# I FORGET WHAT I WAS GOING TO SAY

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A good theory has the characteristic that it raises questions that can be decided by observation and experiment, and thus we are led to new knowledge. In this paper I report on some new observations related to how people communicate and how we sometimes forget what we were going to say.

Some years ago I suggested how the limited capacity of the temporary memory we use when we speak might be related to certain typological features of language structure and to an evolutionary force toward complexity in language change (Yngve 1960). The connection was supposed to work this way: When we speak, we have to keep track of grammatical commitments. For example, if we start a sentence with a dependent clause, we are committed to follow it with a main clause. If this initial dependent clause starts with a subject NP, we are thereby also committed to a VP. If the subject NP starts with a determiner, we have a third commitment, to a noun.

Now if the speaker were innately endowed with a temporary memory of only limited capacity, there would be a limit on the number of simultaneous commitments he could remember, and thus there would be a structual constraint of an exactly specifiable sort on the syntactic complexity of sentences he could produce. This constraint was called a depth limit, sometimes referred to as a limit on left branching. If a person were to try to produce a sentence that would exceed the depth limit, he would not be able to hold in his memory all of the needed commitments. He might become trapped and have to start over, or he might forget what he was going to say. This would be a phenomenon in the realm of speech as opposed to language.

The connection to language change can now be clearly seen. If certain combinations of constructions could not be uttered by a speaker, and in particular if they led to embarrassing faults in smooth speech, speakers would tend to avoid them, and, if avoided, they would pass out of the language. Since language is supposed to guide speech, a language that conformed fairly well to the depth limitation would be a fairly good guide to speakers in keeping their utterances within the bounds imposed by a limited temporary memory.

Thus we have the connection with certain typological features of language. An innate memory limitation leads to a psychological phenomenon in the realm of speech. This is connected through language change to the typological architecture of various languages; under the pressure of a need to preserve expressive power, alternative constructions would be developed and favored by language evolution. Much of the observed complexity of language can be accounted for in this

way. The detailed typological predictions of the depth hypothesis compare remarkably well with observed language structures, and indeed this fact is perhaps the strongest reason for believing that the depth hypothesis may contain more than a grain of truth.[1]

The theoretical implications of this grain of truth, however, are still not completely clear. But it is clear that the transformational theories of Chomsky remain unable to capture the essential insights of the depth hypothesis. Arguments in support of transformational theory that begin by denying the depth-related observational facts when they conflict with the predictions of transformational theory seem to me to be an unscientific way of proceeding, and unlikely to lead us to a fuller understanding of what is going on. It is also clear from the work on the depth hypothesis that a finite state device or finite automaton is in fact adequate for linguistics (1960: 449). Chomsky's "proof" to the contrary is of course invalid because it hinges on a characterization of English that cannot be squared with the observational evidence. Arguments on the "power" required of linguistic theory ought to be turned around: We are endowed innately with a finite device. A phrase structure organization, by allowing a factorization of the state, provides great savings in the permanent memory through efficient use of the temporary memory (1960: 449-50). But a phrase-structure organization has the problem that it might lead to utterances that exceeded the depth limit. According to the depth hypothesis, the language reacts by developing grammatical complexities that effectively keep the language within finite bounds. To argue, as Chomsky has, that these same complexities indicate a need for a more powerful theory, seems to me to be wide of the mark, and in fact just backwards, for their function is to keep the language within the limits of a less powerful theory.

Instead of entering into scholastic arguments as to what a linguistic theory "must" contain, it seems more worthwhile to try to draw predictions from theory that can be confronted with observational evidence. Part of the point of the human linguistics that I am trying to develop is to move away from the ancient and constraining philosophical concepts of language, grammar, and meaning, and to try to get at how people actually communicate. For example, would it be possible to observe people getting trapped in overly deep constructions or forgetting what they were going to say? If we could observe such events and study them in detail, we might learn more about what really goes on in communication.[2]

People do, on occasion, forget what they were going to say. Such lapses are fortunately rare, but it is unfortunate for the linguist who wishes to study them. He would like to be there with his videotape machine and notebook at the appropriate moment. He would actually prefer to have set up the situation so as to

control as many of the relevant variables as possible. In other words, it would be very convenient if we could induce forgetting to order in an experimental situation.

There is good evidence from observed language structures that grammars operate to effectively limit the speaker to sentences involving at most about seven simultaneous grammatical commitments. On the other hand, observed sentences in speech rarely show a maximum depth of more than three or four, and the average depth of speech is probably less than two. This fact has been puzzling, for there would be great gains in efficiency and expressive power for a language that consistently utilized the full capacity of the temporary memory. Perhaps the answer is simply that the various grammatical devices required to enforce an effective upper limit of seven actually operate in such a way as to result in a much lower average value. But there may be another reason. Perhaps the temporary memory used for holding grammatical commitments must be shared and used also for other, possibly nonlinguistic tasks. Then if we were talking while doing something else, we would not have available for speech the full capacity of the temporary memory.

There is in fact some suggestive evidence that the mental equipment used for speech might be shared with other tasks. Suppose your talkative friend is showing you a particular painting at an art exhibit. While you are trying to study the painting, she keeps up a continuous stream of talk. You are inclined to say, "Be quiet for a moment while I look at it." In other words, paying attention to the talk seems to interfere with examining the painting. Other commonplace examples include talking while driving a car. In circumstances where the driving task is a demanding one, the tendency is to stop talking until the driving task eases up. In these examples and others of a similar nature, it is both speaking and listening that are impaired. It's as if some mental equipment could be committed to one task or the other, and when it is committed to both at once, it has a hard time doing a proper job of either. It is difficult to say whether this equipment is of the nature of a memory or of a processor, assuming it makes sense to distinguish the two. A question is thus raised that might be approached observationally. Would an intruding task cause one to forget what one was going to say? If so, we could reason that memory was involved, perhaps the same temporary memory postulated to account for depth-related syntactic phenomena.

I was thus led to try an experiment of the following type. Set up a situation in which a speaker is engrossed in a conversation. Then confront him suddenly with an unrelated task that he must turn to immediately. If this task makes use of a common temporary memory, perhaps any items left there from the conversational task would be wiped out, and when he turned

back to the conversation he would have forgotten what it was he was going to say. Would he in fact forget as our theory would predict?

To find out, we set up for the unrelated task two small lights, a white one and a yellow one. They were in front of a speaker and about thirty degrees to one side. The lights were normally off, but either one could be turned on remotely by the experimenter. The speaker was instructed that whenever a light came on he should immediately interrupt his conversation and report whether the light was white or yellow. A videotape camera was set up so that both the speaker and the lights were clearly recorded.

In the first trial of this procedure,[3] I was the subject while carrying on a discussion with a colleague. The discussion was a genuine one that would have taken place even if there had been no experiment.[4] The videotaping session lasted one hour, and during this time seventeen interruptions were recorded. The second trial of the procedure was during a seminar course,[5] with various students taking turns at alternately being the subject, the party to the conversation, and the experimenter. A number of interruptions were recorded with each of the several subjects.

The results of these experiments show conclusively that people do actually forget what they were going to say under such circumstances of interruption. In the first experiment, about a quarter of the interruptions resulted in obvious forgetting as indicated on the videotape by very long hesitations, groping, and failure to continue the previously established line of discourse. The evidence from the other subjects in the second experiment is consistent with the first. We have induced forgetting in a number of subjects. Additional confirmatory evidence comes from the subject's subjective reports that they experienced the familiar and recognizable feeling of being unable to remember what they were going to say.

The significance of this result is clear. The demonstration of induced forgetting shows that it is a short-term memory process that is disturbed by the competing task, not some processing that does not involve memory. But we do not know whether the information is actually gone or just rendered temporarily unavailable. At the moment we have no solid information on this point.

It is also significant that the subjects experience a subjective feeling of having forgotten. The speaker's awareness of forgetting may be an important link in the mechanism of language change, for the depth hypothesis postulates that speakers try to avoid the kinds of constructions that get them into trouble. Note that speakers are often unaware of their frequent false starts and the associated backtracking and revision.

What we have not been able to tell in these pilot experiments is whether there is any difference in the tendency to forget depending on the number of grammatical commitments presumed to be in the temporary memory at the moment of interruption. We simply don't have enough data for that determination yet.

Well, I have started with a theory; deduced that if the theory is correct, some effect should be observable; designed and carried out an experiment to seek the effect; and found it. The result increases our confidence that there may be some truth in the theory. Such is the relation of theory to observation. I could stop now. But wait. It is also the characteristic of observation and experiment that they sometimes turn up new phenomena, unsuspected and not predicted by existing theories, and thus we are led again to new knowledge and a challenge to future theory. This is the case here. To show you the additional surprising phenomena, let me start by describing briefly a typical instance of interruption leading to forgetting. Then I will go back and discuss what happens in greater detail.

Let us assume that the speaker is deeply involved in a conversation and is in the middle of a sentence when one of the lights comes on. After a short delay he appears to notice the light and he stops speaking. He often stops in the middle of a word, even in the middle of a phoneme, by what appears to be a sudden glottal closure. He then reports the color of the light. In returning to the conversation he goes sometimes back to the beginning of a phrase or clause and repeats perhaps several words up to the point where he had broken off. He then continues beyond the point where he had broken off and completes the phrase or clause. Then he forgets what it was he was going to say. He hesitates and gropes, apparently trying to reconstruct the line of discourse. Sometimes he can hazard another phrase, sometimes not. It is the phenomenon of repetition, starting back at what appears to be a syntactic boundary, and the ability to remember how to complete that syntactic unit while forgetting how to go on from there, that was a new and unsuspected phenomenon, and one with considerable linguistic interest, as we shall see.

Let me present two examples from the first experiment.[6]

(1) I guess...maybe I don't know * that...the next noun phrase has got to be the o-/ ...white...
has got to be the one...that...that...
is the subject of it...or whatever... (274)

(2) You might have to...cancel * off an ex-/ ...yellow...
cancel off an expectation...
and go back...and...or something... (472)

Now let us look in greater detail at what happens. First let us look at what might be called the reaction time for the interruption, that is the time between when the light comes on

and when the subject breaks off his conversation. This time is quite variable. In the first experiment, the subject most often speaks from 1½ to 2½ words in this time, but there are two cases where he speaks 10½ words before stopping, and one of these leads to a clear case of forgetting. I do not yet know what factors are involved in this variability, presumably factors of concentration and attention. The initial instructions and the approach the subject takes to the experiment are thought to be very important. If the subject takes the interruptions as a challenge and divides his attention between the two tasks, he is often able to cope with both without forgetting. He then typically breaks off his conversation between words and smoothly inserts his report of the color, in full stride as it were, then smoothly swings back to the conversation and picks it up at the next word without repetition.

The break itself, as we mentioned before, sometimes comes between words, sometimes in the middle of a word with a glottal closure. The first experiment is typical. We find eleven cases where the break comes after completion of a word or phrase, and six cases where it comes in the middle of a word. In all six cases the break is not correlated with a syllable boundary, but may come even in the middle of a phoneme. If a gesture is in progress, it too is interrupted, with the gesturing hand stopped in mid air.

An interesting comparison can be made with other breaks on the same tape that are associated not with experimental interruptions but with the naturally occurring self-interruptions that precede rephrasings or self-corrections.[7] For these, there are twenty-eight cases of breaks at a word boundary and twenty cases coming in the middle of a word. The ratios are not significantly different. Typical self-corrections with the break coming at a word boundary and in the middle of a word are (3) and (4).

(3) the parenthetical remark,/
the sentence with the parenthetical remark, . . . (136)
(4) But there's n-/
Of all these factors none of them are . . . (437)

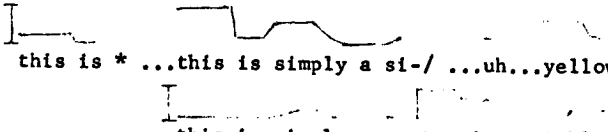
We can tentatively conclude, on the basis of the few cases studied, that the phenomena occurring at the break in the case of experimental interruptions is the same as the phenomena occurring at the break in the case of naturally occurring interruptions. It is thus reasonable to assume that the mechanism or process responsible for the observed breaks in the experimental interruptions is the same as the process used in naturally occurring (self) interruptions.

Recall now that after the subject has announced the color of the light, he sometimes goes back to the beginning of a phrase or clause and repeats perhaps several words up to the point where he had broken off. He always does this when the break occurs in

the middle of a word, and sometimes when the break occurs between words. One might suspect that this repeated material has been remembered as a sound image and simply replayed, but this is not the case. What we have is a repetition and not an exact replay or copy. It is speeded up; there is stress reduction; words may be contracted; an adverb may even be moved from an emphatic to a neutral position. It's a once over for the record, marked as material that has been said before.

Then the subject continues beyond the point where he had broken off, completing the phrase or clause. But this is material that has not been said before, and it is fully stressed, normally paced, and so on. It sounds as if it is exactly what would have been said next if there had been no interruption.

The contrast between the first, or repeated, part and the second, or new, part of the phrase or clause is striking. What is even more striking is that the change from fast, unstressed, speech to normally paced and normally stressed speech appears to come even in the middle of a word at the very point where the break had come. This is a tentative finding on which we hope to get more data. A presumed example of the phenomenon is given in (5).

(5) 


In this example there appears to be a peculiar prosodic anomaly in the word "syntactic." We think it may reflect the point where the one stress pattern switches to the other.

It seems to me that this experimental procedure offers an important tool for linguistic research into intonation, stress, emphasis, and the marking of material as old or new.

Another interesting phenomenon is what happens to the gesture that was broken off with the hand in mid air. After the color of the light has been announced, and simultaneously with the repetition of the beginning of the phrase or clause and its completion, the beginning of the gesture is repeated in diminished form and it is brought to completion. This occurred, for instance, with our example sentence (2) above, where a circular gesture of the hand accompanied the phrase "cancel off an expectation."

The data can also be used to study the segmentation of utterances into units of phrase or clause length. The beginnings of such units can be taken as the points to which speakers return to start their repetitions. The points of ending of these phrases or units can be obtained by the ending point of the rapidly spoken phrase and, in the case of forgetting, by the beginning of the

awkward silence and groping. I have collected here, (6) through (20), some of the data sentences and the segmentations that these techniques have provided. The points of segmentation are indicated by parentheses. I believe the beginning points are more reliable, the evidence for them being clearer.

(6) If we get, in the time available, (six or eight), (33)
(7) The next noun phrase (has got to be the one) that (274)
(8) and now (this is simply a syntactic variable) that (337)
(9) You might have to (cancel off an expectation) and go back (472)
(10) and I was (wondering about that). (486)
(11) and that's what I've been (groping around to find). (492)
(12) At least you demonstrate structurally (what the variable is), (504)
(13) I've not read up on some of these (methodological things) that they do (556)
(14) But I might not have guessed wrong (if you'd used a different word). (635)

The above segmentations come from subject 1. The following come from subject 4.

(15) the meeting (fell into small groups), and mine was (198)
(16) and a list of all their products, (Hostess cupcakes), (202)
(17) It's only useful (against flesh), you know, not useful against any kind of (240)
(18) The kinds of leaflets that people do, hastily like that, (are never read really...
(are never really read by people) who...
who one hands them out to. (250)
(19) One thing that struck me yesterday was how (by seeing) the slide show, it's possible to (353)
(20) But if it were possible to do an exhibit, (I think) it would be worthy of just a great deal of work. (374)

The linguistic significance of this technique of segmentation is considerable, for it allows experimental isolation of natural units right in the flow of speech. The resulting evidence for the units is a lot more direct than, for example, the psychological evidence from the migration of clicks toward phrase boundaries, or the more usual prosodic or grammatical methods of segmentation.

There is considerable evidence in the groping observed that the subject tries to reconstruct what he was going to say from any clues available. In many of the examples where the

subject eventually does appear to recover the train of thought, there are obvious clues in the repeated and completed phrase or clause. Subjective reports from the subjects also indicate casting about for clues. An interesting example that gives the flavor of what happens is (21).

(21) But at least you...demonstrate...structurally
what the variable * is...yellow...you can...
you can explain... ...
what the variable is and...and... (504)

In this example there is no initial going back, but considerable groping and inability to go on beyond three more words. Then after a long pause, there is repetition of "what the variable is." It comes out quickly as if the result of successful remembering, but then there is still inability to go on.

This example may also give some idea of the extent of advanced planning, for the light comes on just before the last word of the phrase in question, and the break comes at the end of the phrase. Thus it can be seen that with these techniques we may be able to probe more deeply into the mechanisms used for speaking.

We can now summarize our findings regarding memory. The subject forgets, but he does not forget everything. He obviously remembers how to speak. He remembers what to do when the light comes on. He remembers where he is, and the general point of the conversation. But he forgets or cannot get at what he was going to say, and with it, we may suspect, he forgets or cannot get at the most recent line of conversation that would presumably contain potent clues to what he was going to say. But he does remember the phrase he was uttering, and he remembers what or how much he has uttered of it, and whether he has completed it.

How can we account for this little island of remembering in a lake of forgetting surrounded in turn by the solid land of more permanent memories?

The fact that the repeated material is differently stressed the second time, and the fact that subjects can complete this phrase before forgetting, are both facts that are consistent with a view in which linguistic material is planned and composed some few words in advance by an upper level process, and then sent, a phrase or clause at a time, to a lower level process for uttering. It is in the upper level planning process that the forgetting that we observe takes place. The island of remembering is associated with the lower-level process.

The general similarity between the experimental interruption and retrace phenomena, and the self-interruption and correction phenomena is consistent with a view in which the lower-level process of uttering is associated with a process of monitoring and feedback. We are continually listening to ourselves speak, and we often catch ourselves misspeaking and then we go back and

correct ourselves. The apparatus needed for such monitoring might be expected to contain two memories, one receiving information from the planning and construction apparatus, and one receiving information from the ears as to what is being said, and a method of somehow comparing the contents of these two memories and detecting differences. These two temporary memories must be distinct from the temporary memory associated with the upper-level planning or composition process, the memory responsible for the forgetting we have observed.

I should also like to point out that linguistic theories of the usual sort are totally incapable of accounting for much of the phenomena I have been talking about. In particular it would seem difficult for any usual linguistic theory to account for a phrase that switched--apparently even in the middle of a syllable--from an unstressed prosodic pattern to a fully stressed one. This adds one more reason to the many that have led me to favor a state theory for linguistics (Yngve 1969, 1970). One only has to arrange for the state to change at the appropriate moment.

I hope I have convinced you that observation and experiment do sometimes turn up new and interesting things that we hadn't suspected and that our theories didn't contemplate at all. We have here a smorgasbord of phenomena that will keep the theoreticians busy for a while, and in the meantime the experimenters can start to use some of these new investigative tools to try to find out more about how people communicate.

Footnotes

1. All languages so far examined show the predicted left-right (temporal) asymmetry, and they all show typological features relatable in an obvious way to the hypothesis. (I have examined more than a few languages.) In English, for example, a typical "right-branching" language, we find left-branching restricted by a hierarchy of sentence, clause, noun phrase, adjective, and adverb; and complex devices of structure reversal and postponement by discontinuous constructions to circumvent the left-branching restrictions and preserve expressive power. Additional details can be found in the 1960 paper. It has been claimed that the so-called "left-branching" languages constitute a counter example to the hypothesis, but I do not find these arguments convincing. In the first place, such languages show extensive agglutination that is used as a depth-conserving device, as predicted by the hypothesis. In the second place, I have not been able to elicit from native informants acceptable sentences with excessive depth. They have instead volunteered alternatives of lesser depth, often involving two sentences instead of one. In the third place, the intuitions of English-speaking linguists as to the proper structuring of sentences in these languages may be warped by their intuitions about English and by their grammatical

preconceptions rooted in the Western tradition. Certain Japanese linguists, in informal discussions, have not diagrammed Japanese sentences in the left-branching manner typical of American students of Japanses since Bernard Bloch, but have used a right-branching structure closer to the structures reported by Bloch's student Eleanor Harz Jorden (1955). I have concluded that most of the criticisms stem from a misunderstanding of the appropriate syntactic criteria to be used in displaying structures for comparison with the hypothesis, and for this a more careful reading of the 1960 paper is the best answer. A temporal asymmetry in language structure rests on solid observational data. Chomsky's tendency to deny a temporal asymmetry at some level of universal grammar may stem from the fact that his view of grammar as a relation offers no principled way of introducing a past-future asymmetry in grammatical theory, or even of introducing a temporal factor at all. Chomsky has, however, admitted most of the important points of the depth hypothesis (Miller and Chomsky 1963) even while appearing to reject it, and this has led to much confusion in the linguistic literature. The psychological literature has also at times confused speech and language phenomena carefully separated in the 1960 paper.

2. Another interesting approach to the whole question of forgetting has been explored by Barbara Sangster in her University of Chicago thesis.

3. Carried out on November 17, 1971.

4. I should like to thank Barbara Sangster, who consented to the intrusion on her discussion with me, and Ann Hollopeter, who kindly served as the experimenter.

5. During the Spring Quarter, 1972.

6. The asterisk marks the point where the light came on. The numbers at the right identify the location on the tape where the examples may be found.

7. I should like to acknowledge the assistance of Trudy Shoch in examining the tape for false starts, stutters, and repeats.

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