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ABSTRACT
                A reconstructive approach to memory for connected
discourse is contrasted with orientations that emphasize passive
reproduction. Conditions under which reconstructive errors in recall
should occur are specified. Most conventional experiments do not
satisfy the conditions. In an experiment involving 360 college
students, subjects were induced not to differentiate information in
discourse from prior knowledge, and subsequently presented
information contradicted expectations formed earlier. Predicted
recall errors from a previously generated set tended to be
manifested. This tendency increased with delay prior to recall. Such
recall errors were almost totally absent when schematic states at
recall did not contradict earlier states and when conventional memory
instructions were employed. The results were interpreted as
supporting the reconstructive theory presented. A preliminary sketch
of a model of inferential reconstruction is also presented.
(Author/AA).

Technical Report No. 2

INFERENTIAL RECONSTRUCTION IN MEMORY
FOR CONNECTED DISCOURSE

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Bartlett (1932) found that reproductions of stories were character-
ized by substantial error, including distortions of old information and
importation of new information. These results led Bartlett to conclude
that memory for connected discourse involves something more than passive
reproduction of stored memories. He hypothesized that to-be-remembered
(TBR) information is assimilated into pre-existing holistic cognitive
structures (schemata) in such a manner as to lose particular identity.
New information which subsequently modifies those schemata exerts a greater
determining force in the schemata than the assimilated TBR information.
Recall under this dual handicap is problematic. Bartlett's solution was
to propose a process of "turning round upon one's schemata." Although the
latter concept has been considered to be obscure and non-operational (e.g.,
Oldfield & Zangwill, 1942), it seems likely that Bartlett intended some
kind of reconstruction mechanism in which past states of schemata are
inferred on the basis of current states. Furthermore, the process can, in
principle, be specified so as to have greater empirical content.

However, subsequent research on memory for connected discourse (e.g.,
Gomulicki, 1956; Johnson, 1970; Meyer, 1974; Meyer & McConkie, 1973;
Spencer, 1973) has completely failed to replicate Bartlett's finding of
substantial gross error in recall. Substance accuracy (other than omis-
sions) was so prevalent in the study by Gomulicki (1956) that he formulated
what can be called an "abstractive-trace retrieval" theory. Comprehen-
sion of discourse includes an active process of forming (constructing) a
selective summary or précis. Once the discourse is comprehended the basis
for subsequent recall is set. The experience will then have a particular

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identity immune from the assimilative effects of one's knowledge or related experiences in the future, with recall depending on the passive re-excitation of appropriate traces and forgetting attributable to some unspecified process of loss of traces (depending on the "structural importance" of individual elements). In addition to the many studies showing substance accuracy in recall, this view also receives support from the common finding of "freezing effects" in discourse recall. If multiple reproductions are required, a very high degree of persistence of content is found (e.g., Bartlett, 1932; Howe, 1970; Meyer, 1974; Spencer, 1973), even when the original passage is repeatedly reinstated (Frederiksen, 1975a,b; Kay, 1955).

It is contended here that all post-Bartlett research and theory dealing with memory for connected discourse adheres (explicitly or implicitly) to an approach which emphasizes passive reproduction at recall rather than active reconstruction. The main thrust of research has been concerned with the criterion problem--how should discourse memory be measured? The solutions have progressed from number of words recalled allowing synonym substitution, to recall of sections of passages comprising completed ideas (with methods of such passage subdivision ranging from the unorganized intuitions of the experimenter to complex hierarchical structures, e.g., Crothers, 1972), to scoring based on complex discourse analysis derived from linguistic theory (e.g., Meyer, 1972; Kintsch, 1974).

Research based on all these scoring methods have had, with few exceptions, one common result: a remarkable faithfulness to the original material in recall. The probability of occurrence of importations of

information from outside the presented discourse, distortions of presented information, and other gross errors of the kind Bartlett reported approaches zero. This consensus on the substantive accuracy of prose recall has led contemporary researchers to employ the following modus operandi. A method of discourse analysis is devised, frequently independent of consideration of individuals' knowledge acquired prior to presentation and always independent of subsequently acquired knowledge (an important determinant of the overall, gross nature of recall in the reconstructive approach). Hypotheses are tested regarding which aspects, derived from the method of analysis, tend to be recalled more or less often. For example, elements of discourse have been shown to be recalled better when they have greater structural importance (e.g., Johnson, 1970) or when the ideas have a more superordinate position in the discourse's hierarchy (e.g., Meyer & McConkie, 1973). Alternatively, aspects of recall which are deviations from the a priori discourse analysis are anticipated but either do not occur with substantial frequency (Spencer, 1973) or are attributed to initial processing only (Frederiksen, 1975a,b).

These kinds of studies will be referred to as supporting the "abstractive-trace" retrieval theory of discourse memory mentioned earlier. Comprehension results in a particular abstract representation of the text (not to be confused with the less general use by Gomulicki, 1956, of "abstractive" to refer to the précis-like quality of recall) which, though selective, does not change with time (other than becoming sparser), with recall consisting of passive retrieval of specific stored memories (elements of the initial representation). The abstractive-trace retrieval approach

should be contrasted with the assimilative-holistic schema, tendency to gross error in recall, and active, inferential, non-reactivation-of-specific-stored-memories characteristics of reconstructive approaches. With the exception of Bartlett's data, all memory for connected discourse results are of the abstractive-trace type.[1] Taking account of the weight of the evidence in favor of abstractive-trace retrieval theory, Zangwill (1972) concluded that the emphasis in memory research and theory should be on reproduction rather than reconstruction. Regarding Bartlett, he said "the theory, in my view never very plausible, is best forgotten" (Zangwill, 1972, p. 127). Zangwill's remarks characterize the current state of the art with respect to the role of reconstruction in memory for connected discourse.

Note should be made of some recent research also using the concept of "construction." The seminal paper by Bransford, Barclay, and Franks (1972) is prototypal of this research. Bransford et al. provide support for the contention that subjects use sentences to form descriptions of situations which may contain more information than a purely linguistic analysis would provide. The extra semantic information in the constructive approach is purported to be the result of some process of interaction with prior know-ledge. In this regard, Bransford et al.'s orientation is clearly seen to coincide with Bartlett's effort after meaning and schema assimilation. Their results are clearly consistent with a constructive approach to language comprehension. However, it should also be clear that Bransford et al.'s research does not address the question of the roles of active re-construction versus passive reproduction in recall. Their results are not inherently inconsistent with the passive abstractive-trace retrieval approach

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to recall. The same caveat, regarding interpretation of data purported to indicate construction in memory, applies to similar sentence recall research (e.g., Barclay, 1973; Honeck, 1973) as well as Frederiksen's (1975a,b) research on connected discourse. Frederiksen found evidence of construction only at the comprehension stage, even though experimental manipulations intended to detect construction at recall were included in his research. It will be argued below that evidence of construction at recall of the kind Frederiksen was seeking would not be predicted to occur given the conditions of his experiments. In order to reduce ambiguity, elaborative processes involved in comprehension will be referred to as "construction", active inferential processes at recall as "reconstruction." The emphasis in recent years has clearly been on construction.

The apparent failure to obtain empirical support for the reconstructive approach to recall, it will be contended here, is the result of various characteristics of conventional laboratory memory experiments which conspire to minimize the likelihood that overt evidence of reconstructive errors could be manifest. Essentially, the problem is that most researchers assume that the reconstructive approach predicts substantial error in recall in all situations. Actually, it seems to the present writer that constructive theory predicts error in recall only under certain specifiable conditions.

First, reconstruction using inference must be required. In principle, if novel information was used primarily to develop a new schema, i.e., was differentiated from pre-existing schemata, and that schema was not modified by subsequent related information, then a constructive approach should predict accuracy in recall (other than omissions). If, however, TBR information

is related to pre-existing schemata, with the predicted assimilation and
resulting loss of particular identity, inferential reconstruction would
be required. To the extent that the inferential process is incapable of
differentiating the TBR information from the prior knowledge, error in
recall could occur. Although more error is predicted in this case than
when information is used to form a new schema, the magnitude of the differ-
ence should not be great. This is because of the probable schema-dominance
of chronologically recent information.

The problem of recall becomes significantly greater when TBR informa-
tion is related to a schema which is subsequently altered by encounter
with information also related to that schema. Dominance due to chronologi-
cal recency is lost, and recall is under the influence of a schema dominated
by other factors. This fact, combined with the assimilative nature of
schemata, leads to the strong possibility that the current state of the
schema at recall will be in some sense inconsistent with the past state of
the schema at the time of comprehension of the TBR information. Recon-
struction then requires inferring the past state of the schema on the basis
of the present, different state of the schema. It is in this situation
that substantial error in recall becomes probable. To summarize, evidence
of reconstructive errors in recall of connected discourse is likely to be
found to the extent of interaction with cognitive structures with loss of
particular identity, and to the extent of subsequent schema-modifications
with resulting difference between present and past schema states. Schema
changes due to subsequent modifications will have by far the greater effect
on producing reconstructive errors at delayed recall. The preceding

orientation will be referred to as the Reconstructive Theory.

Recall which is apparently of the abstractive-trace retrieval type is to be expected when the above conditions are not met. It will be argued that all of the memory for connected discourse experiments, with the exception of one set, induced minimal interaction with cognitive structures. The one set that did manipulate likely schema interaction (Frederiksen, 1975a,b) did not have any subsequent schema modifications. Frederiksen's results are consistent with the present interpretation as will be shown below. The common outcome that error in recall is minimal, suggesting that the memories for individual discourses maintain a particular identity immune from the assimilative effects of knowledge (in most of the research) and future related experiences (in all of the research)[2] would therefore not be surprising.

It will be argued that subjects in conventional memory experiments minimally interact with pre-existing schemata when comprehending TBR connected discourse, and that any information subsequently encountered is either not likely to be related to the schemata of the TBR material or will not even be relatable. When one considers the demand characteristics of experimental situations (Orne, 1962), one of the most prominent is that subjects desire to perform in such a manner as to reflect positively on themselves. The norm of self-presentation in memory experiments is simply to get as high a recall score as possible. If assimilation into pre-existing schemata leads to inaccuracy in recall, subjects would therefore be motivated to increase the dissociability of the TBR information from other cognitive structures (e.g., by focusing on details as Gauld and Stephenson's (1967)

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and Kay's (1955) subjects did).

Why should a research subject integrate the TBR information with his or her other knowledge? The role the information will play in his or her life can be summarized as follows: take in the information, hold it for some period of time, give it back to the experimenter in as close to the original form as possible, and then forget it forever. The information can not be perceived as anything but useless to the subject in his or her everyday life (given the common employment of esoteric or clearly fictional topics as stimulus materials). The information, even when not clearly fictional, is probably not true. In any case, the subject knows that the relative truth of the information has nothing to do with the purpose of the experiment. The perceived function of new information is normally to selectively update one's knowledge (Bransford & McCarrell, 1975). One usually selects aspects of discourse on the basis of such factors as interest, and uses the information to alter the relevant cognitive structures in such a way as to make them reflect what has been derived from the new information. However, it would clearly be absurd and counter-productive to update one's knowledge with the useless, isolated, and probably false information presented in laboratory memory experiments. Furthermore, given the norm of self-presentation of high recall performance, the role of selectivity on the basis of interest is lessened. All of the elements of the TBR discourse are important for a high recall score. The high score is best accomplished by relating the elements to each other rather than relating elements to pre-existing cognitive structures. This may be one reason that recall predictions based entirely on intra-passage relations

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(e.g., Meyer & McConkie, 1973) are so effective. In any case, the likely
result is accuracy in recall.

An aspect of Gauld and Stephenson's (1967) discourse memory research
of interest was their finding that (nonverbatim) accuracy in prose recall
was positively correlated with conscientiousness. Conscientiousness was
ascertained in clinical interviews focusing on such factors as anxiety
about approval of other people and altruism. Accuracy in recall was not
correlated with intelligence (a very common finding with a long history).
In other words, superior recall performance was more likely by subjects with
an "unselfish interest in the welfare of others" than by those more intelli-
gent. This makes one wonder further what role demand characteristics of
the experimental situation may be playing in producing abstractive-trace
retrieval results.

It is well-known that subjects in experiments act as problem-solvers
trying to determine how the experimenter wants them to act. It is also
well established that subjects usually try to cooperate; i.e., they try to
act the way they think the experimenter wants them to (Orne, 1962). In
this context, it seems plausible that the conscientious subjects in a
laboratory experiment think the experimenter does not want idiosyncrasy in
their prose recall, that scientific studies are trying to get at pure
effects with as little between-subject variance as possible (this possibil-
ity is increased the further the subject is into the introductory psychology
course). If this does occur, that would be further motivation to minimize
"effort after meaning." Some support for the contention that this impres-
sion is indeed a common one is indicated by the results of the following

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questionnaire. Students in introductory educational psychology courses at the Pennsylvania State University and at the University of Illinois, and introductory psychology students at the Pennsylvania State University were asked the following question:

Picture yourself in the following situation:

You are participating in an experiment. You are presented with a passage to read. You are either told that it is a memory experiment and you will have to recall the passage, or you are fairly certain that you will have to recall the passage even though you have not been explicitly told. Do you think the experimenter would prefer that you a) keep the information in the passage separate in your mind from other knowledge you may have (so that the results would be "pure," that is unconfounded by idiosyncratic differences between individuals), or b) integrate the information in the passage with your pre-existing knowledge by doing things like relating the information to personal experiences, thinking of implications of the information, etc.?

Among those who had a clear opinion on the question, 44 out of 72 (60%) chose choice (a); i.e., they thought experimenters would prefer that the to-be-remembered information be kept separate so that "purer" results would obtain. This proportion choosing (a) differs significantly from .5 (z = 1.65, p < .05). However, even if these speculations on the demand characteristics of memory experiments and their effects are not totally correct, it will be argued that the basis for most of the interaction

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with cognitive structures in everyday comprehension of discourse is missing
in the isolated context of memory experiments.

Before proceeding, however, an important qualification should be noted.
The present thesis is not that there is no interaction with cognitive struc-
tures in prose memory experiments. Linguists and psychologists are coming
to accept the premise that prose comprehension, even in isolated contexts,
frequently requires the use of some information external to that actually
present in the to-be-comprehended linguistic message. For example, Lakoff
(1971) argues that "a sentence will be well-formed only with respect to
certain assumptions about the nature of the world" (Lakoff, 1971, p. 329).
In this framework, linguistic competence includes the ability to pair
sentences with the presuppositions necessary for well-formedness. Bransford
and Johnson (1972) demonstrated that comprehension sometimes depends on
extralinguistic contextual information, and that the context must be activa-
ted during the comprehension process for it to have a facilitative effect.
Looked at another way, it shows that some interaction with pre-existing
schemata (effort after meaning) will probably always be helpful and sometimes
it will be a necessity for comprehension and efficient memory.

The present point of contention is that the effort after meaning in
the prose memory experiment is a lazy one, stopping as soon as sufficient
relations to knowledge outside of the TBR material have been made to enable
a plausible non-contradictory semantic reading. Consider the following
passage:

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"If the balloons popped, the sound wouldn't be able

to carry since everything would be too far away from

the correct f`   window would also prevent

the sound fr`   since most buildings tend to

be well insulated. Since the whole operation depends

on a steady flow of electricity, a break in the middle

of the wire would also cause problems. Of course, the

fellow could shout, but the human voice is not loud

enough to carry that far. An additional problem is

that a string could break on the instrument. Then

there could be no accompaniment to the message. It

is clear that the best situation would involve less

distance. Then there would be fewer potential pro-

blems"(Bransford & Johnson, 1972, p. 719).

Clearly it is difficult to assign some kind of semantic representation to
the passage. Now picture a guitarist standing by an apartment house holding
onto balloons which are carrying an amplifier and a monkey up to the up-
stairs windows. This update of the organ-grinder's monkey provides a con-
text necessary for comprehension of the passage (as did Bransford and
Johnson's "modern-day Romeo" context). However, if the passage is read
in an experimental situation, you do not think about its implications; how
does it relate to what you have been thinking about recently, e.g., re-
garding the economic situation and Ford? It would not occur to you to ask:
"Did it really happen?", "Will it happen by my apartment?", "So my wife
was right about putting up storm windows?". If you were to come across

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the passage and accompanying picture in everyday life, it would occur in some context which would contribute to its meaning for you. Just as you cannot specify all the particularized meanings of a word in isolation (e.g., Anderson & Ortony, 1975), c   e, paragraph, or story depends on context to some extent for its p. icularized idiosyncratic representation. You might have seen the passage and picture in Business Week accompanying an article on unemployed aerospace engineers and it would mean something different than if you saw the same materials in a magazine for electrical hobbyists, which would mean something still different than if you saw it in either of those places and you were President of the A.S.P.C.A. and worried about monkeys dangling in the air. Additionally, most situations have some kind of communication function, and part of comprehension involves trying to figure out the speaker's intentions. If your butcher showed you the passage and picture, clipped from a magazine, while you were paying for your porkchops, you would not stop with the semantic interpretation that subjects are forced to stop with in Bransford and Johnson's experiment. You would wonder why he was showing it to you and what he was trying to get at. The meaning of the situation to you (and what you might remember about it) might be that the butcher is probably going to raise prices because times are bad. All of these behaviors would involve relating the discourse to prior knowledge to a far greater degree than subjects in a Bransford and Johnson-type experiment are likely to. In the isolated context of the laboratory experiment there is no basis for any of the additional interactions with pre-existing schemata (prerequisite for reconstructive errors) illustrated above. Any effort after meaning beyond the

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minimum required for simple comprehension would be impossible or at least unwarranted in the laboratory situation.

Factors which contribute to variation in the meaning (or significance or "aboutness") of the same discourse include the following: prior linguistic context (～ present in memory experiments); the context of the situation (wh.. ˃ on when exposed to the discourse); knowledge about the communicator (e.g., inferences about shared presuppositions, expectations which influence comprehension, etc.), necessary for determining the communicative function of the discourse and the communicator's intentions (not to be confused with the more basic "illocutionary force," Austin, 1962, which is probably a factor in all comprehension; for example the sentence "Can you open the door" would probably be interpreted by adults as synonymous with "I would like you to open the door" in most contexts); and attitudes of the receiver of the communication. All of these factors lead to greater interaction with pre-existing schemata. It is unusual for any of these factors to be operative in conventional memory experiments in any way relating to the topical content of the TBR discourse.

The point is that the context of the prose in a memory experiment is the experiment itself. If the material interacts with any pre-existing schemata (other than to achieve a minimal plausible semantic representation), they are probably those dealing with experiences and expectations of laboratory experiments, science, etc. This becomes the context by default in the isolated experiment. In other words any effort after meaning will not be directed along lines related to the topical content of the TBR discourse, but toward solving the problem of what the experimenter wants. It is very

unlikely once again that such experiences and expectations, or that any

subsequent modifications of the laboratory experiments/science schemata

will bear directly on the topical content of the TBR material. In summary,

the topical content is not assimilated primarily into any content-related

schemata. Further, it is likely to be the most recent addition to whatever

sc'   primarily related to (since schema interaction based on the

topic of the discourse is minimal, subsequent schema modifications due to

exposure to related information will have no effect; if the material is

fictional, subsequent schema modification is impossible). Finally, the

topical content is part of a not very extensive schemata (if it is part of

any pre-existing schemata at all). Given these conditions, "freezing

effects" and abstractive absence of intrusions in recall would be expected

(given the conditions necessary for inferential reconstruction to produce

error in recall outlined above).

Accuracy in recall and stability in repeated reproductions are consis-

tent with the inferential reconstruction hypothesis when interaction with

cognitive structures (and the resultant loss of particular identity) is

minimal and, particularly when relevant schemata are not subsequently modi-

fied so as to have states at recall dissimilar to the states of the schemata

at comprehension. The demand characteristics of the experimental situation,

the nature of the experimental materials, and the isolated context in which

the TBR discourses are presented all combine to predict the kind of results

found throughout the literature on memory for connected discourse (with

the exception of Bartlett, whose results will be explained in the context

of the present orientation).

In the one set of discourse studies in which probable degree of cognitive interaction was manipulated (Frederiksen, 1975a,b), there were more deviations from the text in recall by subjects in the high cognitive interaction condition (subjects were supposed to try to solve the problems of a fictional island described in the target passage). This result would be predicted by Reconstructive Theory. Furthermore, since the subjects were unlikely to receive schema-altering information about Circle Island on their own during the retention intervals, and Frederiksen did not provide any, the reconstructive model would predict that in repeated reproductions with associated reinstatements of the original passage, the same amount of error would reoccur. Frederiksen's data concurred with this prediction. This is because the schemata which were originally related to and which contributed to the initial comprehension with the resultant errors were unaltered, i.e., each recall was based on cognitive structures in essentially the same state. Frederiksen's expectation was that if errors were not reduced after reinstatement of the original it would indicate construction only at comprehension, but if they were reduced it would indicate low confidence "gap-filling." Such an interpretation ignores the possibility of a normal, high confidence process of inferential reconstruction based on holistic, cumulative schemata, rather than the conscious fabrication of information known not to be correct. In any case, Frederiksen's conclusion that construction is limited to the comprehension stage only is consistent with Reconstructive Theory, given the absence of schema modification. In essence, Frederiksen's research deals only with one aspect (viz., construction at comprehension) of the more complete Reconstructive Theory. The

latter theory, in the form outlined earlier has never received an experi-
mental (i.e., manipulative) test.

A Paradigm for the Investigation of Inferential Reconstruction in Memory
for Connected Discourse

It is expected that reconstructive error in recall can be manifest
when TBR connected discourse is related to pre-existing schemata and there-
by assimilated with a loss of particular identity, and especially when the
discourse information has been assimilated into schemata that are, in turn,
subsequently modified by new information such that their current states
at recall conflict with their states at comprehension.

In attacking the problem of an empirical test of the reconstruction
hypothesis one thing becomes immediately clear: it can not be solved using
the conventional approach, i.e., by looking at the proportion of recall
consisting of importations, distortions, and rationalizations, or by looking
at the proportion of a repeated reproduction that is changed from the
previous reproduction. What proportion importations is necessary to indi-
cate constructive processes? Clearly, meaningful demarcation criteria
cannot be specified arbitrarily; therefore, this method of analysis is a
dead end. As an alternative, reconstructive processes in recall may be
demonstrated by taking advantage of known regularities in cognitive struc-
tures to systematically predict the kinds of changes in recall that are
most likely to occur due to subsequent new inputs to those cognitive struc-
tures if recall is indeed reconstructive and not tied to fixed, lifeless
traces.

The approach taken here is to construct a situation about which sub-
jects would have some consistent expectations and present the situation
to them. They are subsequently provided with ancillary information about
the situation which, in some conditions, contradicts the expectations the
subjects were likely to have (but which does not contradict or interfere
with any elements physically present in the TBR prose m⁻+⁻
expected that, as time passes, the ancillary information will be assimila-
ted with the TBR story into relevant schemata regarding such situations.
If Reconstructive Theory is correct, when the material later has to be
recalled, it will be inferentially reconstructed on the combined basis of
the originally presented prose passage, the contradictory ancillary informa-
tion, and schematic knowledge of what happens in the relevant type of
situation. This will lead to predictable changes and additions to the
original prose passage resulting from the combined effect of the three
factors on which the inferential reconstruction is presumably based.

Specifically, stories were constructed which were expected to be rele-
vant to subjects' underlying knowledge or schemata of how human relation-
ships are affected by various kinds of events. The situation described
(among other things) an engaged couple in which the man was having doubts
about discussing a very important issue--he does not ever want to have
children. When the matter is finally discussed, he either finds out that
his fiancée agrees with him, feeling just as strongly as he does about not
having children, or he finds out that she wants very much to have children.
The elements of these stories are grossly representable using a structural
balance model (Heider, 1958) in which the former situation is balanced and

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the latter is imbalanced. Figure 1 shows the relationships between the
elements in the balance model actually presented in this part of the
story: the positive affective relationship of Bob to Margie, the negative
relationship between Bob and "having children," and a negative (Figure la)
or positive (Figure lb) relationship between Margie and "having children."

Insert Figure 1 about here

Balanced triads contain zero or two negative relationships, imbalanced
triads contain one or three. It was assumed that the state of balance or
imbalance was derivable from each subject's prior knowledge regarding inter-
personal relations and would consistently engender a general positive or
negative expectation (for balanced and imbalanced stories, respectively)
regarding Bob and Margie's relationship.

Subsequently, subjects are incidentally provided with the ancillary
information that either a) Bob and Margie did get married and are still
living together happily, or b) Bob and Margie eventually broke off the
engagement and have not seen each other since (referred to as "married"
and "unmarried," respectively). For those who received the balanced story,
the outcome "married" is ancillary information which is "consistent" with
the expectation derived on the basis of the story and prior knowledge re-
garding interpersonal relations. The outcome "unmarried" for the balanced
story is ancillary information "contradictory" with the gross expectation
predicted by the balance model. On the other hand, consistency of the
ancillary information with the expectation for those receiving the imbalanced
story is reversed: "married" is contradictory and "unmarried" is now

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consistent. Since the state of balance in the story interacts with the ancillary information to determine whether the ter is c istent contradictory, the result. ill be general and not specific to "married" and "unmarried."

Reconstructive Theory predicts that for subjects in a "cognitive interaction" condition (i.e., subjects who are told that the story is true, that the experiment is investigating "changes over time in personal reactions to situations involving interpersonal relations," and that they should think about the story and react to it), schemata concerning knowledge of how interpersonal relations usually work will be activated and the information in the story will be related to those schemata. Subjects are told at recall that the experimenter is not interested in their reactions, and that it is, in fact, purely a memory experiment. Memory of the story will then be inferentially reconstructed in a predictable way based on three integrated factors, i.e., factors having fuzzy or no boundaries or particular identities: accessible elements of the presented story, the ancillary information, and the activated schematic knowledge regarding interpersonal relations.

When either no ancillary information or consistent ancillary information is received by subjects, the reconstructive model would predict basic accuracy in recall. If anything, consistent ancillary information may reinforce existent schemata leading to slight errors in the direction of heightening the degree of balance in balanced stories and the degree of imbalance in imbalanced stories.

However ... ... ts are presented with contradictory ancillary information (i.e., "married" after imbalanced stories or "unmarried" after balanced stories), recall will be problematic. The subject will have to base his recall on schemata which have been modified in a significant way--an overall evaluation of Bob and Margie as having a favorable relationship changed to a state in which the relationship is unfavorable (or vice versa). If reconstruction requires inference about an earlier schematic state based on current schematic states, and the current schematic state is inconsistent with the earlier one, then recall should tend to be erroneous in the direction of producing reconciliation of the conflicting elements. Thus, errors in recall (for contradictory ancillary information subjects) should lessen the degree of balance (i.e., should be imbalancing) for those who read the balanced story, and the errors should lessen the degree of imbalance (i.e., should be balancing) for those who read the imbalanced story. For example, the extent of Bob and Margie's disagreement (in the imbalanced story) might be remembered as less severe than it actually was or even nonexistent.

These predicted errors in recall can be specified a priori. A finite list of balancing and imbalancing error types has been generated (see Table 1) using the three elements and their inter-relations in the balance triads of Figure 1. Again, errors of the balancing kind are predicted for the "contradictory" subjects who read the imbalanced story. The errors consist of changes or distortions of inter-element relations, addition of relations not specified in the original story, or importations of information which explicitly supersedes the presented balance triad. Table 1

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also gives examples of the different kinds of errors.

Insert Table 1 about here

These predicted errors in recall should not be confused with conscious
fabrication to fill gaps in memory. Rather, the errors are seen as the
outcome of a fallible process which is the essential mode of operation in
memory. If the errors are conscious fabrications, subjects should be able
to detect them, as they did in Gauld and Stephenson (1967). In that experi-
ment, the errors probably were just guesses. The conditions of that experi-
ment were such that Reconstructive Theory would not predict any normal
reconstruction-based errors. If, however, the errors in the present experi-
ment are not conscious fabrications, then it should be hard for subjects
to detect them as errors. Since the "predicted" errors (i.e., the a priori
specified changes in the balance triad) are produced by the same process
of inferential reconstruction, in the same specific reconstructive act, and
based on the same underlying schemata as the correct aspects of recall,
the predicteJ constructive errors should be undifferentiable from the
correct aspects of recall. The prediction, then, is that subjects' expressed
confidence in predicted errors should not be less than their confidence
in correct aspects of recall (considering only subjects in "cognitive
interaction--contradictory ancillary information" conditions). Actually,
the constructive errors have a more firm basis in the underlying schemata
(being constructed using the subjects' own rules for organizing the world)
than does most of the information in the original passage (which is arbi-
trarily provided to the subject, rather than being initially generated by

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him/herself). If this is the case, confidence in predicted constructive

error could increase relative to confidence in correct aspects as the

retention interval increases and assimilation proceeds, with the former

eventually becoming greater than the latter.

It is hypothesized that schematic assimilation increases with time.

Therefore all of the predicted effects regarding constructive errors in

recall should increase as delay prior to recall increases.

It should be noted that the reconstructive approach makes no predic-

tions regarding the quantity of errors that will occur in recall. A single

constructive error can reconcile the information from the story with contra-

dictory ancillary information. Therefore, number of recall errors will not

be used as a criterion variable in the main data analysis.

On the other hand, when subjects read the stories in the context of a

conventional memory experiment, the arguments of Reconstructive Theory

lead to the expectation that memory for the stories will be maximally

differentiated from pre-existing schemata (thereby lessening the activation

and participation of prior knowledge regarding interpersonal relations)

and protected from assimilation with the ancillary information. The pre-

diction, therefore, is that recall under memory conditions will be basically

accurate. In particular, the constructive errors predicted for the "cogni-

tive interaction-contradictory" condition will not occur in the "memory-

contradictory" condition.

Method

Subjects were randomly assigned to one of 36 treatment conditions
determined by the factorial combination of four between-subject factors:
instructional set (cognitive interaction or memory); story (balanced or
imbalanced); ancillary information (none, "married," or "unmarried"); and
delay prior to recall (2 days, 3 weeks, or 6 weeks). In the first session,
the story was read and subjects received the ancillary information. In
the second session, subjects recalled the story and rated their confidence
in the various elements of their recalls.

Subjects

Three hundred ninety-four students from introductory courses in educa-
tional psychology and psychology served as subjects. They received extra
credit toward their course grade for participating (only if they attended
both sessions). Thirty-four subjects were eliminated from the analysis so
that sample sizes for all conditions would equal the sample size (ten) for
the smallest group. No more than two subjects were eliminated from any
condition. Elimination of subjects was done randomly within conditions
(with two exceptions noted below when sex was considered). The reason for
eliminating subjects was mainly that initial assignment to conditions was
unequal due to failures to keep appointments for the first session. Tele-
phone reminders and the fact that credit for the first session was given
only if the second session was attended kept the rate of reappearance for
the second session (where recall was solicited) near 100%. The few drop-
outs were randomly scattered across experimental conditions. There were

209 males and 151 females in the final analysis. In none of the experi-
mental conditions were there fewer than four or greater than seven males.
(In the two cases where there were more than seven males in a condition,
sample size was greater than ten and subjects were randomly eliminated
only from among the males in the condition.) Results of the main analyses
did not differ according to sex.

Materials

The stories were constructed to include the elements and relations
of the structural balance triads in Figure 1. The balanced and imbalanced
stories differ only in the last four sentences. The balanced story is
presented below.

This is a story about Bob and Margie. When they met,
they were both twenty years old and beginning their senior
year in college. Bob was majoring in political science and
Margie in history. They didn't know each other until they
were introduced at a party in a mutual acquaintance's apartment.
Since neither of them was particularly extroverted, and they
knew very few people at the party, they seemed glad to have
each other to talk to. They found some interests they had in
common, and hit it off fairly well. They soon began to see
each other regularly.

After several months, Bob began to think he would like
to marry Margie. He felt he loved her, and he believed the
feeling was reciprocated. Still, he was not sure how she would

react. Finally, he asked her to marry him. She agreed and they happily began making plans for their marriage and life together.

However, Bob's happiness was clouded by his awareness that there was something important he had to discuss with Margie-- his strong feeling that he did not want to have children. He avoided bringing the subject up because he didn't want anything to ruin their relationship. However, he soon realized that he could not put off the discussion forever. Filled with apprehension, he told Margie he had a very important matter to discuss with her. He anxiously related to her his strong feelings against having children and awaited her response. Margie was elated. Because she wanted to have a career, she had also felt that she didn't want to have children. They rejoiced in the dissolution of what would have been a very serious problem for them. A long discussion of the status of their relation- ship followed.

For the imbalanced story, the last four sentences are replaced by the following:

Margie was horrified. She had always wanted to be a mother and had her heart set on having many children. They argued bitterly over what had become a very serious problem for them. A long discussion of the status of their relationship followed.

The recalls were printed on bright yellow paper. Recalls were made on plain white paper as were the confidence ratings.

Procedure

Subjects were read the following instructions, which were also printed on a "consent to participate" form in front of them:

[Memory condition] This is a memory experiment. I am interested in the effects of delays in recall on the nature of that recall. You will read a story. At the second session I will ask you to recall the story as best you can. Are there any questions?

[Cognitive interaction condition] This is an experiment concerned with changes in the way people react to stories involving interpersonal relations when there is a delay prior to giving the reactions. You will read a story about two people. The story is true in all respects. I knew both of the people and can vouch for the accuracy of the story. What I would like you to do is think about and react to the story. At the second session I will ask you various kinds of questions concerning your reactions to the story. Are there any questions?

Subjects in all conditions were given three minutes to read the story and were told to use all the time. The stories were then collected. Approximately the next eight minutes were spent by the experimenter going over what to expect in the second session, having the subjects fill out information on the consent forms, and instructing the subjects of the importance

of not discussing the experiment with anyone.

As the experimenter was collecting the consent forms after the eight minutes, he casually said the following (apparently to fill up the time during the collection and without apparent purpose) to all subjects except those in the "none" ancillary information condition:

[Memory condition only] Hey! By the way, I really should let you in on something. The story you read about Bob and Margie happens to be true.

[Both memory and cognitive interaction subjects heard the same ancillary information after this point.]

["Married"] As it turned out, they did get married and they are very happy together to this day.

or

["Unmarried"] As it turned out, they never did get married. The engagement was broken, and they never saw each other again.

After the consent forms were collected, each of the subjects was randomly assigned to one of the three delay conditions (two days, three weeks, or six weeks). Subjects were then reminded that they must show up for the second session in order to get credit for the first one, asked once again not to discuss the experiment, and dismissed.

At the second session, "cognitive interaction" subjects were told the following:

I have to admit that I have deceived you. This is <u>not</u> a study

how people react in situations involving interpersonal rela-

tions. It <u>is</u> a study of memory.

From this point on, what the "memory" subjects heard was the

same as the "cognitive interaction" subjects.]

As you will recall, at the last session you read a story on

a <u>yellow</u> piece of paper. What I would like you to do is to

try to recall the story as best you can. Since you probably

can't remember it exactly, do your best to reproduce as much

of the gist as you can. Include all elements of the story

which come to mind. But I do <u>not</u> want your reactions to or

personal feelings about the story.

The instructions were read a second time and then ten minutes was allowed

for recalling the story.

Subjects were then asked to number each of the sentences in their

recall protocols. For each sentence in their recall they were asked to

rate their "confidence that its meaning was expressed <u>explicitly</u> somewhere

in the story (though not in the same words); inferences which you derived

from the story but not explicitly in the stories should be assigned a

low rating." A nine-point scale was used, with "one" indicating "very

uncertain the meaning of the sentence was explicitly expressed" and "nine"

indicating "absolute certainty the meaning of the sentence was explicitly

expressed." Subjects were instructed to divide compound sentences and

rate the parts individually when their confidence about the parts differed.

rials were then collecte. The subjects were asked again not

the experiment and dismissed.

Da

The primary analyses involved judged determination of the presence

or of constructed errors of the types provided on the judging

she again, these errors were either balancing or imbalancing.

They involved changes of relations between elements of the structural balance

triad, changes in the relative weights of two relations, addition of unpre-

sented relations, or importation of some information which acts to super-

sede or alter the importance of the balance triad in the presented story.

Examples were given in Table 1. The judging list was essentially similar

in content to Table 1.

Each of the recall protocols was randomly assigned an

identification number which was noted with the subject's

treatment condition on a key. The protocols were then shuffled such that

their order could not be expected to reveal any information about their

treatment condition (except that the protocols were separated on the basis

of whether the balanced or imbalanced story had been read; otherwise

errors would be more difficult to isolate).

All 360 protocols were scored by the experimenter in the following

manner. Elements of recalls judged to be instances from the a priori list

(called "predicted constructive errors") were identified by placing their

sentence number (or numbers) on a scoresheet along with the error score.

Positive numbers in the error scores indicated balancing errors, and nega-

tive numbers indicated imbalancing errors (the positivity and negativity

of error types were not known to the reliability udges to avoid biasing).
Absolute values of error scores (ranging from one to five: zero was the
score if no predicted errors were detected) were assigned using the fol-
lowing guidelines. Scores of one to three were used when an error was a
change of a presented element (but not an importation of a new one) and
resulted in a divergence from the story which did not change the valence
of any of the relations. Selection of the specific score between one and
three was based on a subjective estimate of the degree of change from the
original. As will be seen, the magnitude of the effects are so large that
they are clearly demonstrated using any scoring method. Scores of four or
five were assigned when errors which changed or distorted the original (but
did not add new information) led to a change in the valence of a relation
in the balance triad (e.g., changed a positive relation to a negative one).
Errors which were the result of importation or addition of new information
not present in the original received error scores between three and five.
A score of three was assigned when the importation did not change the
valence of any relations in the balance triad (i.e., changes in shades of
meaning as above) or did not override or supersede the balance triad. When
importations changed the valence of relations or when importations super-
seded the original balance triad, scores of four or five were assigned
(depending on perceived magnitude of the change).

Constructive error score for an individual subject could have been
determined in a number of different ways. When there is more than one
error but all with the same sign (i.e., all balancing or all imbalancing),
the total score could be the sum (or average) of all the error scores or

it could simply be the error score of largest absolute value. The latter

basis was used since reconstructive theory predicts only that reconciling

errors will occur. Since a single constructive error can change a triad

from balanced to imbalanced, the number of errors made is not important.

When there are errors of both signs (balancing and imbalancing), a

rare occurrence (particularly for high absolute values), the possibilities

for determining the total score include: summing all the scores; summing

the positive and negative scores with the highest absolute value (i.e.

+3 and -4 would be a total score of -1); average (or sum) of all the posi-

tive scores minus the averages (or sum) of all the negative scores; average

(or sum) of scores only for the sign with the single score of highest

absolute value; or the score with the highest absolute value. Although

all of these measures yield the same consistent and conclusive results, the

results presented will use total scores derived by taking the sum of the

single highest scores with positive and negative signs (i.e., highest

positive score minus the negative score with the highest absolute value).

This is one of the more conservative of the options. Note that omissions

are, in effect, zeroes and therefore count against reconstructive theory

in this experiment.

Reliability of the scoring was ascertained in the following way. Two

judges (paid University of Illinois undergraduates) were familiarized with

the stories, the list of constructive error types, and the scoring system

presented above. One judge selected 20 protocols randomly from the 180

in the "balanced" condition, the other selected 20 from the "imbalanced"

condition. All of the experimental conditions were approximately equally

represented in the total sample of 40. The experimenter blocked out the
ancillary information if it occurred in recall. The judges then assigned
constructive error scores to the 40 protocols. The "single measurement"
reliability (Winer, 1962, p. 126) is .89 between the three judges (the
third set of scores being the experimenter's scores for the 40 randomly
chosen protocols). In the seven instances (out of 40) of experimenter-
scored fours or fives, thirteen of the fourteen scores by the judges were
also four or five. The other one was a "three." The same sentences were
always selected as being "fours" and "fives." Agreement was slightly less
for errors scored by the experimenter as absolute values between zero and
three. However, in only one protocol was an error score with absolute value
less than three scored as a "four" or "five" by one of the two judges. In
any case. as the analyses that follow demonstrate, the same effects occurred
at a high level of significance whether minimal size of a "substantial"
constructive error is considered to be any absolute value between one and
five (inclusive)

Results and Discussion

The primary analyses involved the following dependent variables:
constructive error score, absolute value of constructive error score, pre-
sence or absence of substantial constructive error (where "substantial"
is defined as a constructive error score whose absolute value is greater
than or equal to 1, 2, 3, 4, or 5 in five different analyses), and confi-
dence as a function of correctness vs. incorrectness of recall. Supplemen-
tary analyses follow the primary analyses.

Constructive Error Scores

A four-way analysis of variance was carried out using the following between-subject factors: two kinds of instructions ("cognitive interaction" and "memory") X three lengths of delay interval (two days, three weeks, and six weeks) X two kinds of presented stories (balanced and imbalanced) X three kinds of ancillary information (none, "consistent," and "contradictory"). The "balanced-married" and "imbalanced-unmarried" combinations are "consistent," while "imbalanced-married" and "balanced-unmarried" combinations are "contradictory." The dependent variable is constructive error (errors reflecting alterations or additions to the structural balance triad), the score varying from -5 to +5 with zero indicating no constructive errors (see the Data Analysis section). Negative scores are imbalancing errors, and positive scores are balancing errors.

Reconstructive theory predicts that substantial constructive error in recall (high absolute values) should occur only when there is contradictory ancillary information and only in the cognitive interaction condition. More specifically, for "cognitive interaction-contradictory" subjects who read the balanced story, imbalancing errors are predicted (negative constructive error scores), and for those who read the imbalanced story, balancing errors are predicted (positive constructive error scores). Statistically, these predictions translate into a three-way interaction between type of story, instructional condition, and type of ancillary information with the following components: a significant simple interaction for the "cognitive interaction" condition only between the other two factors; for "cognitive interaction," significant simple effects of "contradictory" vs.

both other types of ancillary information (with no difference between "none"
and "consistent" for both story types; and, for "cognitive interaction,"
significant simple effects of story type only for the "contradictory"
condition. Additionally, the three-way interaction should become more pro-
nounced with increases in the delay interval.

Table 2 presents the mean constructive error scores for each of the
36 conditions.

Insert Table 2 about here

As predicted according to reconstructive theory, there was a signifi-
cant three-way interaction between types of instructions, presented stories,
and ancillary information, $F(2,324) = 27.33$, $p < .00001$. The significant
over-all interaction is composed of a highly significant simple interaction
of story and kind of ancillary information for the "cognitive interaction
group," $F(2,324) = 54.30$, $p < .00001$, and a nonsignificant simple inter-
action of those two factors for the "memory" group, $F(2,324) = 1.41$, $p > .10$.

Means for the simple effects in the significant simple interaction,
i.e., story X ancillary information for "cognitive interaction" only are
presented in Table 3. Differences between stories are nonsignificant when

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Insert Table 3 about here
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there is "none" or "consistent" ancillary information [$F(1,324) < 1$ and
$F(1,324) = 2.28$, $p > .05$, respectively]. The difference between types of
stories is highly significant for the "contradictory" condition, $F(1,324) =$
146.15, $p < .00001$. The simple effects of ancillary information for each

kind of story type are both significant; $F(2,324) = 31.93$, $p < .001$ for

balanced stories, and $F(2,324) = 21.92$, $p < .001$, for imbalanced stories.

For both balanced and imbalanced stories, scores for the "none" and "con-

sistent" ancillary information conditions differ (by a Tukey Wholly Signifi-

cant Difference Test with "family-wise" error rate set at .01) from the

"contradictory" condition and do not differ from each other for both kinds

of stories.

Finally, the tendency toward high positive constructive error scores

in the "cognitive interaction--imbalance--contradictory" condition and high

negative score in the "cognitive interaction--balance--contradictory" condi-

tion, with no tendency toward constructive error in any other condition

(the three way interaction) becomes more pronounced at either three or six

week delayed recall than at the two day delay interval. The result is a

significant four-way interaction, $F(4,324) = 7.55$, $p < .025$. Looking at

the simple interaction of instruction, story, and ancillary information

for each delay interval, the results are $F(2,324) = 2.00$ ($p > .10$),

$F(2,324) = 21.32$ ($p < .001$), and $F(2,324) = 10.23$ ($p < .001$) for two days,

three weeks, and six weeks, respectively. Although the results are in

the predicted direction at two days, the interaction becomes considerably

more pronounced when recall is delayed three or six weeks. The slight de-

crease in the F-ratio at six weeks vs. three weeks can be attributed to

an overall increase in forgetting in the memory condition and an increase

in gap-filling evidenced by low confidence in constructive errors by

"memory" subjects and the existence of a couple of substantive balancing

and imbalancing errors in the same memory condition.

To summarize, all the predictions of Reconstructive Theory were con-
clusively and unambiguously confirmed. In the "cognitive interaction--
contradictory" condition, substantial _predicted_ constructive error occurred.
Examples of constructive errors actually made by subjects in the "cognitive
interaction-contradictory" condition include the following:

"Balancing" errors by subjects reading the imbalanced story:

—— they separated but realized after discussing the matter that
   their love mattered more.

—— they underwent counseling to correct the major discrepancy.

—— they discussed it and decided they could agree on a compromise:
   adoption.

—— she was only a little upset at the disagreement.

"Imbalancing" errors made by subjects reading the balanced story:

—— they had had a severe disagreement about having children at
   some time prior to their agreeing.

—— there was a hassle with one or the other's parents.

—— they _disagreed_ about having children.

—— they at no time discussed their attitudes about having
   children with each other out of fear of rejection and this
   led them to separate.

As can be seen, these errors are gross distortions of the actual story.
They occur only when Reconstructive Theory predicts they should occur.

The rationale in subsequent analyses for the predicted interactions
is basically the same as in this analysis. Therefore, slightly less expli-
cation will be devoted to them.

Absolute Value of Constructive Errors

The constructive error score analysis could conceivably have concealed tendencies in the memory condition to make constructive errors that cancelled each other out (i.e., the data could have resulted from a lesser tendency toward making errors of the same sign for a given presented story in the "memory" condition). To test this possibility, an analysis of variance with the same four factors as the preceding analysis was executed using absolute values of the constructive error scores. Table 4 is analogous to Table 2 with the exception of the changed dependent variable.

Insert Table 4 about here

The hypothesis of counter-balancing errors in the memory condition must be rejected. The interaction of type of instruction and ancillary information is highly significant, $F(2,324) = 14.58$, $p < .00001$. The simple effects tests show nonsignificant differences between instructional conditions when no ancillary information was presented as well as when consistent ancillary information was presented [$F(1,324) = 2.79$, $p > .05$ and $F < 1$, respectively]. However, the absolute value of constructive error socres is higher for the "cognitive interaction" than for the "memory" condition when contradictory ancillary information is provided (means of 2.6 and 0.7, respectively). Whereas there is no difference between types of ancillary information in the "memory" condition ($F < 1$), the effect is significant for the "cognitive interaction" condition, $F(2,324) = 28.75$, $p < .001$. Once again, the "none" and "consistent" conditions do not differ from each other and both differ from the "contradictory" condition which

has higher constructive error scores (by a Tukey Wholly Significant Differ-
ence test with "family-wise" error rate equal to .01). Also, error scores
increase with delay, $F(2,324) = 11.11$, $p < .0001$. Because absolute values
of error scores were used, no effects involving type of story were expected
or found since type of story only influences the sign of the error score.
Also, a three-way interaction with delay was unlikely because mean absolute
constructive error scores were inflated by the addition of low (and less
reliable) scores which had previously tended to cancel each other out.

Likelihood of Substantial Constructive Errors

Thus far it has been demonstrated that higher constructive error scores
(of predicted sign) occur under the conditions predicted by Reconstructive
Theory. The question now considered is whether the same conditions affect
the likelihood of making a substantial, gross reconciling error; i.e.,
will the predictions of reconstructive theory hold, as they do when degree
of error is the dependent variable, when constructive errors are considered
on an all-or-none basis? The problem of defining a "substantial construc-
tive error" was bypassed by analyzing the data using all possible cut-off
points (i.e., five analyses with scores of absolute value > 0, > 1, > 2,
> 3, and > 4 as criteria for deciding that a substantial constructive
error has occurred). As the constructive error score cut-off gets higher
(i.e., as constructive error scores become more reliable and the errors
are judged as more serious departures from the original text), incidence
of constructive errors should become more consistent with the predictions
of reconstructive theory. In particular, constructive errors should occur

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mainly in the "cognitive interaction--contradictory" condition. A few constructive errors of a reinforcing rather than reconciling nature, e.g., balancing errors for balanced stories, might be expected in the two other cognitive interaction--ancillary information conditions since underlying schemata are activated. In other words, an interaction between type of instructions and ancillary information is again predicted. This should especially be true when "four" or "five" is the cut-off, since these scores were only to be assigned in cases where errors changed the valence of the structural balance triad, added relations which altered the state of balance, or imported information which superseded the triad.

Five analyses of variance were carried out using each of the following criteria: constructive error scores with absolute values > 0, > 1, > 2, > 3, and > 4. When the absolute value of a subject's constructive error score was greater than or equal to the criterion for the given analysis, a score of "one" was assigned. Otherwise a score of "zero" was assigned. Analysis of variance with dichotomous data yields Type I error rates almost identical to those for chi-square tests on the same data (e.g., Dunlap, 1974). Analysis of variance has the advantage of greater facility in dealing with higher-order interactions.

Table 5 presents the number of constructive errors (a maximum of ten in each cell) for the criterion "> 3." Under all criteria a significantly

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Insert Table 5 about here
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greater number of subjects make constructive errors in the "cognitive-interaction" than in the "memory" condition, and more at the two and three

week delay intervals than with two-day delay. For all criteria except
"> 0," significantly more subjects make errors in the "contradictory" con-
dition than in the other two ancillary information conditions. Most impor-
tant, for all criteria except "> 0," the type of instruction X ancillary
information interaction is significant ($\underline{p}$ < .0001 in all four analyses).
In all of the four analyses the prediction was upheld that subjects will
make constructive errors in the "cognitive interaction--contradictory"
condition almost exclusively. This is most clearly illustrated when the
criteria are high. It appears that for any definition of "substantial
constructive error" one may choose with respect to constructive error
scores, the predictions of Reconstructive Theory are supported.

Confidence in Substantial Predicted Constructive Errors Relative to Correct
Aspects of Recall

One of the main contentions of Reconstructive Theory is that construc-
tive errors result from a natural process of assimilation and schema modifi-
cation occurring over time, which all information in memory is potentially
subject to. Constructive errors are hypothesized to be the consequence of
the same process that produces correct recall. Therefore, these kinds of
errors should not be detectable by subjects who make them. These errors
are contrasted with easily detectable conscious fabrications to fill gaps
in memory (Frederiksen, 1975a,b; Gauld & Stephenson, 1967) and errors which
are the result of inferential processing at comprehension only rather than
at recall (Frederiksen, 1975a,b; Gomulicki, 1956).

That the constructive errors detected in this study are not of the
abstractive-trace retrieval type, i.e., they are not the outcome of active

processing at comprehension followed by particular and static storage and passive retrieval, is suggested by the increasing incidence of constructive error with longer delay (see, e.g., Tables 2, 4, or 5). The other possibility, i.e., that the errors are conscious gap-fillers or guesses was investigated by examining the confidence ratings.

If the latter hypothesis is correct (i.e., the errors are guesses), the subject should indicate low confidence that the errors were actually present in the original story as compared to their confidence in correctly recalled elements. Reconstructive theory makes the contrary prediction that, since the constructive errors are generated in the same way as correct recall, (mistaken) confidence in predicted constructive errors should be at least as great as confidence in what is correct (i.e., constructive errors should not be easily detectable, as they were in Gauld & Stephenson, 1967). Furthermore, the predicted constructive errors have their origin solely in the internal cognitive processing of the subject, whereas many of the correct aspects of recall are imposed on the subject by the experimenter and may, therefore, not be consistent with the subject's cognitive structures (e.g., if the information is illogical). Therefore, as the process of assimilation increases with time, the more internally consistent and personally generated constructive errors may be assigned higher confidence ratings than the correct experimenter-presented original story elements.

A comparison of the average confidence ratings for correct aspects of recall (only for aspects of the structural balance triad, i.e., the part of the story dealing with the "having children" issue) versus confidence

ratings for constructive errors is presented in Table 6. Any subject who

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Insert Table 6 about here
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had a constructive error score with absolute values equal to four or five
was included in the analysis. The conscious fabrication hypothesis would
predict that recall errors of greater magnitude should be most easily
detectable. Therefore, requiring large constructive error scores for inclu-
sion in the analysis (absolute values of four or five) provides a conserva-
tive test of the normal reconstruction (non-fabrication) alternate hypothe-
sis. The average confidence rating for correct elements is an average of
the confidence ratings for all sentences which were not given error recall
scores greater than one. Subjects in the "cognitive interaction" condition
who made constructive errors under the present criterion did not differ in
their average confidence for correct aspects from "cognitive interaction"
subjects who did not make constructive errors (the data are presented below).

At the three week and six week delay intervals, significantly more
subjects in the "cognitive interaction-contradictory" condition had higher
confidence in their constructive errors than their average confidence for
correct recall, ten to two with one tie at three weeks and ten to two at
six weeks ($p < .04$ using the low power two-tailed sign test). The mean
confidence was slightly higher and three of four subjects had higher confi-
dence in correct aspects at the two-day interval, but the sample is too
small to draw any conclusions ($p > .05$ by the sign test or $t = -1.75$,
$p > .05$). The slight depression in confidence in constructive errors at
the 2-day delay could reflect an unverbalizable awareness that something

was different about the errors (something was), or that "left-to-be-derived" markers were still generally available (see the General Discussion). In any case there is no reason to suspect that the errors even at the two-day delay were guesses since a) the errors were of the same kind as later occurred with high confidence, and b) the confidence is considerably greater than the confidence of "memory" subjects in their errors (see the analysis immediately below).

Further evidence for the contention that the constructive errors in the cognitive interaction-contradictory condition are not gap-filling guesses is provided by comparison with the relative level of confidence ratings of errors in the memory condition (where Reconstructive Theory predicts true constructive errors should not occur). Only seven "memory" subjects received error scores greater than three. The sign of the difference between average error score on correct items and error score for errors clearly tends to be in a different direction for the memory condition than for the cognitive-interaction condition. Using the difference between average confidence for correct information and (mistaken) confidence in errors as the dependent variable, the "cognitive interaction-contradictory-3 and 6 week delay" and the "memory" conditions were compared (the one two-day memory subject was included to increase sample size since the error confidence was one of the higher ones: 6.0). Using a Behrens-Fisher t-test with a Welch correction for degrees of freedom (Games & Klare, 1967), the difference in the differences was significant, $t'(6') = 4.18$, $p < .005$. The difference for the memory condition was significantly above zero [$t(6) = 3.71$, $p < .005$] and it has already been shown with the sign test

that the trend of differences is in the opposite direction for "cognitive interaction-contradictory-3 and 6 week" subjects.

The conclusion is inescapable--the "memory" subjects are already aware of and able to detect their errors (since average confidence in correct aspects is significantly greater than confidence in errors), replicating Gauld and Stephenson (1967). The "cognitive interaction-contradictory" subjects at three and six week delay were not only unable to differentiate the constructive errors from the correct aspects of their recalls, but more had higher confidence in the constructive errors (in relation to confidence in correct aspects) than had lower confidence.

What were the errors that the memory subjects made, if not constructive errors? Five of the errors seemed to be reinforcing errors. This is illustrated by importing information which supersedes the balance triad but preserved the state of balance of the overall story; for example, recalling correctly that Bob and Margie disagreed about having a baby and importing the information that even if they had agreed on that issue, they still had many other issues they did not agree on. These kinds of reinforcing errors even occurred twice when contradictory ancillary information was presented, providing further support for the contention that to-be-remembered connected discourse is processed in such a way as to be immune from assimilative effects of subsequent related information (thereby resulting in abstractive-trace type recall and "freezing" effects). Of the other two errors, one changed the relations of an imbalanced story so as to make it balanced (even though no contradictory information was presented) and only one was a predicted reconciling error in a contradictory ancillary information

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condition (29 of the 39 constructive error scores greater than three in the cognitive interaction condition were of the predicted reconciling contradictory ancillary information type, and all of the error scores greater than three in cognitive interaction-contradictory conditions were reconciling rather than reinforcing).

Finally, it should be noted that confidence in correct asp of recall was approximately the same for those who did not make constructive errors (means c= 7.86, 7.23, and 6.92 for the two day, three week, and six week delay intervals, respectively) as it was for those who did (see Table 6). For the cognitive interaction conditions other than "contradictory," there were six subjects with constructive error scores greater than three for whom average confidence in correct aspects minus confidence in constructive errors was positive and four such subjects for whom the difference was negative, suggesting indifferentiability of constructive errors from correct aspects for these conditions.

Level of Recall

Since the experimental hypotheses did not involve the quantity recalled, a sophisticated protocol analysis for these purposes was not performed. However, on the basis of an "idea units" sub-division, it was found that less of the story (not including the part represented by the structural balance triads of Figure 1) was recalled with increasing intervals of delay, slightly (but nonsignificantly) more of imbalanced than balanced stories was recalled, and there were no other significant differences or interactions for any other conditions. Furthermore, for those subjects whose constructive error scores were greater than three (absolute

values), amount recalled was approximately equal to the amount recalled
by subjects not making constructive errors (comparing within the same level
of delay).

General Discussion

In Reconstructive Theory the nature of the proposed cognitive struc-
tures necessitates, under certain conditions, that the act of remembering
involves inferentially determining the past state of those structures on
the basis of their present states. Recall can be correct when the past
and present schematic states have a relation such that the personal rules
for inference are appropriate, which usually requires some kind of "con-
sistency" between the states. Recall may be erroneous when the rules for
inference are, unbeknownst to the rememberer, inappropriate (usually in
cases of schematic states which have changed so as to become "inconsis-
tent"). When relevant schemata are altered in such a way that their states
at recall are inconsistent with some known residues of their states at
comprehension (e.g., details from the stories), the process of inferential
reconstruction will assume worldly orderliness and reconcile the inconsis-
tency. Such reconciliation will lead to substantial error resulting from
processes operative at recall. Conscious forgetting, "I don't remember,"
can occur when the rememberer has sufficient knowledge in present schemata
to allow awareness that his/her personal inference rules will not allow
satisfactory reconstruction (usually when information in present schemata
indicates altered schematic states, contains the knowledge that the past
states evolved into the present states in some way contradictory to that

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on which the inference rules are based, and no appropriate new inference rule is available). The same processes underly correct recall, erroneous recall, and "forgetting" according to Reconstructive Theory. These processes are elaborated in the SOS Model below.

All of the results of the present experiment conclusively supported the predictions of Reconstructive Theory. When cognitive interaction was induced, a priori specifiable substantial errors of a reconciling type were evident. These errors occurred mainly when ancillary information was presented contradicting expectations based on the interaction of information from the story and prior knowledge regarding interpersonal relations (but not contradicting any story elements). These errors were neither the retrieved outcomes of inferential processing at comprehension (e.g., Frederiksen, 1975a,b) nor conscious fabrications to fill gaps in memory (e.g., Gauld & Stephenson, 1967). Evidence against the former includes the facts that the set of predicted constructive errors were not legitimate inferences based on the text alone (and do not occur in the "none" and "consistent" conditions) and that the predicted constructive errors were considerably less prevalent for short than longer recall delay. That they are not guesses seems clearly demonstrated by the finding that subjects tended to be more confident, at three and six week delayed recall, that the predicted reconciling constructive errors were actually present in the original story than they were confident regarding elements of their recall which really were in the original story. Also, the level of recall for those making and not making constructive errors was the same (Frederiksen's criterion, 1975a,b). The errors are also not the result of demand

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characteristics due to the initial cognitive-interaction cover story. At recall, it was made clear to the subjects that the experimenter really was only interested in memory, that they should recall only what was in the story written on the bright yellow piece of paper, and that their opinions, impressions, reactions, etc. should be excluded.

It was contended that in conventional memory experiments various factors (e.g., the demand characteristics of the situation, the nature of typical materials, and the isolated context in which the discourses are presented) have the effect of minimizing the interaction with pre-existing cognitive structures (to the amount necessary for a plausible and consistent semantic representation) and minimizing the likelihood of subsequent schema modification. Since occurrences of these two factors are necessary prerequisites for reconstructive errors, it was argued that such errors as were found under the "cognitive-interaction" condition should not be present in the recalls of subjects under conditions of a conventional memory experiment. This hypothesis was also clearly confirmed. The results indicated that the TBR discourse did maintain a "particular identity immune from the assimilative effects of prior knowledge or subsequently encountered related information." However, as was demonstrated earlier, accuracy in recall under these conditions is consistent with Reconstructive Theory.

It should also be noted that only an infinitesimal proportion of the context effects (which produce the greater interaction with cognitive structures and schematic modification which lead to reconstructive errors) that are likely to be relevant in language processing and recall in everyday life were operative, even in the "cognitive interaction-contradictory"

condition. Thus, the extent of reconstructive error in the present experiment can still be expected to significantly underestimate that which occurs in everyday life. The utility of conventional memory for connected discourse experiments is therefore called into question. The advantages of increased control should be sought only when results lead to conclusions which differ only in degree from conclusions which would be derived from more natural contexts. However, as the results of the present study indicate, the view of memorial functioning derived from conventional experiments is a _qualitative_ distortion of that found with a minimal simulation of normally occurring contingencies.

An Interpretation of Previous Research Using the Orientation of Reconstructive Theory

A consistent interpretation of diverse results in the memory area is possible relying simply on the notion of differential interaction with cognitive structures and some of the other precepts of Reconstructive Theory.

The simplest matter is accounting for the data supporting abstractive-trace retrieval approaches to recall of connected discourse--i.e., all discourse memory studies with the exception of Bartlett. Since a comprehensive account of these results based on Reconstructive Theory has already been presented, presentation of the arguments here would be superfluous.

Bartlett (1932) found substantial gross error in recall even though the level of cognitive interaction induced by the instructions would not be expected to be greater than for the other discourse memory experiments

(contrary to popular belief; Bartlett did use conventional memory instruc-
tions, see p. 66). The explanation is that the stories Bartlett used were
strange to his subjects and in many places illogical or incomprehensible
to them. The result is that a greater degree of interaction with cognitive
structures was necessary merely to achieve a minimum plausible and consis-
tent semantic reading (i.e., to minimally understand what the stories were
about). Hence the increase in constructive errors.

Bransford and Franks' (1971) finding in a conventional memory experi-
ment that holistic ideas which were never presented are recognized with
greater confidence than parts of the ideas actually presented is possible
with only minimal interaction with cognitive structures. Given the high
level of redundancy of the materials at the semantic level (the same ideas
occurring in different combinations), minimum effort after meaning would
lead to identical semantic representations. It is consistent with Recon-
structive Theory that these identical representations should not be stored
independently each time they occur in another combination.

The tendency to differentiate to-be-remembered stimulus materials
from other knowledge in laboratory memory experiments helps to explain the
findings in verbal learning regarding extra-experimental interference
(Underwood & Postman, 1963) and encoding specificity (Tulving & Thomson,
1973). In experiments with isolated verbal materials there is not even a
necessity for minimal schematic interaction since the "aboutness" of the
materials need not be decided. Hence a conclusion like that of Slamecka
(1966), that experimenter-provided associations in lists are differentiated
from pre-experimental associations and that the latter are not unlearned

due to interference from list associations, is consistent with the orientation in the present research. Tulving and Thomson (1973) concluded that information about presented word lists are stored in a location distinct from the normal associative structure, also correspondent with Reconstructive Theory.

The implications that differentiation of test materials from knowledge structures has for those working in the area of "semantic memory" should be clear. For example, consider the methodology which is the basis for Anderson and Bower's (1973) Human Associative Memory model of sentence recall. After presenting a list of sentences to the subject, he or she is asked whether a certain sentence (e.g., "The hippie touched the debutante in the park.") was part of the presented list. If the subject had not really seen a hippie touching a debutante in the park, but had seen the sentence, the appropriate response would be positive. If a subject did happen to have seen a hippie touching a debutante in the park, but that sentence was not on the presented list, the correct response would have to be negative. In other words, what is tested has nothing to do with what the subject knows. The subject must disregard his knowledge since it may conflict with the arbitrary sentences presented, and the latter determine what is a correct response. This obviously has nothing to do with "semantic" memory in any of the senses in which that term is meaningfully employed.

A Preliminary Sketch of a Process Model of Reconstructive Memory (the SOS Model)

Substantial preliminary work on a model of reconstructive memory has been completed. The flow chart in Figure 2 is a sketch of the model as it would specifically apply in the case of subjects in the "cognitive interaction--imbalanced and married (contradictory)" condition of the present experiment. Many details are omitted, as well as explication of some assumptions, algorithms for generating context-dependent SOSs for specific situations, the role of conscious "left-to-be-derived" markers, and other issues. The presentation here is intended solely as an illustration. For a more general and complete account of the model in its current state, see Spiro (in press).

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Insert Figure 2 about here
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The building block of the model is the "State of Schema" (SOS). SOS is a representation of a sub-set of the information hypothes.zed to be stored in a schema (or a set of related schemata). The information can be, among other things, specific details from a story, general impressions or summary statements (e.g., expectations regarding state of balance of outcomes), general types of events that have occurred in prototypal situations, and rules for inferential reconstruction. It should be noted that the form of molecular representation (e.g., propositional, graph-theoretic, etc.) is irrelevant at this time. In what follows, only paths leading to reconstructive errors will be described at first.

Figure 2 looks at SOS(S) (the state of the schema for the imbalanced story) after the story has been comprehended and some time has passed. SOS(S) is by now assimilated into the schema (schemata) relevant to events (rather than rules) regarding interpersonal relations in general [SOS(IR_G-E)], giving SOS(S) at time 1 [SOS(S_1)]: SOS(S) $\Rightarrow$ SOS(IR_G-E) = {SOS(S)/ [SOS(IR_G-E)]} = SOS(S_1). The information that might be stored in SOS(S_1) includes the following:

(1) negative outcome

(2) important issue: having children (weighted)

    a) disagreement (weighted)

    b) Bob does not want children

(3) other facts and details from the story (e.g., the fact that Bob and Margie are engaged).

The issue "having children" in the context "engaged" is assigned a weight by referring to the "rules" component of SOS(IR_G), i.e., SOS(IR_G-R), probably in combination with an actuarial consultation of SOS(IR_G-E) (to determine what most engaged couples have said and done vis á vis the issue). The rules might include:

R_1: In the context "to-be-married," assign the weight a (for most people, some high value) if there is disagreement on the issue "having children."

R_2: Outcome values [negative for this example] are more important than states regarding issues.

R_3: Reduce $\underline{a}$ by some constant (to $\underline{a}'$) if the state of the

issue is negative (i.e., disagreement) and the outcome

is positive [i.e., the disagreement is less important

if things work out all right; since the outcome is nega-

tive in this story, the "importance of the disagreement"

weight stays $\underline{a}$].

Rule 3 is a consequence of Rule 2. The importance weight assigned to the

disagreement about having children will subsequently help determine what

kind of error is likely to occur in recall.   Indi-

vidual differences are probably quite large in the determination of $\underline{a}$

(as they probably are in assigning weights and criterion values throughout

the model).

The extent of disagreement [2a in $SOS(S_1)$] is also assigned a weight

($\underline{b}$) based primarily on the story, but likely also affected by the importance

weight ($\underline{a}$). Disagreement that is considered less important is probably

also perceived as being of lesser degree (i.e., the disagreers are not as

far apart).

In 2b of $SOS(S_1)$, the valence of only one relation of the disagree-

ment (Bob--"having children") is assumed to be stored, since the valence of

the Margie--"having children" relation is derivable on the basis of 2a and

2b. Whether derivable information is stored, and which elements are left

to be derived are also subject to individual differences, probably.

Assume now that the contradictory ancillary information ("they did

get married") has been received and some time has passed. At time 2, SOS(S)

will now contain the information in #3, $SOS(S_2)$. The outcome, (1) in

$SOS(S_1)$, is changed to positive.

The "importance of the disagreement" weight (a), and the "extent of disagreement" weight (b) are combined to form a composite value, $c[c = f(a,b)]$. $SOS(IR_G-R)$ is then referred to for determination of a threshold value z, which is the value of c necessary to conclude that the disagreement must have been dissolved for the outcome "got married" to have occurred (in the absence of other information). High values of z will be generated when individuals think agreement about having children is essential to agreement about "getting married," and low values of z will be generated when it is considered nonessential. If $c < z$, it is inferred that they must no longer disagree, and 2a is changed in $SOS(S_2)$ from "disagree" to "agree." If $c > z$, 2a in $SOS(S_2)$ remains "disagreed," but the weights of "importance of the disagreement" and "extent of the disagreement (a and b, respectively) are reduced (to a' and b') according to Rules R_2 and R_3 from $SOS(IR_G-R)$, since the outcome is now positive.

More time passes, and recall is attempted at t_3. $SOS(S_3)$ is the same as $SOS(S_2)$, except assimilation with $SOS(IR_G-E)$, is increased. I.e., the boundaries between $SOS(S_2)$ and $SOS(IR_G-E)$, the latter being in interactive relation with $SOS(IR_G-R)$, are less clearly defined. Reconstruction of events involving interpersonal relations relies first on the following rule from $SOS(IR_G-R)$:

R_4: Events must be consistent with outcomes (though not necessarily vice versa), particularly when outcome information is more chronologically recent (as it is here), unless there are reasons for the inconsistency.

The outcome information of (1) in $SOS(S_3)$ is then compared with detail information, (2) and (3), of $SOS(S_3)$. If 2a has been changed to "agree" ($\underline{c} < \underline{z}$ at t_2), consistency will be found. Recall will then be a straightforward output based on $SOS(S_3)$. A likely constructive error is that Margie originally did not want children (if 2b is only "Bob didn't want children," with the Margie--"having children" relation left to be derived). Another likely constructive error is that Bob or Margie had a change of mind about the issue (if both of the relations with "having children" remain in stored form in 2b; i.e. they were not automatically changed when 2a was changed--the subject might think something like "they used to disagree and now I know they agree, so someone had a change of mind").

If inconsistency is found (i.e., if 2a is still "disagree"), inferential reconstruction proceeds as follows. Previously encountered types of situations involving engaged or married couples are generated from $SOS(IR_G-E)$ in a general (unlabeled as to participants) form. Generation is determined by similarities to the details remaining in (2) and (3) of $SOS(S_2)$ and by some index of commonness of occurrence (a function of the number of labeled instances of the general type). Each generated type of situation is analyzed for its reconciling power for the $(R_4$-based) inconsistency of $SOS(S_3)$. The reconciling power is then assigned a value ($\underline{d}$), based on calculations in $SOS(IR_G-R)$. The value of $\underline{d}$ is then compared to a criterion value ($\underline{Y}$). The latter value is a constant plus a variable which is a function of the experiment's accuracy set (Brockway, Chmielewski, & Cofer, 1974). When a premium is placed on accuracy, $\underline{Y}$ will be larger (better reconciliation is required). If $\underline{d} > \underline{Y}$, the reconciliation is clear

(i.e., easily derivable). Any time the reconciliation is so easily deriv-
able from (and totally consistent with) stored information, the rememberer
simply assumes that another case of not attending to easily derivable
information has occurred. The rememberer will then insert the reconciling
generated information in recall. An example of how this might work is by
generating a common situation where many couples had areas of disagreement
with approximately the same importance and extent weights as the (now
lowered) $\underline{a}'$ and $\underline{b}'$ of $SOS(S_3)$. For these couples, their areas of agreement
outweighed the area of disagreement and allowed a happy married life. The
constructive recall error that would result might be something like "they
disagreed, but their positions were not too far apart and the issue was
not that important to them anyway, so other areas (of agreement) were more
important and had a greater effect on their plans and life together."

If for the first generated general situation $\underline{d} < \underline{Y}$, another situation
is generated and the new value of $\underline{d}$ is compared to a slightly increased
value of $\underline{Y}$ (due to its less typical nature and fewer elements in common
with stored details of the story). This process continues until a $\underline{d} > \underline{Y}$
situation is found or until $\underline{w}$ generations are made. The value of $\underline{w}$ also
depends on the accuracy set of the experiment. If the importance of accuracy
is stressed, $\underline{w}$ will be a small value. After $\underline{w}$ unsuccessful generations,
the rememberer will probably indicate that he or she has "forgotten." The
type of process outlined above is assumed to be a common one, and therefore
not a conscious indication to the subject of likely error.

What about recall without reconstructive errors? This will tend to
occur under the following conditions (among others): $SOS(S) \not\Rightarrow SOS(IR_G)$

(lack of assimilation and, therefore, lack of a base for subsequent genera-
tion at recall);not relating contradictory outcome information to $SOS(S_1)$
or not having contradictory information to relate (leaving nothing to re-
concile at t_3); under "memory" instructions (where both of the former two
reasons are operative); under cognitive interaction instructions with "none"
or consistent ancillary information (since the second reason is operative).
Also, a "left-to-be-derived" marker may be stored (see Spiro, in press).
It seems likely that the marker is easily lost over time (possibly because
it is extraneous and not directly related to the topical content of schemata
it is a part of). Accurate recall without reconstructive error (as was
more likely for the "cognitive interaction-contradictory" condition at the
two-day delay interval) may then occur when relevant "left to be derived"
markers are still generally accessible, and, therefore, absence of such a
marker is not assumed by default to indicate that one did exist even if
criterion values are surpassed; or presence of some markers may increase
$\underline{Y}$.

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[1]Although the research of Kintsch and his associates has emphasized

the non-reconstructive aspects of discourse memory, the possibility of

reconstruction has been acknowledged (e.g., Kintsch, et al., 1975).

[2]Loftus and Palmer (1974) did demonstrate effects of schema modifica-

tion subsequent to presentation. Their study, although complementary to

the present one, is not directly relevant. The former research involved

TBR visual scenes. The representation was then manipulated verbally. The

erroneous recall results can be interpretable as demonstrating the dominance

of verbal codes in guiding recall of visual events. Alternatively, the

verbal information can be considered by subjects to be a correction of

their existing representation, an interpretation not possible in the pre-

sent study.

Table 1

Predicted Reconstructive Errors

Bob(P)   Margie(O)

Having Children(X)

Error types	Imbalancing errors (-)	Balancing errors (+)
P-X, O-X	divergence in original valence (e.g., "Bob wanted to have children and Margie didn't," for the balanced story) or in valence at a later time (e.g., "Bob later changed his mind and fought with Margie about having children," for the balanced story)	convergence in valence with respect to original or subsequent attitude (e.g., "Margie agreed" [or "later changed her mind and agreed"] with Bob about not having children," for the imbalanced story) or intentions (e.g., "Margie decided she would try to have children soon," for the balanced story)
	change in the feasibility of X toward divergence (e.g., "for some reason they became aware that it was impossible for them to have children, and this fact made them very unhappy")	change in the feasibility of X toward convergence (e.g., "the problem was resolved when they found out that Margie couldn't have children anyway")
		divergence in the relative importance of the relations to X (e.g., "they disagreed, but Bob felt very strongly about the issue and for Margie it was not so important") or a lessening in the importance of X for both of them (e.g., "it was not a very important matter to either of them and was therefore easily resolvable")

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Table 1 (continued)

Error types	Imbalancing errors (-)	Balancing errors (+)
P-O relative to P-X, O-X		increase in weight (e.g., "their feelings for each other were much more important than how they felt about any issue")
P-O	change in the negative direction, either in the degree of affect (e.g., "Bob began to realize he didn't like Margie as much as he thought he did") or the degree of unity (e.g., "Bob and Margie began to see less and less of each other")	change in the positive direction (e.g., "Bob's love for Margie grew continually at a rapid rate")
Other situations	importation of an imbalanced situation, specific or general (e.g., "they had many other serious areas of disagreement")	importation of a balanced situation, specific or general (e.g., "they had the same attitude on almost everything")
Overriding principle	e.g., "the prospect of marriage is not considered as ideal as it once was"	e.g., "everybody argues and it doesn't mean anything"

Table 2

Mean Constructive Error Scores as a Function of Type of

Delay, Type of Story, and Type of Ancillary Infor

			Delay			
		2 days			3 weeks	
					Ancillary inform	
Instruction	Story	None	Consistent	Contra-dictory	None	Consistent
Cognitive interaction	Balanced	0.1	-0.2	-1.4	0.0	0.9
	Imbalanced	0.2	-0.4	1.0	0.5	-0.3
Memory	Balanced	0.3	0.6	-0.2	0.2	0.2
	Imbalanced	0.1	0.4	-0.2	0.6	0.1

Note:--Scores vary from -5 to +5.

69

Table 3

Mean Constructive Error Scores for the "Cognitive Interaction"

Condition as a Function of Type of Story and

Type of Ancillary Information

		Type of ancillary information		
		None	Consistent	Contradictory
Type of story	Balanced	.13	.47	-2.57
	Imbalanced	.43	-.16	2.47

Table 4

Means for the Absolute Values of Constructive Error Scores as a Function of Type of Instructions,

Delay, Type of Story, and Type of Ancillary Information

		Delay								
		2 days			3 weeks			6 weeks		
		Ancillary information								
Instruction	Story	None	Consistent	Contra-dictory	None	Consistent	Contra-dictory	None	Consistent	Contra-dictory
Cognitive interaction	Balanced	0.5	0.4	1.4	0.8	1.3	3.1	1.1	1.3	3.6
	Imbalanced	0.6	0.8	1.4	1.5	0.7	3.5	1.6	1.4	2.9
Memory	Balanced	0.3	0.8	0.4	0.4	1.0	0.8	0.8	1.1	0.5
	Imbalanced	0.3	0.4	0.4	1.4	0.7	1.0	0.4	0.8	1.1

Note:--Scores vary from zero to five.

Table 5

Number of Subjects with Absolute Values of Constructive Error Scores Greater than Three as a Function of

Type of Instructions, Delay, Type of Story, and Type of Ancillary Information

Instruction	Story	Delay								
		2 days			3 weeks			6 weeks		
		Ancillary information								
		None	Consistent	Contra-dictory	None	Consistent	Contra-dictory	None	Consistent	Contra-dictory
Cognitive interaction	Balanced	0	0	2	0	2	6	1	2	7
	Imbalanced	0	0	2	2	0	7	2	1	5
Memory	Balanced	0	1	0	0	0	0	1	1	0
	Imbalanced	0	0	0	1	0	1	0	0	2

Table 6

Average Rated Confidence in Correct Aspects of Recall Relative to Rated Confidence in

Constructive Errors with Scores of Absolute Value Greater than Three

	Delay					
	2 days		3 weeks		6 weeks	
	Type of recall					
Condition	Correct	Constructive error	Correct	Constructive error	Correct	Constructive error
Cognitive interaction-contradictory	8.08	(4) 7.58	6.80	(13) 7.39	6.57	(12) 7.42
Cognitive interaction-"none" or consistent	----	(0) ----	7.18	(4) 6.63	6.42	(6) 6.17

| | All delay intervals | |
	Correct	Constructive error
Memory-contradictory	7.50	(3) 4.67
Memory-"none" or consistent	7.93	(4) 3.00
Memory-all ancillary conditions	7.74	(7) 3.71

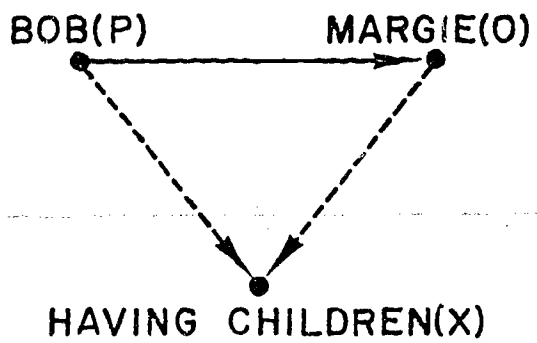Note:--Numbers in parentheses indicate the number of subjects on which the means are based.

Figure Captions

Figure 1. Structural balance representations of an aspect of the
balanced and imbalanced stories.

Figure 2. An SOS Model of inferential reconstruction. (See text
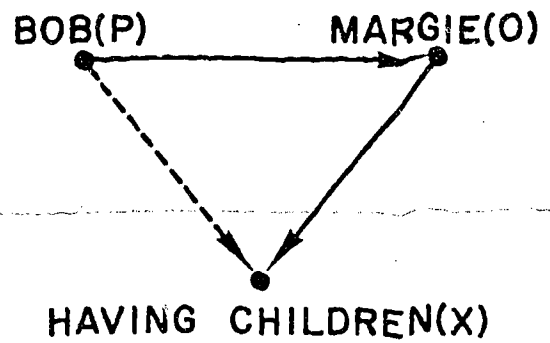for explication.)

Ia
Ib

BALANCED
IMBALANCED

BOB(P)   MARGIE(O)   BOB(P)   MARGIE(O)

HAVING CHILDREN(X)   HAVING CHILDREN(X)

———— POSITIVE RELATION
------ NEGATIVE RELATION

---------> TIME ----------->

t_1 t_2 t_3(recall)

8

$$\frac{SOS(S_2)}{}$$

2a changed to "agree"
[otherwise the same
as earlier $SOS(S_2)$]

9 $\frac{SOS(S_3)}{}$
Same as $SOS(S_2)$
except assimilation
with $SIS(IR_G - E)$
is increased

10 $\frac{SOS(IR_G - R)}{}$
R_4 is determined
to be appropriate
for reconstruc-
tion

2

$$\frac{SOS(IR_G - R)}{Rules \; R_1 - R_3}$$

used to determine
a and b as well as aspects
of SOS (S_1) composition

6 $\frac{SOS(S_2)}{}$
Values of a & b reduced
to a' & b'
[otherwise the same as
earlier $SOS(S_2)$]

12 Using $SOS(S_3)$,
Generate (if
necessary), &
output recall

11
events
consistent
with out-
comes?

YES

Story has been
comprehended
some time has
elapsed

1
$\{SOS(S)/[SOS(IR_G - E]\}$

$= \frac{SOS(S_1)}{}$

(1) negative outcome
(2) important issue =
    having children
    (weight = a)
   a) disagreement
      (weight = b)
   b) Bob does not
      want children
(3) other facts and details
    from story

7 $\frac{SOS(IR_G - R)}{}$
Rules R_2 & R_3 used to
adjust values of a & b

END

NO

$I = 0$

13 $SOS(IR_G - R)$
Check accuracy set
to determine w and
$Y(I)$ values

Ancillary
information
presented

3 $\frac{SOS(S_2)}{}$

(1) changed to
"positive out-
come"
[otherwise $SOS(S_2)$
$= SOS(S_1)$ with
assimilation into
$SOS(IR_G - E)$ in-
creased];
c determined by
a & b

14 $\frac{SOS(IR_G - E)}{}$
Generate situational
type

15 $\frac{SOS(IR_G - R)}{}$
Determine reconcil-
ing power of gene-
rated type: $d(I)$

END

17 Output recall
based on in-
formation from
generated type
in conjunction
with $SOS(S_3)$

4 $\frac{SOS(IR_G - R)}{}$
determine Z

16
$d(I) > Y(I)$
?

YES

NO

$I = I + 1$

END

YES   **5**   NO
$c > Z?$

18
NO $I > w$ YES
?

19 "I forget"

80

81

ERIC