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“Really? She blicked the baby?": Two-year-olds Learn Combinatorial Facts about Verbs By Listening

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Abstract

Children use syntax to guide verb learning. We asked whether the syntactic structure in which a novel verb occurs is meaningful to children even without a concurrent scene from which to infer the verb's semantic content. In two experiments, 2-year-olds observed dialogues in which interlocutors used a new verb in transitive (“Jane blicked the baby!”) or intransitive sentences (“Jane blicked!”). Children later heard the verb in isolation (“Find blicking!”) while watching a one-participant and a two-participant event presented side-by-side. Children who had heard transitive dialogues looked reliably longer at the two-participant event than did those who had heard intransitive dialogues. This effect persisted even when children were tested on a different day, but disappeared when no novel verb accompanied the test events (Experiment 2). Thus, 2-year-olds gather useful combinatorial information about a novel verb based simply on hearing it in sentences, and later retrieve that information to guide verb interpretation.

Children use syntax as well as observations of events to learn verb meanings. This is known as syntactic bootstrapping (Gleitman, 1990). Syntactic bootstrapping works because the syntactic structures licensed by each verb are systematically related to its meaning. For example, transitive verbs take two noun-phrase arguments (e.g., “He tickled him”) and describe conceptual-semantic predicates involving two core participants (tickler, ticklee). In contrast, intransitive verbs take one noun-phrase argument (“He laughed”) and describe conceptual-semantic predicates involving a single core participant (laugher).

In accord with these systematic relationships, children assign different interpretations to novel verbs in different sentence-structures (e.g., Fisher, 2002; Naigles, 1990). In one experiment, for example, 21-month-olds heard a made-up transitive (“He’s gorpung him!”) or intransitive (“He’s gorpung!”) verb while viewing two simultaneously-presented events (Yuan, Fisher, Gertner, & Snedeker, 2007). One event involved two participants (one boy causing another to bend), and the other involved one participant (a boy making arm-motions). Children hearing a transitive verb looked reliably longer at the two-participant event than did those hearing an intransitive verb.

In the preceding example, the syntactic difference between the transitive and intransitive verbs could only convey aspects of verb meaning relevant to the number of participants involved—the verbs’ semantic structure rather than semantic content (Grimshaw, 1993).

Thus, the transitive structure (“He’s gorging him!”) informed children that the verb’s meaning involved two participant-roles; the verb’s semantic content (e.g., cause-to-bend) had to be gathered from observing the events (Fisher, 1996; Gleitman, 1990). But was observation of the events also necessary for children to identify the verb’s semantic structure? Here we ask whether the syntactic structure in which a novel verb occurs independently conveys information about the verb’s semantic structure to children, with no concurrent referential scene providing clues to the verb’s semantic content. Can children learn a new verb’s combinatorial privileges—its transitivity and thus its participant-role number—simply from listening to sentences?

One possibility is that simultaneous access to syntactic and referential contexts is necessary for syntax to guide verb learning. Grimshaw (1994) proposed that children use syntax to guide verb interpretation by first generating a candidate interpretation of an observed scene, then generating an appropriate sentence to express that interpretation, and finally comparing this predicted sentence’s structure with the input sentence; correspondence between the predicted and input sentences leads to learning about the verb’s meaning. On this proposal, the informativeness of syntax depends on scene-derived semantic content. Without a concurrent referential scene, no candidate interpretations are generated, and nothing is learned about the verb. This proposal is derived from lexical-projectionist accounts of the relationship between verb meaning and syntax. On projectionist accounts, verbs’ semantic representations determine their syntactic privileges (e.g., Levin & Rappaport-Hovav, 2005); the syntactic structure itself does not carry meaning independent of the verb.

An alternative possibility is that syntactic structures are independently meaningful, even without a concurrent scene providing information about the verb’s semantic content. A child who hears the sentence “Jane blicked the baby!”, with no helpful referential context, could still learn that blick is transitive and therefore involves two participant-roles. When the verb is later invoked in a referential setting, the child could retrieve this combinatorial information to guide the assignment of semantic content to the verb. This proposal depends on a key claim of the syntactic-bootstrapping theory (Gleitman, 1990), shared by constructional approaches to syntax and semantics (Goldberg, 1995), that syntactic structures themselves contribute meaning to sentences. On this proposal, information about a new verb’s syntactic context is informative independent of its semantic content.

Prior experimental studies of syntactic bootstrapping cannot distinguish these alternatives, because all involved providing children with simultaneous access to syntactic and referential contexts (Fisher, 2002; Naigles, 1990; Yuan et al., 2007). In the current experiments, we separated these information sources, giving children syntactic and referential contexts for a novel verb that were separated in time and unrelated in content.

In two experiments, 2-year-olds were trained and tested on a novel verb in the procedure shown in Figure 1. First, in a dialogue-phase, half the children encountered the verb in transitive sentences, and half encountered it in intransitive sentences. Later, in event-phases, children viewed two simultaneously-presented novel events: a two-participant (one girl swinging another’s leg) and a one-participant event (a girl making arm-circles). During these event-phases, the verb was presented in a syntactically uninformative context (“Find

blinking!”). If children can learn combinatorial facts about a verb without knowing its semantic content, and retrieve these facts when they hear the verb again, then children who heard transitive dialogues should interpret the verb as describing a two-participant relation; they should therefore look longer at the two-participant event than those who heard intransitive dialogues.

Success in our task required that children learn distributional facts about brand-new words. There is considerable evidence for this prerequisite. Infants detect distributional patterns in word-segmentation and artificial-grammar-learning tasks (Gómez & Gerken, 1999; Marcus, Vijayan, Bandi-Rao, & Vishton, 1999; Saffran, Aslin, & Newport, 1996), and they use distributional patterns to assign new words to grammatical categories such as noun and verb (Mintz, 2006). The present experiments extended the study of distributional learning about new words by moving to a new domain, syntactic subcategories within the category verb (transitive versus intransitive), and by asking whether this distributional learning affects the subsequent assignment of semantic content to a verb.

Success in our task also required that, upon re-encountering a verb, children retrieve from their lexicon information about the verb’s combinatorial privileges. Again, there is evidence for this prerequisite. Knowledge of the sentence-structure properties of particular verbs influences preschoolers’ sentence comprehension (Gordon & Chafetz, 1990; Snedeker & Trueswell, 2004) and production (Tomasello, 2000). As indicated by our two proposals above, however, learning a verb’s sentence-structure properties could depend on knowledge of its semantic content (e.g., a verb meaning ‘tickle’ requires two participants, thus two noun-phrase arguments), or could be based in part on distributional learning. These two potential information sources are confounded in studies of familiar verbs. In the present research, we asked whether children can learn combinatorial facts about a new verb from hearing sentences alone, and can later use these facts in sentence interpretation.

Most centrally, success in our task required that children find sentence structures independently meaningful, without the aid of concurrent scenes.

EXPERIMENT 1

Method

Participants—Sixteen 2-year-olds ($M=28.6$ months; range 26.6–30.2; 8 girls), native English-speakers, participated. Another child was eliminated due to fussiness. Children’s productive vocabularies, measured by the Bates-MacArthur CDI (Level-II, short-form; Fenson et al., 2000), ranged from 29–100 ($Mdn=78.5$).

Apparatus—Children sat on a parent’s lap, facing two 20” TV-screens 12” apart, 30” away. Audio stimuli played from a central speaker. A hidden camera recorded children’s eye-movements. Parents wore opaque glasses.

Materials and Procedure—The stimuli were videos of two women conversing and of people performing actions accompanied by soundtracks recorded by a female native

English-speaker. Events were combined into synchronized pairs for presentation on the two TV-screens.

The procedure began with two practice trials involving familiar verbs, one intransitive (clap) and one transitive (tickle). Each trial involved three phases. In the Dialogue-phase of the first trial, two women uttered the verb clap in 8 intransitive sentences (e.g., “Mary clapped!”). This dialogue consisted of two 4-sentence video-clips separated by a 3s interval. The same dialogue video-clip appeared on both TV-screens simultaneously. After a 7s interval, Event-Phase 1 began: Two 8s video events played simultaneously, one on each screen, and children heard “Find clapping!”. The target event showed a man clapping; the distracter event showed another man sleeping. Following a 3s interval, this event-pair was presented again in Event-Phase 2.

After a 4s interval, the second trial proceeded in the same manner. In the dialogue-phase, children heard tickle in 8 transitive sentences (e.g., “Hannah tickled Grandpa!”). In the event-phases, the target event showed one woman tickling another; the distracter showed one woman feeding another. The practice trials informed children that one video in each event-phase matched the soundtrack.

Following a 4s interval, children received a test trial in which a novel verb was introduced in the same manner (Figure 1). In the dialogue-phase, children heard the novel verb in 8 transitive or 8 intransitive sentences. In the event-phases, children watched the two novel events and heard “Find blinking!”

The dialogue video-clips averaged 27.0s (24.1–29.7s). Side of test-event was counterbalanced with dialogue condition.

Coding—We coded where children looked (left, right, away) during the event-phases, frame-by-frame from silent video. Reliability was assessed for 3 children; coders agreed on 98% of video frames.

Looking-times to the two-participant event, the one-participant event, and away were averaged across the test-trial event-phases¹. Inspection of means suggested that children who heard intransitive dialogues tended to look away slightly longer ($M=.54s$, $se=.24$) than did children who heard transitive dialogues ($M=.31s$, $se=.19$). This difference was not reliable in Experiment 1 ($t<1$), but a corresponding difference was reliable in Experiment 2. Given possible differences in look-away times, we conducted analyses on raw looking-times to the two- and to the one-participant event rather than on a single measure of looking-time to one event as a proportion of looking-time to both events.

In both experiments, preliminary analyses of test-trial performance revealed no interactions of dialogue-condition with sex, or with whether children’s vocabulary or practice-trial performance was above or below the median. The data were therefore collapsed across these factors.

¹Data for an event-phase were treated as missing if the child looked away for more than half of that event-phase (2 observations in Experiment 1, 3 in Experiment 2).

Results and Discussion

As Table 1 shows, looking-times during the test trial were affected by dialogue experience. Children who heard transitive dialogues looked reliably longer at the two-participant event than did those who heard intransitive dialogues ($t(14) = 3.05$, $p_{\text{rep}} = .97$, $d = 1.52$). They also looked less at the one-participant event than did those who heard intransitive dialogues, though this difference was not reliable ($t(14) = 1.94$, $p_{\text{rep}} = .90$, $d = .97$). Thus, 2-year-olds learned combinatorial facts about a novel verb in a non-referential context, simply by listening. This knowledge subsequently influenced children's attention to a two-participant event.

EXPERIMENT 2

In Experiment 1, 2-year-olds learned a new verb's combinatorial privileges from dialogues and later recruited that information in verb interpretation. Thus, combinatorial information relevant to a verb's semantic structure can be acquired without access to the verb's semantic content. Experiment 2 sought to replicate this key result and addressed three further questions.

First, could the children in Experiment 1 have detected a superficial pattern during the practice trials that guided their responses in the test trial? During the first practice trial, each sentence in the dialogue-phase mentioned one participant, and each event in the event-phases showed one participant. During the second practice trial, each dialogue sentence mentioned two participants, and each event showed two participants. This pattern might have led children who heard transitive sentences in the test-trial dialogue-phase to prefer the two-participant event. To eliminate this possibility, we omitted the dialogue-phases for the practice trials; thus children had no opportunity to learn that the dialogues were related to the subsequent event-phases.

Second, within the test trial of Experiment 1, could the dialogue effect reflect sensitivity to the number of referents mentioned in the dialogue-phase, rather than learning about the novel verb? Each sentence in the transitive dialogue mentioned two participants, whereas each intransitive-dialogue sentence mentioned one. These sentences might have biased children in the transitive but not the intransitive condition to attend longer to the two-participant event in subsequent event-phases. To eliminate this possibility, we added a control group in which no novel verb was presented during the test-trial event-phases. If the dialogue effect of Experiment 1 reflected learning about the novel verb, then it should disappear when no novel verb was presented during the test-trial event-phases.

Third, we probed the robustness of children's learning by introducing a delay between the dialogue- and event-phases of the test trial. Two delay conditions were implemented. In both, the novel-verb dialogue-phase was presented before the experiment proper began; then children received only the event-phases of the practice and test trials. The event-phases were presented immediately (Same-Day condition) or one to two days later (Different-Day condition).

Method

Eighty 2-year-olds ($M=28.4$ months; 26.8–30.4; 44 girls) participated, 32 in the Same-Day and 48 in the Different-Day condition. Twelve additional children were eliminated for side-bias (3), distraction (1), because their practice-trial performance was more than 2.5 SD below the mean (1), their average two-participant looking-times in the test trial were more than 2.5 SD from the mean of their condition (3), or they did not return for the second session in the Different-Day condition (4). Vocabulary scores ranged from 11–100 ($Mdn=72.5$). Within each delay condition, children were assigned to one of the four combinations of dialogue (transitive, intransitive) and test (experimental, control) conditions.

The materials and procedure for the Same-Day condition were like those of Experiment 1, with several changes. First, the novel-verb dialogue-phase was presented before the experiment on an 8-inch portable DVD-player. The experimenter then removed the DVD-player and initiated the event-phases of the practice and test trials on the two-screen display. The novel-verb dialogue- and event-phases were therefore separated by a delay of 100–120s. Second, the novel-verb dialogue-phase included a third video-clip comprising 4 additional sentences (12 total), to give children ample opportunity to learn the verb's combinatorial privileges. Third, there were no dialogue-phases for the practice trials. Fourth, in the test trial children received three event-phases rather than two, giving them ample opportunity to retrieve what they had learned about the new verb. Fifth, during the test-trial event-phases, half the children in each dialogue-condition heard the novel verb (Experimental: "Find blinking!"), and half heard neutral utterances without the verb (Control: "What's happening?").

The Different-Day condition was identical except that the novel-verb dialogue-phase was presented on a projection-screen in another room and included a fourth video-clip comprising 4 additional sentences (16 total). The event-phases were presented 1 (16 experimental, 11 control) or 2 days later (8 experimental, 13 control). Preliminary analyses of looking-times in the Different-Day condition revealed no interactions of dialogue and/or test condition with whether testing occurred 1 or 2 days later ($F's < 1$).

Coding reliability, assessed for 15 children, yielded 98% agreement. Preliminary analyses showed that look-away times varied with dialogue and test condition: A 2 (Dialogue: Transitive, Intransitive) by 2 (Test: Experimental, Control) by 2 (Delay: Same-day, Different-Day) ANOVA revealed a marginal effect of dialogue ($F(1,72)=3.68$, $p_{rep}=.91$), an effect of test ($F(1,72)=4.64$, $p_{rep}=.93$), and an interaction of dialogue and test ($F(1,72)=4.33$, $p_{rep}=.93$). The means in Table 2c suggest that children in the intransitive-dialogue/experimental condition tended to look away longer than children in other conditions, at both delays. As noted above, this difference in look-away times led us to analyze raw looking-times to the two- and one-participant events.

Results and Discussion

Children who heard transitive dialogues looked longer at the two-participant event (Table 2a) and less at the one-participant event (Table 2b) than did those who heard intransitive dialogues, but only within the experimental condition. The same pattern held at each delay.

Table 3 shows the results of 2 (Dialogue: Transitive, Intransitive) by 2 (Test: Experimental, Control) by 2 (Delay: Same-day, Different-Day) ANOVAs for each dependent measure. Analyses of two-participant looking-times revealed a significant effect of dialogue, and a significant interaction of dialogue and test condition. As in Experiment 1, analyses of one-participant looking-times revealed similar but less statistically robust effects.

In the experimental condition, children who heard transitive dialogues looked reliably longer at the two-participant event than did those who heard intransitive dialogues ($t(38)=4.36$, $p_{\text{rep}}=.99$, $d=1.38$). Two-participant looking-times in the control condition did not vary with dialogue ($t<1$). These effects held within each delay: Effects of dialogue on two-participant looking-times emerged in each experimental group (same-day: $t(14)=3.33$, $p_{\text{rep}}=.98$, $d=1.66$; different-day: $t(22)=2.95$, $p_{\text{rep}}=.97$, $d=1.21$), but in neither control group ($t's<1$).

Similarly, in the experimental condition, children who heard transitive dialogues looked reliably less at the one-participant event than did those who heard intransitive dialogues ($t(38)=3.28$, $p_{\text{rep}}=.99$, $d=1.04$). One-participant looking-times in the control condition did not vary with dialogue ($t<1$). Separate comparisons within each delay condition revealed effects of dialogue that were reliable in the different-day ($t(22)=2.53$, $p_{\text{rep}}=.95$, $d=1.03$) but marginal in the same-day ($t(14)=2.08$, $p_{\text{rep}}=.91$, $d=1.04$) experimental groups, and no dialogue effect in either control group ($t's<1$).

Why was the dialogue effect more robust in analyses of two-participant than one-participant looking-times? The answer may be linked to our finding that children in the experimental condition who heard intransitive dialogues looked away longer than did those who heard transitive dialogues. The means in Table 2 reveal a baseline preference for the two-participant event: Averaged across conditions, children spent 4.59s (per 8s event-phase) looking at the two-participant event, and 2.95s looking at the one-participant event. Children may simply have been unwilling to spend much more time looking at the one-participant event. Children in the intransitive-experimental condition could also have looked away more because the intransitive verb is less constraining given the referential contexts provided at test. A transitive verb must refer to a two-participant event, but an intransitive verb could refer to a one-participant event or to part of a two-participant event (Naigles & Kako, 1993; Yuan et al., 2007).

Experiment 2 replicated and extended the findings of Experiment 1. Two-year-olds learned combinatorial facts about a novel verb in a non-referential context and later retrieved these facts to interpret the verb. This dialogue effect appeared despite the absence of dialogue-phases in the practice trials, eliminating the possibility that the effect resulted from superficial patterns detected during the practice trials. The dialogue effect was restricted to the experimental group, showing that children linked what they learned during the dialogues to the novel verb; the presentation of the novel verb during the event-phases cued children to

retrieve what they had learned. Experiment 2 yielded positive effects when dialogue- and event-phases were separated by a delay of 2 minutes or 1–2 days. Evidently, children's ability to learn and retain combinatorial facts about a new verb from listening is quite robust.

What was the source of the syntax-semantics links that permitted children to draw semantic conclusions about the verb based on its transitivity? In particular, could children have learned during the experiment to link a transitive verb with a two-participant event? In the practice trials, children heard an intransitive ("Find clapping!") and a transitive ("Find tickling!") verb accompanied by appropriate events. Because children knew these verbs and their transitivity, these trials could have provided training in the link between verb transitivity and number of event-participants. This account of our results still requires that children learned the new verb's combinatorial properties from the dialogues, but proposes that their ability to use that knowledge in verb interpretation was supported by learning during the experiment. Prior evidence renders it unlikely that children's success depended entirely on within-experiment learning: 2-year-olds appropriately interpret simple transitive and intransitive sentences containing novel verbs in tasks with no practice trials (Fisher, 2002; Gertner, 2007; Naigles, 1990). Such findings suggest that children at this age already possess some knowledge of the relevant syntax-semantics links. Nevertheless, it remains possible that in our restricted testing context the practice trials might indirectly support novel-verb comprehension, perhaps by priming useful syntactic-semantic representations (Dittmar et al., 2008). Future experiments will explore this possibility.

GENERAL DISCUSSION

In two experiments, 2-year-olds learned about a new verb's combinatorial privileges from brief dialogues, without a referential context that hinted at the verb's semantic content. If they later encountered the verb in a referential context, they retrieved this combinatorial information and used it to guide attention to candidate events. Children who had heard the verb used transitively looked longer at a two-participant event than did those who had heard the verb used intransitively. This effect persisted when testing occurred on a different day. These experiments yield compelling new evidence for a key assumption of syntactic bootstrapping—that sentence structures carry meaning independent of the verbs in those structures. These findings also raise interesting questions for future research about the nature of the combinatorial information children acquired about the new verb from listening experience.

First, how did children encode the dialogue sentences? During the dialogues, children could have created lexical entries with the linguistic status of new transitive or intransitive verbs. Alternatively, they could have created shallower representations, noting that the new verb occurred with two nouns, or with one. Under some circumstances, 25-month-olds distinguish transitive ("The duck is gorging the bunny!") from two-noun intransitive sentences ("The duck and the bunny are gorging!"); Naigles, 1990). In our dialogues, however, the challenge of encountering sentences without referential support might have caused children to resort to shallower representations. Crucially, even shallow sentence representations should lead to success in this task. Elsewhere we have proposed that children are biased to interpret each noun in a sentence as a semantic argument of a predicate term

(Fisher, 1996). Accordingly, as soon as children can identify some nouns, they assign different interpretations to transitive and intransitive verbs by mapping a two-noun verb onto a two-participant conceptual predicate, and a one-noun verb onto a one-participant conceptual predicate. This proposal suggests that even younger children might succeed in a version of this task. Future experiments will pursue this possibility, as well as exploring 2-year-olds' sentence representations by presenting dialogues that disentangle transitivity from the number of nouns.

Still another possibility is that children remembered one or more dialogue sentences verbatim, rather than encoding either of the more abstract representations proposed above. This would be akin to an instance-based account of our findings. Note that even an instance-based account of the present findings would involve interesting generalization on the child's part: Retrieved instances of sentences such as "Anna blicked the baby" or "Jim blicked the cat" did not prevent children from extending our new verb to a two-participant event involving two grown women. This suggests that useful abstraction of some form took place, whether upon retrieval (in an instance-based system) or upon encoding (in an abstractionist system).

Second, did children engage in semantic processing while encoding the dialogue sentences? Even without a useful referential context, children might have used the distributional information available in the dialogue sentences (e.g., two-noun or transitive verb) to infer an appropriate semantic structure (two participant-roles). Alternatively, children could have gathered the distributional information without inferring a semantic structure until they encountered the verb in a referential context. We anticipate that the dialogue-and-test method introduced here will allow us to address such questions, in experiments that manipulate the content of the dialogue sentences and the referential options provided at test. For example, in a recent extension of this task, 2-year-olds' verb interpretations reflected the characteristics of the nouns that filled the verb's argument-slots during the dialogues (e.g., their animacy; Scott & Fisher, in-press). This finding suggests that children assigned a partial interpretation to the sentences containing the novel verbs while they listened to the dialogues, in the absence of a referential scene.

The ability to gather combinatorial facts about unknown verbs by listening, and to retain them over time, could help solve a problem for syntactic bootstrapping and for syntax acquisition: Sentences can contain extra ('adjunct') phrases, and in many languages verbs' arguments can be omitted if they are recoverable in the discourse context. Thus, individual sentences are not reliable indicators of verb argument-structure. In principle, learners could overcome this difficulty by gathering syntactic information across many sentences to estimate each verb's argument-structure (Fisher & Gleitman, 2002). The present findings suggest that children have the necessary tools to do this. Two-year-olds interpret sentences using not only the syntactic information available in the current sentence, but also the verb's syntactic history.

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DIALOGUE PHASE

Screen 1	Screen 2	Transitive dialogues:	Intransitive dialogues:
A: Hey...Jim is gonna blick the cat! B: Really? He's gonna blick the cat? A: And Mary was blicking the man. B: Wow, she was blicking the man. — A: Guess what? Jane blicked the baby! B: Hmm, she blicked the baby? A: And Bill was blicking the duck. B: Yeah, he was blicking the duck.	A: Hey...Jim is gonna blick! B: Really? He's gonna blick? A: And Mary was blicking. B: Wow, she was blicking. — A: Guess what? Jane blicked! B: Hmm, she blicked? A: And Bill was blicking. B: Yeah, he was blicking.

EVENT-PHASE 1

Screen 1	Screen 2
"Find blicking! Where's blicking? See? Where's blicking?"

EVENT-PHASE 2

Screen 1	Screen 2
"Find blicking! Where's blicking? Find blicking! Find blicking!"

Figure 1. Dialogue and event-phases for the novel verb, Experiment 1. Half of the children heard Transitive dialogues, and half heard Intransitive dialogues. The Transitive and Intransitive dialogues were identical except for the presence versus absence of the direct-object noun phrase in each sentence.

Table 1

Mean (se) looking time (seconds) to the two-participant event, one-participant event, and away averaged across the two 8-s event-phases of the test trial, Experiment 1.

	2-participant event	1-participant event	Away
Transitive dialogue	4.82 (.43)	2.87 (.51)	.31 (.19)
Intransitive dialogue	3.33 (.24)	4.12 (.40)	.54 (.24)

Table 2

Mean (se) looking-time (seconds) to the two-participant event, one-participant event, and away, averaged across the three 8-s event-phases of the test trial, Experiment 2.

(a) Looking-Times to the Two-Participant Event						
	Same-Day		Different-Day		Means	
	Experimental	Control	Experimental	Control	Experimental	Control
Transitive dialogue	5.41 (.38)	4.30 (.41)	5.02 (.27)	4.82 (.30)	5.17 (.22)	4.61 (.24)
Intransitive dialogue	4.11 (.09)	4.60 (.45)	3.90 (.26)	4.57 (.32)	3.99 (.16)	4.58 (.26)

(b) Looking-Times to the One-Participant Event						
	Same-Day		Different-Day		Means	
	Experimental	Control	Experimental	Control	Experimental	Control
Transitive dialogue	2.28 (.33)	3.32 (.44)	2.52 (.24)	2.80 (.30)	2.43 (.19)	3.01 (.25)
Intransitive dialogue	3.09 (.19)	3.10 (.45)	3.50 (.30)	3.00 (.31)	3.33 (.20)	3.04 (.25)

(c) Time Spent Looking Away						
	Same-Day		Different-Day		Means	
	Experimental	Control	Experimental	Control	Experimental	Control
Transitive dialogue	.30 (.07)	.37 (.12)	.46 (.10)	.38 (.10)	.40 (.07)	.38 (.08)
Intransitive dialogue	.80 (.16)	.30 (.05)	.60 (.14)	.43 (.10)	.68 (.10)	.38 (.06)

Table 3

Analysis of variance results for Experiment 2.

Effect	Looking-times to the 2-participant event	Looking-times to the 1-participant event
Dialogue	$F(1,72) = 6.56^* p_{rep} = .96$	$F(1,72) = 3.55^{\dagger} p_{rep} = .91$
Test	$F(1,72) < 1$	$F(1,72) < 1$
Delay	$F(1,72) < 1$	$F(1,72) < 1$
Dialogue * Test	$F(1,72) = 7.14^{**} p_{rep} = .97$	$F(1,72) = 3.74^{\dagger} p_{rep} = .91$
Dialogue * Delay	$F(1,72) < 1$	$F(1,72) < 1$
Test * Delay	$F(1,72) = 1.40$	$F(1,72) = 1.87$
Dialogue * Test * Delay	$F(1,72) < 1$	$F(1,72) < 1$

Note: †
 $p < .1$; *
 $p < .05$; **
 $p < .01$