Exact and Conceptual Repetition Dissociate Conceptual Memory Tests: Problems for Transfer Appropriate Processing Theory

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Abstract Three experiments examined whether a conceptual implicit memory test (specifically, category instance generation) would exhibit repetition effects similar to those found in free recall. The transfer appropriate processing account of dissociations among memory tests led us to predict that the tests would show parallel effects; this prediction was based upon the theory's assumption that conceptual tests will behave similarly as a function of various independent variables. In Experiment 1, conceptual repetition (i.e., following a target word [e.g., *puzzles*] with an associate [e.g., *jigsaw*]) did not enhance priming on the instance generation test relative to the condition of simply presenting the target word once, although this manipulation did affect free recall. In Experiment 2, conceptual repetition was achieved by following a picture with its corresponding word (or vice versa). In this case, there was an effect of conceptual repetition on free recall but no reliable effect on category instance generation or category cued recall. In addition, we obtained a picture superiority effect in free recall but not in category instance generation. In the third experiment, when the same study sequence was used as in Experiment 1, but with instructions that encouraged relational processing, priming on the category instance generation task was enhanced by conceptual repetition. Results demonstrate that conceptual memory tests can be dissociated and present problems for Roediger's (1990) transfer appropriate processing account of dissociations between explicit and implicit tests.

Performance on implicit memory tests has been the focus of intense research in the past ten years. However, researchers have been unable to agree upon a standard definition of implicit memory tests. Following Jacoby (1984), Roediger and McDermott (1993) suggested that they could be described as those which engage incidental retrieval. Just as the distinction between intentional and incidental learning during encoding focuses on subjects' intent to memorize, the distinction between explicit and implicit test orientation focuses on subjects' intent to retrieve (see too Richardson-Klavehn, Gardiner, & Java, 1994). Of course, there is no objective measure in either case of subjects' true intentions; nevertheless, an abundance of evidence converges on the claim that subjects do employ different strategies under explicit and implicit testing conditions.

Many implicit memory tests have been devised, and one useful categorization of them, originally derived from transfer appropriate processing ideas, is the contrast between perceptual and conceptual tests (Blaxton, 1989; Jacoby, 1983; Roediger & Blaxton, 1987a; Tulving & Schacter, 1990). Perceptual implicit tests are those in which subjects are required to resolve perceptually-impoverished displays (e.g., word identification, in which words are flashed on a screen very briefly). Conceptual implicit tests are those in which subjects are asked to invoke their semantic knowledge to answer questions or to provide associates to a cue. In both cases, retention (or priming) on the implicit memory test is manifested to the extent that performance on the task is facilitated by recent prior exposure to the target stimulus. Explicit tests can also be classified as conceptual and perceptual, as shown by Blaxton (1989; Roediger & Blaxton, 1987a).

Most implicit memory research has focused on perceptual tests, but our interest in this paper is in conceptual implicit memory tests. Three principal conceptual implicit memory tests have been devised: category instance generation, word association, and answering general knowledge questions. In the category instance generation task, subjects are given a category name as a cue (e.g., *metals*), and they are asked to produce as many exemplars of the category as possible in (say) 20 s. In the word association task, subjects are presented with words (e.g., *bronze*) and asked to say the first word that comes to mind. In the general knowledge task, subjects are asked to answer trivia questions (e.g., *What metal makes up 10% of yellow gold?*) to the best of their ability. In all cases, priming is manifested in the increased tendency to produce the target word (e.g., copper) after having recently encountered it in an earlier phase of the experiment.

Conceptual implicit tests have been shown to exhibit the following patterns of results: (1) a generation effect (an advantage for words generated from a semantic clue over words read; Blaxton, 1989; Smith & Branscombe, 1988; Srinivas & Roediger, 1990), (2) an effect of level of processing (an advantage for items processed with respect to their meaning over those processed at a more superfi-

cial level; Hamann, 1990; Schacter & McGlynn, 1989; Srinivas & Roediger, 1990; Weldon & Coyote, in press), and (3) an effect of semantic organization at study (in lists that contain multiple exemplars of categories, an advantage for lists blocked by category over those containing randomly intermixed items; Blaxton, 1992; Rappold & Hashtroudi, 1991). In contrast, perceptual implicit memory tests have generally been shown to exhibit: (1) a reverse generation effect (i.e., reading a word produces more priming than generating it from a conceptual cue; Blaxton, 1989; Jacoby, 1983; Winnick & Daniel, 1970); (2) no effect of level of processing (Roediger, Weldon, Stadler, & Riegler, 1992; but see Challis & Brodbeck, 1992); and (3) no effect of organization (Rappold & Hashtroudi, 1991).

Many of the studies cited above were designed to test the transfer appropriate processing approach to explaining and predicting dissociations between explicit and implicit memory tests; this theory, which is an extension of Morris, Bransford, and Franks' (1977) approach, holds that performance on memory tests reflects the extent to which the mental operations required by the test match those invoked during the study phase (Blaxton, 1989; Roediger, Weldon, & Challis, 1989). When applied to the implicit memory domain, transfer appropriate processing theory explains the dissociations in the following way. Perceptual memory tests by their very nature require subjects to resolve perceptually-impoverished displays (e.g., completing fragmented words [c _ _ p _ r] or identifying briefly-flashed words.) Because performance on these tests makes demands on the perceptual system, and because (according to transfer appropriate processing logic) performance on a test benefits to the extent to which the study and test processes match, transfer should occur from relevant visual processing during the study episode (e.g., reading the intact word, *copper*). Priming on perceptual tests is greater following reading a word than generating it from a conceptual cue because in the generate condition, the target word is not visually perceived; therefore, perceptual priming is often reduced or absent (but see Masson & MacLeod, 1992). Similarly, the findings that semantic elaboration and list organization do not affect priming on perceptual tests are explained by the observation that these are conceptual variables that do not significantly alter the visual perception of the target word.

More important for this paper is the explanation of performance on conceptual tests. According to the logic of transfer appropriate processing, because conceptual tests invoke subjects' semantic knowledge, they should be affected by study manipulations that affect meaning-based processing. Thus, semantic processing should (and does) produce greater performance than surface-level processing. Similarly, the richer processing achieved by blocking presentation of category instances within a study list (relative to randomly intermixing items from the various categories) enhances performance on these tests. In addition, the conceptual elaboration invoked when generating an item from a conceptual cue enhances performance on these tests (relative to the condition in which the target item is simply read).

Roediger and his colleagues have generally assumed that conceptual tests should behave similarly as a function of various independent variables (Roediger & Blaxton, 1987a; Roediger et al., 1989; Srinivas & Roediger, 1990). Indeed, Roediger and Blaxton (1987a) argued that all conceptual tests should behave like free recall, which they labeled the "paradigmatic" conceptual test in that no external cues are provided for subjects; subjects therefore have to rely solely on top-down, conceptual processes for responding (p. 371). In fact, almost all experiments to date have supported this assumption that all conceptual tests should behave similarly. (Two recent exceptions — Cabeza [1994] and Weldon & Coyote [in press] — are addressed in the General Discussion.) Note that the effects described above (level of processing, generation, and organization) on conceptual implicit memory tests mirror those obtained in free recall and other conceptual explicit tests (Cofer, Bruce, & Reicher, 1966; Craik & Lockhart, 1972; Slamecka & Graf, 1978).

The research reported here was designed to assess the assumption that a conceptual implicit test would behave like free recall as a function of independent variables. One independent variable we chose was repetition. Before explaining the design of our study, we describe briefly the findings with respect to repetition effects — the advantage of repeated events to single events on later retention — in perceptual implicit memory tests and in the conceptual explicit test of free recall.

Following Roediger and Challis (1992), we distinguish between two types of repetition: *exact* and *conceptual*. Exact repetition entails presentation of the same item two or more times. Conceptual repetition is achieved by following an item with a conceptually similar item, such as a synonym, associate, or picture.

Free recall has been shown to be sensitive to both conceptual and exact repetition (e.g., Kolers & Gonzalez, 1980; Melton, 1969). For example, Glanzer and Duarte (1971; see also Durgunoğlu & Roediger, 1987) obtained both exact and conceptual repetition effects by presenting Spanish-English bilingual subjects a Spanish word followed by the same word in Spanish or by its English equivalent. Subjects recalled more items in both conditions than when the concept had been presented only once, in either Spanish or English. Furthermore, when presentations were massed (i.e., one followed the other immediately), the conceptual repetition effect was greater than the exact repetition effect, a finding replicated by Durgunoğlu and Roediger (1987).

Curiously, almost all the studies in the implicit memory domain that address the effect of repetition have employed (1) exact repetition and (2) perceptual implicit memory tests. Conceptual repetition and conceptual implicit memory tests have been relatively neglected. The general finding in the literature on perceptual implicit memory tests contrasts sharply with the pattern obtained on free recall: massed repetition (both exact and conceptual) exerts little or no effect on perceptual priming (Challis & Brodbeck, 1992; Greene, 1990; Jacoby &

Dallas, 1981; Perruchet, 1989). We will not take the space to review all the relevant studies but refer the reader to Challis and Sidhu's (1993) review. Remarkably, these authors found that massed presentation of a word 16 times in the study phase did not produce a reliably greater level of priming (.19) than did four presentations (.15) or a single presentation (.15). Although massed repetition invariably fails to affect perceptual priming, some positive (but small) effects of spaced repetitions have been reported (e.g., Roediger & Challis, 1992, Experiment 3).

To our knowledge, only one article has addressed the question of whether conceptual repetition affects perceptual priming. Roediger and Challis (1992, Experiment 2) demonstrated that conceptual repetition does not enhance priming on a word fragment completion test. That is, immediately following a target word (*copper*) by a semantically related word (*bronze*) did not affect priming of the target relative to the condition in which the target was presented alone, with priming of .34 and .31, respectively. They also failed to obtain an effect of exact repetition on word fragment priming (.33), replicating the common finding discussed above. However, the standard effects of exact and conceptual repetition were obtained on a free recall test, with performance in the conceptual repetition condition (.26) and in the exact repetition condition (.31) exceeding that in the single presentation condition (.09).

The aim of the current experiments was to apply this study manipulation to the conceptual implicit memory test of category instance generation to determine whether this test would behave like perceptual implicit memory tests or like free recall. Like the experiments mentioned above, we restricted our repetition manipulations to massed repetitions. We include several other tests to replicate past work and to examine other issues discussed below. Repetition does not affect priming on perceptual implicit memory tests; does this result generalize to conceptual implicit tests? On the basis of transfer appropriate processing theory, we predicted that it would not. As advocated by Roediger and his colleagues (Roediger, 1990; Roediger & Blaxton, 1987a; Roediger et al., 1989), the theory holds that performance on the category instance generation test should show effects of exact and conceptual repetition because repetition enhances performance on conceptual explicit tests, most notably free recall. In addition, Challis and Sidhu (1993) showed that exact repetition enhanced priming on the conceptual implicit test of answering general knowledge questions.

The first experiment of this series instantiated conceptual repetition in the same way as Roediger and Challis's (1992) experiment in which target words were followed by highly associated words. We expected that the target + associate condition (e.g., present *larceny thief*) would enhance priming on the category instance generation task (producing as many *types of crimes* as possible in 20 s) relative to the target only condition (e.g., present *larceny*). In addition, we expected that the target + target (or exact repetition) condition would enhance priming relative to the target only condition. These predictions were based on the pattern previously obtained in free recall.

We also included a condition in which subjects studied the associate (*thief*) without the corresponding target word (*larceny*). The question in this condition was whether the associate would prime production of the target word. Cramer (1966) and Cofer (1967) labeled this type of priming *indirect* priming, in contrast to direct priming, in which the target is presented in the study episode. Roediger and Challis (1992, Experiment 2) found no indirect priming from an associate on a word fragment completion test (see also Mandler, Graf, & Kraft, 1985). However, because we were using a conceptual implicit test and because an associate is conceptually related to its target word, it seemed plausible that it might promote priming on a conceptual test.

Three other tests were used in this experiment so that we could compare patterns of results across tests. A word fragment completion test was given to some subjects in an attempt to replicate Roediger and Challis's (1992) basic findings with our subjects and procedures. That is, we expected to find that the conditions in which the target word was studied (i.e., target only, target + associate, and target + target) would produce equivalent priming. The associate condition, however, was not expected to produce priming because there would be no overlap in the perceptual procedures between the study and test episodes.

Finally, the explicit counterparts to category instance generation and word fragment completion implicit tests were given. Including these tests permits our experiment to use the retrieval intentionality criterion to evaluate the differences between explicit and implicit tests by comparing performance on the tests when the retrieval cues remain constant and all that changes is the test orientation (Schacter, Bowers, & Booker, 1989). On the category cued recall test, subjects are given category names and asked to use each name to help them remember an instance of the category from the study list. Like the category instance generation test, category cued recall is a conceptual test, and therefore we expected it to manifest exact and conceptual repetition effects. On the word fragment cued recall test, subjects are given word fragments and asked to fill in the letters of a fragment only when they can do so with a word they remember from the study list. This test is difficult to classify (Weldon, Roediger, & Challis, 1989) because it has some perceptual components (subjects must resolve a perceptually degraded representation to perform the test) but also conceptual components (intentional remembering is thought to invoke conceptual processing). Evidence consistent with this claim was obtained by Roediger et al. (1992), who found a level-of-processing effect on this test (but not on its implicit counterpart). Thus, it is generally assumed that word fragment cued recall is a mixed test, having some characteristics of perceptual tests and some of conceptual tests (see Weldon, Roediger, Beitel, & Johnston, 1995). Predictions for this test were therefore difficult to make, but presumably the conceptual aspect involved in intentional recollection would cause this test to reflect repetition effects, unlike its implicit counterpart. Greene (1986) and Challis and Sidhu

(1993) found that multiple presentations (four or more) enhanced performance on a word fragment cued recall test.

Experiments 2 and 3 represent variations on this general approach. In Experiment 2, conceptual repetition was instantiated by following a word with a picture of its referent (or vice versa). In Experiment 3 we returned to the original stimuli used in Experiment 1 but changed the instructions subjects were given at study. In general, the primary focus of the experiments was in whether repetition effects would be obtained on the category instance generation test, although the other test conditions were also of interest.

Experiment 1

In Experiment 1, all subjects viewed a series of 60 words, rating each according to the pleasantness of its referent. Four conditions of presentation were included. In the study phase, target words were presented either once (*vulture*), once followed by a semantic associate (*vulture prey*), twice (*vulture vulture*), or they were not presented but their associates were (*prey*); this manipulation occurred within subjects.

A few minutes after the study phase, subjects were given instructions appropriate to their particular test condition. Until this time, all subjects were treated exactly alike. At test, one of the two types of cues (word fragments or category names) was given along with either implicit or explicit instructions. Cues for all 50 of the target words were presented, with an equal number of cues corresponding to items that had occurred in each of the aforementioned study conditions. Ten of the cues represented items that had not been presented in the study phase; they were used to obtain nonstudied baserates on the implicit tests and false recall rates on the explicit tests. Finally, we included a free recall condition to verify the effects of repetition on that measure.

METHOD

Subjects

One hundred and thirty-five undergraduates from Rice University participated in this experiment in partial fulfillment of course requirements.

Materials

Fifty seven-letter target words and their corresponding word fragments and category names were selected primarily from those used by Srinivas and Roediger (1990). Examples of these materials can be seen in Table 1. For each target word, a conceptually-related associate was chosen to be presented in the study list in the conceptual repetition condition. The selection criteria were that the word was semantically related to the target word but not a member of the same category as the target. The purpose of this latter criterion was to prevent the associates from interfering with the production of target words on the category cued recall test. However, because of this criterion, the target-associate pairs in this experiment were probably not as closely related as those used by Roediger and Challis (1992). We were unable to use their materials, though, because of the possibility of subjects recalling category coordinates instead of targets on the category cued recall test.

TABLE 1
Sample Study and Test Items for Experiments 1 and 3.

Target	Associate	Category Name	Word Fragment
puzzles	jigsaw	toys	_ u z _ l _ s
larceny	thief	types of crimes	_ _ r c _ n y
venison	deer	types of meat	v _ n _ s _ _
kidneys	dialysis	organs of the body	_ _ d _ _ y s
pythons	venom	types of snakes	_ y _ h _ n s
vulture	prey	types of birds	_ _ l _ u r _

The target words and their associates were typed in lowercase letters onto white paper and then transformed into slides. Test sheets consisted of word fragments or category names that were typed in the same font as on the slides. They were constructed such that all target items were represented on each test sheet.

Design

A 5 (study manipulation) × 5 (test type: word fragment completion, word fragment cued recall, category instance generation, category cued recall, free recall) mixed design was used. Study conditions were manipulated within subjects, with each subject studying items in each of the following conditions: target presented once (hereafter referred to as the *target* condition), target presented twice in succession (*target + target*), target followed immediately by an associate (*target + associate*), or only an associate presented (*associate*). The fifth condition was the nonstudied condition, which was used to estimate baseline performance. Test type was manipulated between subjects with thirty subjects participating in each of the following four conditions: word fragment completion, word fragment cued recall, category instance generation, and category cued recall. Fifteen subjects were tested by free recall.

Stimuli were assigned randomly to five different blocks of 10 items. Each block was rotated across subjects such that every item set occurred in each study condition an equal number of times. The order in which items were presented within each block remained constant across all conditions. The order in which the blocks were presented was also counterbalanced. Five study lists were required to complete the counterbalancing.

All test sheets for the cued conditions consisted of cues representing all 50 target items; therefore, they contained ten cues representing each of the five conditions, including the two (associate and nonstudied) conditions in which the target word had not been presented. Thus, for 60% of test cues, the corresponding target had been seen at study (and an additional 20% of the cues corresponded to items whose associate had been studied in the absence of the target word). The proportion of studied items to nonstudied items is higher than usually used, but we wanted (1) the implicit and explicit tests to differ only in

instructions and not by test cues and (2) the proportion of target items in the cued recall conditions to be high enough that subjects would not quit trying. In addition, Challis and Roediger (1993) failed to find any effect of proportion of test cues corresponding to target items on the amount of priming on an implicit word fragment completion test.

Procedure

Subjects were tested in groups of one to four. Until the test instructions were administered, all subjects were treated exactly alike. Subjects were exposed to the material under incidental learning conditions and were led to believe that they were participating in an experiment about judging characteristics of words. At study, items were presented by a slide projector at a 5 s rate and subjects were asked to rate each of the words on a scale of one to seven according to its degree of pleasantness, with 1 representing extremely unpleasant and 7 extremely pleasant. Forty target items were presented at study, including ten target items presented once, ten presented twice, ten presented and followed by an associate, and associates of ten targets presented alone. Thus, 60 slides were shown. Following the presentation of slides, a three minute distractor task consisting of multiplication problems was administered. Subjects were then given the instructions appropriate to their test condition. This entire process of administering the distractor task and the test instructions took approximately five minutes.

Subjects in the implicit word fragment completion condition were told that they were going to participate in a different experiment, one that was designed to investigate how people gain access to words from the letters of which the words are composed. Examples of fragments were shown and subjects were told that they would be given 20 s to complete each fragment with the first word that came to mind. They were told that they would be paced by a tape recorder and that at the sound of each beep on the tape recorder (which occurred every 20 s), they were to advance to the next fragment. They were given cover sheets to prevent them from looking ahead to the items they had not yet reached; they were also asked not to return to any items on which they had already worked.

Subjects in the word fragment cued recall condition were told that they were being given a memory test and that they were to complete only those fragments that they could solve with a word they had seen in the study list. They were asked to be reasonably confident that their responses corresponded only to words they had seen on the slides and were warned that some test fragments did not correspond to studied words. The test sheets were identical to those used in the implicit fragment completion condition. As in all test conditions, subjects were paced at a rate of 20 s per item and were asked to use cover sheets.

Subjects in the category instance generation condition were told that they were participating in a different experiment, the purpose of which was to study the way in which people gain access to words from the categories to which the words belong. They were then asked to write as many instances of each category as they could in the twenty seconds allotted to each of the fifty presented category names.

TABLE 2
Mean Proportion of Target Items Produced as a Function of Study Condition and Test Type in Experiment 1.

		Study Condition				
Test Cue	Test Instructions	T	T+A	T+T	A	NS
Word Fragment	Implicit	.41	.41	.45	.20	.19
	priming	.22	.22	.26	.01	
	Explicit	.47	.55	.49	.02	.02
Category Names	Implicit	.41	.40	.44	.22	.20
	priming	.21	.20	.24	.02	
	Explicit	.62	.62	.57	.02	.00
None (Free Recall)	Explicit	.25	.45	.43	.00	

Note. T refers to the study condition in which the target word was presented once, T + A to that in which the target was followed by a semantic associate, T + T to the condition in which the target was presented twice in succession, A to that in which the associate was presented alone, and NS to the nonstudied (baseline) condition.

Subjects in the category cued recall condition were instructed that some of the words typed on the test sheet corresponded to a category name of one of the items they had studied previously. They were told to write the studied item next to the appropriate category label. Subjects were told to be "reasonably confident" that their responses corresponded only to words that had occurred on the study list and were told that some category names given as cues did not represent items in the list. The entire experimental session lasted approximately 30 minutes for subjects in the four cued tests.

Subjects in the free recall condition were asked to recall as many of the words they had seen on the previously-shown slides as they could remember in eight minutes. They were given blank pieces of paper on which to write the words. Subjects were asked to try to recall words for the full eight minutes. The experimental session lasted approximately 20 minutes for free recall subjects.

RESULTS AND DISCUSSION

Mean proportions correct for all the conditions of the five tests are shown in Table 2. For the groups receiving implicit instructions, proportion correct and priming scores are presented for each condition. Priming scores were calculated by subtracting the mean proportion of nonstudied items completed from the mean proportions from each of the other conditions. Each of the five tests is discussed separately. For all the results reported in this paper, the level of significance was set at .05.

Word Fragment Completion. As predicted, priming was observed on the word fragment completion test for the target (.22), the target + target (.26), and the target + associate (.22) conditions. A within-subjects ANOVA confirmed this observation, showing a significant main

effect of study condition, $F(4, 116) = 24.01$, $MS_e = .019$. Planned comparisons revealed no differences among any of the three conditions in which targets were presented, largest $t = 1.34$. In addition, presentation of an associate alone did not lead to performance reliably greater than the nonstudied base rate, $t < 1$.

These results are consistent with predictions and replicate the findings that conceptual repetition (Roediger & Challis, 1992) and massed exact repetition (Challis & Sidhu, 1993) do not enhance priming on an implicit word fragment completion test. In addition, they support the proposition that the word fragment completion test, a perceptual implicit test, is unaffected by conceptual manipulations at study. One question that follows logically is whether manipulation of test instructions while holding test cues constant would make this test sensitive to the study manipulations.

Word Fragment Cued Recall. Consistent with the hypothesis that this test would be affected by conceptual elaboration at study, presenting an associate immediately after the target led to a greater proportion of items recalled (.55) than presenting the target without its associate (.47). Presenting the target twice in succession at study, however, did not enhance recall (.49) relative to presenting it only once. A one-way within subjects ANOVA (excluding the nonstudied condition) revealed significant differences across study conditions, $F(3, 87) = 116.67$, $MS_e = .016$. Planned comparisons confirmed that directly following a target word with an associate led to significantly greater recall of the target than did presenting the target word twice, $t(29) = 2.11$, SEM = .03, or presenting it only once without its associate, $t(29) = 2.49$, SEM = .03. These latter two conditions did not differ significantly, $t < 1$. Results also revealed that presentation of the target's associate alone did not enhance false recall relative to the nonstudied condition, $t < 1$.

Results for this test were as predicted in that the enhanced conceptual processing invoked by conceptual repetition was reflected at test. However, it was surprising that presenting the target word a second time did not also increase recall relative to once-presented targets; this latter pattern had been predicted on the basis of the free recall results of Roediger and Challis (1992) and by the word fragment cued recall results of Greene (1986) and Challis and Sidhu (1993).

Category Instance Generation. As with word fragment completion, robust priming occurred in all three conditions in which the target word was presented: target (.21), target + target (.24), and target + associate (.20). This observation was confirmed in a one-way within subjects ANOVA in which the nonstudied condition was included, $F(4, 116) = 15.98$, $MS_e = .025$, indicating that reliable differences in production of target words occurred as a function of study condition. Surprisingly, however, neither exact nor conceptual repetition exerted any effect; performance in these conditions was not reliably greater than that in the once-presented condition, both $ts < 1$. That is, no differences were found among the following conditions: target, target + target, or target + associate. In addition, presentation of the associate alone did not reliably increase later production of the target word relative to the baseline condition, $t < 1$.

These results were unexpected, especially because conceptual repetition affected free recall in Roediger and Challis's (1992) study and word fragment cued recall in this experiment. As outlined in the introduction, a review of the sparse literature on the category instance generation test reveals that it generally seems to be affected by conceptual manipulations at study, such as generating (versus reading), levels of processing, and organization of material at study (Rappold & Hashtroudi, 1990; Srinivas & Roediger, 1990). This unexpected finding is addressed in the experiments to follow.

Category Cued Recall. In the category cued recall test, as in the category instance generation test, neither conceptual (.62) nor exact (.57) repetition increased production of target items relative to presentation of the target once (.62). In addition, presentation of the associates alone had only a slight effect (.02) on later "recall" of target words relative to the nonstudied condition. The ANOVA (excluding the nonstudied condition) revealed an effect of presentation condition, $F(3, 87) = 134.71$, $MS_e = .019$. Planned comparisons showed that as in the category association test, neither conceptual nor exact repetition increased recall of target items relative to presentation of the target once, $ts < 1$. The associate did exhibit a small effect, though; when it was presented alone, it led to a false recall rate that was reliably greater than that of the nonstudied words whose associates had not been presented, $t(29) = 2.4$, SEM = 01.

As in the category instance generation results, the lack of repetition effects was unpredicted. One possibility is simply that our materials were less effective than those used by Roediger and Challis (1992); because we could not use category coordinates as associates in our procedure (for reasons described in the Method), our associates may have been more weakly related to the target words. The free recall results permit us to ask if our materials and procedures produced a conceptual repetition effect in free recall.

Free Recall. As shown in the bottom row of Table 2, a conceptual repetition effect did occur, with mean proportion of items recalled being greater in both the target + associate (.45) and target + target (.43) conditions than in the target condition (.25). Thus, both conceptual and exact repetition exerted a positive effect on recall of targets, although there was no difference in the amount of influence they had. In addition, it can be seen that presentation of associates alone did not induce "recall" of the target. A within-subjects ANOVA revealed a significant main effect of study condition, $F(3, 42) = 6.32$, $MS_e = .024$. Planned comparisons confirmed initial observations, showing that proportions recalled of words presented in both conceptual, $t(14) = 3.96$, SEM = .05, and exact, $t(14) = 2.76$, SEM = .06, repetition conditions were greater than recall of words presented only once. The slight difference between the two repetition conditions was not reliable, though, $t < 1$.

These results indicate that the lack of conceptual repetition effects on category instance generation and category cued recall tests cannot be attributed to a weakness in the study manipulation because conceptual repetition affected performance on the free recall test. In fact, the conceptual repetition effect was of the same magnitude (.20) as that obtained by Roediger and Challis (1992, Experiment 2), who reported a .17 conceptual repetition effect in free recall. The constraints we imposed in constructing our materials by not using category coordinates did not weaken the conceptual repetition effect in free recall. Therefore, we can accept the results as producing a dissociation of conceptual memory tests: conceptual repetition enhanced free recall performance but left the implicit test of category instance generation and its explicit counterpart (i.e., category cued recall) unaffected. This pattern is not consistent with our predictions, which were based on the transfer appropriate processing account of memory performance. We expected the three conceptual tests to behave alike and predicted that all would be affected by conceptual repetition.

In Experiment 2, we sought to instantiate conceptual repetition in another (stronger) manipulation. We changed our materials so that conceptual repetition was achieved by presentation of pictures and their corresponding words. If the pattern of results obtained in Experiment 1 were replicated even with a stronger manipulation, then the difficulties for transfer appropriate processing would be more fully established.

Experiment 2

We used six study conditions in Experiment 2: (1) a picture presented once (hereafter called the *picture* condition); (2) a word presented once (the *word* condition); (3) a picture followed by the word that names it (the *picture + word* condition); (4) a word followed by a picture of the concept (the *word + picture* condition); (5) a picture presented twice (the *picture + picture* condition); and (6) a word presented twice (the *word + word* condition). Five tests were used: free recall, category instance generation, category cued recall, word fragment completion, and word fragment cued recall. Numerous comparisons can be made among these conditions; we discuss the picture-word comparison and the conceptual repetition conditions below.

On tests of free recall and recognition, pictures are remembered better than words, a finding called the picture superiority effect (Paivio, 1971; Paivio, Rogers, & Smythe, 1968). Although a number of explanations for this finding have been proposed, all essentially attribute it to pictures producing more elaborate or distinctive encoding than words (e.g., Paivio, 1971; Nelson, 1979). In transfer appropriate processing terms, pictures produce more conceptual elaboration than do words; therefore, performance on free recall is higher following the study of pictures. According to transfer appropriate processing theory, pictures should therefore produce better performance than words on other conceptual memory tests. Thus, we expected to find greater retention for pictures than for words on free recall, category instance generation, and category cued recall.

The picture superiority effect has been shown to be sensitive to the retrieval demands of tests; that is, although it is obtained on conceptual tests (e.g., free recall and recognition), it can disappear and even be reversed on perceptual tests, when the match of physical features between study and test is an important determinant of test performance. Thus, for example, on the word fragment completion test, words produce more priming than do pictures (McDermott & Roediger, 1994; Rajaram & Roediger, 1994; Roediger et. al., 1992; Weldon & Roediger, 1987). We expected to replicate this finding in Experiment 2 on the implicit word fragment completion test.

The primary question driving this experiment was whether conceptual repetition achieved by presenting both a picture and a word would enhance priming on the conceptual test of category instance generation. Paivio and Csapo (1973) showed that following a word with its corresponding picture enhanced performance on a free recall test (.23 recall) relative to simply presenting the picture (.14) or word (.07). Weldon et al. (1995) replicated this finding in word recognition. Therefore, according to transfer appropriate processing theory, the conceptual tests of category instance generation and category cued recall should show the same pattern of results: the picture + word (or word + picture) condition should produce higher rates of performance than the picture condition, and the picture condition should produce higher performance than the word condition. In addition, according to the same logic, pictures should produce more priming than words on the category instance generation test. Free recall was also included in an attempt to replicate the pattern of results obtained by Weldon et al. (1995) and Paivio and Csapo (1973) with our materials and to compare the results to the category instance generation and category cued recall tests.

METHOD

Subjects and Design

Subjects were 360 U.S. Air Force recruits tested at Lackland Air Force Base. Each subject studied either (1) pictures; and pictures followed by their corresponding words or (2) words; and words followed by their corresponding pictures. Each subject then took one of the five types of memory test. Therefore, a 2 (Format of target: picture or word) × 3 (Presentation condition: single presentation, conceptual repetition, or nonstudied) × 5 (Test type: free recall, category instance generation, category cued recall, word fragment completion, word fragment cued recall) mixed design was used. Number of presentations was varied within-subjects, whereas format of the target items and test type were manipulated between-subjects.

Materials

Twenty-one items were selected from the Snodgrass and Vanderwart (1980) norms to serve as materials. Items were divided into three groups of 7 for purposes of counterbal-

ancing. Each subject studied 7 items in a single presentation condition (picture or word), 7 in a conceptual repetition condition (picture + word or word + picture) and 7 items were not studied but served as baseline measures in the later memory tests. Repetitions were always massed. Each subject received the study items in a random order, which was determined separately for each subject.

Test sheets for the four cued memory tests contained cues for all 21 items (14 of which had been studied and 7 of which had not) as well as 7 filler items. Therefore, half of the tested items referred to studied items on both the implicit and explicit tests with word fragment and category name cues.

Procedure

Subjects were tested in groups of 40 or fewer. Until the test instructions were administered, all subjects were treated exactly alike. Subjects were led to believe that they were participating in an experiment about language. Study materials were presented by means of a computer monitor controlled by Micro Experimental Laboratory software (Schneider, 1988). Each picture and word was presented for 3.5 s and followed immediately by a prompt for subjects to rate the item (word or picture) on a scale of one to seven according to its degree of pleasantness. The prompt for the pleasantness judgment remained on the screen until the subject made a response. For each subject, seven target items were assigned to the single presentation condition (i.e., picture or word) and seven items to the repetition condition (i.e., picture followed by the word that names it or vice versa). In the repetition condition, subjects rated both the picture and the word for pleasantness. Thus, they saw, for example, a picture for 3.5 s, rated its pleasantness, then saw the word that names the picture for 3.5 s and then rated its pleasantness. Three filler items were assigned to each study condition. Therefore, a total of 30 pictures and words were shown.

Following the presentation of study items, subjects participated in a five minute distractor task of completing word stems. None of the stems presented in this task corresponded to items that had been studied. Subjects were then given the instructions appropriate to their test condition.

Subjects receiving the free recall test were given lined sheets of paper and asked to write down the names of items that they had earlier rated for pleasantness, without guessing. Further, they were instructed to recall the names of items regardless of whether they had seen them as pictures or words (or both). They were told that they had eight minutes in which to perform the task and to try for the entire time.

Subjects in the other test conditions were given instructions similar to those in Experiment 1. In the cued recall tests (with category names and words fragments as cues), they were always told to provide an answer if they could remember an item that was presented earlier and fit the cue. They were instructed that they should provide an answer regardless of whether they had seen the item as a picture or word (or both). However, they were told that some cues did not correspond to studied items and that they should not try to guess. In the category instance generation task, subjects were asked to write down as many instances of each category as they could in the allotted time. In the word fragment completion task, subjects were instructed to fill the blanks in each fragment to form the first word they thought of that fit the fragment. Emphasis was placed on responding as quickly as possible with the first word to come to mind. The pacing of the cued tests was as in Experiment 1 at the same 20 s/cue pace.

TABLE 3
Mean Proportion of Target Items Produced as a Function of Study Condition and Test Type in Experiment 2.

		Study Condition			
Test Cue	Test Instructions	P	W	P+W	W+P
None (Free Recall)	Explicit	.46	.37	.59	.61
Word Fragment	Implicit	.35	.60	.58	.61
	priming	.04	.27	.26	.28
	Explicit	.46	.58	.69	.69
Category Names	Implicit	.37	.36	.40	.42
	priming	.04	.07	.08	.12
	Explicit	.63	.46	.68	.69

Note. P refers to presentation of a picture once, W to presentation of a word once, P + W to presentation of a picture followed by the word that names it, and W + P to presentation of a word followed by a corresponding picture.

RESULTS

Results of Experiment 2 are shown in Table 3. We discuss the results for each test separately. Seven of the 360 subjects were discarded from analyses due to their obvious failure to follow instructions (e.g., producing extraordinarily high false recall rates on an explicit test).

Free Recall. This test was included to insure that we replicated past results. We did by obtaining (1) the standard picture superiority effect, with pictures producing .46 recall and words producing .37 recall, $t(68) = 1.93$, SEM = .05, and (2) a conceptual repetition effect, with the conceptual repetition conditions produced greater recall (mean of .60) than the single presentation conditions (.42). A t-test between the picture + word condition and the picture condition confirmed this claim, $t(34) = 3.96$, SEM = .03. Note also that the picture + word and word + picture conditions produced remarkably similar results. We made no differential predictions for these conditions, and their similarity further suggests that the difference between the picture and word conditions cannot be attributed to differences in subject groups.

Word Fragment Completion. Consistent with predictions, the word fragment completion test showed no picture superiority effect; indeed, there was no reliable priming (.04) from the picture condition, whereas the

word condition exhibited substantial priming (.27). These observations were confirmed by planned comparisons, $t(35) < 1$ for pictures and $t(35) = 5.6$, SEM = .05 for words. These findings replicate those of Weldon and Roediger (1987), among others.

Presenting both a picture and a word did not enhance priming on the word fragment completion test (mean of .27 priming) above the rate with which fragments were completed after presentation of the word alone (also .27 priming). Thus, as predicted, the sole determinant of priming on this test was whether the perceptual features of the study and test stimuli matched; the conceptual elaboration provided by viewing a picture in addition to the word did not enhance priming on this (perceptual) test.

Word Fragment Cued Recall. On the word fragment cued recall test, we obtained superior recall of words (.58) relative to pictures (.46), $t(69) = 2.03$, SEM = .06. In addition, a conceptual repetition effect was observed, with the conceptual repetition conditions producing enhanced recall (.69) relative to the one-presentation word condition (.58). The difference between recall in the word condition and in the word + picture condition was reliable, $t(34) = 1.89$, SEM = .05. Performance in all conditions was greater than the false recall rate of .05.

These results are fully consistent with transfer appropriate processing theory and with previous results in the literature (Weldon et al., 1989; Weldon et al., 1995). Transfer appropriate processing theory assumes that when test cues that are perceptually impoverished (e.g., word fragments or word stems) are used with explicit test instructions, a conceptual component is added to the already-existing perceptual component of the test. Therefore, although these tests still exhibit sensitivity to matches and mismatches in perceptual features between study and test episodes (e.g., a word superiority effect on a word fragment cued recall test), they also show a conceptual component, which is invoked by the nature of intentional recollection. By this logic, words produce greater recall than pictures because priming aids the resolution of the word fragment in this condition. However, a conceptual repetition effect is obtained due to the greater elaboration of these items at study (see Weldon et al., 1995, for further explication).

Category Instance Generation. Results in this condition did not turn out as predicted by transfer appropriate processing theory. There was no picture superiority effect, with pictures producing .04 priming and words producing .07 priming. In fact, there was only minimal (statistically nonsignificant) priming in both the single presentation conditions, $t(34) = 1.62$, SEM = .04, $p = .057$ for words and $t(35) = 1.01$, SEM = .04 for pictures. Priming in the conceptual repetition conditions was numerically greater (and different from zero, for picture + word $t(35) = 1.73$, SEM = .04 and word + picture $t(34) = 2.71$, SEM = .04). However, tests of significance between the picture and picture + word condition, $t(35) < 1$, and the word and word + picture conditions, $t(34) = 1.2$, SEM = .04, were nonsignificant. Thus, we obtained (1) only very weak support for our hypothesis that a conceptual repetition effect would obtain on this test, and (2) no picture superiority effect.

Category Cued Recall. On the category cued recall test, we obtained a picture superiority effect: Pictures were recalled at a higher rate (.63) than words (.46). This result allows us to infer that the implicit test was in fact measuring incidental retrieval because factors having sizable effects on cued recall did not produce any effect on the implicit version of the test. However, only a small (.05) increase in recall occurred when both a picture and a word had been presented at study (relative to when a picture alone had been presented).[1] Finally, the false recall rate on this test was .03.

Statistical analyses confirmed the above description of the data. Pictures were recalled at a level reliably higher than words, $t(67) = 3.24$, SEM = .05. However, a test between the picture and picture + word conditions showed that items in the picture + word condition were not recalled at a higher level, $t(33) < 1$.

DISCUSSION

Results from this experiment combined with those of Experiment 1 are puzzling. In both cases, conceptual manipulations exerted powerful effects on free recall but null effects or only hints of effects on category instance generation and category cued recall. Furthermore, in Experiment 2 we dissociated category instance generation and category cued recall: category instance generation showed no picture superiority effect, whereas category cued recall reflected this effect. In addition, the conceptual repetition effect was more robust in cued recall than in category instance generation.

Experiment 3

The inspiration for Experiment 3 lies in the distinction between item-specific and relational processing (Einstein & Hunt, 1980): item specific processing engenders thinking about some specific aspects of an item (e.g., the meaning of a word) without regard to the context in which the item occurs; relational processing involves associating or relating items with other items. Einstein and Hunt have shown that the two types of processing make unique contributions to memory performance (see Hunt & McDaniel, 1993, for a review). Obviously, for a conceptual repetition manipulation to take effect, subjects would have to process relations between words (targets and their associates or pictures and their names). However, we had subjects rating pleasantness of items, the task used in Hunt and Einstein's (1981) experiments to study item-specific processing. Perhaps we failed to find conceptual repetition effects in Experiments 1 and 2 because subjects failed to

[1] Note that if the word + picture and word conditions are compared, it could be argued that a conceptual repetition effect was obtained. However, because a picture superiority effect occurred, we chose the more conservative comparison (to the picture condition) as the baseline condition from which to measure repetition effects.

interrelate studied words sufficiently.[2] Therefore, in Experiment 3 we sought to enhance the relational processing subjects gave to items by having them rate each word according to how related it was to the immediately-preceding word. The same materials as in Experiment 1 were used here.

Note that some degree of relational processing must have been invoked in our earlier experiments because conceptual repetition exerted powerful effects on free recall. Nevertheless, we wanted to see whether strengthening this type of processing in Experiment 3 might produce parallel effects on category instance generation and category cued recall.

METHOD

Subjects

Sixty Rice University students served as subjects in return for course credit.

Design

A 5 (study condition: target, target + associate, target + target, associate, nonstudied) × 2 (test type: category instance generation or category cued recall) mixed design was used. Study condition was manipulated within subjects and test condition was manipulated between subjects.

Materials

The same target words and associates as in Experiment 1 were used in this experiment. In addition, the category cues given at test remained the same.

Procedure

Subjects were told that they were participating in an experiment designed to investigate the relatedness of words. They were told that they would see words presented one at a time on the computer screen and that their task was always to judge the degree to which the word was meaningfully related to the word that had immediately preceded it. Several examples were given, using a rating scale of 1 to 7, with 1 representing not at all related and 7 representing extremely related. It was explained that sometimes they would see the same word twice in a row and that these items should be considered maximally related. Each word was presented for 5 s and immediately followed by the rating scale.

Until presentation of the test instructions, all subjects were treated identically. Test instructions were the same as those given in Experiments 1 and 2. To summarize briefly, subjects in the category instance generation task were instructed to fill in as many instances of a given category as they could produce in 20 s. In the category cued recall test, subjects were told to write an instance of a category beside the cue only if they could think of an instance of the category that they had studied previously. In this task, also, 20 s were allotted for each category.

[2] We thank Teresa Blaxton for suggesting this possibility to us.

TABLE 4
Mean Proportion of Target Items Produced as a Function of Study Condition and Test Type in Experiment 3.

		Study Condition				
Test Cue	Test Instructions	T	T+A	T+T	A	NS
Category Names	Implicit	.30	.41	.36	.22	.22
	priming	.08	.19	.14	.00	
	Explicit	.35	.55	.40	.00	.00

Note. T refers to the study condition in which the target word was presented once, T + A to that in which the target was followed by a semantic associate, T + T to the condition in which the target was presented twice in succession, A to that in which the associate was presented alone, and NS to the nonstudied (baseline) condition.

RESULTS

Results are shown in Table 4. We discuss first the category instance generation test and then the category cued recall test.

Category instance generation. Priming was obtained in the following three conditions: target; target + associate; and target + target. In addition, we obtained a conceptual repetition effect: priming was greater in the target + associate condition (.19) than in the target condition (.08). Priming in the direct repetition condition fell between the other two conditions, with .14 priming. No indirect priming (.00) occurred from presentation of the associate.

Statistical analyses confirmed the above descriptions. A one-way ANOVA on the study conditions found a reliable effect of study conditions, $F(4, 29) = 7.9$, $MS_e = .21$, which indicates that an overall priming effect was obtained. Planned comparisons revealed reliable priming in the target condition, $t(29) = 2.24$, SEM = .03, the conceptual repetition condition, $t(29) = 4.45$, SEM = .04, and the exact repetition condition, $t(29) = 3.37$, SEM = .04. The difference between the amount of priming obtained in the target condition and the target + associate condition was reliable, $t(29) = 2.5$, SEM = .04. However, the condition in which the target was presented twice failed to produce reliably greater priming than the single presentation condition, $t(29) = 1.26$, $p = .11$ SEM = .05.

Category cued recall. The pattern of performance on the cued recall test mirrored that obtained on its implicit counterpart. The conceptual repetition condition produced the highest level of recall of the target items (.55), the single presentation condition produced the lowest level (.35), and the direct repetition condition fell in between (.40).

Statistical analyses showed that the target + associate condition produced reliably greater recall than the condition in which the target was presented twice, $t(29) = 3.36$, SEM = .04. When the target was presented twice, recall was not reliably higher than when the target was presented once $t(29) = 1.14$, SEM = .04, $p = .13$.

DISCUSSION

The principal result in this experiment is that both category instance generation and category cued recall

exhibited conceptual repetition effects. When subjects were given instructions to process relations between the studied words, following a word with an associate enhanced performance on the tests (relative to the one-presentation conditions). Both tests also showed a numerical advantage of direct repetition (relative to the one-presentation condition), although this difference did not reach significance in either case.

General Discussion

The three experiments reported here were designed to test Roediger's (1990; Roediger et al., 1989) transfer appropriate processing approach to explaining dissociations between memory tests. The results are mixed. Predictions of the theory were upheld on three tests — free recall, word fragment cued recall and word fragment completion. However, on two other tests, category instance generation and category cued recall, the predictions were at variance with the results. We discuss results of each of the tests in turn before ending with some remarks that may point the way for future research.

Free Recall. Free recall was included as a test in Experiments 1 and 2 because it is considered the quintessential conceptual test, and we wanted to see if manipulation of conceptual repetition would affect free recall. If it did not, then null effects in the other tests would not be surprising. In Experiment 1 we showed that following a target word by a weak associate boosted recall of the target word. In Experiment 2 we showed that following a word (or a picture) by a picture (or a word) also enhanced recall of the target. In addition, in Experiment 2 we showed a picture superiority effect in free recall. Therefore, the free recall results replicate past findings and show that our manipulations did have the intended effects.

Word Fragment Completion. The implicit test of word fragment completion has been classified as a perceptual implicit test (Roediger, 1990), and therefore we expected (a) little or no cross form priming from pictures, (b) no indirect priming, and (c) no conceptual repetition effect. These predictions were all upheld in Experiments 1 and 2. Presenting associates or pictures produced no priming of the target item on the word fragment completion test, and following a target word by either an associate or a picture failed to increase priming over single presentation of the target word. In addition, massed presentation of the target did not enhance priming relative to a single presentation. These results are all consistent with the transfer appropriate processing view and largely replicate prior work (especially Challis & Sidhu, 1993; Roediger & Challis, 1992; Weldon & Roediger, 1987, and Weldon et al., 1995).

Word Fragment Cued Recall. Roediger et al. (1989) suggested that explicit tests involving perceptually degraded cues such as word fragments are sensitive to both perceptual and conceptual factors. The degraded fragment must be resolved (so perceptual factors will be important in this process) and then subjects must use the cue to recollect information from their past, which is assumed to involve conceptual processes. Therefore, results obtained on this test should reflect a mixture of perceptual and conceptual processes. The results of Experiments 1 and 2 bear out this assumption. The study of words produced greater recall than did the study of pictures in Experiment 2, and conceptual repetition enhanced recall in both Experiments 1 and 2. The word/picture results are like those obtained by Weldon et al. (1989, 1995), whereas the conceptual repetition results of Experiment 1 have not been obtained previously. Word fragment cued recall behaved as expected from the transfer appropriate processing view.

Category Instance Generation. This implicit memory test has been shown to produce a generation effect, a level of processing effect, and an effect of organization, as reviewed in the Introduction. Therefore, we fully expected to obtain an effect of conceptual repetition, as well as a picture superiority effect, on this test. However, in the first two experiments, we failed to obtain an effect of conceptual repetition, and in Experiment 2, we did not obtain a picture superiority effect, either. Weldon and Coyote (in press) have also obtained equal priming from pictures and words on conceptual implicit memory tests.

In Experiment 3 we did obtain a conceptual repetition effect (using the associate materials), but only when study conditions emphasized relational processing. Therefore, although the category instance generation test can reveal a conceptual repetition effect, it did not do so in Experiments 1 and 2 under the same conditions that produced the effect in free recall. Therefore, we found dissociations between two conceptual tests, free recall and category instance generation. Clearly, this pattern contradicts predictions of Roediger's (1990) transfer appropriate processing view. However, the present results do permit us to conclude that the category instance generation task meets the retrieval intentionality criterion for an implicit test. As discussed in the next section, the pattern of results from the category instance generation test differed from that on the category cued recall test with all conditions held constant except the type of instructions given at test (implicit or explicit). Therefore, performance on the implicit test was not compromised by conscious recollection. Despite the fact that category names are powerful retrieval cues, they do not automatically provoke conscious recollection when used with implicit test instructions.

Category Cued Recall. This test was assumed to represent another strongly conceptual test, as defined in the transfer appropriate processing view. However, the pattern of results obtained from it differed not only from the category instance generation test in Experiments 1 and 2, as just mentioned, but also (in some cases) from the pattern of free recall. For example, a strong effect of both exact and conceptual repetition occurred in free recall, but neither effect occurred in the category cued recall data. In Experiment 2, a picture superiority effect occurred in category cued recall, as in free recall, but adding a word to a picture greatly augmented free recall but had only a slight and nonsignificant effect in category cued recall.

In short, category cued recall showed important differences between both category instance generation and free

recall. According to Roediger's (1990) transfer appropriate processing view, all three tasks should have behaved similarly.

Theoretical Implications. A large body of evidence has been generated that, in general, supports the transfer appropriate processing view for explaining dissociations between memory tests (see Roediger & McDermott, 1993 for a review). Of course not all the evidence is uniformly supportive (see Masson & MacLeod, 1992; Tenpenny & Shoben 1991; Toth & Hunt, 1990, for some exceptions). On tests using word fragment cues, the results of the present experiments generally supported the transfer appropriate processing approach; however, the results from tests using category names (whether with explicit or implicit instructions) produced discrepant results.

How might the theory be elaborated to account for dissociations among conceptual tests? We can consider an analogous situation in perceptual implicit memory tests, where it has long been clear that the match of particular perceptual features between study and test greatly affects priming. For example, studying words primes performance on a word fragment completion test but not a picture fragment identification test; conversely, studying pictures primes the picture fragment identification test but not word fragment completion (Weldon & Roediger, 1987, Experiment 4). The present results argue that distinctions probably need to be made between forms of conceptual processes. That is, transfer appropriate processing theory has assumed that all conceptual processes are generally similar. In all likelihood, this assumption is wrong. Distinctions between different kinds of conceptual processes must be made. For example Cabeza (1994) has recently shown that two conceptual implicit memory tests can be dissociated. He compared priming on the category instance generation test with priming on a word association test. Study conditions involved either generating category labels for items or generating associates to items. Priming was greater from the study condition involving category label generation on the category instance generation test, relative to the word association study condition. Conversely, priming on the word association test was greater following the word association study condition than the category label generation condition. These results point to the necessity of distinguishing different types of conceptual processes. Although it is clear that transfer appropriate processing theory must be altered to account for the results, we must leave specific developments for the future.

The transfer appropriate processing ideas were originally introduced as an alternative to postulating multiple memory systems to explain dissociations between tests. Over the years, these two approaches have come to be seen as complementary rather than as competitive (see Roediger & McDermott, 1993, and Schacter, 1990; 1992, for the suggested rapprochement). Nonetheless, it is worth spending a paragraph considering how current multiple memory systems (e.g., Squire, 1994; Schacter, 1994) might account for these results. Generally, dissociations between explicit and implicit memory tests are accounted for by postulating separate declarative and nondeclarative memory systems (Squire, 1987) or distinguishing between episodic memory and a perceptual representation system (Tulving & Schacter, 1990). Although these theories would be well-equipped to explain dissociations in our experiments between some explicit and implicit tests (e.g. those we have reported between free recall and primed word fragment completion), these theories are ill-equipped to explain differences found between free recall and category cued recall. After all, both are explicit (episodic) memory tests and therefore one may expect that variables should affect them similarly. Thus, in addition to being problematic to transfer appropriate processing views, some of the present data are not easily aligned with current versions of multiple memory systems theories either.

One approach to explaining test differences that borrows from both the multiple memory systems theories and from the transfer appropriate processing ideas is the componential theory espoused in one form or another by Tenpenny and Shoben (1991), Hintzman (1990), and Moscovitch (1994; Witherspoon & Moscovitch, 1989). These authors argue that each memory test can be considered as composed of various component processes. Tests may share some processes in common, but others will differ on any two tests that can be dissociated. To the extent that manipulations affect similar processes, associations will be found when comparing tests. To the extent that manipulations affect different processes on the various tests, then test differences will be found (Hintzman, 1990). Although this approach is vague unless the component processes are specified in detail, they at least permit a beginning towards understanding dissociations that are problematic for the other views. For example, finding dissociations between category cued recall and category instance generation or dissociations between free recall and recognition (as in the word frequency effect; see Balota & Neely, 1980), or between free recall and category cued recall (as in the present Experiments 1 and 2) are problematic for all extant theories of test differences. In order to explain such differences, it will be necessary to describe the component processes underlying each test, to note which processes distinguish the various tests, and to determine what variables affect the different components. This elucidation remains as a challenge for the future.

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Sommaire

Les effets de répétition
lors de tests de mémoire implicite conceptuels

Trois expériences ont été menées pour vérifier si un test de mémoire implicite conceptuel (spécifiquement, la production de membres de catégories) montrerait des effets de répétition semblables à ceux que l'on trouve dans le rappel libre. Le traitement adapté au transfert afférent aux dissociations implicite et explicite entre les tests de mémoire, comme l'avance Roediger (1990), nous a amené à prédire que les tests montreraient des effets parallèles. Cette prédiction était basée sur l'hypothèse de la théorie du traitement adapté au transfert qui veut que les tests conceptuels agissent comme une fonction à multiples variables indépendantes (voir Roediger et Blaxton, 1987a). Nous nous attendions donc à ce que l'amorçage sur l'épreuve de production de membres de catégories soit amélioré autant par la répétition exacte (présenter l'item cible deux fois) que par la répétition conceptuelle (présenter l'item cible suivi d'un item sémantiquement semblable). Au cours de la première expérience, la répétition conceptuelle a été instanciée en faisant suivre un mot cible (puzzle par exemple) par une association (casse-tête par exemple); cette manipulation n'a pas augmenté l'amorçage du test de production de membres de catégories quand le mot n'était présenté qu'une seule fois bien que la manipulation ait affecté le rappel libre. De même, deux représentations du mot cible n'ont pas augmenté l'amorçage dans la production de membres de catégories mais l'ont augmenté dans le rappel libre (dans le cas d'une seule présentation). Dans la deuxième expérience, la répétition conceptuelle a été atteinte en faisant suivre une image par le mot correspondant (ou vice versa). Dans ce cas, il y eut un effet de répétition conceptuelle sur le rappel libre mais pas d'effet significatif sur la production de membres de catégories ou le rappel par indices. De plus, nous avons obtenu un effet de supériorité de l'image dans le rappel libre mais pas dans la production de membres de catégories. Au cours de la troisième expérience, en utilisant la même séquence d'étude que celle de la première expérience, mais avec des consignes différentes qui encourageaient le traitement relationnel, l'amorçage sur l'épreuve de production de membres de catégories fut augmenté à la fois par la répétition conceptuelle et par la répétition exacte. Les résultats démontrent que les tests de mémoire conceptuels peuvent être dissociés et ne valident pas les dissociations entre les tests de mémoire explicite et implicite du traitement adapté au transfert de Roediger (1990).