about the locus of effect during processing or the nature of the representations involved. However, reflecting on patterns in our data does provide some hints that will guide our ongoing research.

Locus of Effect

Does the verb interact with visual information (at encoding or access) or does it act only to produce a memory-independent response-bias? Response-biases in memory are practically important, as evidenced from work on eyewitness testimony. But still more interesting is the possibility that information from the verb actively guides the way information from the visual event is processed. We offer one broad line of argument that to suggest that our results do not reduce to response bias: Response-bias should only be sensitive to the informativeness of the label and the difficulty of discriminating the visual event, not on the relation between verb and initial event. Conversely, integrative processes should show a more complicated pattern that varies with the particular relations between verb and event. If the visual information cannot be accessed at test with confidence, the label can be used as a guessing strategy about what the scene might have been. A simple guessing strategy works like this: if a scene can be described by a label you heard, then guess that scene is an old item.

1A) This response bias model predicts that the language conditions should differ from the no language conditions in the following way: a) better performance on old items (where test scene will match encoding verb) and on foils that mismatch the label (gallop scene for "skipping"); in both cases the guessing strategy will correctly predict old/new status; b) poorer performance on new foils that match the label (a not-exit foil for an original exit-skip scene described as "skipping"); here the label will still fit this scene (still skipping) and using it as a response bias will incorrectly lead to accepting a new item as old. The same pattern of cost and benefit relative to No Language should be found for both Path and Manner Conditions.

In actuality, the pattern of performance in the Path and Manner Verb conditions is not the same. The Path condition fits the predicted pattern of cost/benefits, but the Manner Verb condition does not. Manner Verb subjects showed (modest) improvement relative to the No Language subjects

for all test types, not a mixed pattern of cost and benefit. The different pattern for Path and Manner Conditions relative to the No Language condition suggests more is going on than response bias. If differences among Label Conditions replicate, this will be one form of evidence that the effect is not all due to response bias.

1B) A related pattern in the data deserves mention here, though it is not diagnostic of whether effects are due to response bias. Not only was the cost/benefit pattern different for the Manner Condition compared to the Path Condition, but performance in the No Language Condition looked much closer to the Manner Condition than to the Path Condition. The No Language Condition might resemble the Manner condition more closely than it resembles the Path Condition because English verbs more commonly encode manner rather than path. Possibly, subjects in the No Language condition were more likely to generate an appropriate manner verb than path verb, and any self-generated labels might function analogously to those provided by the experimenter.

2) A final pattern of differences also suggests that something more than response bias is at work. In the No Language Condition, the foil types were of remarkably similar difficulty with 36% errors for manner versus 35% errors for path foils. However for the language conditions, the path foils (18% errors) were much easier than the manner foils (41% errors). As mentioned in the methods, we had anticipated that the path foils would be considerably easier and that they relied on 'bigger', or more "salient" changes. However, this seemed to be true only when language was provided! Despite counterbalancing, which would equate any effects from response bias, the relative difficulty of foils changed when verbs were provided, in comparison to the No Language Condition. Again this suggests that language changed the way information from the videos was used.

The experiments were not designed to identify when in processing language had its effect. However, data suggest the effect is not solely late, acting as a response bias.

Representation of Path & Manner Verbs and of Events

This study also opens investigation of how different aspects of visual events and of verb meanings are represented. Linguists analyze verb meanings along contrasting dimensions such as Path and Manner. But mental distinctions in verb meanings may not be organized so neatly; the meanings of skip, gallop, leave, and rise might all be different but need not be organized along contrasting dimensions of Path and Manner. For example, verb meanings might be relatively idiosyncratic bundles of schematic information such as the age of typical skippers, how one feels when skipping, together with information about limb movement, etc. But if hearing manner words allowed one to selectively prime other manner verbs, or to selectively attend to manner information in an event, independent of the particular manner associated with a given verb, these findings would argue for the functional significance of Path or Manner attributes. Would any such attributes simply reflect a nonverbal analysis of event structure? Or would this information only be organized into attributes in reaction to processing in a language which treats these particular distinctions as fundamental.

Future Directions

Throughout our future research we can capitalize on understanding of processing drawn from psychology and on linguistic analysis of representation. In turn we hope to provide a more integrated understanding of how language and thought are related in the domain of verbs and events. In understanding how we can describe what we see, we may need to account for how our seeing is affected by description.

Our future research has three aims. First we will trace out when in processing the effect(s) occur(s) and the extent of interaction between visual and verbal information. Second, we will investigate the nature of the information provided by the verb. Are the formal dimensions of Manner and Path psychologically real such that attention can be shifted at the level of the whole dimension? Or is the information provided by the verb a much more specific schema regarding the typical unfolding of one class of events? Third, we want to investigate possible between-language differences, particularly comparing performance in No Language conditions. Do nonlinguistic judgments differ as the result of a history of processing events in terms of one versus another language?

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