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Saying “that” in dialogue: The influence of accessibility and social factors on syntactic production

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Abstract

Previous evidence suggests that when speakers produce sentences from memory or as picture descriptions, their choices of sentence structure are influenced by how easy it is to retrieve sentence material (*accessibility*). Three experiments assessed whether this pattern holds in naturalistic, interactive dialogue. Pairs of speakers took turns asking each other questions, the responses to which allowed mention of an optional “that” before either repeated (accessible) or unrepeated (inaccessible) material. Speakers’ “that” mention was not sensitive to the repetition (accessibility) manipulation. Instead, “that” mention was sensitive to social factors: Speakers said “that” more when adopting another’s perspective rather than one’s own, and tended to say “that” more when attributing emotions to oneself rather than another. A fourth experiment confirmed that in a memory task, the original pattern is observed. These results suggest that “that” mention is sensitive to the cognitive forces that operate within a production task; in dialogue settings, social factors were especially influential.

Producing language involves making choices: Choices about what words, sentence structures, and prosody to use, about how quickly or loudly to speak, and so forth. Many choices are (relatively) straightforwardly determined by the fact that speakers typically speak to express particular meanings -- a speaker will choose “cat” and not “dog” to refer to a domestic feline, for example. But other choices are likely driven by more subtle goals. Why do speakers speak more quickly or slowly in different contexts? Why might they call a domestic feline “cat” or “kitty” or “crazy animal living in my house”?

One increasingly studied choice speakers must make is whether to use certain optional and relatively meaningless words in their sentences. Here, we focus on the production of *sentence-complement structures* such as (1):

(1) I believe (that) you are euphoric.

In sentence-complement structures, a main verb like “believe” takes a clause (‘sentence’) argument like “you are euphoric.” Between these, a speaker can mention or omit a complementizer “that.” Sentences with or without the “that” are grammatically acceptable, and if there is any systematic difference in meaning between the two forms (see, e.g., Bolinger, 1972; Thompson & Mulac, 1991; Yaguchi, 2001), it is subtle. Nonetheless, when producing sentences like these, speakers -- or more precisely, the processes responsible for *grammatical encoding* -- must choose whether to mention the “that.” Our strategy here is to look at the general forces that guide the choice to mention the “that,” to characterize the cognitive mechanisms that are a part of grammatical encoding.

Previous research on grammatical encoding suggests that a major challenge to formulating efficient and fluent utterances comes from differences in *accessibility*. Speakers must retrieve the conceptual and lexical content they intend to put into their sentences. But memory retrieval is complex and variable; some concepts and words are retrieved quickly, whereas others are retrieved more slowly (or not at all, if memory retrieval fails). Meanwhile, sentences cannot be variably worded; the grammars of natural languages generally only permit particular word orders. And so the challenge: Concepts and words can only be uttered in certain orders, but those concepts and words may be retrieved from memory in any order whatsoever.

Here, grammatical encoding may employ cognitive strategies that can help. In particular, if grammatical encoding chooses structures to accommodate differences in conceptual and lexical accessibility, the time course of memory retrieval and the time course of sentence production can be better aligned. To do so, grammatical encoding can choose sentence structures that allow quickly retrieved (more accessible) content to be mentioned sooner and content that is retrieved more slowly (less accessible content) later (see Bock, 1982). Influences of conceptual and lexical accessibility on sentence structure choices are often termed *accessibility effects*.

The paradigm demonstration of accessibility effects on sentence production comes from Bock (1986). Subjects described target pictures that allowed active (“lightning struck the church”) or passive (“the church was struck by lightning”) descriptions. Before describing pictures, subjects heard and repeated prime words that were similar in meaning either to the agent (“thunder” for “lightning”) or the patient (“worship” for “church”) in the target picture. Results showed that speakers tended to use sentence structures that allowed the element that was semantically similar to the prime to be mentioned earlier in the sentence. So, when subjects heard and repeated “thunder,” they tended to describe the picture with “the lightning struck the church,” but when they heard and repeated “worship,” they tended to describe the picture with “the church was struck by lightning.” This suggests that when a concept or word is made more accessible, speakers choose sentence structures that allow for its earlier mention -- an accessibility effect. In turn, by aligning the time course of memory retrieval and sentence production, that production should be more efficient.

Just as with word-order variations (like active and passive), producing the optional “that” in sentence-complement structures can help production processes accommodate variability in memory retrieval. Specifically, by mentioning the “that,” speakers delay mention of the next word, whereas by omitting it, they advance it. Thus, speakers can mention the “that” when the subsequent material takes longer to retrieve and omit it when the subsequent material is retrieved quicker.

Previous evidence shows just such an effect. Ferreira and Dell (2000) had speakers produce sentences like (2)–(5):

- (2) I believed (that) I would miss the flight.
- (3) I believed (that) you would miss the flight.
- (4) You believed (that) I would miss the flight.
- (5) You believed (that) you would miss the flight.

The embedded subjects in sentences (2) and (5) repeat the main subjects. This means that the conceptual and lexical content that speakers produced after the “that” repeated the conceptual and lexical content that speakers had said just two or three words earlier, and so this material should be more accessible. Meanwhile, the embedded subjects in (3) and (4) differ from the main subjects. This means that the conceptual and lexical content that

speakers produced after the “that” did not repeat the conceptual and lexical content that speakers had said just two or three words earlier, and so this material should be less accessible. If “that” mention accommodates differences in accessibility, then speakers should say the “that” less in (2) and (5) than in (3) and (4). Indeed, Ferreira and Dell (2000) observed that speakers said the “that” about 10% less in sentences in which the embedded subject repeated the main subject compared to in sentences in which it did not. Another experiment in the same report showed that a manipulation of the recall prompt that altered the accessibility of the material after the “that” affected production similarly. This provides converging evidence that accessibility influences “that” mention (which in turn helps to discount the possibility that repeated embedded subjects should have been harder to retrieve, due to similarity-based interference, rather than easier, due to identity-based facilitation). Ferreira and Firato (2002) provided independent evidence that memory manipulations (specifically, proactive interference) affect “that”-mention in a manner that reflects accessibility.

Though accessibility effects have been observed on different structures and word orders (Bock, 1977, 1986, 1987; Bock & Irwin, 1980; Ferreira & Dell, 2000; Ferreira & Firato, 2002; Slevc, 2007), in different languages (Christianson & Ferreira, 2005; Prat-Sala & Branigan, 2000), and in response to a range of cognitive factors that condition accessibility (McDonald, Bock, & Kelly, 1993), accessibility effects have not been assessed in one important situation: relatively naturalistic, interactive dialogue. Most tasks that have assessed accessibility effects have used picture description tasks (Bock, 1986, 1987; Prat-Sala & Branigan, 2000; Slevc, 2007), whereas others have used memory-based tasks, where subjects encode sentences into memory and then later recall them (whereupon speakers sometimes alter word orders or structures; Bock, 1977; Bock & Irwin, 1980; Ferreira & Dell, 2000; Ferreira & Firato, 2002). Picture description and sentence recall place especially heavy demands on the processes of conceptual and lexical retrieval, which may be part of the reason why such tasks reveal influences of memory-based factors like accessibility. In tasks that require speakers to retrieve labels for depicted entities and scenes, or recall meanings and words from memory, the ease or difficulty of retrieving material from memory may be the primary cognitive demand. In contrast, in more naturalistic conversational settings, where dialogue, discourse, or environmental factors might support retrieval processes, memory influences may not be so prominent, and other forces may systematically influence sentence formulation instead.

The experiments here were designed to determine whether the types of accessibility effects that have been commonly observed in picture description and memory tasks arise analogously when speakers are engaged in more naturalistic dialogue. To promote tight comparisons with previous work, we had speakers produce sentences that like (2)–(5) above from Ferreira and Dell (2000) that included embedded subjects that did or did not repeat the sentences’ main subjects. To get speakers to produce such sentences naturalistically in dialogue, they were tested in pairs in a task that was described as an inquiry into emotional attribution. Speakers were first introduced to a (simplified) Jamesian theory of emotion, emphasizing that we attribute emotions to people by inferring the emotion from behavior, and we might even do so when we attribute emotions to ourselves:

Because we do not have access to other people’s private thoughts, when we are trying to determine someone else’s emotional state, we must first examine their behavior and then infer what they are feeling. Interestingly, some theories of emotion take it a step further and claim that we do not have direct access even to our own emotional states. According to these theories, in order to determine what emotion we are experiencing, we first examine our own behavior and based on our own observation, conclude what we ourselves are feeling. For example, maybe you

have noticed before that someone has said to you something like, “you look like you’re in a good mood!” to which you may have responded, “you know what, come to think of it, I AM in a good mood.” In other words, what we do is *attribute* emotional states based on behaviors, and not only do we do this to others, but we can also do this to ourselves.

Then, speakers were told that they were going to describe situations to one another that involved one of them observing one of them acting in a particular manner. They would then ask what emotion the observer would attribute to the actor. Respondents were asked to respond in complete sentences. Then by manipulating the observer and actor, sentences with all combinations of “I” and “you” main and embedded subjects were elicited:

- (6) Q: You hear you are screaming obscenities. What do you believe about yourself?
A: I believe (that) I am angry.
- (7) Q: You hear I am screaming obscenities. What do you believe about me?
A: I believe (that) you are angry.
- (8) Q: I hear you are screaming obscenities. What do I believe about you?
A: You believe (that) I am angry.
- (9) Q: I hear I am screaming obscenities. What do I believe about myself?
A: You believe (that) you are angry.

The task successfully implemented a naturalistic interactive dialogue. Subjects were engaged and commented on (and joked about) each other’s responses. There was one report of a subject who attempted to arrange a follow-up engagement with his or her partner. Upon being debriefed and told that the experiment was about the mention of the optional “that,” many subjects were surprised (and disappointed), as they were convinced that the experiment was about emotion. The task is a relatively structured question-and-answer format, and the participants had no goal other than to exchange information. That said, it is worth noting that the subject matter here -- people and their behavior -- is by some estimates the single most common topic that people talk about in everyday conversations (Dunbar, Marriott, & Duncan, 1997). And so, if speakers say the “that” to accommodate variability in accessibility in naturalistic dialogue just as they do in picture description and memory-based tasks, they should say the “that” less in sentences where the embedded subject repeats the main subject, as in (6) and (9), relative to when it does not, like in (7) and (8).

Experiment 1

Method

Subjects—Forty-four subjects from the University of California, San Diego community participated for course credit or cash payment. All reported learning English as their first language. Subjects participated as pairs after signing up for separately listed but common time slots. All procedures were in accordance with the ethical standards of the local institutional review board.

Materials—Forty-eight quadruplets of scenarios were designed to elicit target sentences. Each consisted of two sentences written from a first-person perspective. The first sentence named either the speaker or his or her addressee observing either the speaker or his or her addressee behaving in some particular way:

- (10) I/you hear I/you are screaming obscenities.

The verb denoting the observation varied (*hear, notice, suspect*, etc.) and omitted an optional complementizing “that” to prime speakers in a manner that pulled “that”-mention away from ceiling (see Ferreira, 2003). The 48 sentences all described different behaviors (*screaming obscenities, sighing, throwing dollar bills into the air*, etc.). The second sentence then asked what the observer believed about the actor:

- (11) What do I/you believe about myself/you/me/yourself?

In Experiment 1, the verb in these questions was always *believe*.

The 48 scenarios were randomly assigned to four item groups. A 4×4 Latin square was used to assign all 48 scenarios to four lists such that within a list 12 scenarios described each combination of observer and actor. Across the four lists, each scenario appeared once with each observer-actor combination. Because subjects took turns being questioner and answerer, an alternating structure was imposed on the lists so that the odd-numbered and even-numbered trials each included 6 sentences with each observer-actor combination. Within this constraint, sentences were presented in a fixed, randomly generated order where no more than two immediately successive trials included the same observer-actor combination. The experiments included no filler trials. Six subject pairs were tested on two lists and five on the other two.

Procedure—Upon arriving at the lab and providing informed consent, the experimenter read the setup and instructions aloud to subjects. The setup first described (in lay terms) a Jamesian-type theory of emotions, so as to provide a rationale for the types of sentences speakers were to produce. It established first that we infer others’ emotional states by observing their behaviors, but that some theories state that we do this even for our own emotional states (see the introduction for an excerpt of the instructions). The instructions then stated that participants would take turns reading a statement describing the observation of an actor behaving and asking a question to guess the emotion underlying that behavior. The instructions noted that participants should answer with complete sentences. The experimenter then guided the subjects through four practice scenarios (which were distinct from the test scenarios), with the subjects taking turns on the four. During practice, the experimenter corrected any deviation from these guidelines.

The scenarios were printed on 8.5” × 11” sheets of paper. The experimenter randomly selected one participant to begin. Other than requiring complete sentences, no restrictions were placed on subjects in terms of timing, incidental interactions during the procedure (which were commonplace), and so forth. Experimental sessions were recorded on standard audio cassette tape.

Scoring, design, and analyses—All utterances were transcribed, including all discernible features of speakers’ productions. Utterances were coded for whether a valid sentence-complement structure was produced including the verb *believe* and a full clause complement, and for the content of the main subject and embedded subject. Utterances were excluded from analysis if speakers: (a) did not produce a valid sentence-complement structure (129 of 1152 utterances or 11.2% of all utterances); (b) did not produce the targeted main subject (160 trials or 13.9% of utterances); or (c) did not produce the targeted embedded subject (141 or 12.2% of utterances). Altogether, these criteria led 177 trials (15.4%) to be excluded (note that some utterances violated multiple exclusion criteria).

We analyzed two factors: The main subject speakers produced (*main subject: I or you*) and the embedded subject speakers produced (*embedded subject: I or you*). The proportion of sentences including a “that” was tabulated within each cell of this design for each subject (across scenarios) and for each item (or scenario, across subjects). The proportions were

entered into separate 2×2 repeated-measures analyses of variance (ANOVAs) using both subjects ($F1$) and items ($F2$) as random factors. Mirror analyses carried out with arcsine-transformed proportions (Winer, Brown, & Michels, 1991) yielded the same patterns of significance except where noted. For readability, we report untransformed proportions and analyses thereof. Results reported as significant achieved a p value of .05 or less unless otherwise noted. We report variability with 95% confidence intervals (CIs) based on ANOVA output (Loftus & Masson, 1994; Masson & Loftus, 2003).

Results

The percentages of sentences including a “that” as a function of the main and embedded subject pronouns are shown in Figure 1. Most critical is that speakers did not include or omit the “that” in accordance with simple accessibility: Speakers said the “that” most in sentences like “You believe (that) I...,” in which the embedded subject does not repeat the main subject; they said the “that” at intermediate levels in sentences like “I believe (that) I...” and “You believe (that) you...”; and they said the “that” least in sentences like “I believe (that) you...,” in which (again) the embedded subject does not repeat the main subject, against the simple accessibility prediction.

Breaking down the results in terms of the basic experimental design, speakers produced “that” less when the main subject was “I” (48.7%) than when it was “you” (58.3%), $F(1, 43) = 14.1$, $CI = \pm 5.1\%$, $F(2, 47) = 8.24$, $CI = \pm 5.4\%$. Numerically, they said the “that” less when the embedded subject was “you” (51.2%) than when it was “I” (55.7%), an effect that was significant only by items, $F(1, 43) = 2.43$, $CI = \pm 5.9\%$, $F(2, 47) = 4.4$, $CI = \pm 5.4\%$ (the items analysis was marginally significant when arcsine-transformed values were entered into ANOVA, $F(2, 47) = 3.76$, $p < .06$). These two factors influenced “that” mention independently, $F(1, 43) < 1$, $CI = \pm 7.1\%$, $F(2, 47) < 1$, $CI = \pm 7.2\%$: Speakers said “that” with “I” main subjects 8.3% less than with “you” main subjects when the embedded subject was “I” and 10.8% less when the embedded subject was “you.”

Discussion

The results of Experiment 1 fail to generalize the type of accessibility effects revealed in the previous literature (Ferreira & Dell, 2000) to a more naturalistic, interactive dialogue context. In sentences like “I believe (that) you...,” in which the embedded subject differs from the main subject and so should be relatively hard to retrieve, speakers nonetheless produced the “that” less than in sentences like “I believe (that) I...” and “You believe (that) you...,” in which the embedded subject repeats the main subject and so should have been more accessible. It is worth noting, however, that performance was not unaffected by the manipulation of the main and embedded subject pronouns. Speakers produced the “that” in sentences with “I” main subjects robustly less than in sentences with “you” main subjects. Independently and much less robustly (though this trend will continue to be evident), speakers produced the “that” less in sentences with “you” embedded subjects than in sentences with “I” embedded subjects (note that the effects of “I” vs. “you” in the main and embedded subjects are in opposite directions). For now, we forego speculating about these effects, instead evaluating an alternative explanation for why we failed to observe the same pattern of results here as was observed in Ferreira and Dell (2000).

One explanation for the discrepancy between the current and previous results is that there might be something special about sentences like “I believe (that) you...” that leads speakers to produce the “that” less in them. An interesting possibility is that perhaps the existence of a plausible, well-formed sequence like “I believe you,” where “you” is a direct object, encourages the production process to formulate “I believe you” (with “you” as an embedded subject). Speakers might do this because of the familiarity of the resulting surface string. Or,

they might do this because a surface sequence like “I believe you” can ultimately be produced either with “you” as an embedded subject or direct object, and speakers prefer it (relative to “I believe that you”) to keep options open as to how to continue the string (see Wasow, 1997). Either way, the effect might be to depress “that” mention in sentences like “I believe (that) you are happy,” overcoming any difficulty that might arise in retrieving “you” (because it does not repeat “I”). Experiment 2 assesses this possibility.

Experiment 2

To determine whether the plausibility of “I believe you” as a subject-verb-direct-object sequence caused speakers to say the “that” less, the scenarios in Experiment 2 prompted a response with the verb “think” instead of “believe” (so speakers were asked, “What do you *think* about me?” instead of “What do you *believe* about me?”). In the critical “I”/“you” condition, this should elicit utterances like “I think (that) you...” Because “I think you” is not a plausible subject-verb-direct-object sequence, speakers should not formulate it either because of its familiarity as a surface string or because it keeps options open. Thus, if speakers produced the “that” least in “I believe (that) you” sentences because of familiarity or keeping options open, here the effect of pronoun repetition (with the “that” produced most in sentences with embedded subjects that do not repeat the main subjects) should be observed.

Method

Subjects—Forty-eight new subjects from the same population as Experiment 1 participated. One subject pair was excluded because their recording was lost. Pairs were assigned as in Experiment 1.

Materials—The same critical sentences were used as in Experiment 1, except the verb “think” replaced the verb “believe” in all scenario questions. Six subject pairs were tested on three lists and five on the remaining list.

Procedure, scoring, design, and analyses—Procedure, scoring, design, and analysis were as in Experiment 1. Subjects produced sentences that were not sentence-complement structures on 143 of 1104 trials (13.0%), they produced a different main subject from what the scenario was designed to elicit on 216 trials (19.5%), and they produced a different embedded subject from the scenario was designed to elicit on 192 trials (17.4%). Together, these led 256 or 23.2% of trials to be excluded. This in turn led three subjects to be excluded from the subject analysis because of missing values.

Results

The percentages of sentences including a “that” as a function of the main and embedded subject pronouns are shown in Figure 2. The results replicate the pattern observed in Experiment 1: Speakers said the “that” most in sentences like “You think (that) I...,” in which the embedded subject does not repeat the main subject; they produced the “that” at intermediate levels in sentences when the embedded subject repeated the main subject (“I think (that) I...” and “You think (that) you...”); and they produced the “that” least in sentences like “I think (that) you...” In terms of the basic experimental design, speakers produced “that” less when the main subject was “I” (43.9%) than when it was “you” (53.0%), $F(1, 42) = 876$, $CI = \pm 6.2\%$, $F(2, 47) = 15.5$, $CI = \pm 5.8\%$. Speakers tended to produce the “that” less when the embedded subject was “you” (44.1%) than when it was “I” (52.8%), an effect that was significant only by subjects, $F(1, 42) = 5.59$, $CI = \pm 5.8\%$, $F(2, 47) = 2.64$, $CI = \pm 8.6\%$. These two factors interacted weakly, $F(1, 42) = 3.72$, $p < .07$, $CI = \pm 9.4\%$, $F(2, 47) = 3.02$, $p < .09$, $CI = \pm 11.4\%$ (in the analysis of arcsine transformed

proportions, the interaction was fully significant by subjects, $FI(1, 42) = 5.3$): Speakers said “that” with “I” main subjects just 2.8% less than with “you” main subjects when the embedded subject was “I” but 15.1% less when the embedded subject was “you.”

Discussion

Despite changing the verb from “believe” to “think,” thereby weakening any tendency speakers might have to say “I think you” because it is not a plausible subject-verb-direct-object sequence, speakers still produced the “that” least in sentences like “I think (that) you...” The results of Experiment 2 thus again fail to observe the pattern of results revealed in previous experiments looking at very similar sentences (Ferreira & Dell, 2000).

Statistically, the manipulations of main- and embedded-subject pronoun status influenced “that” production much as they did in Experiment 1: Speakers robustly produced the “that” less in sentences with “I” main subjects compared to sentences with “you” main subjects, and they weakly produced the “that” less in sentences with “you” embedded subjects compared to “I” embedded subjects. Stepping back, the data pattern in Experiment 2 appears different from that in Experiment 1 (see Figure 2), with speakers producing the “that” less in “I think (that) you...” sentences compared to the other three sentences. But it is important to keep in mind that this pattern did not appear in Experiment 1 and was statistically weak in Experiment 2. Also, in another experiment not reported here that used a design quite similar to Experiment 1, the same pattern of results was observed as in Experiment 1, with no evidence (descriptively or statistically) of an interaction. Thus, it seems reasonably likely that the slight tendency toward an interaction here is due to random variation. We thus conclude that across the three experiments, speakers’ mention of “that” is independently influenced (in opposite directions) by whether the main and embedded subjects are “I” or “you.”

At this point, it is clear that the pattern of “that” mention seen in previous experiments that manipulated the repetition (or coreference) of the main and embedded subject pronouns does not replicate. However, the conclusion that the different patterns hinge on the memory versus interactive task setting may not be warranted, as there are a number of differences other than task setting between the current materials and those used by Ferreira and Dell (2000): All of the sentences speakers produced here were about emotion, whereas those produced by speakers in Ferreira and Dell (2000) were about any topic whatsoever. Here, every sentence used the verb “believe” (in Experiment 1) or “think” (in Experiment 2), whereas in Ferreira and Dell (2000), every sentence used a different verb. Might the different patterns of results between the two investigations be due to these factors, rather than to the task setting per se? Experiment 3 assessed this possibility.

Experiment 3

Speakers in Experiment 3 produced sentences based on those from Experiment 1. Specifically, we took the transcription of the actual sentences that our experimental subjects produced (which were provided extemporaneously as responses to the scenario questions) and eliminated disfluencies and other disruptions to ideal delivery. We then generated a set of 24 lists based on these sentences and presented them to a new set of subjects in a memory-based procedure. (We repaired sentences that included the wrong pronouns, and if any sentence was unusable, we randomly selected another sentence from the set to replace it. In addition, to get 24 lists, we duplicated two random pairs of subjects from the 22 pairs originally tested.) If the pattern observed in Experiments 1 and 2 here differs from that in Ferreira and Dell (2000) because of differences in the material (that they are all about emotion, or that they all used the verb “believe” or “think”), then the pattern observed in Experiments 1 and 2 should be observed in Experiment 3 too: Speakers should say the “that”

more in sentences with “you” main subjects than with “I” main subjects, and more weakly, they should say the “that” more in sentences with “I” embedded subjects than with “you” embedded subjects. But, if the pattern observed in Experiments 1 and 2 here differs from that in Ferreira and Dell (2000) because of the task setting, then in the memory-based procedure used in Experiment 3, the Ferreira and Dell pattern should re-emerge: Speakers should say the “that” more in sentences where the embedded subject does not repeat the main subject compared to in sentences where the embedded subject does repeat the main subject.

Method

Subjects—Forty-eight subjects from the same population as Experiment 1 were tested.

Materials—We generated 24 lists of 48 sentences based on the responses produced by pairs of subjects in Experiment 1. Each sentence from the transcription of Experiment 1 was examined for whether it was a valid response (see Experiment 1 exclusion criteria). If the original speaker produced a main or embedded subject different from what we wanted to elicit, it was replaced with the appropriate subject. If the sentence was unusable (say, because the original subject produced no response at all), a different response for the same scenario was obtained from another randomly selected subject’s transcription and inserted at that point in the list. Because sentences were to be presented visually in the context of a memory task, all departures from ideal delivery (fillers, repetitions, pauses, etc.) were removed. Complete sentences were presented in Experiment 1, requiring the “that” to be included or omitted. We randomly divided sentences in each condition in half (based on the eliciting scenario), including the “that” in the sentence for one half and omitting it for the other. This was counterbalanced across lists. Note that only 22 pairs of subjects were tested in Experiment 1; two pairs of subjects were randomly selected to have their responses duplicated, so that 24 lists could be used. Two subjects were tested on each list.

Apparatus, procedure, scoring, design, and analysis—Experiment 3 was administered using PsyScope 1.2.5 (Cohen, MacWhinney, Flatt, & Provost, 1993) on Apple Macintosh computers (running Mac OS 8.0) with 17-inch CRT monitors set to a resolution of 832×624 . Voice responses were collected by Shure SM10A unidirectional headset microphones connected to Marantz Portable Cassette Recorders (PMD 201). Microphones were also connected to CMU Psyscope button boxes to collect voice onset times.

On each trial, subjects were first shown a screen that displayed “< Ready >” along with the current trial number. When subjects pressed the space bar, they were shown a sentence that they were to read aloud and remember. Upon pressing the space bar again, subjects were shown a two-digit number between 52 and 98 that was not divisible by three. At the same time, they heard brief tones that sounded once every 667 ms. Subjects were asked to count backwards by three from the presented number at the pace set by the brief tones. The duration of the countdown period varied inversely with the length (in characters) of the sentence between 4 s and 10 s in one-second increments (1 of 1152 sentences was at least 70 characters long and so had a four-second countdown period; 838 were shorter than 30 characters and so had a 10-second countdown period). Then, subjects were shown the main subject and verb of the sentence (“I/you believe”) and were to recall the entire original sentence.

Productions were excluded as in Experiment 1, except that additionally, a trial was excluded if subjects did not read it correctly when originally presented (56 of 2304 sentences or 2.4% of trials). Subjects did not produce an analyzable sentence-complement structure in 109 sentences (4.7%), they produced an incorrect main subject in 197 sentences (8.6%) and an

incorrect embedded subject in 305 sentences (13.2%). In total, 477 productions were eliminated (20.7%). This led two subjects to be excluded from the subjects analysis because of missing values.

Analyses were as in Experiment 1, except the additional within-subject and within-item factor *complementizer* (*that* or *zero*) was included based on whether the originally presented sentence included a “that” or not.

Results

The percentages of sentences including a “that” as a function of the main and embedded subject pronouns (collapsing across whether sentences originally included or omitted a “that”) are shown in Figure 3. Here the pattern differs from previous experiments. Speakers said the “that” less in sentences in which the embedded subject repeated the main subject (“I”/“I”: 56.5%; “You”/“you”: 52.5%), compared to in sentences in which the embedded subject did not repeat the main subject (“I”/“you”: 60.3%; “You”/“I”: 61.3%). This confirms that the difference in task setting rather than any differences in materials is the primary determinant of the pattern of mention of “that” speakers say in sentence-complement structures as a function of whether the main and embedded subjects are “I” or “you.”

Statistical analyses confirm these observations. The main effect of the main subject was nonsignificant, $F(1, 45) < 1$, $CI = \pm 4.1\%$, $F(1, 47) < 1$, $CI = \pm 3.4\%$. The main effect of the embedded subject was also nonsignificant, $F(1, 45) = 1.92$, $CI = \pm 3.6\%$, $F(1, 47) = 2.68$, $p < .11$, $CI = \pm 3.4\%$. The interaction between the main and embedded subject factors was significant, $F(1, 45) = 7.14$, $CI = \pm 6.7\%$, $F(1, 47) = 7.53$, $CI = \pm 7.0\%$. The main effect of whether the sentence originally included a “that” was highly significant, $F(1, 45) = 279$, $CI = \pm 6.1$, $F(1, 47) = 502$, $CI = \pm 4.5\%$. This shows that subjects had good memory for whether the original sentence included the “that,” as they produced the “that” in 82.3% of sentences that originally included one and in only 32.4% of sentences that did not. Whether the original sentence included or omitted the “that” did not interact with any other factor, all p s $> .09$, showing that speakers’ memory for the “that” in the original sentence did not differ as a function of the main- and embedded-subject pronouns, suggesting that memory for “that” is independent of the interaction observed with main- and embedded-subject pronouns.

Discussion

When speakers were tested in a memory-based procedure, a memory-relevant factor -- accessibility as conditioned by lexical and referential repetition -- measurably influenced speakers’ “that”-mention in sentence-complement structures. Specifically, speakers said the “that” less in sentences where the embedded subject repeated the main subject, relative to sentences where the embedded subject differed from the main subject, replicating the pattern originally observed by Ferreira and Dell (2000).

The contrast between Experiment 1 and Experiment 3 is revealing and important. Speakers produced very similar utterances in the two cases. But in Experiment 1, when speakers were engaged in a relatively naturalistic, interactive dialogue-based task, factors other than lexical or referential repetition determined speakers’ “that”-mention (more on this next), whereas in Experiment 3, when speakers were engaged in a memory task, memory factors primarily determined speakers’ “that”-mention. (It may seem unsurprising that memory factors influence performance in a memory task more than in a non-memory task, but it is important to emphasize that the dependent variable here was how often speakers produced an optional complementizer in their produced sentences -- hardly an obvious feature to be influenced by the contextual setting.) The contrast between Experiment 1 and Experiment 3 places

important limits on the extent to which solely linguistic factors can explain speakers' language-production behavior -- extra-linguistic factors (like the task setting) can swing around the behavioral profile considerably.

At this point, given the robust main effect of the main subject and the marginal main effect of the embedded subject in Experiments 1 and 2, it seems warranted to speculate as to the basis of these effects. Unlike previous investigations (e.g., Ferreira & Dell, 2000, and Experiment 3 here), the current task involves extemporaneous production (in response to the questions in the scenarios) in a socially structured situation. Consequently, factors particular to the social situation may more determine the ease of sentence production than a memory-based factor such as accessibility.

Consider the production demands of the current situation. To produce "I" versus "you" as the main subject, what must speakers do? When producing sentences with "I" as the main subject, the speaker was told that she or he (the speaker) observed some behavior (e.g., dollar bills being thrown into the air), and she or he (the speaker) must infer some emotion from it. In contrast, when producing sentences with "you" as the main subject, the speaker had been told that the speaker's partner observed some behavior, and the speaker must determine what emotion the partner might infer from it. In short, to produce sentences with "I" main subjects, speakers must adopt their own perspective on the described situation, but to produce sentences with "you" main subjects, speakers must adopt their partner's perspective. It is likely that adopting one's own perspective on a situation is easier than adopting a different person's perspective. If so, then it may be easier to formulate the content of sentences with "I" main subjects than sentences with "you" main subjects.

There is a wrinkle in such an explanation, however. Why would the difficulty involved in determining material *before* the "that" -- the "I" versus "you" main subject -- affect "that" mention? Note that the difficulty here may not be in determining that "you" should be the main subject. The difficulty presumably is that *given* that "you" is the main subject -- that the speaker must adopt his or her addressee's perspective -- what should the rest of the sentence say? This specifically pertains to the embedded-clause content, which is indeed formulated after the "that."

Next, recall that speakers tended to produce sentences with "you" embedded subjects with the "that" less than sentences with "I" embedded subjects (though less robustly than the effect of the main subject). What must speakers do to produce sentences that have "I" versus "you" embedded subjects? To produce sentences with "I" embedded subjects ("I/you believe (that) I am euphoric"), the speaker must attribute the inferred emotion to the speaker him or herself. To produce sentences with "you" embedded subjects ("I/you believe (that) you are euphoric"), the speaker must attribute the inferred emotion to his or her partner. A well known effect in the social psychology literature is the *fundamental attribution error* (Jones & Harris, 1967): People tend to make dispositional attributions to others ("She helped the crying child because she's a nice person") but situational attributions to oneself ("I helped the crying child because the child needed help -- anyone would have!"). And so, when attributing an emotion to oneself, speakers might have difficulty formulating sentence content, because they typically conceive of their own behavior in terms of situations rather than dispositions. If so, people might find it more difficult to attribute a dispositional cause -- here, an emotion -- to themselves than to others. This may make it more difficult to formulate the content of sentences with "I" embedded subjects than with "you" embedded subjects, leading speakers to say the "that" more.

If the perspective-taking and emotion-attribution factors described here indeed influence "that" mention, then we should find that the same pattern of effects occurs for third-party

mentions as well: If speakers need to say a sentence with “she” as a main subject, they still need to take another person’s perspective, which by this account should be more difficult, and if they need to say a sentence with “she” as an embedded subject, this involves attributing an emotion to someone else, which should be relatively easier (but again, note that the effect of embedded subject has been weak in all experiments). Experiment 4 tested this possibility.

Experiment 4

Experiment 4 was like Experiment 1 with just one change: In addition to scenarios describing the subjects as observers and actors, the scenarios described the experimenter as observing or acting or both, as in (12):

(12) I see Michelle is throwing dollar bills into the air. What do I believe about her?

These scenarios elicited forms like “You believe she is euphoric.” All nine combinations of “I,” “you,” and “Michelle/she” were elicited (and additional stimuli were added so that enough sentences were elicited per condition). If the effect of main subject arose because it is easier to produce a sentence that takes one’s own perspective than someone else’s perspective, then “she” should pattern with “you”: Speakers should say the “that” relatively less in sentences with “I” main subjects than in sentences with “you” and “she” main subjects. At the same time, if the effect of embedded subject arises because it is easier to produce a sentence that attributes an emotion to another person than to oneself, “she” again should pattern with “you”: Speakers should say the “that” relatively less in sentences with “she” and “you” embedded subjects than in sentences with “I” embedded subjects.

Method

Subjects—Fifty-four new subjects from the same population as Experiment 1 participated.

Materials—Six new scenarios were added to the 48 scenarios from Experiment 1. All scenarios were supplemented so that they referred to the experimenter (“Michelle”) as the observer, actor, or both. These elicited responses with “she” (or sometimes “Michelle”). The 54 scenarios were randomly assigned to nine item groups. A 9×9 Latin square was used to assign items to nine lists such that within a list nine scenarios described each combination of observer and actor. The same counterbalancing strategy was used as in Experiment 1. Six subject pairs were tested on each list.

Procedure, scoring, design, and analysis—The procedure was as in Experiment 1, except the instructions were modified so that the possibility of referring to the experimenter was mentioned. The experimenter introduced herself as “Michelle” and noted that she was described in the scenarios, but she left the room once the practice phase ended. Scoring was as in Experiment 1, except that “she” or “Michelle” was allowed for utterances eliciting third-person forms. Speakers did not produce a valid sentence-complement structure in 40 of 1458 utterances (2.7%), they did not produce the targeted main subject in 76 utterances (5.2%), and they did not produce the targeted embedded subject in 96 utterances (6.6%). Altogether, these criteria led 137 trials (9.4%) to be excluded. This led four subjects to be excluded from the subject analysis due to missing values.

In Experiment 4, the main and embedded subject factors both could be *I*, *you*, or *she*. Analysis was as in Experiment 1, except planned contrasts were carried out to assess whether the “I” condition differed from the “you” and “she” conditions (the remaining orthogonal contrast comparing “you” to “she” is also reported).

Results

Note that the predictions in Experiment 4 are about main effects, and so Figure 4 shows the percentages of sentences in which a “that” was produced for each main subject collapsed across embedded subject (top panel) and each embedded subject collapsed across main subject (bottom panel). All cell means are reported in Table 1. First, the main effect of main subject was significant, $F(2, 98) = 5.95$, $CI = \pm 5.2\%$, $F(2, 106) = 3.37$, $CI = \pm 5.5\%$ (in the analysis of arcsine transformed proportions, this main effect by items was marginally significant, $F(2, 106) = 3.05$, $p < .06$). Speakers produced the “that” less when the main subject was “I” (63.4%) than when it was “you” (72.4%) or “she” (69.1%), $F(1, 98) = 10.3$, $F(1, 106) = 6.72$. Sentences with “you” and “she” main subjects were not produced with “that” differently, $F(1, 98) = 1.60$, $F(1, 106) < 1$. This is consistent with the prediction that the variation in “that” mention as a function of main subject is due to difficulty in determining sentence context as a function of perspective taking, assuming that it is easier to take one’s own perspective than another’s perspective, and it is about equally easy to take a second-person’s perspective as a third-person’s perspective (especially if both were initially unfamiliar).

The main effect of embedded subject was also significant, $F(2, 98) = 7.21$, $CI = \pm 5.8\%$, $F(2, 106) = 6.87$, $CI = \pm 5.7\%$, though the specific pattern of “that” mention was messier. In a nutshell, speakers barely produced the “that” more in sentences with “I” embedded subjects (72.2%) than in sentences with “you” embedded subjects (70.8%) produced, though they did produce the “that” more in sentences with “I” embedded subjects (72.2%) than in sentences with “she” embedded subjects (62.0%). This led the planned comparison assessing “I” versus “you” and “she” sentences to be significant only by subjects, $F(1, 98) = 5.34$, $F(1, 106) = 2.36$, $p < .13$, whereas the orthogonal comparison of “you” and “she” sentences was fully significant, $F(1, 98) = 9.07$, $F(1, 106) = 11.4$. So, the variation in “that” mention as a function of the embedded subject is largely between sentences with “I” versus sentences with “she” embedded subjects. This is consistent with the hypothesis that that variation is due to difficulty in determining sentence content as based on something like the actor-observer discrepancy: Speakers said the “that” least in sentences where they attributed emotions to another person rather than to themselves, though the difference between “you” and “I” embedded subjects should have been larger.

The interaction between the main and embedded subject factors was not significant, $F(4, 196) < 1$, $CI = \pm 9.7\%$, $F(4, 212) < 1$, $CI = \pm 10.6\%$.

Discussion

The results of Experiment 4 generally confirm the predictions derived from the hypothesis that “that” mention is influenced by the difficulty of determining sentence content as a function of social-cognitive factors. In particular, if speakers say the “that” less when sentences have “I” as the main subject compared to “you” because it is more difficult to take another person’s perspective, then they should do so also when “she” is the main subject, and this is what is observed. Of course, other factors other than perspective taking may be common to the “you” and “she” conditions that are also different from the “I” condition, but given the a priori prediction of the nature of production with “she,” our confidence is increased that a factor like perspective taking influences performance in this task.

The pattern of results with the embedded subject did not come out quite as cleanly. The (post hoc) account of the effect of embedded subject in Experiments 1 and 2 was that speakers tended to say the “that” more in sentences with “I” embedded subjects than those with “you” embedded subjects because it was harder to formulate sentence contents that described speakers attributing emotions to themselves rather than to another, in accordance

with the actor-observer discrepancy. This predicts that when describing sentences with “she” embedded subjects, speakers should also say the “that” less, which in fact is what was observed in Experiment 4. However, sentences with “you” were not produced with “that” less (at least appreciably -- the difference was 1.4%). It is worth noting that in Experiments 1 and 2, the difference between sentences with “I” and “you” embedded subjects was not particularly robust. Furthermore, if one were to speculate as to whether “you” versus “she” sentences differ more from “I” sentences, it would likely be “she” sentences, as it may be relatively more difficult to attribute emotions to someone who you are speaking directly to rather than to a third party who is not in the room. Nonetheless, the most reasonable bottom-line assessment here seems to be that the results of the experiments provide qualified support for the claim that difficulty of emotion attribution (and the effects thereof on sentence formulation) influenced “that” mention in the experiment.

Overall, the results of Experiment 4 suggest that in a social setting like that established here, social forces are an important influence on the cognitive mechanisms that formulate sentence content. When answering a question, whose perspective one must take and (more tentatively) who one must make attributions of determines how easily speakers can formulate sentence content thereby influencing subtle features of their sentences, like whether they include a “that.” In some ways, this constitutes a valuable interface between the fields of social cognition and sentence production.

General Discussion

Two general observations can be taken from the four experiments presented here:

1. When speakers produce sentences in interactive dialogue, a pattern of “that” mention observed several times in previous memory-based sentence-production procedures (Ferreira & Dell, 2000) is not observed. Specifically, speakers said the “that” least in sentences like “I believe (that) you...” (Experiment 1) as well as in sentences like “I think (that) you...” (Experiment 2), even though the embedded subject does not repeat the main subject in such sentences and so should be less accessible (and so speakers should want to mention the “that” so the embedded subject is mentioned later). The effect with “think” suggests that speakers weren’t omitting the “that” because “I believe you...” is a familiar or frequent pattern. These observations fail to generalize the pattern of results observed in memory-based sentence-production procedures to the more naturalistic, interactive dialogue assessed here.
2. Speakers mentioned the “that” less when the main subject was “I” compared to when it was “you,” and less robustly, they mentioned the “that” less when the embedded subject was “you” than when the embedded subject was “I.” The results of Experiment 4 confirmed predictions derived from explanations that these effects are due to the influence of perspective-taking and (more tentatively) emotion-attribution upon difficulty of sentence formulation: Speakers mentioned the “that” less when they said sentences that described their own perspective rather than another’s perspective, and they mentioned the “that” less when they said sentences that attributed an emotion to a third party rather than to themselves (with a weaker effect of attributing an emotion to a conversational partner). This suggests that in social settings such as the current highly interactive dialogue, social-cognitive factors that determine the difficulty of formulating sentence content are more influential than memory factors. This observation was further confirmed by the complementary observation in Experiment 3: When the same sentences that revealed likely social-cognitive influences in Experiment 1 were produced in a memory-based procedure, speakers mentioned “that” as influenced by accessibility

(as determined by whether the embedded subject repeated the main subject) rather than as influenced by perspective taking or emotion attribution.

The effect of social-cognitive forces on “that” mention reveals that in general, factors beyond strictly linguistic ones can influence the details of grammatical encoding. Likely, this is because specific tasks have conceptualization requirements (here, the need to take a perspective on a situation and attribute an emotion), which can exert systematic influences on grammatical encoding processes. Furthermore, situated dialogue, with its cues to the material to be mentioned, may support the sorts of retrieval processes that are more burdensome in isolated production settings. As theoretical efforts continue to move the analysis of language behavior into more ecological settings (Pickering & Garrod, 2004), this promises to be an important and relevant insight. Furthermore, this suggests that theories of grammatical encoding will need to take into account the production demands of particular task contexts. Indeed, if the account here that perspective-taking and attribution difficulty affect “that”-mention is correct, then even in an interactive task like the current one, if the topic under discussion is not emotion, a different pattern of results should be observed.

An alternative explanation for the effects observed in the dialogue experiments -- especially the main effect of the main subject -- comes from the literature exploring possible semantic or pragmatic differences between sentence that include versus omit the “that.” In particular, one proposal is that sentences without the “that” convey a stronger degree of epistemic commitment to the content of the embedded clause than sentences with the “that” (Thompson & Mulac, 1991). The idea is that when a speaker utters a sentence like “I believe you are angry,” she or he is more certain that “you are angry” than when a speaker utters a sentence like “I believe that you are angry.” Note that this fits well with the effect of the main subject in the dialogue experiments: In general, speakers said the “that” less when the main subject was “you” (as in “You believe you are angry”) compared to when it was “I” (as in “I believe you are angry”), and speakers may naturally feel less certain of someone else’s attribution of an emotion (“You believe...”) than their own attribution of an emotion (“I believe...”).

This possibility was tested with a followup experiment that replicated Experiment 1, but with one set of additions. In particular, after each response, the speakers and addressees were asked to rate utterances on a 1 to 7 scale (with 7 being “more”) along two dimensions. First, the speaker was asked to rate “how certain or confident you are the emotion you described underlies that behavior.” Second, both the speaker and the addressee were also asked to rate “how unusual or unexpected you think the emotion described for that particular behavior is,” on the assumption that if the speaker or addressee rated an emotion as more unusual, it may have been more difficult to conceive.

The pattern of “that” mention in the experiment, shown in the top-left panel in Figure 5, replicated Experiment 1. We also measured whether the different pronoun conditions led to different ratings of certainty or unusualness. The mean certainty ratings across conditions are shown in the top right panel of Figure 5. The results show no systematic differences among any of the experimental conditions in terms of how certain speakers were of the emotion they attributed. This fails to support the claim that speakers will be less certain of their attributions when they are describing their partner’s potential attribution than when describing their own. In terms of unusualness ratings, speakers’ own ratings showed a marginally significant difference such that they rated the emotional attributions as slightly more unusual when the main subject was “you” than when the main subject was “I” ($p < .07$), and addressees’ ratings of the speakers’ attributions showed a significant difference in the same direction. This fits with the possibility that the differences observed for “I” versus “you” main subjects were due to greater difficulty in conceiving sentence content with “you.”

We also used a logistic regression to determine whether “that” mention is correlated with the different ratings (including both subject and item as random factors), but no systematic relationship was revealed. Thus, though the experimental conditions may differ in terms of subjects’ assessments of how unusual or unexpected the emotional attributions within them were, there is no evidence to suggest that any of these rated dimensions of variation directly affect “that” mention.

Though “that”-mention in a task such as the interactive dialogue used here appears to be influenced by social-cognitive factors, other influences over “that”-mention likely operate as well. (For a range of factors, see Jaeger, 2010.) One powerful factor is individual differences, in that some speakers often or always say the “that” whereas others rarely or never do. For example, in Experiment 1 here, six (of 44) speakers said the “that” in all analyzable utterances and another five said it 90% of the time; one speaker never said the “that” and another six said it less than 10% of the time.

It is worth noting that all experiments involved the production of potential *garden path* sentences -- sentences in which comprehenders tend to adopt an initial syntactic analysis that differs from its eventual syntactic analysis. In general, garden path sentences are difficult to comprehend. Here, sentences like “I believe you...” are garden-path sentences, because the “you” can be interpreted as a direct object even though it is not. The other sentence types are not potential garden-path sentences, because “I” cannot be a direct object, nor can “you” when “you” is the main subject. Interestingly, the “that” eliminates the garden path: “I believe that you...” does not allow a direct-object analysis of “you.” This raises the possibility that speakers might avoid producing disruptive garden-path sentences by including the optional “that” in them. If so, they should mention the “that” more in sentences like “I believe (that) you...,” where the “that” can eliminate a garden path, than in the other sentences.

Figures 1–5 show that in no experiment did speakers mention the “that” more in “I believe you...” sentence type than in the other three sentence types (the absence of this effect in a memory task, in Experiment 3, replicates observations in Ferreira & Dell, 2000). This suggests that speakers do not use the optional “that” to avoid producing garden path structures, even in more naturalistic, interactive dialogue. Why this is so is not fully determined by the current data: Speakers may not avoid the garden path because they do not avoid garden paths or ambiguities in general (see Ferreira, Slevc, & Rogers, 2005), because in spoken production and comprehension, the prosody of spoken utterances effectively avoids the garden path by itself (but note that writers do not seem to use the “that” to avoid garden paths either; see Ferreira, 2006). Or, it may be that in a question-and-answer task like that used here, the question determines the form of the answer sufficiently that avoiding ambiguity is not necessary. Nonetheless, extension of the lack of garden-path avoidance to a more naturalistic task setting is noteworthy.

Producing language involves making choices. The experiments presented here suggest that the contexts within which speakers produce language can have systematic and interesting effects on speakers’ linguistic choices, even quite subtle ones like whether to mention an optional “that” in their sentences. This is likely because different contexts place different demands on speakers and their grammatical encoding systems. Speakers’ linguistic choices help to manage these demands, presumably smoothing the communicative enterprise as a whole.

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Figure 1.

Percentages of sentences produced with "that" as a function of main and embedded subject ("I" or "you") in Experiment 1. Error bars report 95% confidence interval derived from subject ANOVA.

Figure 2.

Percentages of sentences produced with "that" as a function of main and embedded subject ("I" or "you") in Experiment 2. Error bars report 95% confidence interval derived from subject ANOVA.

Figure 3.

Percentages of sentences produced with "that" as a function of main and embedded subject ("I" or "you") in Experiment 3 (collapsed across whether the original sentence included or omitted the "that"). Error bars report 95% confidence interval derived from subject ANOVA.

Figure 4.

Percentages of sentences produced with “that” as a function of main subject collapsed across embedded subject (top panel) and embedded subject collapsed across main subject (bottom panel) in Experiment 4. Error bars report 95% confidence interval derived from subject ANOVA.

Figure 5. Percentages of sentences produced with "that" (top left panel) and average certainty and unusualness (other three panels) as a function of main and embedded subject ("I" or "you") in followup experiment. Error bars report 95% confidence interval derived from subject ANOVA.

Table 1

Percentage of sentences produced with “that” as a function of main and embedded subjects in Experiment 4.

Main subject	Embedded subject			Mean
	I	you	she	
I	68.7	66.7	55.0	63.4
You	76.7	73.3	67.3	72.4
She	71.3	72.3	63.7	69.1
Mean	72.2	70.8	62.0	68.3