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The Effect of Elaboration on Memory: Self-Generated Elaboration vs Experimenter-Provided Elaboration

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THE EFFECT OF ELABORATION ON MEMORY: SELF-GENERATED

ELABORATION VS EXPERIMENTER-PROVIDED ELABORATION

by

Sung-il Kim

A thesis submitted in partial fulfillmemt
of the requirements for the degree

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Sung-il Kim

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ABSTRACT

The Effect of Elaboration on Memory: Self-Generated

Elaboration vs Experimenter-Provided Elaboration

by

Sung-il Kim, Master of Science

Utah State University, 1988

Major Professor: Dr. Kenneth A. Kiewra
Department: Psychology

The purpose of this study was to investigate the
effect of elaborations on memory. Two types of
elaborations (self-generated elaboration and experimenter-
provided elaboration) were examined. The experiment
consisted of three phases (incidental learning phase,
immediate test phase, and delayed test phase). In the
incidental learning phase, subjects were asked to make
plausibility judgments about 28 fictitious episodes. Half
of these were about well-known individuals and the other
half were about unknown individuals. Each name (either
well-known or unknown) was presented with either two
supportive facts or without the supportive facts. During
the immediate test phase, subjects were given unexpected
memory tests. One week later, unexpected delayed memory
tests were administered. Results from both immediate and

delayed tests indicated that self-generated elaborations based on prior knowledge subjects had about well-known individuals enhanced the retention of target information, whereas experimenter-provided elaborations involving the presence of supportive facts only benefited memory performance when the subjects had prior knowledge about the individuals. Experimenter-provided elaborations were also effective to the extent that the encoding context was reinstated at testing.

(57 pages)

CHAPTER I

INTRODUCTION

The effectiveness of learning is obviously directly related to the learners' ability to remember learning material. The importance of memory is so patently clear that understanding of factors that might increase or decrease memory of learning material is central to efforts to improve learning.

Much research aimed at improving the learning and retention of verbal information has been conducted by memory theorists and psychologists. Of the memory variables investigated, one that has been the topic of considerable investigation is the effect of elaborations on memory (e.g., Anderson & Reder, 1979; Bransford,1979; Mandl, Schnotz, & Tergan, 1984; Reder, 1979; Weinstein, 1978)

Elaborations, as defined by memory theorists, are the process of adding any information that supports, clarifies or further specifies the information to be learned. The addition can be a logical inference, a continuation, an example, a detail or anything else that serves to embellish the target information.

Several studies have shown that elaboration enhances learning (Craik & Tulving, 1975; Fisher & Craik, 1980; Stein, Littlefield, Bransford, & Persampieri, 1984).

Other studies (Reder & Anderson, 1982; Bradshaw & Anderson, 1982; Walker, 1986), however, have found that elaboration is not useful or, in some cases, actually interferes with the retention of the target information. Such conflicting findings emphasize the fact that there is not as yet enough known about the impact of elaboration on memory.

Therefore, there is a great need for exploring the conditions under which effective elaborations are more likely to be produced. Furthermore, it is also important to distinguish among different types of elaborations clearly and to investigate the effect of each type of elaboration independently.

CHAPTER II

REVIEW OF LITERATURE

Elaboration can arise from two distinct sources. First, the learning material itself can contain elaborations of the target information, and second, the learner can generate elaborations independently. These two types of elaborations are termed experimenter-provided elaborations and self-generated elaborations, respectively (Stein & Bransford, 1979; Rohwer & Ammon, 1971).

Many theorists have argued that the experimenter-provided elaboration facilitates retention of the to-be-learned material. This concept of experimenter-provided elaboration has become the major theoretical explanation for differences in memory performance. Craik and Tulving (1975), for example, performed a series of experiments that indicated positive effects for degree of elaboration. They argued that greater amounts of experimenter-provided elaboration facilitate retention when the elaborations are semantically congruous with the target information. For example, Craik and Tulving (1975, experiment 7) embedded words in sentence frames that were varied with respect to three levels of sentence complexity, ranging from simple (e.g., He dropped the WATCH) to complex (e.g., The old man hobbled across the room and picked up the valuable WATCH from the mahogany table). It was found that the embedded

target words (capitalized in the above example) were
recalled to a progressively greater degree from simple to
complex contexts. Fisher (1981), and Fisher and Craik
(1980) also reported that elaborations that are more
associatively related to target information (e.g., "He
washed in the bath") can result in better retention than
those that are less associatively related (e.g., "He took
a bath").

Another series of experiments supporting the
beneficial effects of experimenter-provided elaborations
was conducted by Stein and his colleagues (e.g., Stein &
Bransford, 1979; Stein, Bransford, Franks, Owings, Vye, &
McGraw, 1982; Stein et al, 1984). Stein and Bransford
(1979), for example, studied subjects' recall of
adjectives cued by the sentence frames within which they
had been presented. The elaborations in this case were
additional phrases or clauses that increased the
importance of the adjective relative to the plausibility
of the sentence. For example, given a statement such as
"The tall man bought the crackers", relevant additional
information such as "The tall man bought the crackers that
were on the top shelf" improved cued recall performance
because the additional information about the crackers
(that were on the top shelf) is especially relevant to a
tall person. But irrelevant additional information such
as "The tall man bought the crackers that were on sale"

was clearly much less effective in reducing the arbitrariness of the relationship between "tall" and "buying the crackers"; consequently, irrelevant additional information did not improve the cued recall performance.

Alternatively, there is ample research supporting the idea that self-generated elaborations facilitate retention. This support comes from experiments involving subjects who had additional knowledge that allowed them to generate more elaborations than other subjects generated. Some experiments contrasted experts who had a substantial amount of domain-relevant knowledge (e.g., knowledge about baseball) with nonexperts who had little relevant knowledge (e.g., Arkes & Freedman, 1984; Chiesi, Spilich, & Voss, 1979). The results indicated that experts displayed superior recognition memory performance relative to that of the nonexperts.

In other experiments, subjects were provided with additional information that was relevant to a passage to be read (Bower, Black, & Turner, 1979; Brown, Smiley, Day, Townsend, & Lawton, 1977; Sulin & Dooling, 1974). In these cases, subjects who had access to more relevant knowledge were more likely to falsely recognize not-presented, but relevant information and were also more likely to make plausible inferences at recall based on this additional information. Bower et al. (1979), for instance, had subjects read short stories about common

situations such as visiting a doctor. All of the familiar stories were considered to be a part of everyone's prior knowledge and therefore likely to produce self-generated elaborations. When subjects in the Bower et al. study (1979) recalled the stories, about 20 percent of what was recalled were self-generated elaborations rather than information explicitly stated in the stories. For example, the "doctor" story did not state that "John entered the doctor's office", nor did it state that "the nurse checked John's blood pressure and weight". However, some subjects recorded these ideas in their recall protocols. These data suggest that subjects elaborated on the stories as they were reading them. They used their prior knowledge of what typically happens in everyday events to generate elaborations.

The most plausible explanation for the beneficial effects of both types of elaborations was proposed by Anderson and his associates (Anderson, 1983a, 1983b; Anderson & Reder, 1979; Bradshaw & Anderson, 1982), who suggested that elaborated memory traces are more easily recalled for two reasons. First, the presence of an elaborated memory trace results in more network redundancy, which involves forming connections between the target information and related knowledge. Once these connections are formed, the existing memory trace contains not only the given information, but also other related

information. When the target information is stored with related information, retrieval can be facilitated. For example, a particular retrieval cue may fail to activate the to-be-recalled information. However, that cue may activate previously related information, which in turn activates the target information. The effectiveness of this process, of course, depends on the degree of overlap in meaning between the elaboration and the to-be-recalled information.

The second explanation of the beneficial effect of elaboration is based on inferential redundancy. This refers to the fact that the subject may be able to infer the material studied from remaining elaborations. The availability of additional information within the memory trace enhances the individual's ability to retrieve the elaborated material and therefore to infer or reconstruct the to-be-recalled information.

An important point to note about Anderson's (1983a, 1983b) formulation is the structure of the memory trace that results from the elaboration. This structure must include a high degree of interrelatedness between target information and additional information. This interrelatedness is necessary if the alternative pathways from the cue to the target proposition are to exist. The addition of random bits of information to target information may or may not provide the appropriate

interrelatedness. Anderson addresses this distinction by distinguishing between relevant and irrelevant fan. He refers to a relevant fan as information that results in extra propositions that provide additional pathways to the target proposition. An irrelevant fan, on the other hand, refers to information that results in extra propositions with pathways leading away from the target proposition. In summary, according to Anderson's (1983a, 1983b) model, when elaboration results in a memory trace with a high degree of interrelatedness between the target and the additional propositions (a relevant fan), recall performance is enhanced; when the degree of interrelatedness between the target fact and the additional proposition is low (an irrelevant fan), then recall is not facilitated.

Although there is strong support for elaboration theory, some recent research suggests that experimenter-provided elaboration does not necessarily facilitate retention, even if additional information is related to the target concept. Reder and Anderson (1980, 1982),for example, found that students who read fully elaborated chapters, taken verbatim from standard college textbooks, consistently performed worse than did students who read chapter summaries that were one fifth as long. The advantage for the summaries held up at a variety of retention intervals (ranging from 20 minutes to one year),

and for various tests of declarative memory, including forced-choice verification, short answer, and free recall (Allwood, Wikstrom, & Reder, 1982). The advantage for summaries was also found under a variety of study conditions. In the initial experiments, a fixed study time was imposed on subjects in both elaborated and summary conditions. However, Reder (1982) also found an advantage for summaries in a nonlaboratory setting, in which subjects studied the materials at home at their own pace. Reder and Anderson (1982), meanwhile, still found an advantage for chapter summaries over elaborated chapters when reading time was equated by presenting sentences for fixed time periods on a computer screen.

One shortcoming of these experiments (Reder & Anderson, 1980, 1982) is that the experimenters failed to control for the memory load because they used a between-subjects design. Therefore, some subjects had to study five times more material than did other subjects. Another problem was that the materials to be learned were thematically related to each other, which perhaps caused interference. Additional information about one topic may have interfered with the recall of other information about the same topic, rather than have served an elaborative function (e.g., Moeser, 1979; Smith, Adams, & Schorr, 1978).

Another factor that may contribute to the

effectiveness of elaboration is the degree of prior knowledge that the learner brings to the learning situation. Mandl et al. (1984), for example, found that elaborated texts facilitated recall and comprehension, but only when the reader was very knowledgeable about the topic area; otherwise, elaborated texts produced poorer performance than unelaborated ones.

The role of prior knowledge may have also been at the root of mixed findings by Bradshaw and Anderson (1982). Subjects not provided with relevant elaborations may have generated effective elaborations from prior knowledge and therefore performed at a level similar to those subjects provided with elaborations. More specifically, Bradshaw and Anderson compared subjects' recall of target sentences presented in one of three different contexts. The first context, called the single-sentence condition, presented a single fact (the target sentence) about a historically famous person. The second context, called the unelaborated condition, presented the target sentence in addition to two other sentences about that person. However, these latter two sentences were not specifically related to the information given in the single target sentence, except that all sentences contained information about the same person. The third context, the elaborated condition, presented the same target sentence about a famous person, but also provided two sentences that

allowed the reader to infer the specific information presented in the target sentence. The additional sentences either provided the cause or stated the consequences of the information contained in the target sentence. Thus Bradshaw and Anderson were testing whether inferential redundancy (the elaborated condition) would increase recall of the central target fact beyond that of the unelaborated or single-fact conditions. Using the names of the historical figures as cues, Bradshaw and Anderson obtained recall data indicating that the elaborated condition produced the highest level of recall for the target sentence. The unelaborated condition produced the lowest level of recall performance, with the single-sentence condition falling in between. There was, however, no significant difference between the elaborated and the single-sentence condition. When Walker (1986) replicated the experiment of Bradshaw and Anderson (1982), he also found no significant differences in recall performance between the elaborated and the single-sentence condition.

These findings (Bradshaw & Anderson, 1982; Walker, 1986) are inconsistent with Anderson's elaboration theory. According to Anderson's elaboration model (1983a, 1983b), the recall performance of subjects in the elaborated condition should have been greater than the performance of those in the single-sentence condition, because

elaboration provides network redundancy and inferential redundancy that are not produced by the single-sentence condition. Perhaps the findings of nonsignificance by Bradshaw and Anderson (1982) and by Walker (1986) can be explained by the distinction between the self-generated and the experimenter-provided elaboration discussed earlier. Because subjects in the single-sentence condition already had some prior knowledge about the famous historical figures before the experiment, they might have used their prior knowledge to elaborate upon the learning material, thereby creating multiple pathways to the target information. This self-generated elaboration based on prior knowledge may have raised their recall performance to the level of subjects in the elaborated condition, such that there was no recall difference between the two groups. One possible interpretation of this result is that the strong effect of self-generated elaboration might have masked the effect of experimenter-provided elaboration. In order to assess the pure effect of experimenter-provided elaboration, self-generated elaboration must be kept to a minimum among control group subjects.

One method for reducing self-generated elaboration is by using unknown names as well as well-known names in the experimental materials. If unknown names are used, then subjects will have no prior knowledge regarding the

learning material. Thus, the effect of self-generated elaboration should be minimal and the effects of experimenter-provided elaboration can be viewed more clearly. The present study attempted to manipulate the degree of self-generated elaboration by using both known and unknown names in the experimental materials.

CHAPTER III

METHOD

Subjects and Design

Twenty Utah State University undergraduates from an introductory psychology course, receiving course credit for their participation, were assigned to every cell of a 2 x 2 x 2 repeated measures design. The independent variables were (a) prior knowledge (well-known name, unknown name), (b) elaboration (supportive facts and target fact, target fact only), and (c) time of test (immediate, delayed). The dependent variables were recognition test scores, name-cued test scores, and context-matching recall test scores.

Materials and Apparatus

The materials for this experiment included acquisition materials and two post-tests.

There were four types of acquisition materials that varied on two dimensions: prior knowledge and elaboration. The acquisition materials were a set of fictitious episodes about each of 28 individuals. Half of these individuals were well-known figures (e.g., Abraham Lincoln). These well-known figures were chosen so that most subjects had prior knowledge about them and could identify them.[1] The names of the remaining 14 individuals

were common American names, with no famous referent, drawn
from a telephone directory (e.g., Sam Kelly). These common
names were chosen so that subjects had no prior knowledge
about them. In fact, it was shown that experimental
subjects did not have any prior knowledge about the
unknown names when they were asked to identify any
familiar names among the unknown names after the
experiment.

Each name (either well-known or unknown) was
presented under either an elaborated or unelaborated
condition. In the elaborated condition, a target fact and
two supportive facts about the well-known or unknown
individual were presented. The two supportive facts were
plausible reasons for the target fact such that the
relationships between the target fact and the supportive
facts were causal relations. The two supportive facts
were designed to be as unrelated to each other as possible
in order to provide two distinctive pathways to the target
fact.[2]

In the unelaborated condition, the same target fact
about the well-known or unknown individuals was presented
but without supportive facts. Thus, each target fact was
presented in four different ways: well-known/elaborated,
well-known/unelaborated, unknown/elaborated,
unknown/unelaborated. An example of a target fact
underlined in each of these four conditions appears in

Table 1 (see Appendix A for the complete set of experimental materials).

Table 1

Examples of Experimental Materials

Well-known/elaborated condition:

John Lennon watched all the football games on T.V.

John Lennon subscribed to magazines about football

John Lennon remembered almost all of the football players' names

Unknown/elaborated condition:

Gary Spencer watched all the football games on T.V.

Gary Spencer subscribed to magazines about football

Gary Spencer remembered almost all of the football players' names

Well-known/unelaborated condition:

John Lennon remembered almost all of the football players' names

Unknown/unelaborated condition:

Gary Spencer remembered almost all of the football players' names

---

The post-test materials included name-cued and context-matching recall tests and a recognition test. The name-cued recall test consisted of the names of all 28 individuals that had been presented during the learning phase. The context-matching recall test consisted of the names of the individuals plus the supportive facts about

each individuals. A sheet of blank paper was provided for subject responding. The recognition test consisted of 28 target facts and 28 foils. The foils were constructed by randomly mis-pairing previously presented names and target facts (e.g., Bill Cosby remembered almost all of the football players' names).

The apparatus for presenting the acquisition and test materials was an IBM personal computer. Both the acquisition and test materials were presented to each subject individually in random order. The computer also recorded and scored the recognition test responses.

Procedure

The experiment consisted of three phases: (a) incidental learning phase, (b) immediate test phase, and (c) delayed test phase.

In the incidental learning phase, the experimental instructions were first presented on the computer screen (see Appendix B for the complete experimental instructions). The instructions were presented in the form of a cover story and informed subjects that the purpose of the experiment was to obtain normative data about story comprehensibility. To do so, subjects were instructed to make a plausibility judgment about each presented episode by pressing one of three designated keys on the computer keyboard, indicating whether they found

each episode to be "plausible", "implausible", or "neutral". Subjects were also instructed that the last sentence of each episode would be underlined. In order to control the various learning strategies that might be used by subjects, the instructions did not specify that retention tests would be administrated about the stories for which judgments were made. Following instructions, subjects were presented with two practice episodes to get accustomed to using the designated computer keys. Next the experimental materials were presented. Each fact about an individual was presented, one at a time, on the middle of the screen for three seconds. After three seconds, the fact was automatically replaced by another fact. The two supportive facts were always presented before the target fact in elaborated conditions. The target fact was underlined so that the subject knew that all the facts about one individual had been given.

In order to reduce potential primacy and recency effects, 16 filler sentences about eight other individuals were also used. These were not actually part of the experimental materials. Half of the filler sentences was presented at the beginning of the incidental learning phase and the other half was presented at the end. These filler sentences were not used for retention tests. The order of presentation of the 28 episodes for each subject was randomly determined.

After subjects had read and made plausibility judgments about each of the 28 episodes, subjects were immediately given the unexpected name-cued recall test. The names of the 28 individuals from the 28 episodes appeared on the screen one at a time and subjects were instructed to write down whatever provided facts they could remember about each individual. Subjects were allowed to work at their own pace during the name-cued recall phase and were asked to press the space bar on the computer keyboard to receive the name of the next individual.

After completing the immediate name-cued recall test, subjects were given the immediate recognition test. For this test, the name of each of the 28 individuals was given along with a target fact that had been either presented previously with that individual (a "yes" response) or pertained to one of the other individuals (a "no" response). Subjects were asked to complete this phase at their own pace. At the end of the recognition test, subjects were asked to return at the same time one week later. They were told that they would participate in a similar experiment, but they were not given any information about the delayed test phase.

One week later subjects reconvened and participated in the delayed test phase. Subjects first took the name-cued recall test which was identical to the immediate

test. Next, they took the recognition test. This test presented the same foils from the immediate test, but presented them in a random order. Immediately after the delayed recognition test, subjects took a new test called the delayed context-matching recall test. In this test, the two supportive facts and the name from each episode were provided one after another on the computer screen. Subjects were asked to write down the target fact for each episode using the two supportive facts and the name as retrieval cues. Subjects were also instructed to complete this test at their own pace.

CHAPTER IV

RESULTS AND DISCUSSION

To determine the main and interactive statistical effects of prior knowledge (well-known name, unknown name), elaboration (supportive facts and target fact, target fact only), and the time of test (immediate, delayed), separate 2 x 2 x 2 ANOVAs were conducted on name-cued recall and recognition scores. Another separate 2 x 2 ANOVA was conducted on delayed context-matching recall scores only, in which the first factor was prior knowledge (well-known name, unknown name) and the second factor was elaboration (supportive facts and target fact, target fact only).[3]

Context-matching and name-cued recall tests were scored in the same manner. A response was scored correct and credited one point if the response reflected the general meaning of the original target fact. Protocols that contained errors in tense or that used synonyms were not marked incorrect as long as the verb and object of the target fact were maintained. The cued recall protocols were scored independently by two judges whose inter-rater reliability coefficient was .97.

Recognition Performance

The ANOVA for recognition scores revealed a

significant main effect for prior knowledge, F (1,133) = 156.77, MSe = 3.45, $p < .001$. This finding indicated that subjects correctly recognized more target facts about well-known individuals (M = 11.70) than target facts about unknown individuals (M = 8.03).

There was also a significant main effect for time of test, F (1,133) = 10.48, MSe = 3.45, $p < .005$. Subjects correctly recognized more target facts on the immediate test (M = 10.34) than on the 1-week delayed test (M = 9.43).

Although the main effect of elaboration was not significant ($p > .05$), the elaboration by prior knowledge interaction was significant, F (1,133) = 5.28, MSe = 3.45, $p < .05$. Fisher LSD tests ($p < .05$) indicated that subjects remembered more target facts about well-known individuals under elaborated conditions, but remembered more target facts about unknown individuals under unelaborated conditions. Table 2 presents the means and standard deviations for this interaction, and Figure 1 provides a visual description.

The other two-way interactions and the three-way interaction were not significant. Sixty-four percent of the variance in recognition scores was explained by the treatment variables (R^2 = .64). The complete summary table for the analysis of recognition scores appears in Table 3.

Table 2

Mean Number (and Mean Percentage) and Standard Deviation
of Correctly Recognized Target Facts over Immediate and
Delayed Tests

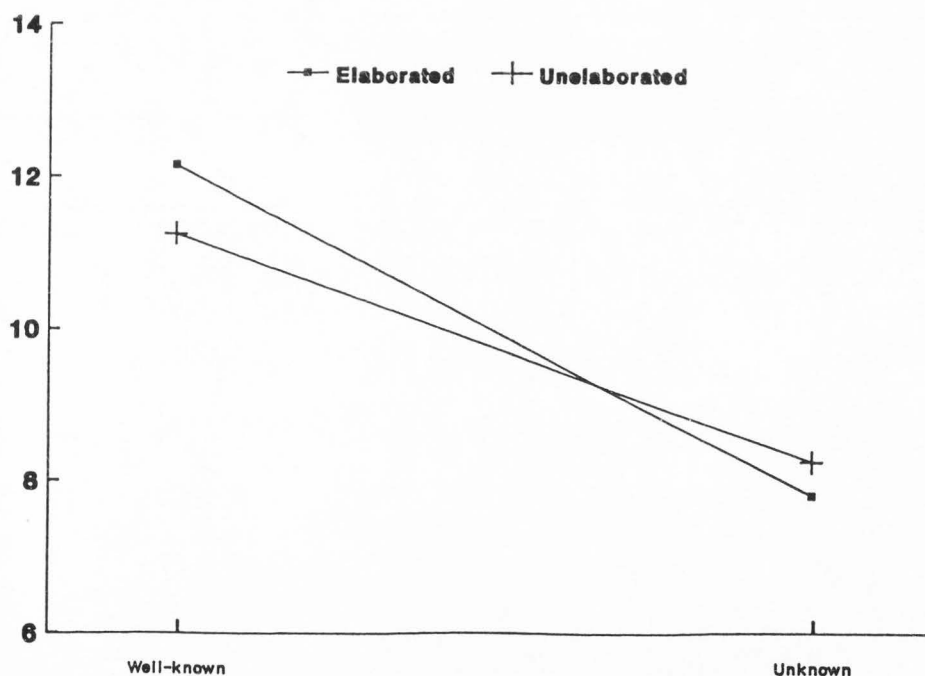| | Prior Knowledge | | | |
| | Well-known | | Unknown | |
Elaboration	Mean	SD	Mean	SD
Elaborated (n = 40)	12.15 (87%)	1.29	7.80 (56%)	2.15
Unelaborated (n = 40)	11.25 (80%)	2.79	8.25 (59%)	1.95

Figure 1. Number of Correctly Recognized Target Facts
among the Four Treatment Groups over Immediate and
Delayed Tests (Maximum Number = 14).

Table 3

Analysis of Variance Summary Table for Recognition Scores

Source of Variation	SS	df	MS	F	p
Subjects	213.98	19	11.26	3.27	.001
Elaboration (E)	2.03	1	2.03	0.59	.445
Prior Knowledge (PK)	540.23	1	540.23	156.77	.001
Time (T)	36.10	1	36.10	10.48	.002
E x PK	18.23	1	18.23	5.29	.023
E x T	1.60	1	1.60	0.46	.497
PK x T	0.10	1	0.10	0.03	.865
E x PK x T	0.40	1	0.40	0.12	.734
Residual	458.33	133	3.45		

Name-Cued Recall Performance

The ANOVA for name-cued recall scores revealed a significant main effect for prior knowledge, F (1,133) = 241.69, MSe = 1.20, p < .001. More target facts were recalled about well-known individuals (M = 2.75) than unknown individuals (M = 0.06). The main effect for time of test approached significance, F (1,133) = 3.81, MSe = 1.20, p < .053 with subjects recalling more target facts on the immediate test (M = 3.90) than on the delayed test (M = 1.58). These findings mirrored the results of recognition scores.

The two-way interactions and the three-way

interaction were not significant ($\underline{p} > .10$, in all cases).
Seventy-one percent of the variance in name-cued recall
scores was explained by the treatment variables ($\underline{R}^2 =$
.71). The complete summary table for the analysis of
name-cued recall scores appears in Table 4.

Table 4

Analysis of Variance Summary Table for Name-Cued Recall
Scores

Source of Variation	$\underline{SS}$	$\underline{df}$	$\underline{MS}$	$\underline{F}$	$\underline{p}$
Subjects	94.47	19	4.97	4.16	.001
Elaboration (E)	1.06	1	1.06	0.88	.349
Prior Knowledge (PK)	288.91	1	288.91	241.69	.001
Time (T)	4.56	1	4.56	3.81	.053
E x PK	0.31	1	0.31	0.26	.614
E x T	1.41	1	1.41	1.18	.280
PK x T	2.76	1	2.76	2.31	.131
E x PK x T	0.16	1	0.16	0.13	.718
Residual	158.98	133	1.20		

Context-Matching Recall Performance

The ANOVA for context-matching recall scores
revealed a significant main effect for prior knowledge, $\underline{F}$
$(1,57) = 156.77$, $\underline{MSe} = 1.58$, $\underline{p} < .001$, indicating that
more target facts were recalled about well-known

individuals ($\underline{M}$ = 5.35) than about unknown individuals ($\underline{M}$ = 2.45) when supportive facts were provided as retrieval cues.

The main effect for elaboration was also significant, $\underline{F}$ (1,57) = 68.39, $\underline{MSe}$ = 1.58, $\underline{p}$ < .001, indicating that elaborated target facts ($\underline{M}$ = 5.10) were recalled better than were unelaborated target facts ($\underline{M}$ = 2.70) when the two supportive facts and names were provided as a retrieval cues. In other words, recall of the target fact was better when the target fact was originally presented with two supportive facts at acquisition than when the target fact was presented alone.

The elaboration by prior knowledge interaction was also significant, $\underline{F}$ (1,57) = 18.98, $\underline{MSe}$ = 30.01, $\underline{p}$ < .001. Although significantly more elaborated target facts were recalled than unelaborated target facts in both well-known and unknown conditions, recall differences between elaborated and unelaborated target facts were significantly greater under unknown than well-known conditions, as indicated by Fisher LSD tests ($\underline{p}$ < .05). Table 5 presents the means and standard deviations for this interaction and Figure 2 provides a visual description. Seventy-eight percent of the variance in context-matching recall scores was explained by the treatment variables ($\underline{R}^2$ = .78). The complete summary

table for the analysis of context-matching recall scores appears in Table 6.

Table 5

Mean Number (and Mean Percentage) and Standard Deviation of Correctly Recalled Target Facts on Context-Matching Recall Scores

Elaboration	Prior Knowledge			
	Well-known		Unknown	
	Mean	SD	Mean	SD
Elaborated (n = 20)	5.90 (84%)	1.12	4.30 (61%)	1.89
Unelaborated (n = 20)	4.80 (69%)	1.47	0.60 (9%)	1.10

Table 6

Analysis of Variance Summary Table for Context-Matching Recall Scores

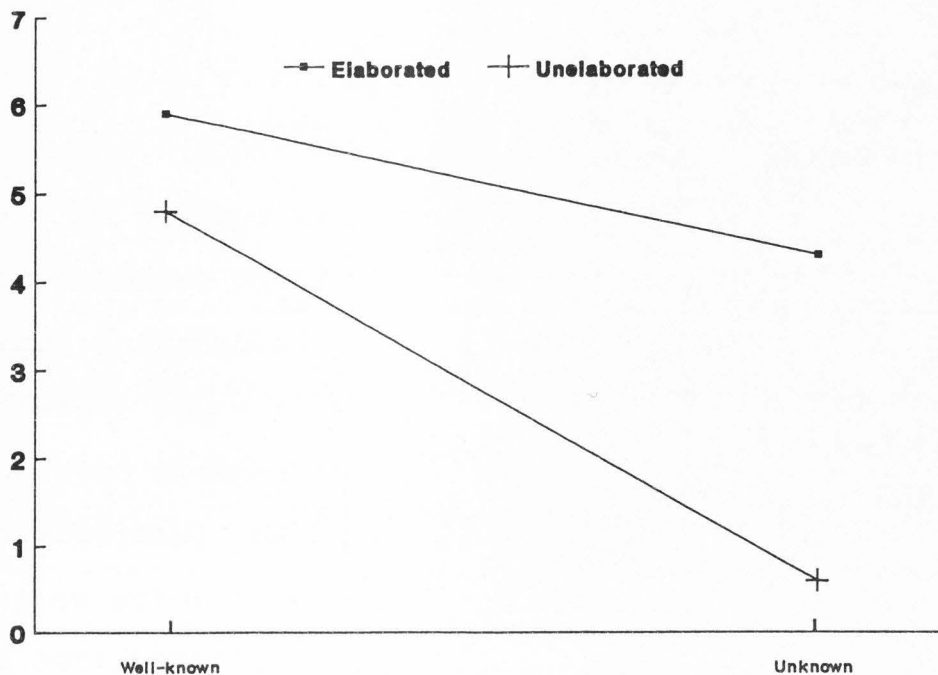| Source of Variation	SS	df	MS	F	p
Subjects	62.24	19	3.28	2.07	.018
Elaboration (E)	108.11	1	108.11	68.39	.000
Prior Knowledge (PK)	154.01	1	154.01	97.42	.000
E x PK	30.01	1	30.01	18.98	.000
Residual	90.11	57	1.58		

Figure 2. Number of Correctly Recalled Target Facts among
the Four Treatment Groups on the Context-Matching
Recall Test (Maximum Number = 7).

CHAPTER V

SUMMARY AND CONCLUSIONS

The present study increases knowledge of the circumstances under which elaboration enhances memory of target information. In this study, the effects of two different types of elaborations were explored: self-generated elaborations and experimenter-provided elaborations. Self-generated elaborations occur when one relates prior knowledge to the new target information. The more associated prior knowledge a person has, the more chance he/she has to generate an elaboration. On the other hand, experimenter-provided elaborations occur when the learning material itself contains some additional information that is related to the target information. In this case, the learner primarily ties the target information to the additionally provided information rather than to some previous personal knowledge.

In this experiment, it was found that (a) self-generated elaborations had a strong beneficial effect on both recognition, and name-cued and context-matching recall performance, (b) experimenter-provided elaborations facilitated recognition performance, but only when the learner had some prior knowledge, and (c) the experimenter-provided elaborations were effective to

the extent that the encoding context was reinstated at retrieval.

The beneficial effect of self-generated elaborations was seen when subjects remembered more target facts about well-known individuals than unknown individuals. This result suggests that the subjects connected the target information and their prior knowledge about well-known individuals when making plausibility judgments. This connecting process is elaboration which is generated by subjects.

The beneficial effects of self-generated elaboration can be explained in terms of increased network redundancy (Anderson, 1983a, 1983b) which involves forming connections between the target information and related knowledge. One illustration of network redundancy relative to these experimental materials is shown in Figure 3. In this example, a subject must make a judgment about whether a particular target fact (i.e., "remembered almost all of the football players' names") is plausibly related to a well-known name (i.e., John Lennon). In making this judgment, it is likely that the target fact will be connected to not only the name but also to knowledge previously acquired about the well-known individual (e.g., "was a member of the Beatles", "was assassinated" or "was from England"). These additional connections provide multiple retrieval
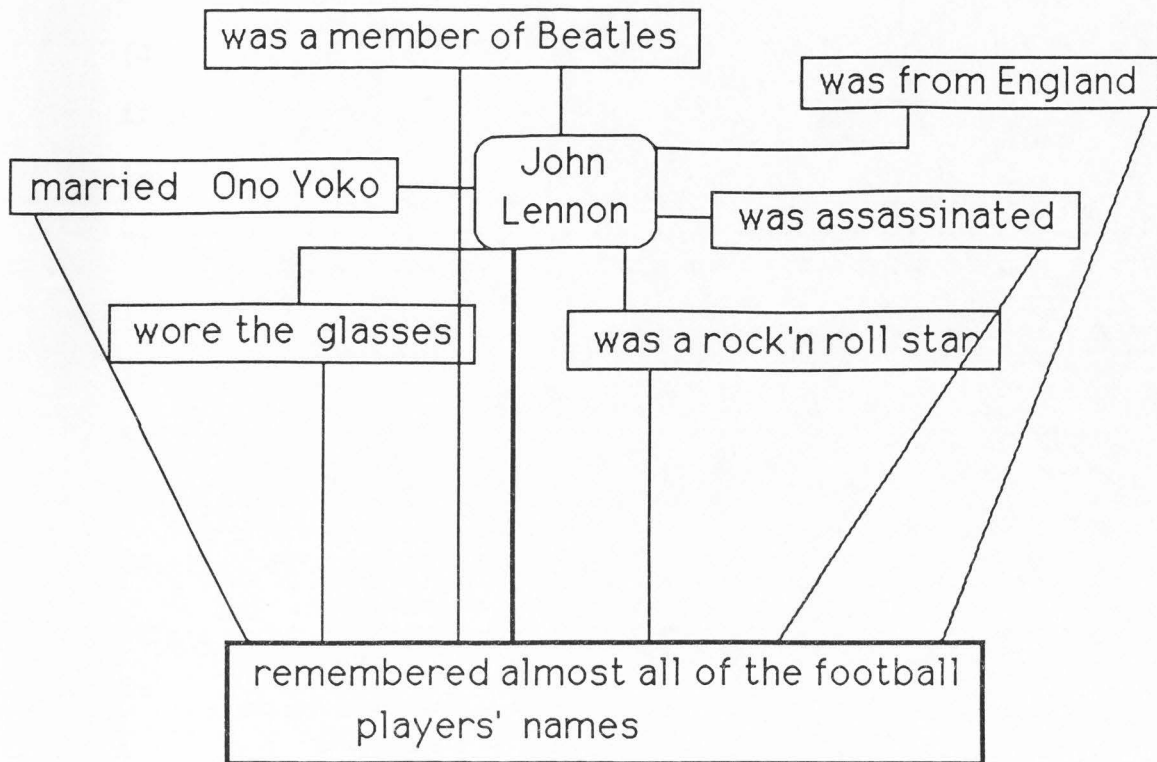
(a)
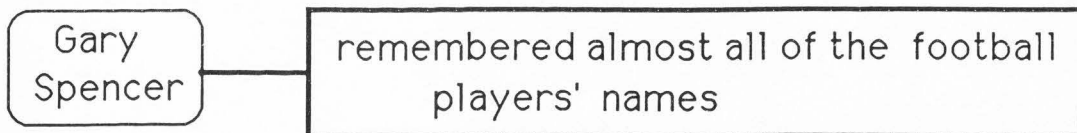
(b)

Figure 3. Hypothetical Representation of Self-Generated
Elaboration about a Well-known Individual (a), and an
Unknown Individual (b).

pathways to the target fact. Thus the retrieval cue (i.e., John Lennon) may activate the previously related information (e.g., "was a member of the Beatles"), which in turn activates the target information (i.e., "remembered almost all of the football players' names").

On the contrary, a person who makes a plausibility judgment concerning a target fact (i.e., "remembered almost all of the football players' names") and an unknown name (e.g., Gary Spencer) has limited or no prior knowledge about the name. In this case, the network redundancy is not increased. Thus, if the connection between the name and the target fact is forgotten, the target fact cannot be activated because there are no other retrieval pathways to the target information. This finding was consistent with previous research investigating expertise (e.g., Chiesi et al., 1979) showing that experts outperform novices on memory tasks particular to their domain of expertise.

Although there is uniform support for self-generated elaboration, the beneficial effects of experimenter-provided elaboration are observed under a limited set of conditions. The experimenter-provided elaboration increased the recognition of target information pertaining to well-known individuals but not to unknown individuals. In other words, providing additional information (e.g., "watched all the football games on

T.V." and "subscribed to magazines about football")
improved recognition scores only when the learner had
some prior knowledge about the individual (e.g., John
Lennon but not Gary Spencer). Because the additional
information (i.e., two supportive fact) about well-known
individuals provided more retrieval pathways to the
target information, there were more opportunities to
retrieve the target information. On the other hand, if
the learner did not have prior knowledge, then
experimenter-provided elaboration did not facilitate
recognition performance. This finding paralleled that of
Mandl, Schnotz and Tergan (1984) who found that
elaborated texts facilitated recall and comprehension,
but only when the reader was very knowledgeable about the
topic area.

Interestingly, the effect of experimenter-provided
elaboration was quite small when recall cues consisted of
names only (e.g., John Lennon), but the effect was
greatly enhanced by reproviding the two supportive facts
(e.g., "John Lennon watched all the football games on
T.V." and "John Lennon subscribed to magazines about
football") as was done for the context-matching recall
test. This result is compatible with the notion of
context effects (Thomson, 1972) and the theory of
encoding specificity (Tulving & Thomson, 1973). Both
ideas suggest that experimenter-provided elaboration is

effective to the extent that the encoding context is reinstated at retrieval.

Although the context-matching test is not uncustomary, it may have provided an unfair advantage for the elaborated group which received the name and supportive facts as retrieval cues. The unelaborated group, meanwhile, only received the name as a retrieval cue as was consistent with their acquisition condition. It is possible that providing the additional supportive facts at recall would have aided the unelaborated group since the target fact and supportive facts were thematically related in this study. This can be investigated in future research by presenting the supportive facts and the name as retrieval cues for both elaborated and unelaborated groups.

It was expected that experimenter-provided elaborations would increase network redundancy. Results from the recognition and name-cued recall tests, however, suggest that experimenter-provided elaboration did not increase network redundancy because experimenter-provided elaboration was not effective. It may be, however, that the facilitative effects of experimenter-provided elaboration were masked by weak links between the name and the associated target fact. In other words, the supportive facts may have been adequately linked to the target fact (network redundancy), but the target and

supportive facts may not have been adequately linked to
the name unless it was a well-known name. Therefore,
when only the unknown name was provided as a retrieval
cue, it was difficult for subjects to recall the target
fact. Evidence for this account came from context-
matching recall results. When the name was provided
along with supportive facts as retrieval cues, then the
target facts were recalled correctly for even the unknown
names.

In order to best observe the effect of experimenter-
provided elaboration, the weak links between the unknown
name and the associated facts should be strengthened.
One potential means for doing so involves the keyword
method. In a study by Shriberg, Levin, McCormick, and
Pressley (1982), the keyword method was an effective
technique for forming strong connections between unknown
names and their associated facts. Alternatively, the
weak links between the arbitrary names and the associated
facts which mask potential elaboration effects can be
removed by using a pronoun (e.g., he) as the subject of
each sentence in the learning materials, instead of the
actual name (e.g., John Lennon). Using a pronoun may
remove the interference that potentially occurs when
trying to recall several arbitrary names along with their
associated facts.

In conclusion, whereas self-generated elaborations

using prior knowledge enhance the retention of target information, experimenter-provided elaborations that provide additional information do not always benefit memory performance. Experimenter-provided elaboration can, however, facilitate the retention of target information if the learner has prior knowledge about the topic area. Alternatively, additionally provided information, in the form of experimenter-provided elaboration, can have a beneficial effect on memory performance even when subjects lack prior knowledge if the additionally provided information is reinstated at retrieval.

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FOOTNOTES

1. Twenty-seven students, not involved in any other way with the experiment, were asked to rate their prior knowledge about forty well-known individuals on a scale of 1-3 as well as the "fame" of those individuals. From this pilot test, the 28 individuals who rated most highly on both scales were included in this experiment.

2. These 28 episodes were derived from a list of 34 episodes that were rated on a five-point scale by 27 students who were in no other way involved with this experiment. The students rated each episode with respect to how well the two supportive facts in each episode may have independently and plausibly caused the target fact.

3. To determine whether or not the nature of plausibility judgments during the incidental learning phase had any effect on memory performance, a one-way ANOVA was conducted among the three types of response judgments (yes, no, and neutral). The ANOVA showed no effect for response type, $F(2,36) = .02$, $MSe = 262.52$, $p > .80$.

APPENDICES

Appendix A
Experimental Materials

The names in the parenthesis are the unknown names. The
target fact for each episode is underlined.

Robert Redford worked as a short-order cook.

Robert Redford had an allergy to wheat.

Robert Redford refused to eat hamburgers.

(Gordon Barnard)

Bob Hope was late to his wedding day.

Bob Hope forgot to bring a neck-tie.

Bob Hope's new wife didn't speak to him on their
honeymoon.

(Sam Kelly)

Oliver North was very frugal.

Oliver North was indifferent to outward appearance.

Oliver North always wore old clothes.

(Frank Rowell)

Muhammad Ali loved to eat in an expensive restaurant.

Muhammad Ali lost lots of money in the poker game.

Muhammad Ali borrowed money from his friends.

(David Martin)

Sigmund Freud liked to develop his own film.

Sigmund Freud was color-blind.

Sigmund Freud took all his photographs in black and white.

(Gerald Herbert)

Frank Sinatra was very weak from birth.

Frank Sinatra went swimming in the night.

Frank Sinatra spent over a month in bed.

(Albert Jones)

John Kennedy didn't know how to cook.

John Kennedy invited many people for his birthday party.

John Kennedy had to call a professional cook.

(Carl Mitchell)

Michael Jackson had chronic indigestion.

Michael Jackson wolfed down his food very quickly.

Michael Jackson took a whole bottle of TUMS.

(Bruce Thomas)

Adolf Hitler liked to count his money each Friday.

Adolf Hitler's family lost all its money in a foreclosure.

Adolf Hitler refused to put his money in a bank.

(Harry Lucas)

Albert Einstein didn't sleep well one night.

Albert Einstein over-exercised the next morning.

<u>Albert Einstein dozed during the afternoon conference.</u>

(Henry Peterson)

Abraham Lincoln grew up on a farm.

Abraham Lincoln's wife majored in zoology.

<u>Abraham Lincoln came to know how to train animals.</u>

(Timothy Arnold)

Bill Cosby frequently held parties.

Bill Cosby always turned the radio on loudly.

<u>Bill Cosby was made to move out of his apartment.</u>

(Paul Ellis)

Thomas Edison was in financial difficulties.

Thomas Edison usually stayed away from home.

<u>Thomas Edison was deserted by his wife.</u>

(Larry White)

Elvis Presley was a careless driver.

Elvis Presley drank too much at a party.

<u>Elvis Presley had a car accident.</u>

(Stanley Gilbert)

Charles Darwin kept his promises well.

Charles Darwin liked to tell jokes.

<u>Charles Darwin was very popular among his friends.</u>

(Ralph Foster)

Sylvester Stallone's father valued bravery.

Sylvester Stallone swam 3 miles a day.

Sylvester Stallone rescued 4 drowning people throughout

his life.

(Arthur Colman)

Paul Newman liked to listen to music.

Paul Newman lived a luxurious lifestyle.

Paul Newman bought an expensive audio component.

(Mark Newell)

Johnny Carson was an Eagle Scout.

Johnny Carson's hobby was rock climbing.

Johnny Carson knew how to tie every knot known to man.

(George Olson)

Joe Namath was born into a poor and large family.

Joe Namath didn't receive any scholarships.

Joe Namath worked in a restaurant to earn money for

school.

(John Davis)

Charlie Chaplin had many old, precious stamps.

Charlie Chaplin was always worried about things being

stolen.

Charlie Chaplin had stamps insured for five thousand dollars.

(Scott Bailey)

William Shakespeare was easily frightened.

William Shakespeare watched the trapeze artists at the circus.

William Shakespeare closed his eyes.

(Marty Taylor)

Babe Ruth didn't study when he was a child.

Babe Ruth was always up to some mischief.

Babe Ruth was often scolded by his parents.

(Bill Atkins)

John Lennon watched all the football games on T.V..

John Lennon subscribed to magazines about football.

John Lennon remembered almost all of the football players' names.

(Gary Spencer)

Walt Disney liked to eat spicy food.

Walt Disney had lived in Mexico.

Walt Disney often went to a Mexican restaurant.

(Brian Palmer)

John Wayne enjoyed a change in routine.

John Wayne enjoyed decorating.

<u>John Wayne changed the arrangement of furniture every month.</u>

(Steve Daniels)

Jon McEnroe was an only child.

John McEnroe didn't like solitude.

<u>John McEnroe wanted to have many children.</u>

(Jack Ferguson)

Benjamin Franklin would awaken at the slightest sound.

Benjamin Franklin walked in his sleep.

<u>Benjamin Franklin always made sure to lock his bedroom door.</u>

(Jeffery Brown)

Ludwig Beethoven went barefooted during his childhood.

Ludwig Beethoven sweated profusely.

<u>Ludwig Beethoven liked to wear sandals.</u>

(Roger Vincent)

Appendix B
Experimental Instructions

This experiment is being conducted to understand how people comprehend stories. Please read the following instructions carefully and try your best throughout the experiment.

You are going to view a series of episodes about some individuals. The episodes consist of either one sentence or three sentences. Each sentence will be presented on the computer screen for three seconds, one at a time. After three seconds, the sentence will disappear automatically and the next sentence will appear. The last sentence of each episode will be underlined. When you see the underlined sentence, that indicates the end of one episode.

Whenever you see an underlined sentence, you have to make a judgment about the plausibility of each episode. Your response has to be completed within three seconds. If you think the episode is plausible, press the "yes" key on the right. If you don't think the episode is plausible, press the "no" key on the left. If the episode seems to be neutral, press the "neutral" key in the center. Please remember that all you have to do is read each sentence carefully, and make a plausibility judgment at the nd of each episode. Now you are going to do two practice exercises. If you have any questions, please ask the experimenter at this time.

(Following the two practice exercises)

You did very well. Now you are going to work with actual experimental materials. Please fix your eyes on the middle of screen and read each sentence carefully; make a judgment as soon as you read the underlined sentence. You should not ask any questions during the experiment. Even if you make a mistake, please continue your work without pausing. Once again, please try your best.