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## The Influence of Topic Status on Written and Spoken Sentence Production

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### Abstract

Four experiments investigate the influence of topic status and givenness on how speakers and writers structure sentences. The results of these experiments show that when a referent is previously given, it is more likely to be produced early in both sentences and word lists, confirming prior work showing that givenness increases the accessibility of given referents. When a referent is previously given and assigned topic status, it is even more likely to be produced early in a sentence, but not in a word list. Thus, there appears to be an early mention advantage for topics that is present in both written and spoken modalities, but is specific to sentence production. These results suggest that information-structure constructs like topic exert an influence that is not based only on increased accessibility, but also reflects mapping to syntactic structure during sentence production.

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A speaker or writer is faced with a number of different syntactic options when producing a sentence, such as the active (*the dog bit the cat*) versus passive voice (*the cat was bitten by the dog*). Because such options can convey the same propositional content (e.g. a biting event in which the dog is the biter and the cat is the bitee), one natural question to ask is what influences a speaker (or writer) to use one construction instead of another.

The structural choices that speakers and writers make are not merely stylistic, but reflect the *information structure* statuses assigned to the referents and events indicated in the sentence (e.g. Lambrecht, 1994). For example, some structures can assign *topic status* to a referent, which means that particular referent is currently under discussion and is what the sentence is about. Another major division that most theories of information structure make is between whether a particular referent is already known or *given* to the interlocutors or whether a referent is something not yet known or *new*. In this paper, we are interested not only in whether something was previously given, but in *how* it was given. In particular, we investigate the influence of topic status on the ordering of referents in a sentence, examining whether topic status has an effect above and beyond simply being previously given. These results also address whether any such effects of topic can be separated from effects of givenness. The results of these experiments inform our understanding of how sentences in discourse are formed.

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<sup>2</sup>These kind of constructions have been analyzed as cases of left-dislocation (Zubizarreta, 1998). English also has the syntactic means for placing an argument ahead of a subject, including left-dislocation. Interestingly, Prat-Sala and Branigan's English speakers did not make use of this kind of construction, instead using passives to place the prominent argument early and thus changing the grammatical role assignments of sentence argument to accommodate early topic placement.

Portions of this work have been presented at CUNY and AMLaP and at the ZAS workshop, including publication in ZAS Working Papers. All mistakes remain our own.

Though defining topic status can be somewhat tricky, we will adopt an approach based on a commonality among many definitions of topic: The topic of an utterance is the referent that has information added to it – it is what the utterance is *about* (Reinhart, 1982). Structurally, linguistic analyses suggest that topics tend to be associated with early, prominent syntactic positions (that is, positions that occur higher in a syntactic tree), such as grammatical subject (e.g., Lambrecht, 1994). For example, in a sentence like *The dog bit the cat*, the subject (dog) could be considered the topic and what the sentence is about (thus it is the dog that is having new information, namely its cat-biting, added to our knowledge about it).

However, little research has investigated whether speakers actually produce topics in prominent syntactic positions in online production, and if so, what the processing underpinnings of such production might be. While prior linguistic analysis has shown that topics are often subjects, psycholinguistic research has found that simply being previously mentioned (or *given*) in prior discourse at all also makes something more likely to be mentioned earlier in a sentence, and in syntactically prominent positions like subject (e.g. Bock and Irwin, 1980; Bates and Devescovi, 1989). One influential interpretation of this givenness effect (e.g. Bock and Warren, 1985) is that prior mention leads to increased accessibility of both the lexical and conceptual representations of the given referent. In this approach, as in others in production and comprehension research (e.g. Foraker & McElree, 2007), accessibility is defined in terms of the speed with which something is processed or produced. Accessibility in this context means that high-accessibility referents will be retrieved sooner during the sentence production process than referents with lower accessibility. Crucially, according to this approach, the production system is biased such that words that are retrieved sooner will be positioned earlier (and in higher syntactic positions) than words that are retrieved later; this allows quickly retrieved words to be placed into their sentence positions and sent off for further production (so that their accessibility need not be maintained), and also buys time to retrieve more slowly retrieved words. So, givenness leads to increased accessibility, thus leading to early (and prominent) placement in a sentence. It is important to note that increased accessibility will not necessary lead to faster times in terms of when speakers begin their utterance because there are a number of factors that influence how quickly people begin to speak (cf. Griffin & Ferreira, 2006 for further discussion).

However, being a topic is not necessarily the same as being given - not all previously given referents in a discourse are assigned topic status, nor must all topics be explicitly mentioned (e.g. Prince, 1981; and others). This provides two potentially different kinds of factors that could influence the order in which speakers place referents in sentences: accessibility of lexical and conceptual representations (e.g. via givenness) and topic status. A particularly intriguing and parsimonious possibility is that these two influences are not actually separate at all: the influence of topic status on sentence production could be reduced to the same accessibility influences that underlie effects of givenness. This would be possible if, for example, linguistically defined statuses like *topic* lead to systematic differences in the accessibility of lexical and conceptual representations, which would then in turn affect the production system in the same way as other accessibility-based influences, such as being previously given. In fact, topic status is often associated with increased accessibility of the topic referent (Lambrecht, 1994; Ariel, 1990; and others), and so this seems to be a likely possibility. We will test this hypothesis in the work presented here.

This paper addresses two questions about the influence of topic status on the production of syntactic structure: The first is whether referents with topic status will be treated differently by speakers and writers than referents that are merely given, compared to referents that are new. Thus, we aim to replicate the previously established finding that given referents are produced in sentences sooner than new referents (e.g. Bock and Irwin, 1980), but we will also examine whether topic referents have an additional advantage for early mention,

compared to merely given referents. The second question is whether any such early mention advantage for topics can be reduced to otherwise independently-motivated accessibility influences that have already been revealed in studies of sentence production. Despite the appeal of this hypothesis, it is entirely possible that topic status exerts an influence that is distinct from increased accessibility. For example, some models of sentence production (e.g. Levelt, 1989) have proposed that there is a specific ‘+topic feature’ that influences how speakers produce sentence structures.

Answers to these questions are pursued with four experiments. First, Experiment 1 examines whether one specific way of conferring topic status (mention in an ‘about’-phrase) has an influence on current or future topic status. Experiment 2 then tests explicitly for effects of topic status in online, spoken sentence production. Experiments 3 and 4 examine whether the effects found in Experiment 2 are due to online changes in accessibility. Experiment 3 does this by looking at an offline written sentence task and Experiment 4 looks for topic effects outside of a sentence production context.

### Effects of givenness and accessibility on sentence production in speakers

Psycholinguistic research has revealed that there are a number of different factors, linguistic and non-linguistic, that influence speakers’ choices of word orders. Before we turn to the role that topic status may play, let us first review some key findings related to the effect of givenness and accessibility on word order.

A number of studies have investigated the influence of givenness, with the main finding that referents that have been previously given in recent discourse are more likely to come sooner in sentences than referents that have not been previously given (Bock and Irwin, 1980; Bates and Devescovi, 1989; Prentice, 1967; Turner and Rommetveit, 1968; Flores d’Arcais, 1975). Results from Bock and Irwin (1980) showed that this effect of givenness is due to the accessibility of both the conceptual representation of the given referent and the accessibility of the word itself (termed lexical accessibility). Using a sentence-recall task, Bock and Irwin found that speakers produced sentences in which words that were either identical or conceptually-related to a word given in a previous sentence were mentioned sooner, but this effect was significantly larger for the identical words. For example, if speakers were asked to remember a sentence like *The rancher sold the horse to the cowboy* and then they heard *A rancher received an inquiry from a cowboy about something he needed for his act* as a prompt to recall that sentence, speakers were more likely to reverse the order of the phrases to produce the identical word earlier in the sentence: *The rancher sold the cowboy the horse*. Bock and Irwin also found that simply providing the identical words in isolation as prompts for sentence recall (e.g. *cowboy*) created the same effect, suggesting that lexical accessibility alone can influence word order, and thus establishing that both conceptual and lexical givenness influence word order (and/or sentence structure).

However, it is important to note that most studies of givenness in sentence production have treated givenness as an all or nothing status – either something is previously given or it is not. Even though in many cases the given referent was not just mentioned, but mentioned in a prominent syntactic position (such as in subject position), it was only compared against conditions in which it was not mentioned at all. However, from the perspective of information structure, it doesn’t just matter whether something is given, but *how* it is given.

One study of sentence production suggests that topic status could be an important influence on sentence production: Prat-Sala and Branigan (2000) proposed that there are actually two contributions to conceptual accessibility: *inherent* accessibility and *derived* accessibility. Inherent accessibility refers to the accessibility of a referent due to its intrinsic features like animacy, imageability, and prototypicality, with animate, imageable and typical referents

having the highest degree of inherent accessibility. For example, the concept of *dog* would have a higher inherent accessibility than the concept of *justice*. Derived accessibility refers to temporary increases in the accessibility of a referent due to the context in which it is presented (linguistic or non-linguistic). In their study, Prat-Sala and Branigan combined two aspects of context, adjectival modification and placement in a *there*-construction, to increase the derived accessibility of one referent over another in a setup sentence (they refer to this as a manipulation of *prominence*). In their task, speakers would hear a sentence like *There was this old rusty swing standing in a playground near a scooter, swaying and creaking in the wind* before being asked to describe a picture that contained both a swing and a scooter. Their results showed that the more richly described referent (*swing*) was mentioned earlier more than the less richly described referent (*scooter*), and especially so for inanimate rather than animate referents. The authors argued that the way in which the target word (e.g. *swing*) was mentioned in context led to a temporary increase in the derived accessibility of the corresponding concept from memory. Our hypothesis is that topic status could have the same influence under this type of account: contexts that assign topic status to the referent could also cause an increase in derived accessibility.

The results summarized in this section show that given referents are placed earlier in sentences by speakers compared to new referents. However, there is very little prior work examining whether *how* something is given influences this effect. Thus, despite theoretical work suggesting that it should have some impact (e.g. Ariel, 1990; Lambrecht, 1994), it is not clear whether topic status will systematically impact the production of sentences, either for speakers or for writers. In the next section, we will outline the materials that we developed to test the influence of topic status on sentence production, in both spoken and written contexts.

## Materials used in all experiments

A set of 40 experimental items was constructed for use across all four experiments presented in this paper. Each item in this set consisted of four setup sentences and a target verb with two noun arguments. The target verbs were all theme-experiencer verbs (e.g., *frighten*, *annoy*, *please*), which we chose because verbs of this type are roughly equally biased in their use between passive and active voices (Altmann & Kemper, 2006; Ferreira, 1994) and so should not bias speakers toward either structure<sup>1</sup>. Item sets were then constructed in the following way. First, the verbs were each matched to two different nouns that naturally corresponded to the theme and experiencer roles assigned to arguments of this type of verb. For example the verb *annoy* was paired with two nouns that could serve as theme and experiencer arguments: *traffic* and *driver* respectively.

The arguments of these theme-experiencer verbs were then used to construct four set-up sentences that crossed two factors: Which argument was mentioned in the sentence (theme vs. experiencer) and the information status of that argument (given vs. topic). This produced four conditions, and allowed us to compare responses to given vs. new referents, in addition to examining effects of topic status. An example set of sentences is given in Table 1.

In Table 1, the *mentioned argument* refers to whether the final word in the setup sentence was the word receiving the experiencer role assigned by the target verb or whether it was the

<sup>1</sup>Some of the verbs of this type have also been used in studies of implicit causality (e.g. Garnham, Traxler, Oakhill & Gernsbacher, 1996), in which the interpretation of an ambiguous pronoun in a clause following these verbs (e.g. *Jill frightened Sue because she ...*) appears to be biased toward interpreting the pronoun referent as the subject of this verb (e.g. *she* refers to *Jill*, not *Sue*). However, this bias appears to be influenced by other factors, including the coherence relation between the clauses (Kehler, 2002; e.g. *Jill frightened Sue, so she...* in which *she* refers to *Sue*). While this is an interesting property of these verbs, we do not believe it has an impact on the results in our tasks.

theme. In all but one item, the mentioned argument also corresponded to a difference of animacy such that the experiencer arguments were all animate and the theme arguments were inanimate.

Next, we manipulated the information status of the mentioned argument so that it was either *given* (i.e., merely mentioned) or had *topic* status. In the given condition, the mentioned argument (e.g. *driver* or *traffic*) was presented peripherally, as the object argument in an adjunct phrase. Furthermore, emphasis was taken away from the given argument by making the subject noun definite in all conditions and adding a pronominal reference to the subject noun in the adjunct clause. Thus, in the given condition, an argument that was mentioned had given status for any upcoming discourse, but was unlikely to be considered the topic of the setup sentence, nor was it likely to be seen as the most likely upcoming topic in any following discourse.

In the topic condition, we chose to use *about* phrases to manipulate topic status because they provide a way to influence topic status without using grammatical subject position. Aboutness is one of the principle defining characteristics of topichood (Lambrecht, 1994; Reinhart, 1982; and others). Thus, to make something a topic within a sentence, it is necessary to make the sentence (or utterance) be about that something. One test for aboutness is the felicitousness of placement in an *about* phrase (Kuno, 1972; Reinhart, 1982; Lambrecht 1994 and others): Elements that can be topics will sound acceptable when included in a paraphrase of the sentence that places them in an *about*-phrase. So, in the topic condition, the target word in the setup sentence was presented as the object of the preposition *about*. Also in this condition, an indefinite noun was used in subject position followed by a verb and then followed by the word *something* and then the *about*-phrase.

Before we can test for effects of topic status on sentence production, we need to confirm that referents in an *about*-phrase are actually assigned topic status. Experiment 1 thus examined whether readers judged an argument in an *about*-phrase to be the topic of the setup sentence itself, and also whether they considered it to be the most likely future topic.

## Experiment 1

The goal of Experiment 1 was to examine whether *about*-phrases have an impact on the identification of the topic in the current sentence and/or influence predictions about the likely topic of a hypothetical following utterance. In Experiment 1a, we focused on whether mention in an *about-phrase* would specifically influence the status of the two noun arguments from our set of experimental items. Thus, we asked participants to circle the part of the sentence that they felt was the topic of that sentence, and then select one of two nouns as the most likely topic of a hypothetical following sentence. This second task provides direct evidence about the future topic status of the two particular argument nouns that we will use in Experiments 2-4, and is very important to confirming topic status in Experiments 2-4. However, this task is also highly constrained and may not reflect participants' true expectations about the identity of a future topic. So, in Experiment 1b we gave participants the same materials but asked them to provide the most likely future topic by filling in a blank after the sentence.

## Methods

**Participants**—Forty members of the University of California, San Diego community participated in Experiment 1a. Twenty-eight members of the University of Florida community participated in Experiment 1b.



**Design and Materials**—In both experiments, the 160 setup sentences from the experimental item sets described above were used (see Table 1), giving both of these experiments a 2 x 2 design with factors of Mentioned Argument (theme vs. experiencer) and Information Status (given vs. new). These sentences were divided into four lists using a Latin square design such that each item was given exactly once in each list and each list contained equal numbers of items from each condition (i.e. 10 of each condition). Forty filler items were added to each list and then lists were pseudorandomized such that no two consecutive items were from the same condition and no more than three experimental items ever appeared in a row. Two versions of each list were created with different orders of items and fillers. This was to help prevent any spurious effects of item order within the lists.

**Procedure**—After giving informed consent, participants were seated in a quiet room and given one of the experimental lists in the form of a printed packet. In Experiment 1a, all test items in the packet were presented as a sentence followed by two nouns. On experimental trials, participants were given the setup sentences followed by the two possible target arguments associated with each sentence (e.g. the theme and the experiencer arguments of the target verb for that item). They were asked to do two things for all items: circle the part of the sentence that they considered to be the topic of that sentence<sup>1</sup>, and choose one of the two following nouns as the most likely topic of the next sentence. On experimental trials, one of these nouns was always previously given in the setup sentence (either in the *about* or *given* condition) and the other noun was not previously mentioned at all. In Experiment 1b, the procedure was identical except that participants were given a blank line instead of two nouns and were asked to write down the most likely topic of the next sentence.

## Results

In Experiment 1a, two measures were calculated: the proportion of times the target argument was circled as the topic of the setup sentence (the current topic) and the proportion of times that the theme argument was selected as the most likely topic of the next sentence (future topic). We used this second measure because we specifically wanted to know whether prior mention of the theme as either merely given or topic in the setup sentence would make it more likely to be selected as the topic in a hypothetical future sentence. This analysis will allow clear comparison to the results of Experiments 2–4. Table 2 shows the results of these measures. For all measures, two-factor (mentioned argument x information status) repeated measures ANOVAs were performed with participants (F1) and items (F2) as random factors. These two types of analyses (with participants and items) were done for all analyses in order to confirm whether our results were consistent across participants and items.

For the current topic measure, the overall pattern of results is that the topic condition causes an increase in selection as current topic, with a main effect of information status ( $F_1(1,35) = 4.971, p < .032$ ;  $F_2(1,39) = 6.67, p < .014$ ) but no effect of mentioned argument ( $F_s < 1$ ). There was also an interaction of argument and status, reflecting the fact that the effect of status was larger for experiencers than themes ( $F_1(1,35) = 4.565, p < .04$ ;  $F_2(1,39) = 5.315, p < .027$ ). Planned pair-wise comparisons show that the effect of information status was significant for experiencers ( $t_1(35) = 2.47, p < .02$ ;  $t_2(39) = 2.78, p < .01$ ) but only marginal for themes ( $t_1(35) = 1.78, p < .08$ ;  $t_2(39) = 1.86, p < .07$ ). These results show that while there was an overwhelming dispreference for the mentioned argument as the topic of the current sentence (the subject of the main clause was chosen instead in nearly all other cases), the mentioned argument was still chosen *relatively* more often in the topic condition.

For the future topic, there was a main effect of mentioned argument ( $F_1(1,35) = 48.01, p < .001$ ;  $F_2(1,39) = 230.6, p < .001$ ), with participants selecting the theme as the most likely future topic more often when it was previously mentioned. There was no effect of

information status ( $F_1(1,35) = 2.36$ , n.s.;  $F_2(1,39) = 1.78$ , n.s.) but there was an interaction of mentioned argument and status ( $F_1(1,35) = 25.93$ ,  $p < .001$ ,  $F_2(1,39) = 36.33$ ,  $p < .001$ ), reflecting the fact that themes were chosen more when previously mentioned in the topic condition and less when it was the experiencer that was mentioned in the topic condition. Further, there was an additional preference for the theme when it was mentioned in an *about*-phrase, which is reflected in the increase in theme selection in the theme-topic condition compared to the theme-given condition. Planned pairwise comparisons further showed that the effect of information status was significant in both the theme-mentioned ( $t_1(35) = 4.29$ ,  $p < .001$ ;  $t_2(39) = 5.26$ ,  $p < .001$ ) and experiencer-mentioned ( $t_1(35) = 4.26$ ,  $p < .001$ ;  $t_2(39) = 3.67$ ,  $p < .001$ ) conditions.

For Experiment 1b, we calculated the current topic measure in the same way as Experiment 1a, but because only the target argument appeared in each item, there was no reason to expect participants to spontaneously provide other, unmentioned argument. Thus, for the future topic measure in Experiment 1b we instead calculated the proportion of times that the target argument was provided. This means that we were not able to assess the influence of prior mention of future topic status, but were able to see if there was a modulation of the preference for a previously-given argument, based on whether it was mentioned in an *about*-phrase or not. The results of these measures are shown in Table 3.

As in Experiment 1a, there was an overall dispreference for the target argument to be chosen as the current topic (it was circled only 9% of the time on average). However, the target argument was again chosen relatively more often in the topic condition compared to the given condition, with a marginal effect of information status ( $F_1(1,27) = 3.81$ ,  $p = .06$ ,  $F_2(1,39) = 65.0$ ,  $p < .0001$ ), but no effect of mentioned argument ( $F_s < 1$ ) or interaction of type and status ( $F_1(1,27) = 2.40$ , ns,  $F_2(1,39) = 1.31$ , ns). This effect was limited in this case to the experiencer, with planned pairwise comparisons showing that the effect of information status was significant for experiencers ( $t_1(27) = 2.22$ ,  $p < .04$ ;  $t_2(39) = 4.71$ ,  $p < .001$ ) but not for themes ( $t_1(27) = 1.48$ , ns,  $t_2(39) = 3.31$ ,  $p < .003$ ).

For the future topic measure, information status again had an influence, with the target argument more likely to be spontaneously produced when it was in the topic condition: The mentioned argument was provided as the most likely future topic 71% of the time when it was previously mentioned in an *about*-phrase, compared with 41% in the given condition. There was a significant effect of information status ( $F_1(1,27) = 51.229$ ,  $p < .0001$ ,  $F_2(1,39) = 100.8$ ,  $p < .0001$ ) but no effect of argument type ( $F_1(1,27) = 1.32$ , ns,  $F_2(1,39) = 1.571$ , ns) nor an interaction ( $F_s < 1$ ). Planned pair-wise comparisons show that the effect of topic was significant for both experiencers ( $t_1(27) = 6.2$ ,  $p < .0001$ ,  $t_2(39) = 7.2$ ,  $p < .0001$ ) and themes ( $t_1(27) = 5.65$ ,  $p < .003$ ;  $t_2(39) = 7.9$ ,  $p < .0001$ ).

## Discussion

The key finding from Experiment 1 is that *about*-phrases influence the topic status of their referents, with *about*-phrase referents being more likely to be chosen as topic, especially as the most likely future topic. Although there was an overwhelming preference to select the subject of the main clause as the current topic, aboutness did modulate this preference, particularly when the noun in the *about*-phrase was the experiencer argument. Because experiencer arguments were animate in all but one item (and themes always inanimate), this may reflect an interaction with animacy in which animate referents are more likely to be seen as current topic.

## Experiment 2

In Experiment 2, we tested whether the increased future topic expectation found in Experiment 1 would have an online influence on speakers' choice of syntactic structure. In this experiment, speakers heard the setup sentence and then were presented with the verb and its two arguments. Speakers were asked to then use those words to produce a transitive target sentence that was well-formed, that followed from the setup sentence, and that contained all three target words (see also V. Ferreira, 1996). The basic logic of this task is that the syntactic structure of the target sentence should be systematically affected by the information structure of its arguments, as determined by specific manipulations of the setup sentence.

The critical question is, will the difference in previous mention and information status of the target argument in the setup sentence cause speakers to mention that argument in different syntactic structures? We make two major predictions. First, previously-mentioned target arguments should appear earlier in speakers' utterances than new arguments. Observation of this result would confirm previous findings that givenness affects word order (e.g., Bates & Devescovi, 1989; Bock, 1977; Bock & Irwin, 1980), and would validate the present methodology as suitable for investigating discourse-level distinctions. Second, because topics are often associated with especially prominent grammatical roles like subject, we predicted that arguments marked as topic should appear in such prominent positions more often than merely given arguments. This would manifest in our results by an additional early-mention advantage for the mentioned target arguments in the topic condition compared to the given condition.

### Methods

**Subjects**—Forty UCSD undergraduates participated for course credit.

**Design and Materials**—We used the item sets described above for a 2x2 experimental design with all factors within speakers and within items. In addition, 48 filler items were created to prevent speakers from guessing the nature of the experimental manipulations. All filler items also had three target words, consisting of a transitive verb and two nouns. To control for potential display order effects, two presentation versions of each item were created, with noun positions swapped.

Eight lists of experimental items were created such that each experimental item appeared exactly once in each list and every list had the same number of items from each condition. Thus, no speaker saw any item more than once, and each item appeared in each list in a different condition. All filler items were included in each list. Lists were pseudo-randomized such that no more than two items ever appeared in the same condition consecutively.

**Procedure**—The experiment was presented with PsyScope 1.2.5 (Cohen, MacWhinney, Flatt, & Provost, 1993). Speakers were seated in front of a computer screen in a quiet room. They wore a lightweight headset microphone, which was connected to a PsyScope button box and was calibrated before the experiment to correctly trigger its voice key. Speakers were instructed to listen to the setup sentence, played through a speaker, while looking at the screen. At the offset of the setup sentence, a fixation cross appeared at the center of the screen (for 500 msec). At the offset of the cross, the target verb appeared at the same location, with the two target nouns centered beneath it. The verb was always inflected for past tense/past participle (only verbs for which these forms are identical were used). The purpose of placing past morphology on the verb was to mark it as a verb. The two noun arguments under the verb were bare and singular. The order of the nouns was systematically



varied, so that on half the trials for any particular item, the theme argument came first and on the other half the experiencer argument came first.

Speakers were instructed to read the words silently and then produce a grammatical sentence that used all three words and followed from the sentence they just heard. At the onset of the speakers' voice, the three words disappeared. Subjects' responses were recorded onto audio cassette and later transcribed.

## Results

Speakers' transcribed responses were coded. Trials in which speakers failed to use all three words or produced ungrammatical or nonsensical utterances were excluded, removing 115 out of 1600 items (7%, with all conditions affected roughly equally). The remaining responses were coded for fluency, syntactic structure, and the relative order of the theme and experiencer arguments.

Two types of analyses are possible: an analysis of syntactic structure (e.g. passive versus active) or an analysis of the percentage of times a particular argument appeared first (e.g. a measure of how often the theme argument preceded the experiencer argument generally, or a *theme-first* measure). These are substantially overlapping measures, and so only the theme-first analysis is presented here, for three reasons: First, there is little difference between the results found for the two measures when they are compared. Relevantly, none of the 1485 trials that were included in the analysis of the theme-first measure involved conjunctions or disjunctions of the target nouns, and only 15 involved possessive relationships (which one might consider to still involve a prominence asymmetry). This means all of the trials analyzed in the theme-first measure involved themes in higher syntactic positions than experiencers. Second, using the theme-first proportion measure allows us to more directly compare these results to the results of Experiment 4. Finally, using the theme-first measure allows more data to be analyzed. It should be noted that our use of this measure is not intended to imply that the effects are due to word order variation as opposed to syntactic structure assignment. Theme-first sentences were in virtually all cases active sentences, and because in all trials there was a syntactic position difference between themes and experiencers, the theme-first measure is completely compatible with a syntactic role assignment locus for any effect found.

The proportion of times that speakers produced the theme first in target sentences is shown in Figure 1.

To examine these observations statistically, the theme-first proportion measure was submitted to two-way repeated-measures analyses of variance (ANOVAs) using both subjects ( $F_1$ ) and items ( $F_2$ ) as random factors. The fixed factors entered into the ANOVAs were previous mention (experiencer *vs.* theme) and information status (given *vs.* topic). Variability is reported with 95% confidence-interval halfwidths based on single degree-of-freedom comparisons (Loftus & Masson, 1994). The results of this analysis show the following: First, the theme was mentioned first more often when it was previously mentioned ( $F_1(1,39) = 30.44, p < .001, CI = \pm.06; F_2(1,39) = 45.35, p < .001, CI = \pm.05$ ). However, speakers did not mention the theme first more often in topic conditions compared to merely given ( $F_1(1,39) = 3.6, p < .07, CI = \pm.03; F_2(1,39) = .248, n.s., CI = \pm.05$ ). Most importantly, there was an interaction of mentioned argument and information status ( $F_1(1,39) = 8.43, p < .01, CI = \pm.06; F_2(1,39) = 5.54, p < .02, CI = \pm.07$ ). This shows that speakers mentioned the theme first more often when it had been mentioned as topic rather than given, and placed it first less often when the experiencer had been mentioned as topic rather than given. The significant effect of the interaction between mentioned argument and information structure show that the theme was mentioned first more often when it was

previously mentioned, compared to when the experiencer was previously mentioned, and further, that the theme was mentioned first even more often when it was previously mentioned as topic than as given.

## Discussion

Experiment 2 showed that previously mentioned entities have an early-mention advantage, and most interestingly, this early-mention advantage was greater when an argument was previously mentioned in an *about*-phrase. The early-mention advantage for previously given elements is in keeping with the many studies that have shown that givenness affects sentence production (e.g., Bates & Devescovi, 1989; Bock, 1977; Bock & Irwin, 1980). The new result here is the interaction between previous mention and information status: When the theme was mentioned in a way that made it more likely to be predicted as future topic, it had an increased early-mention advantage compared to when it was merely given.

This early mention advantage for topics suggests that it is not only whether something had been previously mentioned, but how it had been mentioned that influenced sentence-production behavior. These results converge with those of Prat-Sala and Branigan (2000), who also found that the manner of prior mention influenced the way in which arguments were placed in an utterance. However, the cognitive or representational underpinnings of this effect are less clear. Prat-Sala and Branigan (2000) argued that their results were attributable to a temporary increase in conceptual accessibility due to the surrounding context of the target element. Their account may explain the results seen so far by arguing that when context assigns either current or future topic status to a referent, this increases (derived) accessibility. That increased level of accessibility can then give the topic a greater chance of being ready to be produced first, causing it to come early more often than other previously given arguments. By this account, any task that taps such accessibility should show such an effect. However, other proposals (e.g. Levelt, 1989) suggest that topic status is particular and thus only relevant to the sentence production process itself, perhaps as part of a discourse. If the early mention advantage for topics seen in this experiment are due to sentence-specific topic status rather than changes in accessibility, then (a) we should see these effects even in more open, offline production tasks and (b) we should not find these effects outside of a sentence production context. These two cases will be tested in Experiments 3 and 4 respectively.

## Experiment 3

Experiment 2 provided evidence for a first mention advantage for topic status in online spoken language production in a relatively constrained context in which the speaker was obliged to remember the previous setup sentence and use a particular set of words. In Experiment 3 we examined whether we would find this same effect in a more open, offline task, when the participants could look back to the prior setup sentence, were given only the verb to use in their target sentence, and wrote down their responses rather than produce them out loud. It could be the case that the effect of topic status seen in Experiment 2 does not carry over to an offline task like written sentence production, in which participants have neither an increased memory load nor time pressure to produce an utterance, and instead have the opportunity to plan their sentences. We tested this possibility in two ways: First, in Experiment 3a we used the same setup sentences as in Experiment 2. Then, in Experiment 3b we modified the setup sentences to ensure that our results were due to topic status and not some other aspect of the setup sentence.

## Experiment 3a

### Methods

**Participants:** Twelve members of the University of Florida community participated. These participants did not take part in any of the other experiments reported in this paper.

**Design and Materials:** The two theme setup-sentences were taken from the set of experimental items described above, giving this experiment a single factor: Information Status (given *vs.* topic). Each sentence was paired with its target verb.

Experimental items were divided into two lists using a Latin-square design with each item given exactly once in each list and each list containing equal numbers of items from each condition (i.e. 20 of each condition). Forty filler items from Experiment 2 were added to each list and then lists were pseudorandomized such that no two consecutive items were from the same condition and no more than three experimental items ever appeared in a row. Two versions of each list were created with different orders to prevent any spurious effects of item order within the lists. Each item consisted of the setup sentence followed by the theme-experiencer verb in parentheses, presented in past tense/participle form. The verb was preceded by an arrow to help remind participants that they needed to use it in the sentence that they produced. Under each setup sentence there was a blank line for their response.

**Procedure:** After giving informed consent, participants were seated in a quiet room and given the experimental materials in the form of a printed packet with items appearing in a numbered list. Participants were instructed to read each sentence and verb and then write down a sentence that both used the verb and naturally followed the sentence they had just read.

**Results:** Out of the 480 responses to experimental items, 16 (3%) were excluded because they were ungrammatical, did not contain the given verb, or failed to use the verb appropriately (i.e., as a verb). The remaining responses were coded (yes or no) for whether they contained coreference to the target noun in the setup sentence and/or coreference to the subject. If they contained coreference to either of these, then the form of the corefering expression was coded (pronoun, repeated, other). Finally, each response was coded for whether the first-mentioned entity in the sentence corresponded to the subject or target in the setup sentence (or to something else). The results are given in Table 4 as proportions out of all analyzed responses.

Because this experiment had a single, two-level factor, paired-sample t-tests were used to compare proportions between the given and topic conditions, with both participants ( $t_1$ ) and items ( $t_2$ ) as random factors. The results show that mention in an *about*-phrase has a clear effect on how the target is treated in participants' responses. Crucially for our purposes, the target theme noun was more likely to be mentioned first in the sentence when it had occurred in an *about*-phrase ( $t_1(11) = 4.55, p < .001; t_2(39) = 2.5, p < .02$ ). Interestingly, mention in an *about*-phrase also resulted in more instances of coreference with the theme overall ( $t_1(11) = 4.84, p < .001; t_2(39) = 3.36, p < .002$ ), as well as the specific case of using a pronoun to corefer ( $t_1(11) = 5.04, p < .001; t_2(39) = 4.46, p < .001$ ).

## Experiment 3b

The results of Experiment 3a suggest that topic status influences word order as well as the form of coreferential expressions. However, it is possible that the difference between the given and topic conditions is not being driven by the *about*-phrase *per se* but rather by some other difference between the conditions that is especially relevant when one can look back to the setup sentence. There are two systematic differences in particular that are likely

candidates: the difference in subject definiteness (subjects were always definite in the given condition and always indefinite in the about condition) and the extra coreference (always pronominal) to the subject in the given condition compared to the about condition. To examine this possibility, materials from main set of experimental items were modified to minimize these differences.

## Methods

**Participants:** Twelve members of the University of Florida community participated. These participants did not take part in any of the other experiments reported in this paper.

**Design and Materials:** The materials were identical to those in Experiment 3a except for two changes in the given condition. First, the subject was made indefinite by using the determiner *a* instead of *the*. Second, the embedded clause was altered by removing the subject pronoun and inflecting the verb with the progressive – *ing*. Some verbs needed to be altered in order to keep the sentences as natural sounding as possible. In these cases, the verb was changed in both the given and topic conditions. An example of the modified materials is given below, with the prompt verb in parentheses.

1. Given: A passenger realized something while watching the traffic. (annoyed)
2. About: A passenger realized something about the traffic. (annoyed)

**Procedure:** The experimental procedure was identical to Experiment 3a.

**Results:** One item was dropped from analysis due to a typographical error for that item in the printed packet. All 468 responses to the remaining 39 experimental items were entered into a computer data file and coded in the same way as in Experiment 3a, with 9 responses (2%) removed from further analysis as a result of coding procedures. The results are also given in Table 4. Also as before, paired-sample t-tests were used to compare proportions between the given and topic conditions, with both participants ( $t_1$ ) and items ( $t_2$ ) as random factors.

The pattern of results here are very similar to those found in Experiment 3a: mention in an *about*-phrase had an effect on how the target was treated by participants in their response sentences. Once again, and most importantly, mention in an *about*-phrase caused increases in first-mention ( $t_1(11) = 4.52, p < .001; t_2(38) = 3.13, p < .003$ ). There was also a marginal effect on increased coreference to the about-phrase reference, both in any form ( $t_1(11) = 2.12, p < .06; t_2(38) = 2.10, p < .05$ ) and with pronouns ( $t_1(11) = 2.04, p < .07; t_2(38) = 2.62, p < .02$ ).

**Discussion:** The results of Experiment 3a and 3b provide supporting evidence that future topic status influences the written production of sentences, even in this more open-ended task. This suggests that the effects seen in Experiment 2 were not entirely due to the processing demands of an online sentence production task. However, it is important to note that while topic status did cause an increase in the number of times the topic was mentioned first, topic antecedents still had lower proportions in these measures than the grammatical subjects in the setup sentence. Thus, while overall it appears that topic status influences the position of an element within a sentence, it does not completely override the influence of being mentioned in subject position. This could be because subject position is a very strong cue to topic status in English, or it could be because of an independent structural preference for coreference with subject-mentioned antecedents that would not be diminished by a shift in topic status or accessibility of the target. Further work is needed to tease these possibilities apart.

This brings us to our second prediction: A first-mention advantage for topic should also be seen outside of a sentence production context if such an advantage is due to an extra increase in accessibility. Experiment 4 was designed to test this prediction, and thereby examine whether the early mention advantage for topic is specific to sentence production or due to a more generalized increase in accessibility. To do this, we replaced the sentence-production task with a word-recall task. If the effects seen in Experiment 2 were due to an additional increase in accessibility for the topic referents above being merely given, then this same pattern of effects should manifest in any task that is sensitive to accessibility, such as word-recall.

## Experiment 4

In this experiment, speakers memorized three target words (e.g. *passenger*, *traffic*, *driver*), then heard a setup sentence (e.g. *The passenger noticed something about the traffic*), and then recalled the three target words that they had just memorized. The logic, as with Experiments 2 and 3, was to determine whether the setup sentence would influence performance on the main task – in this case the *order* of recall of the target words. In order to prevent speakers from engaging in rehearsal strategies for the three target words, the recall task was made more difficult by adding a mental arithmetic task immediately following the initial presentation of the target words. The math task was a simple, two-digit plus two-digit addition problem that speakers were asked to solve in their heads and then give the answer to out loud. Also, to ensure that speakers paid attention to the setup sentence, they were asked on filler trials to recall the setup sentence itself rather than the target words. Speakers were not told until the end of the trial whether they were to recall the words or the sentence, and so needed to attend to both the words and the sentence in order to be certain of being able to recall either accurately.

## Methods

**Participants**—48 UCSD undergraduates participated for course credit.

**Design and Materials**—Setup sentences were left unchanged, but the target words were updated by replacing the verb with the other noun from the setup sentence (e.g. *passenger*) so that the target words were all from the same word class (i.e. nouns) and speakers would thus be less tempted to try to (covertly) generate sentences from the target words, especially during the memorization phase. The design is similar to Experiment 2, however, the screen order factor was dropped and a random presentation of the three words for each trial was used instead. The two remaining setup-sentence factors remained unchanged: Mentioned Argument (experiencer, theme) and Information Status (given, topic).

**Procedure**—Setting and equipment were as in Experiment 2. Speakers were instructed to read and memorize three words when they appeared on the screen. After the words disappeared, a math problem appeared. Speakers calculated the answer to the problem in their heads and stated the answer to the question out loud, which the experimenter recorded by hand onto a score sheet. Speakers then heard the setup sentence, played through a speaker, while looking at the screen. At the offset of the setup sentence, either a “1” or “2” appeared, indicating that speakers should recall the three words from the beginning of the trial (1) or the subsequent sentence (2). Speakers’ responses were recorded onto audio cassette as well as recorded in real-time by the experimenter. In cases of doubt during data entry, the audio cassette record was consulted.



## Results

The proportion of times that the theme was the first-recalled word (out of the number of times that the theme and experiencer were both recalled) was calculated and is reported in Table 5. To investigate these results statistically, the theme-first measure was submitted to two-way repeated-measures ANOVAs.

Speakers' first-recalled words were more likely to be the theme when the theme was previously mentioned in the setup sentence compared to when the experiencer was, with a main effect of previous mention that was significant by subjects and marginally significant by items ( $F_1(1,47) = 4.41, p < .04, CI = \pm.06$ ;  $F_2(1,39) = 3.86, p < .06, CI = \pm.06$ ). This pattern was not affected by the information status of the mentioned argument, with no main effect of information status or interaction with mentioned argument (all  $F_s < 1$ ).

The proportion of times that the theme was recalled first in Table 5 is fairly small in all conditions. This may be because in our materials themes were nearly always inanimate, whereas the other two arguments were animate. Generally, animate entities tend to be mentioned first (e.g., Prat-Sala & Branigan, 2000; McDonald, Bock & Kelly, 1993), so the themes in this experiment may have been at a comparative early-mention disadvantage. Another similar measure is the number of times the themes were recalled before the experiencers, regardless of absolute position (as opposed to the above measure, which counted how often the theme was the first-recalled word). The pattern of results with this relative measure is shown in Figure 2. Again, themes were recalled earlier than experiencers when themes were previously mentioned in the setup sentence, but no systematic effect of topic status was evident. Two-way repeated-measures ANOVAs on this measure support these observations, with a significant main effect of mentioned argument ( $F_1(1,47) = 13.9, p < .001, C = \pm.07$ ;  $F_2(1,39) = 16.8, p < .001, C = \pm.07$ ). The main effect of information status was not significant, nor was the interaction between the factors (all  $F_s < 1$ ).

## Discussion

The previously mentioned (given) arguments were recalled earlier in word lists than unmentioned (new) arguments, consistent with the idea that givenness effects are indeed due to increased accessibility (although our results cannot determine whether the effects were due to conceptual or lexical accessibility). Furthermore, because topics were not recalled earlier in word lists than merely given words, the results also suggest that the influence of topichood on the production system is not due to a generalized increase in conceptual or lexical accessibility.

## General Discussion

Two questions were raised at the beginning of this paper. The first was whether distinctions other than given versus new influence the production of syntactic structure. After Experiment 1 confirmed that *about*-phrases can confer (current or future) topic status, the results of Experiments 2 and 3 provided evidence for such an influence, as there was an early mention advantage for topic arguments over given but non-topic arguments in both online (spoken) and offline (written) modalities.

The second question concerned the nature of an information structure effect on the language production system, and in particular whether such an effect can be reduced to more general effects of increased accessibility, such as has been proposed for givenness. In keeping with many previous studies, our results show that previously given elements appear to have an early mention advantage over new elements. This effect was seen in both sentence production contexts (Experiments 2 and 3) and word-recall contexts (Experiment 4), suggesting that the locus of the effect must be relevant both within and outside a sentence-

production task. These results thus provide further confirming evidence that prior mention or givenness increases the accessibility of the given argument.

But, the same does not appear to be true for topic status. In our experiments, topics were also previously mentioned, and so some part of the early-mention effect for topics was due to an increase in the accessibility of the referent. However, our results indicate that the additional advantage of topics over merely given non-topics is unlikely to be entirely due to this increase: In a task that did not require sentence processing (Experiment 4), topics no longer showed this advantage over merely given elements – there was only an effect of givenness for both topics and merely given referents. This could be because speakers were not producing sentences or because they did not need to comprehend the context sentences fully as sentences (beyond memorizing them for production in filler trials). Crucially, once the sentence-production task was removed, only the effect of givenness remained. This pattern of results suggests that the early mention advantage for topics over merely given arguments in Experiments 2 and 3 was not due to a general increase of accessibility, but something specific to the sentence production system.

This distinction between givenness as an influence on the more domain-general availability of a concept or word and topichood as a more language-specific influence specifically on the sentence-production system can be explained by considering the different theoretical natures of givenness and topichood. While topic status and givenness often coincide, they do not need to (Prince, 1981; and others), and while givenness may operate through a general influence on accessibility and not on something specific to sentence production, the same does not need to be true for topichood. This idea is supported by the fact that one can make an element given non-linguistically. For example, objects that are physically co-present with the speakers can be treated as given. This suggests that being previously given is not necessarily always a linguistic property. On the other hand, the information structure status of topic is more likely to be linguistically dependent (as something that a linguistic statement is about), and thus topic arguments might more reasonably see their influence restricted to sentence-production contexts. This does not imply that givenness and topic are not correlated; topic-marked arguments may have increased levels of accessibility due to being given, and this is probably the most common state of affairs. These results imply only that topic and given statuses are representationally dissociable.

However, if the locus of the topic effect is not increased accessibility, then there must be some other source. Our results do not provide a definitive explanation of this other source, but do suggest that topic status is something that the production system is only sensitive to when generating a sentence. Thus, one likely possibility is that topic status has a direct influence within the sentence production system, which we will outline below.

First, nearly all models of sentence production posit at least two distinct levels of representation: a message level and a formulation level (e.g. Bock & Levelt, 1994; Levelt, 1989). At the message-level, representations are conceptual in nature: it is at this beginning point that the content of the utterance is planned. At the formulation level, the linguistic representations that match that message-level content are selected and ordered into a sentence structure. It is this representation that is then forwarded for articulation. Accessibility may apply at either level: increased accessibility of a concept may cause it to be sent for formulation earlier than other concepts, and increased accessibility of a word may cause it to be selected earlier and thus placed earlier in the structure of the utterance ( see Levelt, 1989 for a summary of the evidence in favor of accessibility influences at both levels of production).

In many approaches to information structure, statuses like topic are not assigned directly to syntactic positions themselves, but to representations of real-world referents (Lambrecht, 1994). Thus, it seems reasonable that representations at the message-level could be initially marked with topic status (as proposed by Levelt, 1989). Topic status (and information structure more generally) could then be best characterized as involved in the mapping between the message-level and grammatical structures. This kind of mapping is like the assignment of grammatical roles, which involves mapping message-level features to formulation-level representations. However, in this case, the message-level imposes constraints that determine how words are assigned grammatical roles.

More specifically, one way to implement such a mapping is to follow Levelt's (1989) proposal that an element at the message-level can be marked with a "+topic" feature. This "+topic" feature would influence the assignment of its referent's word in a syntactic structure, causing it to be placed in a more prominent position whenever possible. This assignment process would no doubt interact with factors like accessibility. For example, topics are rarely new in a discourse, and thus a current sentence topic is nearly always also given. As we have already seen, such givenness also causes words to be placed earlier via accessibility. Furthermore, even when not overtly given, topics are also nearly always definite, another feature that is associated with early placement in a sentence. Thus, there are at least two factors in addition to the "+topic" marking that can cause a word to be assigned to a prominent syntactic role or position. These three factors together strongly influence the system to place topics early and prominently. This effect is captured by the theoretical observation that all things being equal, the canonical position for topics is the grammatical subject position.

However, there is some evidence that suggests that it is word order rather than syntactic role assignment that is influenced by topic status. Prat-Sala and Brangian (2000) found that Spanish speakers made use of dislocated actives to place prominent (possibly future topic) arguments early in their utterances without making them grammatical subject<sup>2</sup>, suggesting that the placement of words in sentences is not due to syntactic role assignment directly but rather to placing the most accessible thing first, using whatever means available. This at first appears to contradict our interpretation of Experiment 4: If topics are not always assigned to grammatical subject position, and can instead have an apparently *less* prominent role while still being placed early, then the placement of topics within a sentence cannot be directly linked to grammatical role assignment. However, this ignores the fact that such early, pre-subject positions can themselves be considered linguistically prominent. In fact, several

<sup>2</sup>Participants were given the following instructions:

In linguistic theory, most sentences are considered to have "topics". The topic of a sentence is its central element, the part that any new information conveyed by the sentence is added to. For example, if you had a sentence like "As for the milkman, he noticed the yogurt had gone bad," the milkman would be the topic because he's the thing that the sentence has new information concerning, that is, that he noticed something. But, if the sentence was "As for the yogurt, the milkman noticed that it had gone bad," then the yogurt would be the topic because it is now the yogurt that is having new information added to it – the fact that it had gone bad.

In the following pages, we're going to show you the first sentence in a story. It will look something like this:

Current Topic?	Next Topic?
1. As for the milkman, he noticed that some yogurt had gone bad.	<input type="radio"/> milkman <input type="radio"/> mold

We want you to do two things with each sentence: First, we want you to determine what you think the topic of each sentence is, and then circle it in the sentence. Second, imagine that another sentence is going to be written that continues the story. We want you to decide which of the two things listed next to the sentence is most likely to be the topic of that next sentence, and check the box next to your choice.

approaches to the syntactic manifestation of information structure suggest that topics that are placed in a pre-subject topic phrase (generalizing away from any particular instantiation of this kind of phrase) can be considered more prominent than grammatical subjects (e.g. Polinsky & Potsdam, 2001). Thus, finding that languages place topic (or “prominent”) elements in pre-subject position is not necessarily evidence against the idea that words are associated with decreasingly prominent syntactic structure positions as a sentence is produced over time.

Another apparently conflicting observation to our proposal is that there are cases in which the topic is found after the subject. This could be due to interactions of topic-marking with the myriad of other influences of word order and syntactic role assignment already discussed. The need for syntactic flexibility in the face of multiple automatic and controlled factors has been discussed before (e.g. Bock, 1982). It is difficult to claim that topic-marked elements must always seize topic or subject position. Indeed, topic-marked elements themselves could be affected by changes in accessibility, including those discussed earlier, which means that they are not guaranteed a prominent position, though they would still in those cases retain topic status. Thus, this possibility only serves to highlight the conclusions from the literature reviewed in the introduction: Word order in sentence production is multiply determined, involving a complicated system of influences from perceptual, conceptual, and linguistic sources. It is possible that the topic for a speaker may be different from what the listener decides is topic. In fact, one means for topic shift might come about from having a speaker place a topic-marked element post-verbally, which would then allow the next speaker to choose a new topic.

A different interpretation of our results is that what we have so far discussed in terms of information status could more precisely be called prominence or salience. Though it is possible to characterize the difference between the status of the critical arguments in Experiments 2–4 as changes of prominence, we suggest two reasons why this may be less satisfactory. First, until we can determine which specific aspects of language form cause changes in prominence, a delineated idea of what causes prominence cannot be developed. Thus, by considering theoretical constructs such as topic, it may be possible to gain a more detailed understanding of the specific factors involved under the more general category of prominence. Second, and more importantly, the idea of prominence is generally assumed to be a graded property that would parsimoniously be characterized on a continuum with givenness. This characterization does not mesh well with the results of Experiment 4, which suggested that topichood is not simply an increase in prominence that adds to an increase in availability over and above the effect of givenness.

In conclusion, the present experiments suggest that topics are mentioned in more prominent positions in utterances. In our studies, this effect appears limited to sentence production, which is consistent with the idea that the influence of topic status on sentence placement is separate from the effect of givenness (which *does* have an influence outside a sentence context, suggesting that givenness works by increasing the accessibility of referents or lexical entries). While acknowledging the influence of other known factors on word order, we propose that the topic status of a sentence argument in previous discourse causes a speaker to be more likely to mark the corresponding message-level concept as topic for use in the next utterance. This effectively gives the concept a representational basis upon which sentence-production processes can place the corresponding word into a prominent, sometimes even topic-specific, position within a sentence.

## Acknowledgments

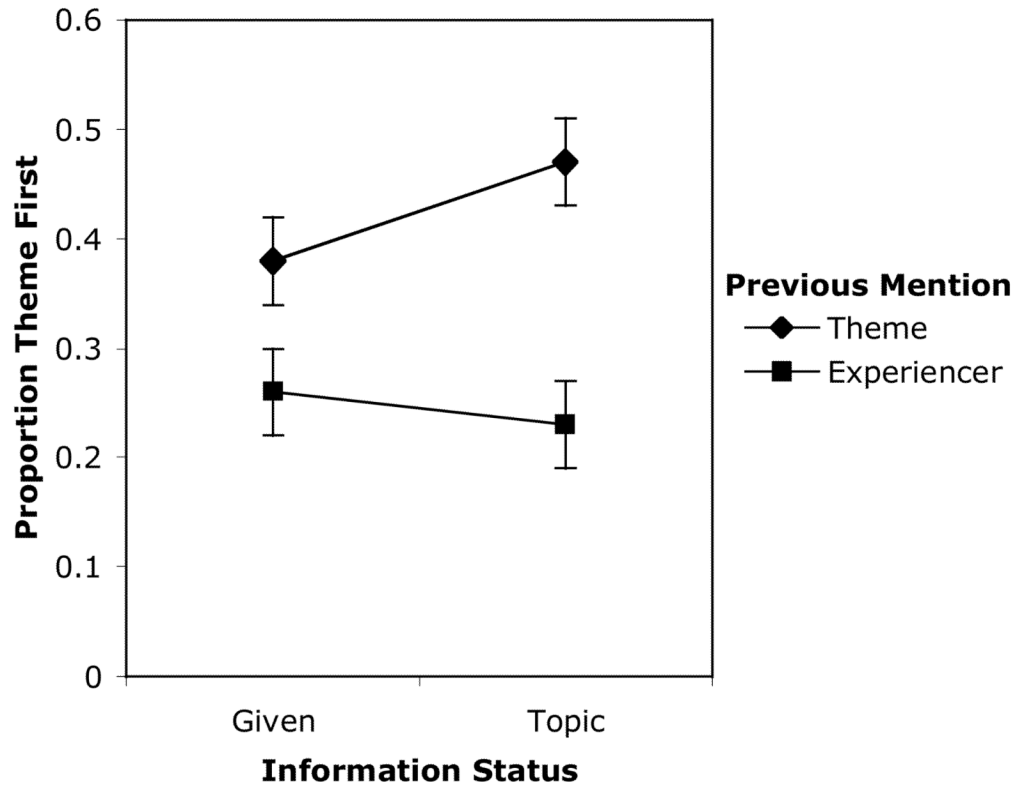
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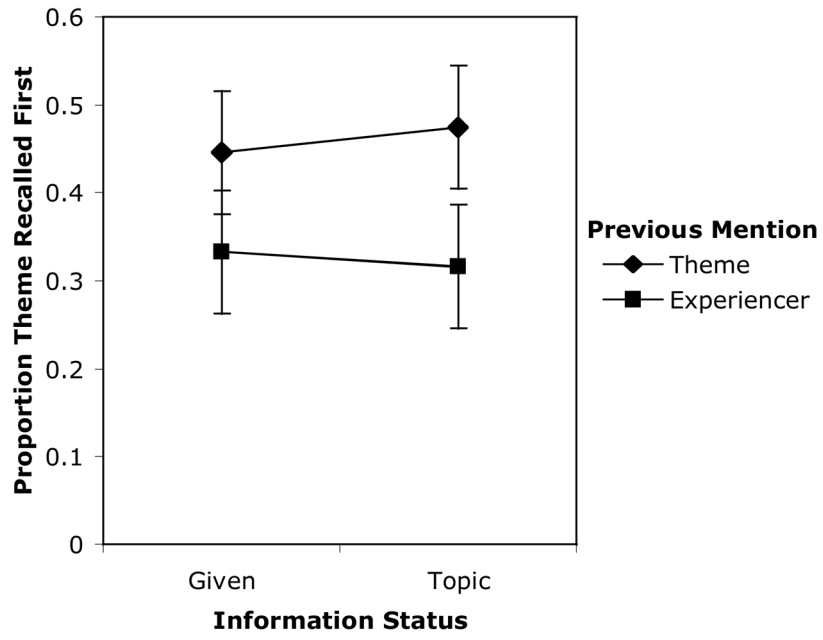
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**Figure 1.**  
Proportion of theme-first responses in Experiment 2



**Figure 2.**  
Proportion of Theme Recalled Before Experiencer in Experiment 4

**Table 1**

## Example Set of Stimuli

Mentioned Argument	Information Status	Setup Sentence
Theme	Given	The passenger realized something when he saw the <i>traffic</i> .
Theme	Topic	A passenger realized something about the <i>traffic</i> .
Experiencer	Given	The passenger realized something when he saw the <i>driver</i> .
Experiencer	Topic	A passenger realized something about the <i>driver</i> .

Note. Mentioned arguments in the setup sentence are italicized. The target verb for this set is *annoyed*. A sample target sentence for this item is: *The traffic annoyed the driver.*

**Table 2**

Proportions of responses with the target argument selected as the current topic and proportions of responses in which the theme argument was chosen as the most likely future topic in *Experiment 1a*

Current Topic	Information Status	
	Given	Topic
Argument type		
<u>Experiencer</u>	.031 (.01)	.114 (.04)
<u>Theme</u>	.056 (.03)	.089 (.03)
Future Topic		
Argument type	Given	Topic
<u>Experiencer</u>	.292 (.04)	.181 (.04)
<u>Theme</u>	.647 (.05)	.817 (.04)

Note. Standard Errors reported in parentheses.



**Table 3**

Proportions of responses with the target argument selected as the current topic and proportions of responses in which the target argument was given at the most likely future topic in *Experiment 1b*

Current Topic	Information Status	
	Given	Topic
Argument type		
<u>Experiencer</u>	.046 (.02)	.146 (.06)
<u>Theme</u>	.061 (.03)	.121 (.05)
Future Topic		
Argument type		
<u>Experiencer</u>	.429 (.06)	.725 (.06)
<u>Theme</u>	.40 (.05)	.686 (.05)

Note. Standard errors are given in parentheses

**Table 4**

Proportions of responses for subject and target arguments in Experiments 3a and 3b

Information Status of Target				
	Experiment 3a		Experiment 3b	
Coreference (all forms)	Given	Topic	Given	Topic
Subject	.74 (.05)	.61 (.04)	.82 (.03)	.68 (.04)
Target	.45 (.04)	.60 (.04)	.43 (.04)	.53 (.03)
Coreference (pronominal)				
Subject	.69 (.07)	.56 (.06)	.75 (.05)	.63 (.04)
Target	.16 (.03)	.30 (.04)	.22 (.03)	.33 (.05)
First Mentioned				
Subject	.45 (.07)	.32 (.05)	.74 (.04)	.53 (.05)
Target	.36 (.07)	.54 (.05)	.18 (.03)	.31 (.04)

Note. Standard errors are given in parentheses.

**Table 5**

Proportion of theme recalled first in Experiment 4

Mentioned Argument	Information Status	
	Given	Topic
Experiencer	.173	.199
Theme	.255	.249