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Autor: Vuchinich, Samuel

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Expanding the Comparison Operation in Models of Language Comprehension*[4]

The comprehension of a given unit of language in text or discourse is highly dependent on the context preceding the occurrence of the unit. The basic processing of phonetic, syntactic, and semantic properties yields only a partial component of what is «comprehended» when the sentence or utterance is perceived. Additional concurrent processing of contextual properties allows a fully developed comprehension to occur.

Precisely how context affects comprehension is not well understood at present. Some important experimental work (Bransford and Franks, 1971; Haviland and Clark, 1974; and others) has shown the significance of the structure of context for comprehension. Such studies demonstrate the need to develop a more complex model for the relationship between target unit and context than that provided by studies of picture-sentence verification tasks. The verification task research was based on Gough's (1965) old «congruence principle» which placed only a relationship of identity at the crux of target-context ties. Problems with the verification paradigm and the congruence principle have been duly pointed out (Tannenhaus et al, 1976). More recent research has focused on how a target unit gets integrated into its context (Garrod and Simon, 1977; Swinney and Hakes, 1976; Hupet and Le Bouedec, 1977; Thorndyke, 1976). These studies have shown the relevance of such elements as inferences, text memory, anaphoric relations, knowledge structure, and newness of information for comprehension. Although there is some effort to support and strengthen the given-new contract approach (Hupet and Bouedec, 1977; Thorndyke, 1976) it is apparent in the lack of theoretical compatibility in the various studies and the difficulty with task comparibility in the methods that some parts of the target-context puzzle are missing. The present study offers a model of target-context relations in comprehension which specifies and complements these recent developments.

Recent work from the semiotic perspective has significantly furthered the formal understanding of indexical relations in discourse

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and text (Bellert, 1970; Trybulec and Saloni, 1974; Lipski, 1974; Paun, 1976; Nowakowska, 1976). These indexical relations have been found to be intimately involved in the production of cohesion. A wealth of literature has developed in semiotics as well as in linguistics, poetics, and the sociological analysis of conversation on the cohesion of language units larger than the sentence. This research has analyzed how conversations, texts, poems, and other naturally occuring bodies of language are held together. The work has carefully refined the operation of indexical relations. The central hypothesis of this paper is that the same formal mechanisms which have been shown to produce cohesion in discourse and texts are criterially involved in language comprehension. More specifically, those mechanisms which create cohesion function to tie a target language unit to its context. In doing this tying these mechanisms serve in the production of comprehension. A model of comprehension is described in detail and then tested with data from live conversations.

Cohesion Mechanisms

Even a limited review of the cohesion literature is beyond the scope of this paper. The literature consistently points to a core set of assumptions about how cohesion works. These assumptions will be reviewed and then specific mechanisms will be described.

First it is clear that information about text and discourse is stored in memory as the text or discourse proceeds. Recent psycholinguist research verifies this assumption (eg. McKoon, 1977; Kintsch, 1975) indicating further how the information is structured in memory. But more important for present purposes the cohesion literature has shown that there are specifiable formal relationships between sentences and utterances which are essential for the production of cohesion. These formal relationships serve as templates for tying text and discourse together. Such relationship templates constitute standardized modes of association. When such a template is exhibited between elements in text or discourse the hearer/reader recognizes its occurrence and the result is the perception of cohesion. The concept of these templates as standardized modes of association is central to the model of comprehension to be developed presently.

These unit template relationships must be exhibited in a series of language units for them to be perceived as a text or a discourse. Such templates define texts and discourse. Furthermore, the hearer or

reader must be in possession of these specified templates in order to recognize their occurrence and thus perceive the discourse or textual properties. This last point has major implications for a processing model of language comprehension. It means that these templates must be included in the internal machinery for processing the relationship between a target item to be comprehended and its preceding context.

Templates that have been isolated and shown to produce cohesion include repetition (Huisman, 1973; Halliday and Hasan, 1976; Trybulec and Saloni, 1974); ellipsis (Lipski, 1974; Gunter, 1974; Halliday and Hasan, 1976; Speier, 1972), pronominalization (Crowell, 1973; van Dijk, 1973), conjunction (DuBois, 1973; Halliday and Hasan, 1976), presupposition (Lipski, 1974; van Dijk, 1973), and others. The term UNIT TEMPLATE will refer to one of these specific types of formal associational relationship between two or more utterances or sentences. A UNIT TEMPLATE earns its status as a unit because it provides *only one* irreducible connection between sentences or utterances. A single sentence or utterance may exhibit more than one UNIT TEMPLATE tie to its context. But all formal relationships to context can be enumerated in terms of specific UNIT TEMPLATES.

For methodological clarity this report focuses on the functioning of only one type of unit template. This type is a well documented variety independently isolated with diverse methods and variously labelled as logical connectives (Cromwell, 1973), conjunction (Halliday and Hasan, 1976), logical relations (van Dijk, 1973), logical operation's procedures (Vuchinich, 1975), and logical relationships (Eisenstat, 1975). These labels all refer to the systematic application of formal logical concepts (i.e. identity, causality, negation) to form the structure of a unit template. A specific logical concept serves to link together the two or more items in a unit template.

Three such logical unit templates will be examined here. Two are based on causality, one on identity. Examples of each are drawn from conversational data.

Example 1

A: He ya-really gave a lot of money away.
B: Well it was just a tax thing.

Turn B presents tax benefits as the cause for the philanthropy acted in turn A. The template operating here exhibits two related items,

the second being the cause for the first. This kind of template will be called an ACCOUNT-the second item accounts for the first.

Example 2

C: .... it gets me around but I can't park it up here on campus. I leave it down by the athletic office.

D: Oh hyah. Then you still have to walk.

As a result of parking «by the athletic office» conversant C has to walk to get to campus. The template here exhibits two related items, the first being the cause of the second. This kind of template will be called an ACCOUNT, the second item accounts for the first.

Example 3

E: ... they had to get all these extra kids in heh heh heh so they brought in around eight of these great big trailers.

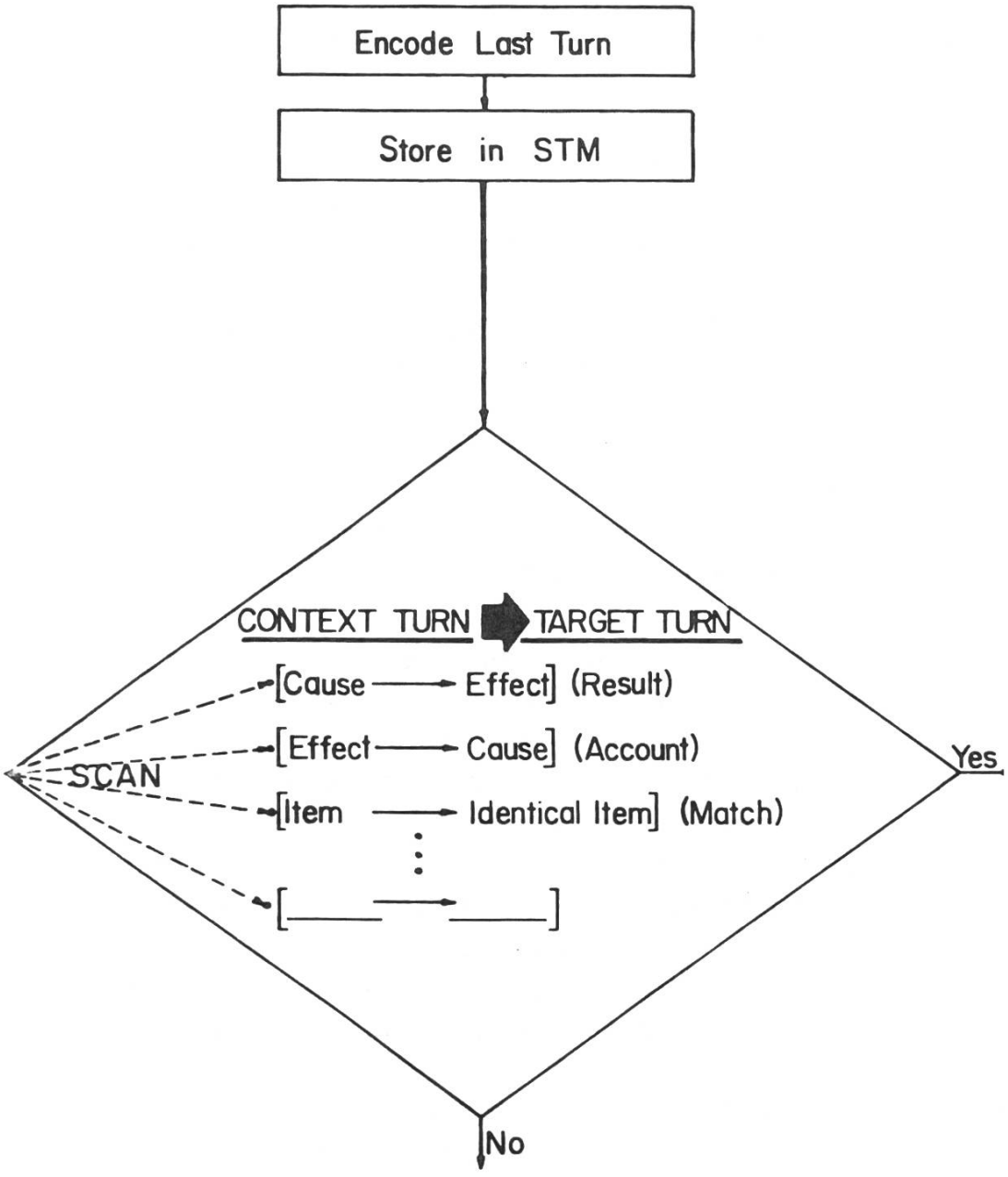
F: Oh, they pulled that trick in Flint too.

Flint is an identical case of a place where «big trailers» were brought in for «extra kids.» The template here also exhibits two related items, the second being an identical case of the first. This template will be called a MATCH, the second item matches the first.

It is here posited that a set of linking templates such as these are a basic part of the language processing machinery. When a unit of discourse or text is presented for processing this set of templates is scanned simultaneously with the items stored in memory from the preceding context to find a prior occurring item which links to the presented target item under the auspices of a unit template. When such a template link-up is found a standardized perception of the cohesive relationship between target item and context is achieved. The traditional psycholinguistic models of comprehension in verification tasks based on the «congruence principle» (Clark and Chase, 1972; Gough, 1965) used identity as the only standardized association between representations as the basis of comprehension. The present description expands the number of standardized associations used in comprehension.

These templates can be used to conceptualize a comparison operation similar to those employed in the chronometric and constituent models of language comprehension (Carpenter and Just,

1975; Clark and Chase, 1972). The inclusion of such templates can make these earlier model designs compatible with the more recent findings on the relationships between target and context in comprehension (Thorndyke, 1976; Haviland and Clark, 1974; Hupet and Le Bouedec, 1977; Garrod and Simon, 1977). Figure 1 outlines the unit template comparison operation. The three templates focused upon are listed but the operation includes other templates. This comparison operation will now be applied in a more general model.

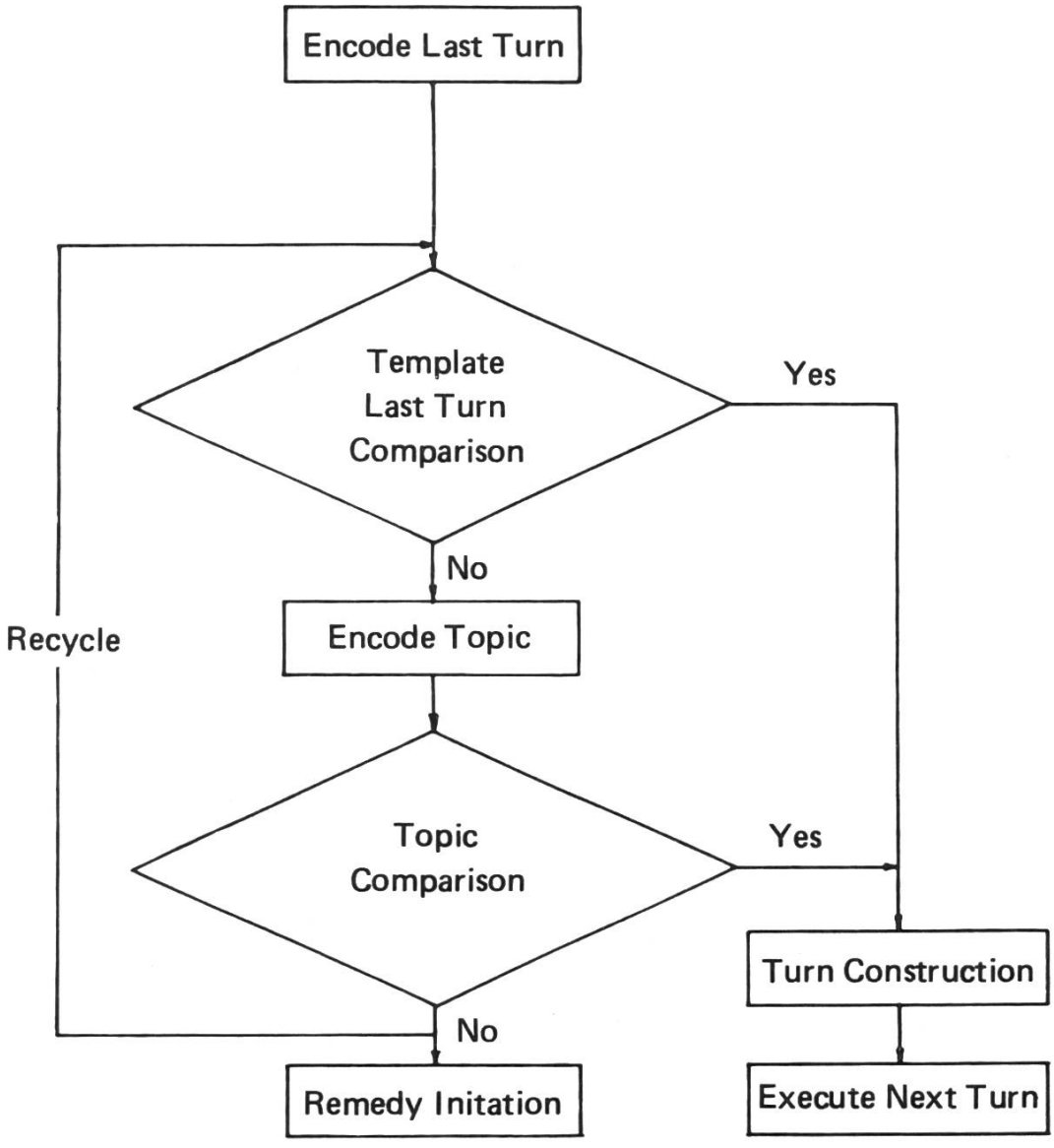


The psycholinguistic models of language comprehension have almost exclusively been tested in forced choice experimental designs. Subjects respond to written bits of material in a rigid, game-like, artificial situation. Excellent control is possible in these settings but some serious problems arise as language comprehension is not as easily confined and isolated as other phenomena psycholinguists investigate. Tannenhaus et al. (1976) criticized the use of the popular verification tasks claiming that the representation modeled is highly conditioned by the task. Other tasks employed have a validity problem because comprehension in an artificial, game-like setting may not be the same as comprehension in conversation or reading a book. Other recent researchers (e.g. Thorndyke, 1976) have seen the need to use paradigms which attempt to duplicate the natural situations in which language processing occurs. In order to avoid validity problems and to expand the applicability of models of language comprehension the template comparison operation developed above will be tested in a processing model for the comprehension of turns in ordinary conversation. For ordinary conversation to occur comprehension must occur in a practical, rigorous way. A model of language comprehension should thus explain how the comprehension of turns at talk occurs. The large body of research findings on ordinary conversation makes a processing model for turn comprehension possible.

A simple model of the processing leading to the comprehension of a turn at talk in conversation is depicted in Figure 2. In ordinary conversation the immediately prior turn (last turn) is criterial in the processing of a given target turn. Conversation is built turn to turn and each successive turn serves a conversant as a monitor of how his or her talk is understood by other conversants. That each turn at talk involves a conversant's analysis of the immediately prior turn has been thoroughly demonstrated (Sacks, 1972; Jefferson, 1974; Schenkein, 1972; Turner, 1977). The model thus posits that the template comparison operation first compares the encoded target turn with the immediately preceding turn. It is assumed that such prior turns have been stored in short term memory (Jarvella, 1971).

If a perceptual template obtains between the target turn and the last (immediately prior) turn then a form of comprehension of the target turn occurs and the hearer uses that comprehension is constructing his next turn. If a scan of the templates reveals no formal relation-

ship between target turn and last turn then the hearer must look for other aspects of the prior talk to which the target turn can be anchored. In ordinary conversation this search is organized via the mechanism of discourse topic[1]. A discourse topic is a symbolic element (lexical item, phrase, proposition) which is successively referred to across several turns in conversation. The talk focusing on one topic serves to produce a contextual frame (Thorndyke, 1976; Goffman, 1974; Minsky, 1975) for the local organization of conversation. The



1 Discourse topic is not to be confused with topic-comment sentence structure. (See Li, 1976)

accomplishment of topics is very complex (Adato, 1976; 1971; Scheifflen and Keenan, 1976; Sacks, 1968; Schegloff, 1972) and has clearly been shown to be significant in language comprehension (Garrod and Trabasso, 1973; Haviland and Clark, 1974) and memory (Crothers, 1972; Chafe, 1972; Perfetti and Goldman, 1974). For present purposes discourse topic is a structured contextual frame to which a target turn can be tied if no template tie to the immediately prior turn can be found. If a target turn is perceived to be «predicted by or consistent with» (Thorndyke, 1976), or have some template relationship to a discourse topic, then a form of comprehension is achieved and used in constructing the next turn. Notice that if a template tie exists to the last turn the discourse topic is automatically furthered (Vuchinich, 1975).

If the target turn is found to be related to neither the immediately prior turn or to the contextual topic the model posits a recycling of the turn through the same two comparison operations. The built-in templates are re-scanned with the propositions stored in memory searching for an element in the context that can be template linked to the target turn. This particular process constitutes a search for «inferential bridges» (Haviland and Clark, 1974; Thorndyke, 1976) from the target to the context. The standardized templates specify the kind of inferences that are possible. If recycling yields a link then comprehension occurs and new turn construction. If a recycling search yields no link-ups the model posits that no comprehension occurs.

In ordinary conversation this lack of turn comprehension is a significant occurrence. Conversational systems, as mentioned above, require subtle turn by turn demonstrations of mutual understanding. This turn by turn comprehension is so important to the functioning of conversation that when an uncomprehended turn occurs the conversational system requires that a remedial sequence be initiated immediately in order to repair the difficulty[2] (e.g. «Huh?»). The functioning of remedial sequences in ordinary conversation is well documented (Sacks, 1972; Schegloff, 1972; Jefferson, 1974; Goffman, 1971). When no template ties from target turn to context are found, the model posits that the hearer will initiate a standardized remedy sequence as a kind of conversational reflex rather than construct a new next turn. This remedial feature built into the conversational system

2 Ambiguous turns with partial ties may not generate a remedy due to some connections being exhibited. This is consistent with Schutz' view of the «natural attitude» as developed by Garfinkel (1967) and Cicourel.

is useful for present purposes because the lack of comprehension is precisely marked immediately following the uncomprehended turn by a natural behavior system. In addition a reliable measure of no comprehension can serve as a baseline in measuring degrees of comprehension.

Recycling could theoretically continue indefinitely. This does not occur, and for good reasons. Lengthy searches for connecting links would create highly disruptive gaps in the flow of conversation. The conversational system in American English is built to minimize gaps between as well as overlaps in turns (Sacks, Schegloff, and Jefferson, 1974). The average gap between turns is around 300 milliseconds. Longer gaps would result in the fading of items stored in short term memory and eventually those in long term memory which produce the crucial topically framed context. The result of long gaps would be a serious breakdown in the cohesion of conversation. Since the creator of target turn is present, a remedy initiation can immediately get a clarification without sacrificing cohesion. Thus there is a definite upper boundary on the time recycling a target turn before a remedial sequence is initiated.

Predictions from the Model

This model for comprehension in ordinary conversation posits that the comprehension of a target turn is primarily dependent on the formal relationship between the target turn and its context. Furthermore, it is postulated that a discrete set of logical templates are part of the processing machinery in the comparison operation. The structure of the model requires that a response to a target turn be processed along one of three distinct processing paths. The first path is followed only if a target turn displays unit template connection to the last turn. A second path is followed only if the target turn does *not* display a template tie to the last turn but *does* include a tie to topical context. The third path is followed only if a target turn displays *neither* tie to last turn *nor* topical tie to the context. Table 1 lists the operations which comprise each processing path as derived from the model depicted in Figure 2.

Table 1: Processing Paths for Turns by Target-Context Relationship

Target-Context Relationship	Operations Included
*U*nit *T*emplate to Last Turn (UT)	Encode Last Turn Encode Target Turn Unit Template Comparison to Last Turn Turn Construction Execute Turn
*T*opic *O*nly (TO)	Encode Last Turn Encode Target Turn Unit Template Comparison to Last Turn Encode Topic Topic Comparison Turn Construction Execute Turn
*N*o Relationship to Last Turn *N*o Topic Relationship (NN)	Encode Last Turn Encode Target Turn Unit Template Comparison to Last Turn Topic Comparison Recycle Remedy Initiation

Each of the specific stages requires a discrete time for execution regardless of which path it is a part. It is possible to estimate the relative elapsed time for execution of the various processing paths. The model can predict whether it should take longer to process a target turn related to its context by a UT format, topic or no connection. Following other tests of comprehension models these predictions will be used to test the present model.

Because the processing path for topic only turns includes two stages, over and above the operations required for UT turns the prediction follows that processing time for UT target turn (t_{UT}) should be less than processing times for topic only target turns (t_{to}). Similarly t_{ut} should be less than processing time for target turns with no connection to context (t_{nn}).

Predicting the relative processing time for TO turns and NN turns requires closer consideration. Both paths share the same first five operations but then the TO path ends with turn construction whereas the NN path ends with recycling and remedy initiation. As indicated above, the time for recycling has an upper boundary necessitated by gap minimization requirements of conversation. Turn construction shares this same upper boundary. Thus processing of TO turns and

NN turns shares the same first five stages and is limited by the same upper boundary. This suggests that a prediction of no significant difference in processing times between the TO turn path and NN turn path is in order. That the recycle unit and remedy initiation require no time consuming creative production supports the suggestion that these two stages combined take no more time than the creative turn construction stage. Thus the model predicts that $t_{to} \simeq t_{nn}$.

Although the model predicts no significant difference between t_{to} and t_{nn} it does posit that the time is consumed by different operations. In order to test this aspect of the model data other than elapsed time are necessary. Since the test is carried out in ordinary conversation such additional data are available. The remedial and topical character of subjects' responses to target turns is coded and used to show that t_{to} and t_{nn} are results of distinctive processing paths. The richness of subject response is one major advantage the use of ordinary conversation has over the use of forced choice designs. In ordinary conversation subjects naturally exhibit (in a variety of ways) the way they comprehend a turn at talk by the particular way they respond to it.

The comparison operation developed here includes a scanning procedure which occurs across the logical templates in searching for a standardized tie between target turn and context. This scan functions on a simple recognition basis. If a given template does not obtain for a context-target pair no time is lost, the sweep across templates simply continues. Unlike the chronometric/constituent model, the present model is not iterative within the comparison operation. A lack of a fit of one template does not lead to additional processing time as a mismatch in the constituent comparison models would. Iteration occurs only in the recycling phase described above.

If the scanning mechanism functions in this manner then the type of template used should not affect processing time for a properly executed UT tie. This would be the case if iteration were occurring in the comparison operation as more rarely used templates would be reached by the scan later and would be predicted to take longer to process because of all the template checking that preceded them. The model thus predicts that processing time for turns tied to context by different templates will not vary significantly.

These predictions will be tested by observing processing times for turns at talk that are 1) tied to last turn by a logical template (UT turns), 2) not template tied to last turn but tied to the topic (TO turns), 3) not tied to the context in any way.

It should be noted that these various predictions are not what would be expected from either common sense predictions or previous studies of language comprehension.

Method

The audio portion of 52 ten-minute conversations between a confederate and a naive subject was used as data. A confederate was used to insure the occurrence of a sufficient number of the appropriate turn types for statistical analysis. Detailed transcriptions of the conversations were produced. Conversation prior to and following target turns of the appropriate type (UT, TO, NN) uttered by the confederate were selected out of the data for analysis. A simple confederate-produced target turn and the naive subject's response to it were treated as a trial. The trials were aggregated and analyzed statistically to test the predictions of the model.

Subjects. The 52 naive subjects were undergraduates at the University of Michigan and were paid $ 2.50 for their participation. There were 32 female and 20 male subjects.

Materials. The design was built to yield natural subject response to particular types of target turns. Target turns were thus materials but because they were to be introduced casually into conversation their exact content would not be predetermined. The confederate was trained with a simple set of rules for producing TO and NN ties. Since UR ties occur naturally subject was not informed about them but produced them nevertheless. Examples of each type of target turn follow.

No connection target turns were produced by the confederate by placing a grammatically correct, normally intoned sentence which had no relationship whatever to the context turn, or any prior talk immediately after a subject's turn. No gap was allowed as a topic change signal. Turn four in Example 5 is a case of a NO connection target turn produced by the confederate.

Example 5
Subject: ..... there's a totally different standard for in state and out of state to get in and just the kind of people that are here, its just really different.
Confederate: Yeah

Subject: Cuz I have friends at home who had «B» averages and didn't get in and in state people have «C» averages and get in, it depends

Confederate: Water has hydrogen in it.

Producing Topic Only target turns was more difficult because there is such a powerful tendency for a speaker to use templates on last turns in relevant turn construction. But a specifically topic only tie was required to test the model. To overcome this tendency and insure proper topic-only target turns the confederate was trained to produce some turns that made reference to on-going topic and *also* specifically misused a given template on last turn. Misusing a template means the scanning procedure would find no template that obtained. A misused template consists of a turn that includes the following elements:

(1) reference to prior occurring item
(2) reference to a logical template relationship
(3) a new item syntactically tied to the logical template relationship and the prior item, but which does *not* exhibit the properties called for by the logical relationship regarding the prior item.

Example 6 shows a «topic only» target turn produced with this procedure.

Example 6
Subject: Well unless your not a member, if you're a member of TM, people do ah simply becuz its such a () high price to get in there (1.0 sec)

Confederate: Its like water polo.

The «its» in the confederate term refers to «the price of TM» which is a topic of the talk. So the turn is on-topic according to the topic check comparison. The «like» refers to the item match UR format. «Water Polo» is the new item that is in no specifiable way «like TM.» Water polo does not exhibit the properties called for by the template regarding TM. The match template does not obtain for the confederate's turn.
Unit Template turns are described in an earlier section.

Confederate. The confederate was a twenty-year old female, University of Michigan undergraduate who was naive regarding the purpose and hypotheses of the study. She was trained to casually introduce «two or three» TO or NN turns during otherwise normal conversations. The smaller number of target turns per dyad was used to maintain the ordinary character of the conversation.

Procedure. Subjects were recruited from a public area on the University of Michigan campus for participation in a «Sociology Experiment.» They were told by the recruiter that the experiment would take forty-five minutes, that another subject would be participating, that there was no shock or stress involved and that they would be

paid $ 2.50. When they arrived at the appointed room, they were met by the experimenter and instructed to wait for the other subject (S_2). When the other subject arrived, the experimenter said to both subjects, «Okay we can get started now. Come this way please.» The subjects were lead to a small room furnished with two chairs at a 3' x 3' table. After both subjects were seated the experimenter said, «Okay, the first thing we'd like you to do is just get acquainted for ten minutes. I'll be back for you after that.» The experimenter immediately left the room and shut the door behind him. Ten minutes later the experimenter returned to the room and interviewed the subjects one at a time. It was explained that their talk had been recorded via a microphone embedded in the ceiling and if they wished, the recording would be immediately erased. No subject chose to erase the tapes. Permission for analysis of the tapes was obtained. Subjects were debriefed, paid and dismissed. Initially twenty-four dyads with both naive subjects were run to insure that ordinary conversation would occur in this setting and for use in a related study. Then in 52 more dyads the «other subject» (S^2) described above, unbeknownst to the naive subject, was a trained confederate.

Coding. The elapsed time between each selected target turn and the subject's verbal response to it was measured with a stop watch three times and a mean was calculated. That duration will be called the processing time.

Each response to a target turn was examined for the presence of a remedy initiation. If the subject's response to the target turn was in interrogative form indicating lack of understanding (e.g. «What?» «Huh?») that response was coded as a remedy initiation.

The four turns prior to the target turn were examined for repeated reference to a single topic. Such a referent was generally found and was treated as the last topic for the target turn. Except for NN turns the target turns were also «on» this topic. The subject's response to the target turn were coded with regard to whether or not they referred to the last topic as well. If no reference, direct or implied, to the last topic was found in the response to the target turn that response was coded as «topic terminated.» If a reference to the last topic was found in the subject's response it was coded as topic «survived.»

One hundred two UT target turns, one hundred seventeen TO target turns and nineteen NN target turns were generated by the confederate. These turns and the subject's responses to them were used as data for the analysis.

Results

As predicted by the model, processing time following UT target turns was significantly less than processing time following TO target turns and NN target turns $F(1,198) = 79.261$, $p < .001$ and $F(1,117) = 41.51$ $p < .001$ respectively[3]. The mean processing times were $L_{ut} = 270$ msec, $L_{to} = 1730$ msec, $L_{nn} = 1460$ msec. Also as predicted there is no significant difference in processing time following TO target turns and NN target turns ($F(1,117) = 0.492$, $p < 0.1$). Note that the significance level is high enough to avoid a ß type error. To further test the model it must be shown that the same processing time is consumed in different processing paths for TO and NN turns.

The model predicts that subjects should respond to NN turns by producing a remedy sequence initiation instead of moving through the turn construction stage. Table 2 displays the percent of remedy initiations which follow each type of target turn.

Table 2: Remedial and Topical Response. Characteristics of Three Types of Target Turn

	Logical Template Relationship (n = 102)	Topic Only (n = 117)	No Relation (n = 19)
Remedy Initiation (%)	12.7	40.2	79.9
Topic Survived (%)	61.2	42.7	0.0

Target turns with no connection to context met with a remedy initiation response significantly more often than the topic only turns (chi square = 9.90 $p < .0016$). The turn construction stage was generally by-passed in processing turns with no connection but was generally employed in response to topic only turns. The remedy initiation coding thus supports the model's predictions of different processing path for TO and NN terms.

In Table 2 all NN turns did not get a remedy initiation and all UT terms did not yield new turn construction as the model would predict.

3 Since each subject was presented with a different set of test terms within unique contexts the materials can be treated as a random effect. With subjects as a random effect the language-as-fixed-effect fallacy is avoided and the «quasi F-ratio» is unnecessary. (Clark, 1973, 448).

The model does not account for every case. There is static in any model but some comments are in order. Topic-only turns got a remedy initiation response 40.2 % of the time. This is unexpectedly high given that the model predicted turn construction rather than remedy. This high initiation rate can be seen as an artifact of the way TO turns were produced. The misused template most likely touched off some remedy initiations.

The present model posits that topicality is an important feature of conversation prior to a target turn which determines the way it is processed. More particularly it predicts that if a target turn refers to a last topic it will be processed through the turn construction operation even if no template relationship formats obtain between the last turn and target turn. Turn construction entails usage of template relationships in building response to target turns and these employ reference to items in prior talk. What this means is that it is likely that a turn processed through the turn construction stage in response to a target turn will share a topical reference with the target turn. This is to be distinguished from no connection target turns which are not processed through turn construction stage. Responses to no connection target turns should have no topical cohesion with the target or context turn. The model thus predicts that the topic being referenced in target and context turns should continue more often into the response turn for UT target turns and TO target turns than to NN turns. If the topic continues to the response turn it is labelled as surviving. This prediction is important because it uses topicality as a variable which demonstrates the distinctiveness of the processing paths of TO and NN turns.

Table 1 shows that topics survived the TO target turns more often than NN turns. The difference was significant (Fisher's Exact Probability = 0.0001). This finding is further evidence that TO turns and NN turns are processed along different paths although their processing times are not significantly different.

The model predicts that there should not be a significant difference in processing times following target turns that exhibit various type of logical templates. This prediction is based on the scanning mechanism posited for the template comparison operation. The processing times following the three types of UT target turns were compared in an analysis of variance test and there was no significant difference. $t_{match} = 230$ msec., $t_{account} = 270$ msec., $t_{result} = 370$ msec. ($F(2,96) = 0.254$, $p > 0.1$).

In order to reduce the risk of making a type II (or B) error (claiming no significant difference when one exists) a very low F value was required and obtained. This lack of a significant difference supports the model's claim that a scan occurs without iteration inside the template comparison operation itself. Note that the value of the mean latencies (200–300 msec) corresponds to the time associated with one constituent comparison in the chronometric/constituent models of comprehension in verification taks. This indicates that in conversation humans can accomplish complex cross turn comparisons (i.e., based on more relations than identity) as quickly as tasks where only identity matching is involved.

Discussion

The successful test of the model described above demonstrates the viability of a comparison operation which includes built in templates. The functioning of the template comparison operation specifies the recent work on how a sentence gets integrated into its context (Hupet and Le Bouedec, 1977; Garrod and Sanford, 1977; Thorndyke, 1976; Haviland and Clark, 1974). These studies exercised a healthy hesitation to build any more formal machinery into the integrating process than is essential. But given the template oriented nature of the large cohesion literature, the non-accumulative diversity and task specific nature of target-context relations in these studies, the accurate predictions of the present model and the success of the comparison operation models in simpler comprehension type tasks, the inclusion of a template comparison operation can be seen to be warranted. Important on-going work on the structure of text (and context) in memory (e.g. Kintsch, 1975; McKoon, 1977; Kintsch, 1974) promises to allow more precise examination of integration process in comprehension.

The present study shows that comprehension of a target unit is dependent on both its relationship to the immediately prior turn and separately, to the broader conversational context (discourse topic). Studies of comprehension and integration into context should thus be able to distinguish between integration of immediately prior materials from more distant information. This is consistent with Perfetti and Goldman's research on topicalization (Perfetti and Goldman, 1975; 1976). The work on the given-new contract thus far has been largely limited to the immediate short term context with the vague

«bridging» concept handling anything else, and yet it is treated as a general model.

The accurate predictions of the model in a live conversational design contributes to the validity of models of language comprehension in general. The conversational setting allowed precise measurement of degrees language comprehension as a dependent variable. Fine distinctions were possible because conversants display the nature of their comprehension of a turn in the way they build their response. This important feature of conversation could be utilized in further studies of comprehension.

University of South Carolina
at Sumter
Sumter – USA

Samuel Vuchinich

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