Path and Manner Priming: Verb Production and Event Recognition

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Abstract

Path and manner are important organizing dimensions of verb lexicons. We investigated how priming with path verbs, manner verbs, or no priming might influence event processing. Before watching a videotaped target event, subjects were primed by path and manner verbs accompanying other, unrelated events. We found effects of priming verbs on the verbs subjects produced to describe an unlabeled event. We found effects of verb produced on subsequent recognition. We compare these effects from self-generated verbs with effects from experimenter-produced verbs.

Introduction

Language and vision provide two powerful systems for learning from the world. Information acquired from what we see and what we are told is the basis for much of our knowledge of the world (Jackendoff, 1987). How does language influence processing of visually presented information? Researchers have tested for effect of language on nonlinguistic cognition within- and between- languages.

Tests for within-language effects vary the term or expression accompanying nonlinguistic information and look for effects of language on nonlinguistic cognition. Typically, this research is motivated by questions about effects of schema or expectations on memory, not questions about language per se. For example, experiments from tests of top-down effects (Carmichael, et al, 1932; Gentner & Loftus, 1979; Schooler &Engstler-Schooler,1990) to tests of eyewitness testimony (Hall, Loftus, & Tousignant, 1984; Loftus & Palmer, 1974; McCloskey& Zaragoza, 1985) have found effects of accompanying labels or descriptions.

Tests for between-language effects have been motivated by the Whorfian (1956) hypothesis. Recent studies have found effects of languages on a variety of cognitive tasks (Gopnik&Choi, 1990, Hoffman, Lau, & Johnson, 1986, Shatz,Martinez, Diesendruck & Akar, 1995; also noneffects Malt et al, in press) including visual memory (Levinson, 1996). Most relevant to the domain we investigate is the research on event representation, specifically path versus manner information. Researchers have found between-language effects on how path versus manner is expressed (Berman & Slobin, 1994; Naigles et al 1998) and affects similarity (Naigles, personal communication).

Our research investigates within-language effects on event memory for path versus manner information. Specifically, we look at how alternative, descriptive verbs effects visual recognition. We were particularly interested in how path and manner verbs affect memory for path and manner information because these aspects of events seem particularly prominent and important.

Manner verbs refer to the way in which a figure carries out a motion. “Hop,” “skip,” and “jump” are examples of English manner verbs. Path verbs refer to the trajectory over which a figure moves, typically with respect to another reference object. “Rise,” “arrive,” and “cross” are examples of English path verbs. Manner and path are two of only a handful of aspects of motion events which are typically conveyed by the verbs of a language. This privilege suggests both aspects are central, important information in other aspects of event cognition. Languages seem to select one of these aspects to be normally conveyed by the verbs, with other information typically carried by ‘satellite’ constructions outside the verb (Talmy, 1985). In English the verb lexicon is organized around manner information and path information is typically conveyed by expressions outside the verb, specifically prepositional phrases. Many other languages, including Romance languages, typically convey path information in the verb and manner in satellites. Nevertheless, within any one language there is variation in verb meaning as well: English has a handful of path verbs, most lower frequency and of Latinate origin (Levin, 1993). Thus manner and path are two important aspects of verb representation that are systematically expressed in language, their method of expression differs across languages, but there is also some variation within a language.

Our previous research (Billman &Krych, 1998) capitalized on within-language variation (verb choice) to investigate how language information and visual information might be coupled. We presented participants

with video-taped events accompanied by either manner or path verbs. Participants returned for a visual recognition test in which no verbs or labels were presented. The test required discriminating the old items from new items with changed manner of motion or else changed path of motion. We found that type of verb initially spoken by the experimenter interacted with the type of recognition errors. Specifically, hearing a path verb ("exiting") made participants more likely to correctly reject a changed path foil relative to hearing a manner verb ("skipping") and hearing a manner verb aided rejection of changed manner foils relative to hearing a path verb.

The current experiment also looks for this disordinal interaction of language at encoding with type of recognition error. It also uses much the same presentation of events at encoding and test. However, the language manipulation is more indirect.

In the current experiment, the participant generated a verb describing the target events and we looked for effects of this participant-generated verb on recognition. We tried to influence the participants' choice of verb by priming (encouraged by other priming effects in language, Bock, 1990). Our primes were experimenter-provided manner or path verbs for unrelated events shown before the target.

We look for 1) effects of priming condition on the type of verbs generated, 2) effects of self-generated verbs on type of recognition, and 3) also for a direct effect of priming condition on type of recognition errors. We expected that effects of labeling by self and by another would be similar, and to this extent expected to replicate and extend our previous findings. However, there might also be differences. Listening to language generated by others might be more likely to focus a listener on aspects of the event not already attended to. Production processes might be more strongly influenced by language-internal factors such a markedness, frequency, and existence of alternative similar forms.

Method

Participants

Ninety-nine Georgia Tech students received course credit for participation. Data from the 75 self-reported, monolingual native English-speaking students are reported here.

Procedure

On the first day participants viewed a series of everyday events. In the Path and in the Manner Condition, some events were labeled with a verb by the experimenter and these labeled trials served as primes. In the No Language (unprimed) Condition no events were labeled by the experimenter. In all conditions there were a few target events unlabeled by the experimenter, and for these the participants were asked to generate their own descriptive verb. On the second day participants returned for the recognition test. No language was provided or generated for any recognition trial. Participants judged whether a presented scene was identical to one they had seen on the first day or differed in any respect.

Encoding Session

Participants were told they would see a series of short video-taped events and that they should watch these very carefully. They were told that for some events the experimenter would ask them to write down a verb describing what was happening in the event and they would be asked to do so by questions such as "what is the woman doing?" presented right before the event began. In the Manner and Path conditions the experimenter spoke a descriptive verb or the question roughly four seconds before the event began; in the No Language condition the experiment said "next scene" to alert the participants, instead of a descriptive verb. An unrelated filler task followed encoding.

Recognition Session

On the next day participants took a difficult recognition memory task viewing video clips with no accompanying description. All items concerned the scenarios they had seen the day before. Subjects judged whether each video was "identical" to the original clip or differed in any way. Participants responded by marking one end of six-point scale for old items ("Sure Old") and the other end for new items ("Sure New"). Responses were scored as correct or incorrect in the analyses here. After the recognition task, subjects described events but this data is not reported here.

Stimuli

At both encoding and recognition, participants viewed video clips of everyday events involving human agents. They lasted 3 to 20 seconds with five seconds of black between scenes. The critical events were designed in sets of three: one original, target event and two foils. The Path Foil changed the path along which the figure moved in the original, target event, while the Manner Foil changed the manner of movement of the figure. Two orders of encoding and of recognition tapes were used.

Encoding Stimuli

The originally-presented target events were designed to be good examples 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**. These were the items for which the participants produced descriptive verbs. There were six target events: skip/exit, jog/cross, tiptoe/ascend, float/rise, hop/enter, and fly/descend. Immediately before a target scene, 2-3 priming items were presented. Priming events illustrated unrelated motion events. In the Manner Condition, the experimenter labeled these priming events with English manner verbs while in the Path condition, the experimenter labeled primes

Table 2.
Verbs Produced for each Event

Type	1 **Ascend/ Tiptoe**	2 **Exit/ Skip**	3 **Descend/ Fly**	4 **Enter/ Hop**	5 **Cross/ Jog**	6 **Rise/ Float**
PATH	Ascend (1) Gohome(1)	Leave(10) Exit (1)		Enter(22) Arrive (3)	Cross(5)	Rise(43)
MANNER	Walk(11) Tiptoe(5) Step(3)	Skip(56) Frolick(1) Hop(1) Prance(1) Tror(1) Walk(1)	Fly (17) Glide(1)	Walk (24) Hop(5)	Jog(43) Run(22)	Float(24) Fly(1) Soar(1)
COMBO	Climb(40) Climb...(6) Go+Climb(1)	SkipOut (1)		WalkThru(1)		
OTHER	Exercise(2) Go(1) Move(1) Progress(1) Hurt(1)	Play(1)	Land(57)	Knock(6) Visit(5) Move(3) Go(1) Pretend(1)	Exercise(5)	Move(1) Stop(1)

with English path verbs and in the No Language condition they were unlabeled.

Thirty events were presented at encoding: 6 target events, 1 description-practice event, 15 priming events, and 8 fillers (to increase the diversity of events presented). Target events, the practice event, the filler events, and the priming events which immediately preceded each target event were identical across all three conditions.

Recognition Stimuli.

The 30-item recognition test presented old and new versions of filler (8old/8new) and of the target events (6 old and 12 new). Each original target event had a foil with a changed path and a foil with a changed manner. The changes in these foils were designed to be great enough so that the verb originally generated to describe the original event (e.g., "skipping") would not describe the foil event. For example, in the manner foil for the skip/exit scene the child galloped rather than skipping and in the path foil the child stopped in the door rather than exiting.

Table 1.
Design of Target and Foils for Recognition Test

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

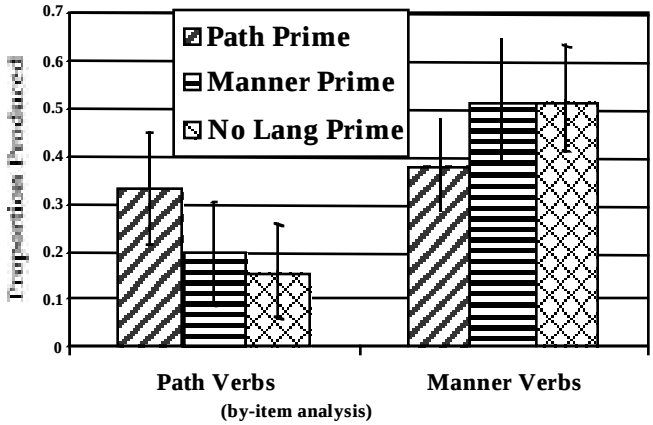
Design

Encoding Condition (Manner Verb Prime/ Path Verb Prime/ No Language Prime), a between-subject variable was crossed with Recognition Item Type (Path Foil/ Manner Foil/ Old), a within-subject factor.

Results

We asked how priming affected verb production, how verb production affected recognition, and whether there was a direct effect of priming on recognition. Data analyses throughout are done by-item. Although this gives us small n, it allows a stable unit of analysis both for effects of condition and for conditionalized effects of verb produced.

Figure 1.
Condition Differences in Verbs Produced



Verbs Produced.

Details of the verbs produced are shown in Table 2. Events varied in the variety of verbs produced and degree of concentration in a few dominant responses. The scenes had been designed to be good illustrations of specific verbs (listed as the event identifier), but they might also be

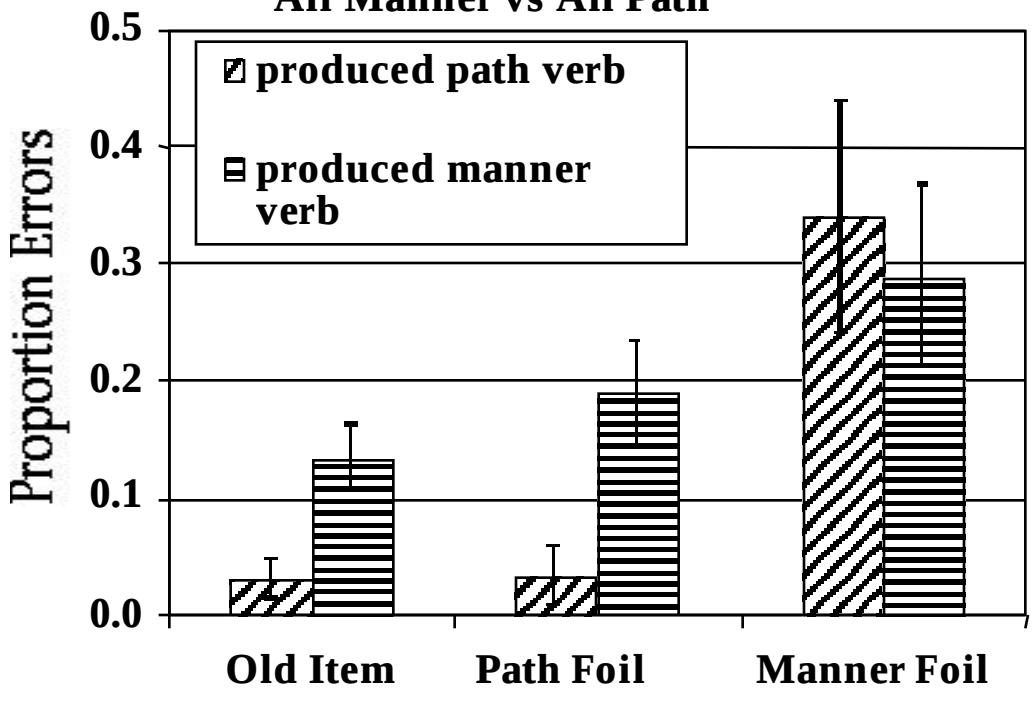
described by other verbs. The descend/fly scene was the most homogeneous, with 98.7% or responses in the two most dominant verbs, “fly” and “land." Interestingly, the plane did not in fact land in the original scene, but was very widely classified in terms of the normal activity in the scenario. The enter/ hop and ascend/tiptoe scenes were the most varied with 64% and 72% of responses in the two most dominant verbs. These were also the most varied in terms of numbers of different verbs used and use of phrases. These scenes also evoked verbs focused on additional or more abstract aspects than the simply the movement of the figure.

Effects of Priming on Verb Type Produced. We were particularly interested in whether priming with path or manner verbs would alter the proportion of path and manner verbs produced. Figure 1 shows how the proportion of manner and path verbs produced was influenced by the priming condition. (The proportion of verbs classified either as Combination or as Other was between 28% and 31% across the three conditions). Since we have other response categories, numbers of manner and numbers of path verbs do not necessarily trade off and can be analyzed as two levels of the production variable.

The interaction of priming condition with type of verb produced was significant ($F[2,10]=8.33$, $p=.007$). Path-priming produced more path verbs and fewer manner verbs than either Manner-priming or no verb priming, which look similar. Overall, there was not a main effect of priming condition on proportion of combined path or manner responses; 71% of produced verbs were manner or path in the Path-Primed condition compared to 72% in Manner-Primed and 69% in No Verb Priming ($F<.01$). Overall, 49% of responses were manner verbs and 21% were path verbs. Although this preference for manner verbs seems large, items are highly variable and the difference is not significant in a by-item analysis ($F[1,5] = 2.20$, $p =.20$).

Effects of Producing Path vs. Manner Verbs on Recognition. Given that a manner or path verb was produced, is this production related to subsequent recognition judgments? Figure 2 shows that producing a path versus manner verb benefits recognition in path foils and old items, with a small harmful effect on manner foils. A 2x3 ANOVA (by-item) found that the type of verb produced interacted with type of recognition item in influencing number correct ($F[2,8]=6.59$, $p=.020$). [Reduced df reflect loss of one event where no path verbs were produced]. The effect of item type was also significant ($F[2.8]=6.66$, $p=.02$) with the highest error rates coming from false manner recognition, but in this test there was no overall effect of verb produced because of the tradeoff on path versus manner foils. Follow-up analyses localized the effect. A 2x2 ANOVA including manner and path foils but not old items, now showed a significant effect of item type, $F[1,4]=7.10$, $p=.056$, and a significant interaction $F[1,4]=10.75$, $p=.031$,

Figure 2.
All Manner vs All Path

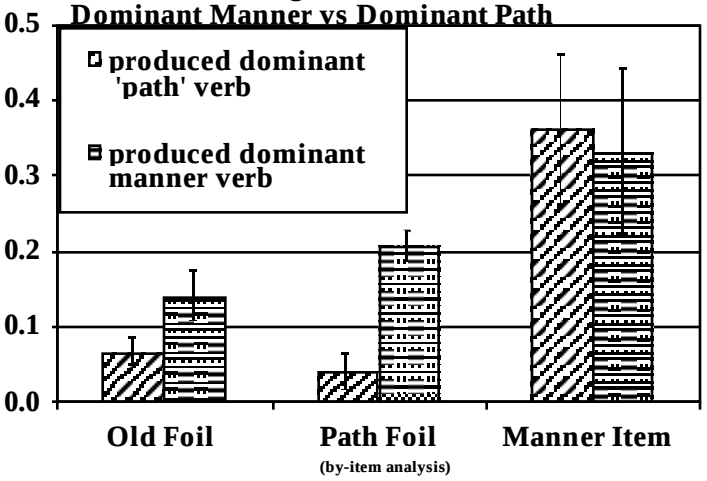


(by-item analysis)

but no main effect of verb produced. Further, paired t-tests showed an advantage of producing a Path Verb for reducing errors on Path Foils (p=.017) and on Old Items (p=.035), but not on Manner foils.

Effects of Producing Dominant 'Path' or Manner Verb on Recognition. A second analysis complemented the Manner/Path Produced analysis reported above. The Manner/Path analysis above mixed very different types and frequencies of verbs for each event. Further, for two of the events it excluded the most frequently used verb conveying path information. These two events had common verb responses which carried path information but

Figure 3.



which were not simple path verbs and hence were not included in the Manner-Path Verb analysis. For the "descend/fly" event, no true path verbs were produced and "land" (classified in the Other verb type) was by far the dominant response. For the "ascend/tiptoe" event, "climb" (classified as Combination) was the dominant response, which includes manner as well as path information. Since the path component of these two verbs was clearly the relevant aspect for these scenes, we designed these 'path-verbs' for a supplemental analysis. In this Dominant 'Path'-Manner analysis, we looked at the effect of two verbs for each event: the one most frequently used 'path' or the one most frequently used manner-verb. This analysis includes more data than the first, but fewer verbs.

The results parallel the first analysis. In the 3 (Item Type) x 2 (Dominant Verb Produced) ANOVA (by-item), item type was significant, F[2,10]=6.70, p=.014, the interaction of item type and dominant verb produced was significant, F[2,10]=7.25, p=.011, but not the effect of verb produced F[2,10]=3.85, p=.107.

Direct Effect of Priming on Recognition Type. We also measured whether the subjects primed with path or manner (or unprimed) differed in recognition error types, not considering what sort of verb they generated, as shown in Table 3. The interaction of condition and item type was not significant, nor was condition, F's < 1, but item type was, F(2,71]=31.8, p<.001.

Table3. Proportion Errors by Condition & Item Type

ERRORS	Old Items	Path Foil	MannerFoil
Path Primed	.07	.13	.38
Manner Primed	.11	.14	.32
No Language	.12	.13	.32

Conclusion

Summary

We found an effect of priming condition on what verbs subjects produced to self-describe events. Manner verbs were produced more often in the manner-primed than path-primed condition; path verbs were produced more often in the path-primed than manner primed condition. The unprimed condition looked similar to the manner-primed condition.

The fact that we are able to produce this priming in verb use suggests that the linguistically analyzed dimensions of manner and path may be "psychologically real" and influence on-line performance tasks, such as verb generation.

We found that the nature of the descriptive verb produced by participants predicted their later recognition. Errors on manner foils were more likely when a path rather than manner verb had been produced and errors on path foils were more likely when a manner rather than path verb had been produced.

The pattern of results here replicates and extends our earlier studies with experimenter-provided verbs.

Interpretation

These findings extend our understanding of how language is implicated in the perception and memory for events. Linguists have analyzed the verb lexicon as organized around distinctions of manner and path (Talmy, 1985). We found that use of path versus manner verbs primes different path or manner verbs used in describing unrelated scenes. This suggests that the dimensions relevant to a formal analysis of the verb lexicon also guide access and verb choice. Manner and path may act as psychological dimensions, perhaps both guiding access in the lexicon and attention in event perception.

The similarity between the recognition findings in this experiment and our prior findings suggests that whether someone hears or produces a verb, the effect is similar: distinctions in meaning carried by that verb influence recognition.

Future Work

Additional analyses of this data will investigate verb frequency and verb discrimination. Performance with path verbs departs from performance with manner verbs or no language and we are interested in understanding the possible variety of factors which produce this asymmetry between manner and path.

Sometimes participants generated verbs which discriminated the target and foil event and sometimes the verbs did not discriminate. For example, if a participant said "running" this would apply to both to the original jogging scene and to the dash manner-foil, hence not discriminating target from foil. Analyzing effect of whether a path or manner verb does or does not distinguish foil from target will help identify how the verbs have their effect.

We are also interested in identifying what information about an event is made more memorable by different verbs, and what the mechanism of influence is. Verbs might exert their influence in guiding attention at encoding, in providing a more structured or integrated representation, or in serving as a separate retrieval cue during recognition.

References

Berman, R. A. & Slobin, D. I. (1994). Relating Events in Narrative: a Crosslinguistic Developmental Study. Hillsdale, NJ: Lawrence Erlbaum Assoc.

Bekerian, D.A. & Bowers, J.M. (1983) Eyewitness testimony: Were we mislead? Journal of Experimental Psychology:Learning, Memory, and Cognition, 1, 139-145.

Billman, D.O., & Krych, M. (1998). Path and manner verbs in action: Effects of"Skipping" or "Exiting" on event memory. In Program of the Twentith Annual Conference of the Cognitive Science Society. Erlbaum: Hillsdale, NJ.

Bock, K. (1990). Structure in language: Creating form in talk. American Psychologist, 45, 1221-1236.

Carmichael, L., Hogan, H.P., & Walter, A.A. (1932). An experimental study of the effect of language on the reproduction of visually perceived forms. Journal of Experimental Psychology , 15, 73-86.

Choi, S. & Bowerman, M. (1992). Learning to express motion events in English and Korean: The influence of language specific lexicalization patterns. In Lexical and Conceptual Semantics, B. Levin & S. Pinker (Eds.) Elsevier/Blackwell: Cambridge, MA.

Gentner, D. & Loftus, E. (1979). Integration of verbal and visual information as evidenced by distortions in picture memory. American Journal of Psychology, *92(2),* 363-375.

Gopnik, A. & Choi, S. (1990). Do linguistic differences lead to cognitive differences? A cross-linguistic study of semantic and cognitive development. First Language, 10, 199-215.

Hall, D.F., Loftus, E.F., & Tousignant, J.P. (1984). Postevent information and changes in recollection for a natural event. In G.L. Wells & E.F. Loftus (Eds.) Eyewitness Testimony. Cambridge University Press: Cambridge.

Hoffman, C., Lau, I. & Johnson, D. R. (1986). "The Linguistic Relativity of Person Cognition: An English-Chinese Comparison." Attitudes and Social Cognition.

Jackendoff, R. (1987). On beyond zebra: The relation of linguistic and visual information. Cognition, 26, 89-114.

Kay, P. (1996) Intra-speaker relativity. In Rethinking Linguistic Relativity, J.J. Gumperz & S.C. Levinson (Eds). Cambridge University Press: Cambridge.

Levin, B. (1993). *English Verb Classes and Alternations: a Preliminary Investigation.* U. Chicago Press: Chicago.

Levinson, S.C.. (1996) Relativity in spatial conception and description. In Rethinking Linguistic Relativity, J.J. Gumperz & S.C. Levinson (Eds.). Cambridge University Press: Cambridge.

Malt, B.C., Sloman, S.A., Gennari, S., Shi, M., & Wang, Y. (in press). Knowing versus naming: Similarity and the linguistic categorization of artifacts. Journal of Memory and Language.

McCloskey, M. & Zaragoza, Z. (1985) Misleading post event information and memory for events: Arguments and evidence against memory impairment. Journal of Experimental Psychology: General, 114, 3-18.

Munnich, E., Landau, B., & Dosher, B. A. (November, 1997). Universals of spatial representation in language and memory. Poster session presented at the 38th Annual Meeting of the Psychonomic Society, Philadelphia, PA.

Naigles, L. R., Eisenberg, A. R., Kako, E. T., Highter, M., & McGraw, N. (1998). Speaking of motion: verb use in English and Spanish. Language and Cognitive Processes

Schooler, J.W. & Engstler-Schooler, T.Y. (1990). Verbal overshadowing of visual memories: Some things are better left unsaid. Cognitive Psychology, 22, 36-71.

Shatz, M. J., Martinez, I. M., Diesendruck, G., & Akar, D. (SRCD March 30- April 2, 1995--Indianapolis). "The Influence of Language on Children's Understanding of False Belief."

Talmy, L. (1985). Lexicalization patterns: Semantic structure in lexical forms. In T. Shopen (Ed.), Language Typology and Syntactic Description, vol. 3: Grammatical Categories and the Lexicon. Cambridge University Press.

Whorf, B. L. (1956). Language, Thought and Reality: Selected Writings of Benjamin Lee Whorf. T. B. Caroll (ed.). Cambridge, MA: MIT Press.