

Explanation and conceptual memory

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This study investigated whether memory for well-understood ideas could be improved by deeper understanding. In Experiment 1, subjects learned ideas presented with or without additional explanations designed to increase understanding of the ideas. In Experiment 2, subjects learned ideas presented with explanations or qualifications that increased processing, but not understanding, of the ideas. Explanations and qualifications both increased free, as well as cued, recall of the ideas, suggesting that the effects of explanation are the result of increased processing, rather than of deeper understanding.

It seems to be generally believed that the more fully ideas are understood, the better they will be remembered. Although incomprehensible or ambiguous information is not remembered as well as that which is well understood (e.g., Bransford & Franks, 1976; Bransford & Johnson, 1972; Dooling & Lachman, 1971), it is not clear whether memory for unambiguous, well-understood ideas can be improved by more complete understanding such as that provided by additional explanation. Therefore, we examined the effect of explanations on memory for well-understood, but unrelated, ideas. The explanations were designed to promote deeper understanding of individual ideas, but not to relate the ideas to each other. In addition, normal aged and young subjects were used to determine whether more complete understanding facilitated recall of ideas.

EXPERIMENT 1

Method

Subjects. The subjects were 16 college students (mean age = 19.7 years) and 16 normal senior citizens (mean age = 70.1 years). All subjects were screened for cognitive deficits to exclude unrecognized dementia in the aged (Jacobs, Bernhard, Delgado, & Strain, 1977), and all gave written informed consent. The young subjects were women attending Stern College of Yeshiva University. The aged subjects were 5 men and 11 women recruited from the Academy for Gerontological Education and Development in the Bronx.

Materials. Each subject learned two different lists of 16 unrelated ideas presented in the form of clearly understandable sentences. In one list, the subject learned a set of base ideas presented alone (e.g., "The quiet librarian was about to shriek"). In the second list, a different set of ideas was presented along with additional explanations (e.g., "The hungry couple went ice-skating / because there was a restaurant near the lake"). The base ideas

(sentences) were of the form "The hungry couple went ice-skating" rather than "The hungry couple went to the grocery store" because the former seemed to call for an explanation, whereas the latter seemed to be relatively self-explanatory. The explanations were designed to increase understanding of each idea by explaining the relationship between its subject and predicate.

Procedure. Each subject was tested alone; he or she learned one set of ideas presented without explanations and another set presented with explanations. The order of presentation of the sets was counterbalanced across subjects. During presentation, each sentence was read aloud to the subject, who was told to listen to the entire sentence before writing it on a card that would then be removed. When explanations were presented, the subject was asked to write the explanation and the base sentence and then to rate, on a 6-point scale, how well the explanations or qualifications explained each base idea. The subject was told to remember only the base idea in this condition. After all 16 sentences had been presented, the subject counted backwards by 3s from 100 for 15 sec and then was asked for written free recall of the base ideas in any order. This was followed by controlled recall in which each base idea was cued by written presentation of its subject. The subjects were asked to remember as much of each idea as they could and to use their own words, if necessary, for recall. Verbatim recall was not required because the aim was to investigate memory for ideas, not for sentences. Recall for ideas was scored as complete or incomplete by consensus of three raters, who scored as incomplete only those ideas that clearly could not be considered complete.

Design. The design of this experiment was a $2 \times 2 \times 2 \times 2$ mixed factorial. The within-subject factors were condition (base sentence alone or sentence with explanation) and type of recall (free recall or controlled recall by cuing with subject). The between-subject factors were age (young or aged) and order of conditions (sentence alone first or explanation first).

Results

The results of Experiment 1 are shown in Figure 1. The level of significance chosen for this experiment was $p = .05$.

A repeated-treatments analysis of variance was carried out on the total number of ideas recalled. Because order had no effect on performance, it was not treated as a factor in this analysis. The analysis shows that the explanations increased recall by both age groups [$F(1,30) = 67.8$, $MSe = 5.37$], which suggests that more complete understanding can improve memory for ideas. Because this effect was obtained for cued recall [$F(1,30) = 56.3$, $MSe = 5.35$], as well as for free recall [$F(1,30) = 27.1$, $MSe = 2.43$], it appears

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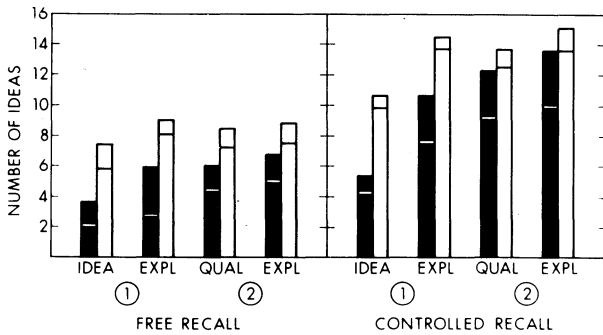


Figure 1. Number of ideas recalled by normal-aged (dark bars) and young adults (light bars) after a single presentation in Experiments 1 and 2. The total number of ideas shown by each bar consists of complete ideas (lower part) and incomplete ideas (upper part).

that the effect of explanations is at least partially due to better storage of the ideas. The cued-recall data show that the same cues produced better recall in the explanation condition than in the sentence-alone condition by both age groups (see Figure 1), which suggests that the explanations increased storage of the base ideas. Finally, the analysis showed that cued recall is greater than free recall by both age groups [$F(1,30) = 73.3$, $MSe = 6.34$], even though the aged recalled fewer ideas than did the young [$F(1,30) = 31.6$, $MSe = 15.9$].

EXPERIMENT 2

Experiment 1 showed that recall of clearly comprehensible ideas can be improved by explanations, which suggests that recall of ideas is increased by deeper understanding. However, it is possible that the effects of the explanations were due to additional, more extensive processing of each idea (e.g., Craik and Tulving, 1975), rather than to more complete understanding. Therefore, Experiment 2 compared recall of ideas presented either with additional explanations or with qualifications designed to promote additional processing without increasing understanding (e.g., “The quiet librarian was about to shriek / even though the students were busy working”). These two conditions allowed us to determine whether the improvement of memory by explanation is due to more complete understanding or to the additional processing induced by the explanations.

Method

Subjects. The subjects were 16 college students (mean age = 19.3 years) and 16 normal senior citizens (mean age = 69.5 years). All subjects were screened to exclude unrecognized dementia in the aged. The young subjects were women attending Stern College, and the aged subjects were 7 men and 9 women recruited from the Academy of Gerontological Education and Development in the Bronx.

Materials. The same base sentences used in Experiment 1 were used in Experiment 2. For each sentence, a qualification was con-

structed that was designed to induce deeper processing of each idea without increasing understanding. Each subject learned two sets of ideas, one with additional explanations and the other with qualifications.

Procedure. Each subject learned two sets of 16 unrelated ideas. During presentation of each set, the sentences were presented one at a time on typed cards for the subjects to read aloud at their own rate. As in Experiment 1, the subjects were asked to rate the adequacy of each explanation or qualification, but were told to remember only the base idea. After all 16 sentences of the first set had been presented, the subjects counted backwards for 15 sec and then attempted written free recall of the base ideas. However, cued recall was delayed until after presentation and free recall of the second set of ideas so that the subjects would not try to learn the explanations or qualifications in the second set. After free recall of the second set, cued recall of both sets was obtained by written presentation of the 16 qualifications alternating with the 16 explanations to cue recall of their respective base ideas.

Design. Experiment 2 employed the same design as Experiment 1. The within-subject factors were condition (explanations or qualifications) and type of recall (free recall or cuing by explanation or qualification). The between-subject factors were age (young or aged) and order of conditions (explanations first or qualifications first).

Results

Figure 1 also displays the results of Experiment 2. As in Experiment 1, an analysis of variance of the total number of ideas recalled revealed a significant effect of age [$F(1,30) = 13.4$, $MSe = 7.81$], with the aged recalling fewer ideas than the young. The analysis shows that controlled recall of ideas by both age groups was considerably improved by cuing with either explanation or qualifications [$F(1,30) = 342.97$, $MSe = 3.42$]. Figure 1 shows that controlled recall was nearly perfect, indicating that both groups were able to effectively process the explanations and qualifications in conjunction with the base ideas. The very high level of controlled recall also shows that nearly all of the ideas were stored and retained in retrievable form by both age groups. The high level of controlled recall by the aged is consistent with previous work showing that age-related differences in learning and memory can be reduced or eliminated by controlled processing during learning and cuing during recall (e.g., Perlmutter, 1979; Smith, 1977; Till & Walsh, 1980).

More importantly, the analysis indicated that there was no significant difference between the effects of explanation or qualifications on free recall by either young or aged. There was also no significant difference between the effects of explanations or qualifications on cued recall by the aged, but the young recalled slightly more after being cued with explanations than after being cued with qualifications [$F(1,15) = 9.1$, $MSe = 3.66$]. However, this small difference is significant only for recall of total ideas, and not for recall of either complete ideas or incomplete ideas alone. These findings do not seem to provide convincing support for the hypothesis that improvement of memory by explanations is due to more complete understanding. Since qualifications and ex-

planations both increase memory, it appears that any meaningful modification that induces additional, more extensive processing or adds meaning to an idea may enhance learning and retrieval of that idea.

DISCUSSION

The results of both experiments together indicate that the improvement of memory by explanation of already understood ideas does not seem to be due to more complete understanding, since qualifications increase memory as well. How explanations or qualifications enhance memory and increase recall is unclear. Although explanations and qualifications presumably increase cognitive processing by providing the subject with a particular way to think more about the base idea, they also seem to add meaning to the base idea and to make the idea more specific and precise, which might enhance encoding and improve retrieval (e.g., Craik and Simon, 1980; Craik and Tulving, 1975). Explanations and qualifications are very effective cues, but we do not yet know how such conceptual cues guide retrieval. Understanding how explanations and qualifications enhance memory should contribute to our understanding of conceptual memory.

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