Journal of Experimental Psychology:
Learning, Memory, and Cognition
2006, Vol. 32, No. 1, 33–43

Copyright 2006 by the American Psychological Association
0278-7393/06/$12.00 DOI: 10.1037/0278-7393.32.1.33

Part-List Cuing Can Be Transient and Lasting: The Role of Encoding

Karl-Heinz Bäuml and Alp Aslan
Regensburg University

The presentation of a subset of learned items as retrieval cues can have detrimental effects on recall of the remaining items. For 2 types of encoding conditions, the authors examined in 3 experiments whether such part-list cuing is a transient or a lasting phenomenon. Across the experiments, the detrimental effect of part-list cues was consistently found to be transient with a high degree of interitem associations and lasting with a low degree. These results indicate that the persistence of part-list cuing depends on encoding, thus challenging both strategy disruption and retrieval inhibition as general accounts of part-list cuing. A 2-mechanism account is provided according to which the 2 mechanisms mediate the effect in different encoding conditions.

Keywords: episodic forgetting, part-list cuing, interitem associations, strategy disruption, retrieval inhibition

Episodic remembering benefits largely from the presence of adequate retrieval cues. Corresponding evidence has been accumulated over decades, including both laboratory work (e.g., Tulving, 1974) and applied situations (e.g., Geiselman, Fisher, MacKinnon, & Holland, 1985). If, for instance, participants are presented a categorized list and, at test, receive one item from each category as a retrieval cue, then such cuing typically enhances recall performance compared with unaided free recall (Hudson & Austin, 1970). Ironically, however, this beneficial effect of cuing can be reduced if participants at test receive several items from each category rather than one item as a retrieval cue (Roediger, 1973; Slamecka, 1968). In general, if more part-list cues are provided than are necessary to remind participants of the various categories, or subjective units, cuing can be detrimental.

The detrimental effect of part-list cuing has been found to be fairly robust and to emerge in episodic as well as semantic memory (Brown, 1968). The effect has been observed in recall, recognition, and reconstruction tasks (Oswald, Serra, & Krishna, in press; Serra & Nairne, 2000; Todres & Watkins, 1981); in veridical and false memory settings (Bäuml & Kuhbandner, 2003; Kimball & Bjork, 2002; Reysen & Nairne, 2002); with intralist and extralist cues (Roediger, Stellon, & Tulving, 1977; Watkins, 1975); and in intentional and incidental memory tasks (Peynircioğlu & Moro, 1995; see Nickerson, 1984; or Roediger & Neely, 1982, for a review).

Karl-Heinz Bäuml and Alp Aslan, Department of Experimental Psychology, Regensburg University, Regensburg, Germany.

The research reported here was supported by Deutsche Forschungsgemeinschaft Grant FOR 448 to Karl-Heinz Bäuml. We thank A. Samenieh for her help in the experimental work.

Correspondence concerning this article should be addressed to Karl-Heinz Bäuml, Department of Experimental Psychology, Regensburg University, 93040, Regensburg, Germany. E-mail: karl-heinz.baeuml@psychologie.uni-regensburg.de

Accounts of Part-List Cuing

An old, though still prominent, account of part-list cuing is retrieval competition (Rundus, 1973). Retrieval competition explains part-list cuing by assuming that reexposure of items as cues strengthens these items' representation. During attempts to recall the noncue items at test, this strengthening of the cue items leads participants to covertly retrieve cue items before noncue items. Because each covert retrieval of a cue item reflects a failure to retrieve a new noncue item and because the retrieval process is assumed to stop after a critical number of failures, this competition bias can lower recall chances for the noncue items and thus cause the detrimental effect of part-list cuing.

Although retrieval competition is consistent with a number of basic findings in the part-list cuing literature (see Nickerson, 1984; or Roediger & Neely, 1982), over the years the results of several studies have challenged the principle (B. H. Basden, Basden, & Stephens, 2002; D. R. Basden & Basden, 1995; D. R. Basden, Basden, & Galloway, 1977; Bäuml, Kissler, & Rak, 2002; Sloman, Bower, & Rohrer, 1991). Particularly challenging is the repeated recent demonstration that strengthening per se does not cause forgetting (Anderson, Bjork, & Bjork, 1994; Anderson, Bjork, & Bjork, 2000; Bäuml, 1997, 2002; Ciranni & Shimamura, 1999). Consistently, when researchers directly compared the effect of reexposure of a subset of learned items for use as retrieval cues with reexposure of the same items for additional learning, they found that relearning did not cause forgetting but that part-list cuing did (Bäuml & Aslan, 2004).

An alternative account of part-list cuing is strategy disruption (D. R. Basden & Basden, 1995; D. R. Basden et al., 1977). According to this account, participants form individual retrieval plans or strategies when they encode a set of items. Such retrieval plans can be based on a variety of information to organize recall, including temporal, spatial, and interitem associative information (see B. H. Basden et al., 2002, for a discussion). The theory assumes that when part-list cues are presented, these cues disrupt retrieval by forcing a serial recall order that is inconsistent with the initial retrieval plan. Raaijmakers and Shiffrin's (1981) search-of-

associative-memory model and Sloman et al.'s (1991) incongruency principle make related suggestions. In effect, all of these accounts attribute part-list cuing to a change in the retrieval process from a more effective one when cues are absent to a less effective one when they are present.

Strategy disruption is consistent with numerous findings in free and serial recall and also in serial reconstruction tasks (B. H. Basden et al., 2002; D. R. Basden & Basden, 1995; D. R. Basden et al., 1977; Serra & Nairne, 2000). Researchers have suggested two lines of evidence to be particularly supportive for the principle. The first line is that, in accord with strategy disruption, part-list cuing appears to induce smaller recall impairments if the presentation of cue items is consistent with participants' preferred recall order than if it is strategy inconsistent (B. H. Basden et al., 2002; D. R. Basden & Basden, 1995; Sloman et al., 1991). The other is that a release from part-list cuing has been reported in a repeated testing situation, in which cues were present in the first test and absent in the second test (D. R. Basden & Basden, 1995; D. R. Basden et al., 1977). Because the absence of the cues in the second test should permit participants to return to their original strategies, the finding is consistent with strategy disruption.

Another, more recent account of part-list cuing is retrieval inhibition (Anderson et al., 1994; Bäuml & Aslan, 2004). Like retrieval competition, this account assumes that the presentation of part-list cues leads to covert retrieval of the cue items at test. In contrast to retrieval competition, however, this covert retrieval is not supposed to cause forgetting because of biased competition. Rather, the covert retrieval is assumed to cause inhibition of the noncue items, very similar to how overt retrieval of a subset of previously learned material has been shown to cause inhibition of the nonretrieved material (see Anderson, 2003, for a review of retrieval-induced forgetting). As a corollary, this account assumes that part-list cuing and retrieval-induced forgetting are functionally equivalent.

Consistent with the inhibition account, the results from several recent studies that compared part-list cuing and retrieval-induced forgetting as directly as possible within a single experiment found neither qualitative nor quantitative differences between the two forms of forgetting. These studies include comparisons in veridical and false recall (Bäuml & Kuhbandner, 2003), the role of a delay between retrieval practice/part-list cuing and the recall test (Bäuml & Aslan, 2004), and children's episodic memory (Zellner & Bäuml, 2005). Support for an inhibitory account comes also from studies showing that detrimental effects of part-list cuing not only occur in free and cued recall but generalize to tests of word completion (Bäuml & Aslan, 2004; Bäuml et al., 2002; Peynircioğlu, 1989) and item recognition (Oswald et al., in press; Todres & Watkins, 1981). Finding the effect across this whole range of tests agrees with the view that cuing causes forgetting by affecting the representation of the noncue items (see also Anderson, 2003; Bäuml, Zellner, & Vilimek, 2005; Hicks & Starns, 2004; or Veling & van Knippenberg, 2004).

Distinguishing Between Strategy Disruption and Retrieval Inhibition

Although strategy disruption and retrieval inhibition differ fundamentally in their assumptions about the underlying mechanisms of part-list cuing, each of the two accounts can explain a variety of findings. This raises the question of how we can distinguish between the two accounts. To us, two lines of findings appear particularly promising to distinguish between strategy disruption and retrieval inhibition. The first is the demonstration that detrimental effects of part-list cuing are not restricted to tests of free and cued recall but generalize to tests that use item-specific cues. Forcing participants to use experimenter-guided (random) retrieval strategies—as researchers typically do when using item-specific cues—should disrupt their personal strategies regardless of whether part-list cues are provided (Peynircioğlu, 1989). Finding reliable detrimental effects of part-list cuing in tests of word completion (Bäuml & Aslan, 2004; Bäuml et al., 2002; Peynircioğlu, 1989) and item recognition (Oswald et al., in press; Todres & Watkins, 1981) thus challenges explanations solely based on strategy disruption. The finding, however, is consistent with retrieval inhibition, according to which the presence of part-list cues affects the representation of the noncues.

The other line of findings to distinguish between strategy disruption and retrieval inhibition comes from repeated testing experiments. In these experiments, researchers examine whether the forgetting found in a first recall test, in which part-list cues are present, disappears in a subsequent test, in which the cues are removed. Indeed, according to the inhibition account of part-list cuing, the detrimental effect of cues should reflect long-term changes in the items' activation levels and thus be lasting. Consistently, in retrieval-induced forgetting studies, experimenters have shown that the forgetting lasts at least up to 20 min (Anderson et al., 1994; Anderson & Spellman, 1995) and is not reduced across successive recall tests (Zellner & Bäuml, 2004). Thus, if part-list cuing is mediated by the same form of inhibition as retrieval-induced forgetting, the same result should show up for part-list cuing, and the detrimental effect should be lasting.

By contrast, according to the strategy disruption account, the forgetting should be short-lived and eliminated if the cues are removed. Because strategy disruption attributes the forgetting to altered retrieval strategy in the presence of cues, the removal of those cues should enable participants to turn back to their original strategies and thus eliminate any forgetting the cues originally produced (D. R. Basden & Basden, 1995, p. 1666). D. R. Basden and Basden (1995) examined the issue in several repeated testing experiments and, in fact, found the detrimental effect of part-list cuing to largely disappear once the cues were removed (see also D. R. Basden et al., 1977). These results on the release from part-list cuing with repeated testing support the strategy disruption account and challenge explanations solely based on inhibition.[1]

[1] Finding part-list cuing with item-specific cues and a release from the forgetting with repeated testing both challenge retrieval competition. Because retrieval competition attributes part-list cuing to strengthening-induced output order biases, the effect should disappear once item-specific cues are present (Bäuml, 1997; Bäuml & Aslan, 2004). If the strengthening of the cues is responsible for the detrimental effect, part-list cuing should not disappear with repeated testing, given that strengthening effects are known to persist for quite a while (Slamecka & McElree, 1983). Together with the other challenges mentioned above, these failures speak strongly against retrieval competition as an appropriate account of part-list cuing.

The Possible Role of Encoding

The fact that one of the two lines of evidence emphasized above supports strategy disruption and challenges retrieval inhibition and the other supports retrieval inhibition and challenges strategy disruption suggests that neither of the two accounts can serve as a complete theory of part-list cuing. Two possibilities arise. One possibility is to reject both strategy disruption and retrieval inhibition and search for a new account to explain the two lines of findings. The other possibility is to assume that both strategy disruption and retrieval inhibition underlie the detrimental effect of part-list cuing, though with different contributions in different experimental contexts. To be useful, such an account needs to specify as exactly as possible what the contexts are in which strategy disruption is the mediating mechanism and what the contexts are in which retrieval inhibition is the mediating mechanism.

Indeed, a closer look at prior work shows that there is a wide range of encoding conditions in which the detrimental effect of part-list cuing has been reported. These situations include experiments that might have favored the building up of interitem associations and an elaborated retrieval plan, such as experiments in which repeated study–test trials were used for learning or in which participants were instructed to encode items serially (B. H. Basden et al., 2002; D. R. Basden & Basden, 1995; D. R. Basden et al., 1977; Serra & Nairne, 2000). These situations, however, also include experiments with a single learning trial and no instruction to encode items strategically, conditions in which interitem associations might have played a minor role (Bäuml & Aslan, 2004; Bäuml et al., 2002; Oswald et al., in press; Peynircioğlu, 1989).

Given this tentative distinction between two types of encoding situations, a striking observation arises. The transient nature of part-list cuing—regarded as indicative of strategy disruption (e.g., D. R. Basden & Basden, 1995)—has only been shown in the first type of situation, that is, with a putatively high number of interitem associations, but has not yet been examined in the second type, that is, with a putatively low number of interitem associations. The detrimental effect of part-list cuing with item-specific cues—regarded as indicative of retrieval inhibition (e.g., Bäuml & Aslan, 2004)—has been found in the second type of situation, that is, with a putatively low number of interitem associations, but it has not yet been shown in the first type of situation, that is, with a putatively high number of interitem associations.

This pattern of results suggests that different mechanisms may be responsible for the detrimental effect of part-list cues in different encoding situations. In particular, the pattern is consistent with the proposal that strategy disruption is the responsible mechanism in case of a high degree of interitem associations and that retrieval inhibition is the responsible mechanism in case of a low degree. Providing a rationale for such a proposal, researchers have argued that a low degree of interitem associations induces a list representation with a high amount of interitem interference, triggering inhibitory processes on the noncue items once part-list cues are provided and covertly retrieved (Anderson et al., 1994; Bäuml & Aslan, 2004). Following this view, inhibition, not strategy disruption, should be the mediating mechanism of part-list cuing in situations with a low degree of interitem associations.

It has been suggested that interitem associations can reduce interitem interference or even eliminate it (E. E. Smith, Adams, & Schorr, 1978), thus leaving not much room for inhibition to occur. Support for this proposal comes from research on the so-called integration effect, in which it has been demonstrated that interconnecting the items of a list—or category—reduces competition among the single items. Integration effects have been shown in research on the fan effect (Radvansky, 1999) and on retrieval-induced forgetting (Anderson, Green, & McCulloch, 2000; Anderson & McCulloch, 1999; Bäuml & Hartinger, 2002; Bäuml & Kuhbandner, 2003). In one study, researchers also showed an integration effect for part-list cuing (Bäuml & Kuhbandner, 2003). In all of these cases, integration eliminated the forgetting.

Although in integration studies interitem associations are supposed to be established among most list—or category—items, in some cases, interitem associations may be established for a small subset of the items only. Indeed, evidence for strategy disruption has typically been reported in situations in which participants create preferred output orders. This holds true for situations with repeated study–test trials, in which participants repeatedly study and recall items and their recall order grows more consistent over trials (D. R. Basden & Basden, 1995; see Tulving, 1962). It also holds true for serial recall and reconstruction tasks, in which participants are instructed to encode the items in the presented order (B. H. Basden et al., 2002; Serra & Nairne, 2000).

Such situations may lead to interitem associations, in which the items within a list or category are associatively chained together, with one item serving as the retrieval cue for the next list item (see Murdock, 1983). Like integration structures, such chainlike structures may have the benefit that interference is largely reduced or eliminated, so that inhibition does not occur. As opposed to integration structures, however, the existence of a preferred and possibly relatively rigid output order may make recall vulnerable to disruption in the presence of part-list cues (D. R. Basden & Basden, 1995). Thus, strategy disruption, not inhibition, may be the mediating mechanism of part-list cuing in this type of situation.

If this two-mechanism proposal of part-list cuing impairment is right, then the presence of part-list cues should cause forgetting of noncues both in situations with a low degree of interitem associations and in situations with a high degree of (chainlike) interitem associations. However, only in situations with such a high degree of interitem associations should the forgetting be short-lived; the forgetting should reflect a disruption of participants' retrieval strategies, which should be eliminated once the cues are removed (D. R. Basden & Basden, 1995; D. R. Basden et al., 1977). In situations with a low degree of interitem associations, the forgetting should be lasting; in this case, the forgetting should be caused by retrieval inhibition, which has been shown to cause long-lasting effects on item recall (Anderson, 2003; Zellner & Bäuml, 2004). We examine this prediction in three experiments.

Experiment 1

In Experiment 1, we examine the persistence of part-list cuing in a condition with a high degree and a condition with a low degree of interitem associations, which we refer to as the *high associative* and *low associative* conditions, respectively. We exposed participants to categorized lists, with each category consisting of target and nontarget items. After learning and a short distractor task, there were two successive recall tests, with part-list cuing occurring as part of the first recall test but not the second. In the first test,

we provided the nontarget items of each category as retrieval cues for recall of a category's target items (*part-list cuing*) or asked participants to recall both target and nontarget items without any part-list cues (*no part-list cuing*). In the second test, which occurred after another distractor task, in both conditions participants had to recall all of the previously learned items.

Half of the participants in the experiment participated in the high associative condition, and half participated in the low associative condition. In the high associative condition, we put participants through two successive study–test cycles, thus mimicking the procedure used in some previous part-list cuing work (e.g., D. R. Basden & Basden, 1995). In the low associative condition, we used just one study trial without any test trial, thus mimicking the procedure used in other previous part-list cuing work (e.g., Bäuml & Aslan, 2004). In both conditions, there was no instruction to encode the material strategically.

On the basis of prior work, we expected to find detrimental effects of part-list cuing in both the high and the low associative condition. On the basis of the proposal that the type of encoding determines whether strategy disruption or retrieval inhibition mediates part-list cuing, we expected that the detrimental effect of part-list cuing would be caused by strategy disruption and would be short-lived in the high associative condition, thus replicating prior work on the release from part-list cuing (D. R. Basden & Basden, 1995; D. R. Basden et al., 1977). In the low associative condition, however, we expected that the detrimental effect would be caused by retrieval inhibition and would be lasting. The experiment takes place at a time when the persistence of part-list cuing has not yet been examined with a low degree of interitem associations. The results speak to the issue of whether the persistence of part-list cuing depends on encoding; thus, they impose important restrictions on theoretical accounts of part-list cuing.

Method

Participants

Seventy-two students at Regensburg University, Regensburg, Germany, participated in the experiment. They were tested individually.

Materials

We constructed two study lists, each consisting of words from two semantic categories. Each category contained eight items, four target and four nontarget items, which were drawn from several published norms (Battig & Montague, 1969; Mannhaupt, 1983; Scheithe & Bäuml, 1995). Because previous work provided evidence that categories' high-frequency exemplars may be more susceptible to part-list cuing effects than their low-frequency exemplars (Bäuml et al., 2002; Kissler & Bäuml, 2005), for each selected category we used the four exemplars with the higher word frequency as the target (noncue) items and the four exemplars with the lower word frequency as the nontarget (cue) items. Across categories, targets had a mean rank order of 11.8 (range = 10.8–14.3), and nontargets had a mean rank order of 28.5 (range = 24.3–35.0). Within each category, no two items began with the same first letter.

Design

The experiment had a mixed design with three factors: encoding, cuing, and testing. We manipulated encoding (high associative, low associative) between subjects, and we varied cuing (part-list cuing, no part-list cuing) and testing (*critical test*, *final test*) within subject. For each participant, the experiment consisted of two parts, which differed in which of the two lists the participant had to learn and whether part-list cues were provided. Each part consisted of three main phases: an initial study phase, a critical test phase, and a final test phase. In the initial study phase, half of the participants went through two study–test cycles (high associative encoding); the other half received just one study trial (low associative encoding). In the critical test phase, participants in one part of the experiment were provided the nontarget items as cues and were asked to recall a category's target items (part-list cuing); in the other part they were asked to recall both target and nontarget items without any part-list cues (no part-list cuing). In the final test phase, participants had to recall all of the studied items, irrespective of whether part-list cues were provided in the critical test. The order of the two parts of the experiment was counterbalanced across participants, as was the assignment of lists to the two parts. The whole experiment was carried out within one session.

Procedure

Study phase. The 16 items of a list were presented successively on index cards at a 5-s rate, each item together with its category label (e.g., *FRUIT–apple*). Presentation order was random, with the restriction that no more than two items from the same category were presented adjacently. Whereas in the low associative condition participants received only one study trial, in the high associative condition participants went through two study–test cycles. After the first study trial, these participants did a 30-s backward counting task and were then tested on all items they had learned. We tested the two categories of a list successively on separate sheets of paper. We provided participants the category name on top of the sheet and gave them 40 s to recall and write down the category's eight items in any order. Promptly following this first study–test cycle, we conducted a second study–test cycle in exactly the same way. To facilitate associative encoding, we kept both the presentation order of items and the testing order of categories in this second cycle the same as in the first study–test cycle. We counterbalanced the order of a list's two categories across subjects. The study phase in both encoding conditions ended with a 30-s backward counting task as a recency control.

Critical test. Following the distractor task, we carried out the critical test. In the no part-list cuing condition, participants performed a category-cued-recall test. For each of the two categories, we gave the category name on top of the sheet, and participants had to recall all of the previously learned items of that category. In the part-list cuing condition, we additionally provided participants a category's four nontarget items in random order as part-list cues. We instructed them to read the four items aloud and use them as retrieval cues for recall of the remaining (target) items. We gave participants 40 s to write down as many items of the category as possible. We counterbalanced the order of a list's two categories across participants. After finishing the critical test, participants engaged in a 2-min distractor task, in which they rated the attractiveness of faces.

Final test. After the distractor task, we carried out a final recall test, which was identical for the part-list cuing and no part-list cuing conditions. We assessed memory performance using exactly the same category-cued-recall test as we used in the critical test in the no part-list cuing condition. Again, we tested a list's two categories successively for 40 s each. For each participant, the order of the tested categories was the same as in the critical test.

Results

Performance in the Study Phase

As reported in Table 1, in the high associative condition, performance for target items improved significantly, from 73.3% in the first test to 89.9% in the second test of the study phase, $F(1,$

Table 1
Percentage of Target Item Recall for Each Condition in Experiment 1 (Standard Errors in Parentheses)

	Type of encoding			
	High associative		Low associative	
Test	Cues	No cues	Cues	No cues
First	73.6 (2.5)	72.9 (3.0)	—	—
Second	88.9 (1.7)	91.0 (2.1)	—	—
Critical	80.6 (2.2)	90.3 (1.9)	56.6 (3.4)	69.8 (3.2)
Final	88.5 (2.1)	89.9 (2.3)	57.3 (3.2)	68.1 (2.8)

Note. First and Second Test refer to recall tests during the study phase of the experiment. They were conducted in the high associative encoding condition only.

35) = 109.3, $MSE = 0.009$, $p < .001$, thus reflecting successful learning. There was no difference in recall level between the part-list cuing and the no part-list cuing conditions, $F(1, 35) < 1$, which we expected given that, up to this point, we had not yet introduced the part-list cuing manipulation.

Detrimental Effects of Part-List Cuing

Table 1 shows that, with high associative encoding, target item recall in the critical test was significantly worse in the presence than in the absence of part-list cues (80.6% vs. 90.3%), $F(1, 35) = 19.9$, $MSE = 0.009$, $p < .001$, thus demonstrating the standard result of part-list cuing. This detrimental effect of part-list cues did not occur in the final recall test (88.5% vs. 89.9%), $F(1, 35) < 1$, which indicates that there was a release from part-list cuing in this encoding condition. Supporting this view, a 2 × 2 analysis of variance with the two factors of cuing (part-list cues or no part-list cues) and testing (critical or final test) yielded a significant interaction between the two factors, $F(1, 35) = 14.0$, $MSE = 0.004$, $p = .001$.

Also with low associative encoding, target item recall in the critical test was significantly lower in the presence than in the absence of part-list cues (56.6% vs. 69.8%), $F(1, 35) = 17.6$, $MSE = 0.018$, $p < .001$. In contrast to the high associative condition, however, this detrimental effect was still present in the final test (57.3% vs. 68.1%), $F(1, 35) = 15.5$, $MSE = 0.013$, $p < .001$, indicating that there was no release from part-list cuing in this encoding condition. Consistently, a 2 × 2 analysis of variance with the two factors of cuing (part-list cues or no part-list cues) and testing (critical or final test) showed no significant interaction between the two factors, $F(1, 35) = 1.6$, $MSE = 0.003$, $p > .20$.

Together, the results for the two encoding conditions suggest that the type of encoding determines whether there is a release from part-list cuing in the final test. A 2 × 2 × 2 analysis of variance with the three factors of encoding (high associative or low associative), cuing (part-list cues or no part-list cues), and testing (critical or final test) confirmed this suggestion by yielding a significant interaction among the three factors, $F(1, 70) = 4.0$, $MSE = 0.004$, $p < .05$.

Beneficial Effects of Part-List Cuing

To determine whether the reexposure of nontarget items as retrieval cues in the critical test had a beneficial effect on these items' later recall, we examined the proportion of nontargets recalled in the final test. In the low associative condition, reexposure significantly improved these items' recall in the final test (69.8% vs. 59.0%), $F(1, 35) = 9.1$, $MSE = 0.023$, $p < .01$. In the high associative condition, reexposure showed the same tendency, although the effect failed to reach significance (91.0% vs. 88.9%), $F(1, 35) < 1$. Because recall level was very high with high associative encoding, this failure probably reflects a ceiling effect (see Experiment 3).

Discussion

The results of the experiment indicate that encoding has a major influence on the detrimental effect of part-list cues. In the high associative condition, we found the detrimental effect of part-list cues to be short-lived and to disappear once the cues were removed, thus replicating prior work that also used repeated study–test cycles for learning and reported a comparable release from part-list cuing (D. R. Basden & Basden, 1995). By contrast, in the low associative condition, we found the detrimental effect of part-list cues to be lasting and to remain largely unaffected when the cues were removed. This result is the first demonstration of a lasting part-list cuing effect. It shows that, dependent on encoding, part-list cuing can be transient or lasting. This finding challenges both strategy disruption and retrieval inhibition as general accounts of part-list cuing, which either assume that part-list cuing causes short-lived forgetting (strategy disruption) or assume that it causes lasting forgetting (retrieval inhibition).

Recall performance without part-list cues was fairly high in the high associative condition of this experiment. Accordingly, one could argue that the apparent release from part-list cuing in this condition was the result of a ceiling effect: Had there been enough measurement room, not only performance in the part-list cuing condition but also performance in the no part-list cuing condition would have increased, so that the forgetting effect observed in the final test would have been the same as the one observed in the critical test. This is very unlikely. In fact, in prior work, in none of the experiments in which a release from part-list cuing was reported did performance in the no part-list cuing condition increase across tests (D. R. Basden & Basden, 1995; D. R. Basden et al., 1977). Because performance in this prior work was also never close to ceiling, this observation suggests that the release found in the present experiment was real and not compromised by a ceiling effect. We address the issue again in Experiment 3.

Experiment 2

In Experiment 1 we examined the persistence of part-list cuing by using recall tests in which the items of a category could be recalled in any order. Although this is the standard procedure in the part-list cuing literature (e.g., D. R. Basden & Basden, 1995), such a noncontrol of output order might have affected the results of Experiment 1. This possibility arises if reexposure of the nontargets as cues in the critical test affects the items' output order in the final test. Indeed, reexposure of the nontargets in the critical test may strengthen these items' representation and thus increase the likelihood that, in the final test, participants recall these items prior to the target items (Wixted, Ghadisha, & Vera, 1997).

Output interference refers to the observation that an item's recall probability declines as a function of its serial position in the testing sequence (Roediger, 1974; A. D. Smith, 1971; Tulving & Arbuckle, 1966). Prior nontarget recall, therefore, may cause output interference for the target items and reduce subsequent recall of these items. The finding of a nonrelease from part-list cuing with a low degree of interitem associations in Experiment 1, therefore, might have been caused through output interference in the final test rather than a lasting effect of the part-list cuing manipulation itself.

To address the issue, we repeated Experiment 1 for the low associative condition, this time controlling for output order biases at test. In both the critical and the final recall test, we provided category-plus-first-letter cues to control participants' output sequence. In the critical test, we used these letter cues to test the target items only; in the final test, we used them to test the target items first and the nontargets last. The results provide direct evidence about whether, with a low degree of interitem associations, the detrimental effect of part-list cues is lasting.

Method

Participants

Thirty-six students at Regensburg University participated in the experiment. They were tested individually.

Materials

We used the same materials as in Experiment 1.

Design

The design was identical to that of Experiment 1 except for the following three changes: First, we omitted the high associative condition—that is, we used only a low associative condition. Second, we controlled output order by using a category-plus-first-letter cued-recall test rather than a category-cued-recall test in both the critical and the final recall test. Third, we tested only the target items in the critical test.

Procedure

Study phase. The study phase exactly matched the procedure of the low associative condition of Experiment 1.

Critical test. The critical test exactly matched the procedure used in Experiment 1, with the only differences being that we assessed only memory for the target items and that we used a category-plus-first-letter cued-recall test. In the no part-list cuing condition, we gave participants the category name and the unique first letters of the four target items in random order and asked them to write down the words from the study phase that corresponded to the cues. The part-list cuing condition differed only in that participants had to recall the same target items in the presence of the four cue items that we provided in random order in addition to the category-plus-first-letter cues. For each category, we gave participants 20 s to write down the corresponding words.

Final test. We tested both the target and the nontarget (cue) items using category-plus-first-letter cues. As in the critical test, we gave participants the category name and the unique first letters of the to-be-recalled items in random order and asked them to write down the words from the study phase that corresponded to the cues. To control for output order effects, we always tested a category's target items before its cue items. For both the target and the cue items, participants had 20 s to write down the four to-be-recalled items. As in Experiment 1, the test was blocked by category, and, for each participant, the order of categories was the same as in the critical test.

Results

Detrimental Effects of Part-List Cuing

As reported in Table 2, in the critical test, participants recalled significantly fewer target items in the presence than in the absence of part-list cues (77.4% vs. 86.8%), $F(1, 35) = 7.6$, $MSE = 0.021$, $p < .01$. The same pattern showed up in the final recall test, with lower performance in the part-list cuing condition than in the no part-list cuing condition (79.5% vs. 87.5%), $F(1, 35) = 5.3$, $MSE = 0.021$, $p < .03$. A 2×2 analysis of variance with the two factors of cuing (part-list cues or no part-list cues) and testing (critical or final test) yielded no significant interaction between the two factors, $F(1, 35) < 1$, indicating that the difference in recall performance between the part-list cuing and no part-list cuing conditions was equivalent in the two tests.

Beneficial Effects of Part-List Cuing

Providing the nontargets as retrieval cues in the critical test had a beneficial effect on these items' recall performance in the subsequent final recall test. In fact, reexposure in the critical phase improved nontarget recall significantly (76.0% vs. 65.6%), $F(1, 35) = 7.2$, $MSE = 0.050$, $p < .02$.

Discussion

In Experiment 1, we found lasting forgetting with a low degree of interitem associations, which, because of the noncontrol of possible output order biases, might have been the result of output interference in the final test rather than reflecting a real nonrelease from part-list cuing. In Experiment 2 we repeated the experiment, this time controlling for participants' output sequence. Again, no evidence for a release from part-list cuing arose. Consistent with the results from Experiment 1, this finding indicates that, with a low degree of interitem associations, the detrimental effect of part-list cues is lasting. The results of Experiment 2 also provide a replication of previous findings by showing that the detrimental effect of part-list cues not only holds in tests of free and nonitem-specific cued recall but occurs in tests of item-specific cued recall as well (Bäuml & Aslan, 2004; Bäuml et al., 2002; Peynircioğlu, 1989).

Experiment 3

The results of Experiment 1 and Experiment 2 show a release from part-list cuing with repeated study–test cycles and a nonre-

Table 2
Percentage of Target Item Recall for Each Condition in Experiment 2 (Standard Errors in Parentheses)

	Low associative encoding	
Test	Cues	No cues
Critical	77.4 (2.5)	86.8 (2.3)
Final	79.5 (3.1)	87.5 (2.2)

lease from the effect with single study trials. These findings indicate that encoding influences part-list cuing, with different effects in case of a low degree of interitem associations and in case of a high degree. Because such a role of encoding imposes important restrictions on theoretical accounts of part-list cuing—for instance, it challenges both strategy disruption and retrieval inhibition as general accounts of part-list cuing—the goal of Experiment 3 is to replicate this pattern using different material and a different procedure to induce chainlike interitem associations.

In Experiment 3, we exposed participants to uncategorized item lists, consisting of target and nontarget items. Again, half of the participants were assigned to the high associative condition, and half were assigned to the low associative condition. In both conditions, there was just one study trial. In the high associative condition, we used a so-called story condition, in which we instructed participants to encode each presented item as a sentence and then associate the single sentences to a common story (Sahakyan & Delaney, 2003). In the low associative condition, we presented no such instruction, thus mimicking the procedure used in the low associative condition of Experiment 1. There were again two successive recall tests, with part-list cuing occurring as part of the first recall test but not the second. On the basis of the results of Experiment 1, we expected to find detrimental effects of part-list cuing in the first recall test for both the high and the low associative condition. More important, we expected the forgetting to be again short-lived in the high associative condition and lasting in the low associative condition.

Method

Participants

Forty-eight students at Regensburg University participated in the experiment. They were tested individually.

Materials

We constructed two lists, each list consisting of 24 unrelated common nouns drawn from several published norms (Battig & Montague, 1969; Hager & Hasselhorn, 1994). We randomly divided each list into two subsets of 12 items, representing the target and nontarget items in this experiment.

Design

The design of the experiment was exactly the same as in Experiment 1. It was a mixed design with three factors—encoding, cuing, and testing—with encoding (high associative, low associative) manipulated between subjects and cuing (part-list cuing, no part-list cuing) and testing (critical test, final test) varied within subject. There were only two differences from Experiment 1. First, in the initial study phase, half of the participants studied the items without a specific learning instruction (low associative encoding), whereas we asked the other half to make up a story from the to-be-learned items (high associative encoding). Second, because the lists were not categorized, in the critical and final test, we provided no category cues. Just as in Experiment 1, for each participant, the experiment consisted of two parts, which differed in which of the two lists were learned and whether part-list cues were provided.

Procedure

Study phase. We presented the 24 items of a list successively and in random order on a computer screen for 4 s each. In the low associative condition, participants read the presented items aloud, but we gave no further instruction of how to learn the items. In the high associative condition, we asked participants to generate a meaningful sentence from each presented word and interrelate these sentences to a common story. We told them to say the sentences aloud to ensure compliance with the instruction (see Sahakyan & Delaney, 2003, for further details of this procedure). Following the last item of the list, participants counted backward from a random three-digit number for 30 s as a recency control.

Critical test. In the no part-list cuing condition, we gave participants a sheet of paper and asked them to write down as many of the previously learned items as possible. In the part-list cuing condition, we provided participants with the nontarget items in random order on top of the sheet. We asked them to read these items aloud and use them as retrieval cues for recall of the remaining (target) items. In both conditions, we gave participants 4 min for this recall test. After the critical test, all participants engaged in a 2-min distractor task, in which they rated the attractiveness of faces.

Final test. The final recall test was identical for the part-list cuing and the no part-list cuing conditions. Participants had 4 min to freely recall and write down all previously learned items.

Results

Detrimental Effects of Part-List Cuing

As reported in Table 3, with high associative encoding, target item recall in the critical test was significantly lower when part-list cues were present than when they were absent (61.1% vs. 70.1%), $F(1, 23) = 4.6$, $MSE = 0.021$, $p < .05$. This detrimental effect of part-list cuing, however, was no longer present in the final test, in which target item recall was roughly the same in the part-list cuing and no part-list cuing conditions (67.3% vs. 69.8%), $F(1, 23) < 1$. Indeed, a 2×2 analysis of variance with the two factors of cuing (part-list cues or no part-list cues) and testing (critical or final test) yielded a significant interaction, $F(1, 23) = 7.5$, $MSE = 0.003$, $p < .02$, thus demonstrating that the effect of part-list cuing differed reliably across the two tests.

Also with low associative encoding, target item recall in the critical test was significantly lower when cues were present than when they were absent (48.2% vs. 59.3%), $F(1, 23) = 5.0$, $MSE = 0.029$, $p < .05$. Contrary to the high associative condition, however, this difference between the part-list cuing and the no part-list cuing conditions was also present in the final recall test (47.1% vs. 57.9%), $F(1, 23) = 5.5$, $MSE = 0.026$, $p < .05$. Consistently, a 2×2 analysis of variance with the two factors of cuing (part-list cues or no part-list cues) and testing (critical or final test) showed no significant interaction between the two factors, $F(1, 23) < 1$, indicating that the amount of forgetting did not vary across the two tests.

Table 3
Percentage of Target Item Recall for Each Condition in Experiment 3 (Standard Errors in Parentheses)

	Type of encoding			
	High associative		Low associative	
Test	Cues	No cues	Cues	No cues
Critical	61.1 (4.0)	70.1 (3.6)	48.2 (4.7)	59.3 (3.4)
Final	67.3 (3.9)	69.8 (3.8)	47.1 (4.7)	57.9 (3.7)

These results point to short-lived forgetting with high associative encoding and lasting forgetting with low associative encoding. A 2 × 2 × 2 analysis of variance with the three factors of encoding (high associative or low associative), cuing (part-list cues or no part-list cues), and testing (critical or final test) supported this suggestion by yielding a significant interaction among the three factors, $F(1, 46) = 4.3$, $MSE = 0.003$, $p < .05$. The amount of release from part-list cuing thus varied reliably across encoding conditions.

Output Order Analysis

We also examined the effect of the presentation of part-list cues in the critical test on participants' recall order on the final test. To this end, we calculated an index and, for each participant, divided the mean output position of target items by the sum of mean target and mean nontarget output positions. The resulting measure ranged between 0.00 and 1.00, with higher values reflecting later target and, hence, earlier nontarget item recall and lower values reflecting earlier target and, hence, later nontarget item recall. A value of 0.50 indicates that, on average, target and nontarget items had the same mean output position in the recall sequence.

With low associative encoding, we found an index value of 0.50 in the no part-list cuing condition and 0.48 in the part-list cuing condition. Besides the slight tendency for an earlier recall of target items in the part-list cuing condition than in the no part-list cuing condition, there was no reliable effect of cuing on output order, $F(1, 22) < 1$,[2] indicating that the presentation of part-list cues in the critical test did not bias recall order on the final test. Consistent with the results from Experiments 1 and 2, this finding suggests that the observed nonrelease from part-list cuing in the low associative condition was not the result of output interference. There was also no effect of part-list cuing on output order with high associative encoding. Here we found an index value of 0.51 in both the no part-list cuing and the part-list cuing conditions, $F(1, 23) < 1$, indicating that output order on the final test was not biased through the presentation of part-list cues in the critical test.[3]

Beneficial Effects of Part-List Cuing

Providing the nontargets as retrieval cues in the critical test had a beneficial effect on these items' recall in the final test. Both in the high and in the low associative conditions, reexposure significantly improved nontarget item recall (80.8% vs. 72.5%), $F(1, 23) = 5.9$, $MSE = 0.014$, $p < .05$, and (67.3% vs. 55.5%), $F(1, 23) = 6.1$, $MSE = 0.028$, $p < .05$, respectively. The result for the high associative condition thus confirms the suggestion that the failure to find a significant benefit in the high associative condition of Experiment 1 was due to a ceiling effect.

Discussion

The results of Experiment 3 again demonstrate that encoding influences the persistence of the part-list cuing effect. In the high associative condition, we found the detrimental effect of part-list cues to be short-lived and to disappear once the cues were removed; in the low associative condition, we found the detrimental effect to be lasting and to remain largely unaffected when the cues were removed. These results replicate the findings of Experiment 1 and generalize them to uncategorized lists and to a second method of inducing chainlike interitem associations.

Strategy disruption assumes that the presentation of part-list cues disrupts participants' retrieval plans but that the participants return to their original strategies once the cues are removed (D. R. Basden & Basden, 1995; D. R. Basden et al., 1977). Thus, on the final test of the high associative condition, not only recall performance but also output order of the items should be the same in the part-list cuing and the no part-list cuing conditions. The present results are consistent with this prediction. They show not only the same recall performance but also the same mean output order of cue and noncue items in the two conditions.

Recall performance without part-list cues was fairly high in the high associative condition of Experiment 1, so that, in principle, the observed release from part-list cuing in this condition might have been the result of a ceiling effect. In the present experiment, we again found a release from part-list cuing in the high associative condition. This time, however, recall performance was far from ceiling. This finding supports our conclusion that the release from part-list cuing observed in Experiment 1 was real and not due to a ceiling effect. It is also consistent with the results from prior work (D. R. Basden & Basden, 1995; D. R. Basden et al., 1977).

General Discussion

A Two-Mechanism Account of Part-List Cuing

The results of the present experiments show a release from the detrimental effect of part-list cuing if the material is learned through several study–test cycles or is encoded in terms of a story connecting the single items, situations that favor the building up of (chainlike) interitem associations and elaborated retrieval plans. In addition, the results show a persistence of the effect if the material is learned through a single study trial and without an instruction to encode the items strategically, situations in which interitem associations should have played a minor role. These findings indicate that part-list cuing depends on encoding and is transient with a high degree of interitem associations and lasting with a low degree.

The strategy disruption account attributes the detrimental effect of part-list cuing to altered retrieval strategy in the presence of cues. The removal of those cues should enable participants to return to their original strategies and thus eliminate the forgetting (D. R. Basden & Basden, 1995; D. R. Basden et al., 1977). By contrast, according to the retrieval inhibition account, the detrimental effect of cues should be the result of inhibitory processes operating on the noncue items and thus should reflect long-term changes in the items' activation levels (Anderson et al., 1994;

[2] We excluded 1 participant from this analysis because of her failure to recall at least one nontarget item. In such a case, the mean recall position of items is not defined.

[3] We also used other indexes to examine whether the presentation of part-list cues in the critical test affected output order on the final test. Some of these indexes compared absolute mean output position of items across conditions; others compared normalized mean output positions (see Reysen & Nairne, 2002). Although, of course, the different indexes led to different absolute index values for the single items and conditions, all of them led to the same main conclusions concerning the role of part-list cuing on items' output order.

Bäuml & Aslan, 2004). Finding transient forgetting in some encoding conditions and lasting forgetting in others challenges both explanations of part-list cuing solely based on strategy disruption and explanations solely based on retrieval inhibition.

We have argued that encoding conditions may differ in their degree of interitem associations and thus induce forgetting for different reasons. A low degree of interitem associations may induce a list representation with a high amount of interitem interference, which may trigger inhibitory processes on the noncue items once the cues are provided and covertly retrieved (e.g., Bäuml & Aslan, 2004). A high degree of interitem associations—built up through repeated study–test cycles (D. R. Basden & Basden, 1995; present Experiment 1), instructions to encode items serially (B. H. Basden et al., 2002; Serra & Nairne, 2000), or instructions to encode items in terms of a story (present Experiment 3)—may lead to an elaborated retrieval plan with a preferred output order, which may be vulnerable to disruption if part-list cues are present (e.g., D. R. Basden & Basden, 1995).

Following this two-mechanism account of part-list cuing impairment, strategy disruption should be the responsible mechanism in situations with a high degree of interitem associations, and retrieval inhibition should be the responsible mechanism in situations with a low degree. Because strategy disruption is supposed to induce transient forgetting (D. R. Basden & Basden, 1995; D. R. Basden et al., 1977) and retrieval inhibition is supposed to induce lasting forgetting (Anderson et al., 1994; Zellner & Bäuml, 2004), this two-mechanism account predicts that the detrimental effect of part-list cues should be short-lived with a high degree of interitem associations and lasting with a low degree. This is exactly what the results of the present experiments show.

Relation to Previous Part-List Cuing Work

Previous part-list cuing studies provided evidence that cues consistent with a participant-generated retrieval plan induced a much smaller amount of forgetting, if any, than cues inconsistent with such a plan. Researchers have found such a pattern in free recall, serial recall, and serial reconstruction tasks (B. H. Basden et al., 2002; D. R. Basden & Basden, 1995; Serra & Nairne, 2000) and have argued that it is indicative of strategy disruption. It is interesting to note that these findings arose in situations in which the experimenters used several study–test cycles or an instruction to encode the material serially; thus, the findings fit well with the suggested picture that, with a high degree of (chainlike) interitem associations, part-list cuing impairment is mediated by strategy disruption.

Other studies reported detrimental effects of part-list cuing not only in free or serial recall but also in recognition (Oswald et al., in press; Todres & Watkins, 1981) and word completion (Bäuml & Aslan, 2004; Bäuml et al., 2002; Peynircioğlu, 1989; see also the present Experiment 2), findings indicative of a role of retrieval inhibition. Consistently, a number of parallels between part-list cuing and retrieval-induced forgetting have emerged, including experiments on veridical and false recall (Bäuml & Kuhbandner, 2003), the role of a delay between retrieval practice/part-list cuing and test (Bäuml & Aslan, 2004), and the equivalent role of extralist items in the two cases (Bäuml, 2002; Roediger et al., 1977; Watkins, 1975). All of these findings arose in situations with one study trial and no instruction to encode the material strategically and thus agree with the suggested view that, with a low degree of interitem associations, part-list cuing impairment is mediated by retrieval inhibition.

The proposal that, depending on encoding, part-list cuing impairment is caused by strategy disruption or retrieval inhibition suggests that results obtained with one type of encoding may not generalize to the other. Indeed, because only retrieval inhibition is supposed to affect the representation of the noncue items itself (e.g., Bäuml & Aslan, 2004), finding part-list cuing with item-specific cues should only be possible with a low degree of interitem associations but should not hold with a high degree. Because cue consistency should mainly play a role in strategy disruption (e.g., D. R. Basden & Basden, 1995), cue consistency findings may be restricted to situations with a high degree of interitem associations and should not be present with a low degree. In general, a number of dissociations between the two types of encoding should arise, pointing to disruption-specific effects of part-list cuing for the one type of encoding and inhibition-specific effects for the other. The present finding regarding the persistence of the part-list cuing effect is the first demonstration of such a dissociation.

Chainlike Versus Integration-Like Interitem Associations

The results from the present and also previous work suggest that both encoding with a low degree of interitem associations and encoding with a high degree of interitem associations can induce part-list cuing impairment. However, there is also evidence that with a high degree of interitem associations no part-list cuing impairment may arise at all.

Indeed, research on the fan effect (Radvansky, 1999) and on retrieval-induced forgetting (Anderson, 2003) suggests that interconnecting list items may reduce retrieval competition. In retrieval-induced forgetting, both instructions to interrelate presented items in a meaningful way (Anderson, Green, & McCulloch, 2000; Anderson & McCulloch, 1999) and the use of strong preexperimental interitem associations (Bäuml & Hartinger, 2002; Bäuml & Kuhbandner, 2003) have been shown to eliminate retrieval-induced forgetting. Also using strong preexperimental interitem associations among list items, Bäuml and Kuhbandner (2003) recently provided evidence for such an integration effect in part-list cuing as well. They found the typical part-list cuing impairment with a low degree of preexperimental interitem associations and no part-list cuing impairment with a high degree of such associations.

On the basis of these findings, it seems as if different types of interitem associations may differ in their susceptibility to part-list cuing, with only chainlike interitem associations being vulnerable to disruption, not integration-like interitem associations. As we have argued, chainlike interitem associations may lead to a strong preference for a single output order, with costs arising if the preferred retrieval plan needs to be abandoned. In contrast, integration-like interitem associations may not establish a strong output order preference and rather may be compatible with a number of retrieval routes. Because to date only one study has examined integration effects in part-list cuing (Bäuml & Kuhbandner, 2003), however, we can draw no firm conclusions on the issue yet.

Part-List Cuing Versus Retrieval-Induced Forgetting

The suggested two-mechanism account of part-list cuing impairment differs from the typical one-mechanism account of retrieval-induced forgetting, which attributes the forgetting solely to retrieval inhibition (Anderson, 2003; but see MacLeod, Dodd, Sheard, Wilson, & Bibi, 2003; and Perfect et al., 2004). In fact, to date, no claim has been made according to which different mechanisms may underlie retrieval-induced forgetting in different encoding situations. A very recent study by Dodd, Castel, and Roberts (in press) may lead to a change in this respect. Dodd et al. reported three experiments in which they let participants learn categorized lists consisting of 10 or 12 items from two categories. The items were blocked by category, and in one experiment there was an instruction to encode the material serially. By manipulating which items individuals were cued to recall during retrieval practice, Dodd et al. found retrieval-induced forgetting only if the to-be-practiced items interfered with the list's serial order. The authors took this result to argue for a strategy disruption component in retrieval-induced forgetting.

Dodd et al. (in press) were silent about the possible reason why, in their experiments, strategy disruption should have played a critical role, given that the results of many previous retrieval-induced forgetting studies provided evidence for the role of inhibition in retrieval-induced forgetting. Similar to the present study, a possible explanation may lie in the role of encoding. Whereas in many previous retrieval-induced forgetting studies researchers examined situations with a relatively high level of interference among the single items (Anderson, 2003), Dodd et al. argued that in their experiments participants constructed serial order representations of the lists, which were disrupted or not depending on which items were practiced.

If Dodd et al.'s (in press) argument is right, not only part-list cuing but also retrieval-induced forgetting might depend on encoding, with retrieval inhibition being the responsible mechanism in situations with a low degree of interitem associations and strategy disruption being the responsible mechanism in situations with a high degree of (chainlike) interitem associations. If this is true, retrieval-induced forgetting and part-list cuing might not only be functionally equivalent in situations with a low degree of interitem associations but be functionally equivalent in general.

Conclusions

We have conducted the present study at a time when two conflicting lines of part-list cuing work exist in the literature. Whereas one line attributes the detrimental effect of cues to strategy disruption, the other attributes the effect to retrieval inhibition. Arguing that fairly different encoding conditions were used in these two lines of work, in the present study we have examined the effect of encoding on part-list cuing impairment directly. As it turned out, encoding indeed influenced part-list cuing impairment, being transient in the case of a high degree of interitem associations and lasting in the case of a low degree. These findings challenge both strategy disruption and retrieval inhibition as general accounts of part-list cuing. They are consistent, however, with a two-mechanism account of part-list cuing, according to which strategy disruption underlies the forgetting with a high degree and retrieval inhibition with a low degree of interitem associations.

References

Anderson, M. C. (2003). Rethinking interference theory: Executive control and the mechanism of forgetting. *Journal of Memory and Language, 49,* 415–445.

Anderson, M. C., Bjork, E. L., & Bjork, R. A. (2000). Retrieval-induced forgetting: Evidence for a recall-specific mechanism. *Psychonomic Bulletin & Review, 7,* 522–530.

Anderson, M. C., Bjork, R. A., & Bjork, E. L. (1994). Remembering can cause forgetting: Retrieval dynamics in long-term memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20,* 1063–1087.

Anderson, M. C., Green, C., & McCulloch, K. C. (2000). Similarity and inhibition in long-term memory: Evidence for a two-factor theory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26,* 1141–1159.

Anderson, M. C., & McCulloch, K. C. (1999). Integration as a general boundary condition on retrieval-induced forgetting. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 25,* 608–629.

Anderson, M. C., & Spellman, B. A. (1995). On the status of inhibitory mechanisms in cognition: Memory retrieval as a model case. *Psychological Review, 102,* 68–100.

Basden, B. H., Basden, D. R., & Stephens, J. P. (2002). Part-set cuing of order information in recall tests. *Journal of Memory and Language, 47,* 517–529.

Basden, D. R., & Basden, B. H. (1995). Some tests of the strategy disruption interpretation of part-list cuing inhibition. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21,* 1656–1669.

Basden, D. R., Basden, B. H., & Galloway, B. C. (1977). Inhibition with part-list cuing: Some tests of the item strength hypothesis. *Journal of Experimental Psychology: Human Learning and Memory, 3,* 100–108.

Battig, W. F., & Montague, W. E. (1969). Category norms for verbal items in 56 categories: A replication and extension of the Connecticut category norms. *Journal of Experimental Psychology Monographs, 80*(3, Pt. 2), 1–46.

Bäuml, K.-H. (1997). The list-strength effect: Strength-dependent competition or suppression? *Psychonomic Bulletin & Review, 4,* 260–264.

Bäuml, K.-H. (2002). Semantic generation can cause episodic forgetting. *Psychological Science, 13,* 357–361.

Bäuml, K.-H., & Aslan, A. (2004). Part-list cuing as instructed retrieval inhibition. *Memory & Cognition, 32,* 610–617.

Bäuml, K.-H., & Hartinger, A. (2002). On the role of item similarity in retrieval-induced forgetting. *Memory, 10,* 215–224.

Bäuml, K.-H., Kissler, J., & Rak, A. (2002). Part-list cuing in amnesic patients: Evidence for a retrieval deficit. *Memory & Cognition, 30,* 862–870.

Bäuml, K.-H., & Kuhbandner, C. (2003). Retrieval-induced forgetting and part-list cuing in associatively structured lists. *Memory & Cognition, 31,* 1188–1197.

Bäuml, K.-H., Zellner, M., & Vilimek, R. (2005). When remembering causes forgetting: Retrieval-induced forgetting as recovery failure. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 31,* 1221–1234.

Brown, J. (1968). Reciprocal facilitation and impairment in free recall. *Psychonomic Science, 10,* 41–42.

Ciranni, M. A., & Shimamura, A. P. (1999). Retrieval-induced forgetting in episodic memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 25,* 1403–1414.

Dodd, M. D., Castel, A. D., & Roberts, K. E. (in press). A strategy disruption component to retrieval-induced forgetting. *Memory & Cognition.*

Geiselman, R. E., Fisher, R. P., MacKinnon, D. P., & Holland, H. L. (1985). Eyewitness memory enhancement in the police interview: Cognitive retrieval mnemonics versus hypnosis. *Journal of Applied Psychology, 70,* 401–412.

Hager, W., & Hasselhorn, M. (1994). *Handbuch deutschsprachiger Wortnormen.* [Handbook of German word norms]. Göttingen, Germany: Hogrefe.

Hicks, J. L., & Starns, J. J. (2004). Retrieval-induced forgetting occurs in tests of item recognition. *Psychonomic Bulletin & Review, 11,* 125–130.

Hudson, R. L., & Austin, J. B. (1970). Effect of context and category name on the recall of categorized word lists. *Journal of Experimental Psychology, 86,* 43–47.

Kimball, D. R., & Bjork, R. A. (2002). Influences of intentional and unintentional forgetting on false memories. *Journal of Experimental Psychology: General, 131,* 116–130.

Kissler, J., & Bäuml, K.-H. (2005). Memory retrieval in schizophrenia: Evidence from part-list cuing. *Journal of the International Neuropsychological Society, 11,* 273–280.

MacLeod, C. M., Dodd, M. D., Sheard, E. D., Wilson, D. E., & Bibi, U. (2003). In opposition to inhibition. In B. H. Ross (Ed.), *The psychology of learning and motivation* (Vol. 43, pp. 163–214). San Diego, CA: Academic Press.

Mannhaupt, H.-R. (1983). Produktionsnormen für verbale Reaktionen zu 40 geläufigen Kategorien. [Production norms for verbal responses to 40 common categories]. *Sprache & Kognition, 2,* 264–278.

Murdock, B. B., Jr. (1983). A distributed memory model for serial-order information. *Psychological Review, 90,* 316–338.

Nickerson, R. S. (1984). Retrieval inhibition from part-set cuing: A persisting enigma in memory research. *Memory & Cognition, 12,* 531–552.

Oswald, K. O., Serra, M., & Krishna, A. (in press). Part-list cuing in speeded recognition and free recall. *Memory & Cognition.*

Perfect, T. J., Stark, L.-J, Tree, J. J., Moulin, C. J. A., Ahmed, L., & Hutter, R. (2004). Transfer appropriate forgetting: The cue-dependent nature of retrieval-induced forgetting. *Journal of Memory and Language, 51,* 399–417.

Peynircioğlu, Z. F. (1989). Part-set cuing effect with word fragment cuing: Evidence against the strategy disruption and increased list length explanations. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15,* 147–152.

Peynircioğlu, Z. F., & Moro, C. (1995). Part-set cuing in incidental and implicit memory. *American Journal of Psychology, 108,* 1–11.

Raaijmakers, J. G. W., & Shiffrin, R. M. (1981). Search of associative memory. *Psychological Review, 88,* 93–134.

Radvansky, G. A. (1999). Memory retrieval and suppression: The inhibition of situation models. *Journal of Experimental Psychology: General, 128,* 563–579.

Reysen, M. B., & Nairne, J. S. (2002). Part-set cuing of false memories. *Psychonomic Bulletin & Review, 9,* 389–393.

Roediger, H. L., III. (1973). Inhibition in recall from cueing with recall targets. *Journal of Verbal Learning and Verbal Behavior, 12,* 644–657.

Roediger, H. L., III. (1974). Inhibiting effects of recall. *Memory & Cognition, 2,* 261–269.

Roediger, H. L., III, & Neely, J. H. (1982). Retrieval blocks in episodic and semantic memory. *Canadian Journal of Psychology, 36,* 213–242.

Roediger, H. L., III, Stellon, C. C., & Tulving, E. (1977). Inhibition from part-list cues and rate of recall. *Journal of Experimental Psychology: Human Learning and Memory, 3,* 174–188.

Rundus, D. (1973). Negative effects of using list items as recall cues. *Journal of Verbal Learning and Verbal Behavior, 12,* 43–50.

Sahakyan, L., & Delaney, P. F. (2003). Can encoding differences explain the benefits of directed forgetting in the list method paradigm? *Journal of Memory and Language, 48,* 195–206.

Scheithe, K., & Bäuml, K.-H. (1995). Deutschsprachige Normen für Vertreter von 48 Kategorien. [German norms for exemplars from 48 categories]. *Sprache & Kognition, 14,* 39–43.

Serra, M., & Nairne, J. S. (2000). Part-set cuing of order information: Implications for associative theories of serial order memory. *Memory & Cognition, 28,* 847–855.

Slamecka, N. J. (1968). An examination of trace storage in free recall. *Journal of Experimental Psychology, 76,* 504–513.

Slamecka, N. J., & McElree, B. (1983). Normal forgetting of verbal lists as a function of their degree of learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 9,* 384–397.

Sloman, S. A., Bower, G. H., & Rohrer, D. (1991). Congruency effects in part-list cuing. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 17,* 974–982.

Smith, A. D. (1971). Output interference and organized recall from long-term memory. *Journal of Verbal Learning and Verbal Behavior, 10,* 400–408.

Smith, E. E., Adams, N., & Schorr, D. (1978). Fact retrieval and the paradox of interference. *Cognitive Psychology, 10,* 438–464.

Todres, A. K., & Watkins, M. J. (1981). A part-set cuing effect in recognition memory. *Journal of Experimental Psychology: Human Learning and Memory, 7,* 91–99.

Tulving, E. (1962). Subjective organization in free recall of "unrelated" words. *Psychological Review, 69,* 344–354.

Tulving, E. (1974). Cue-dependent forgetting. *American Scientist, 62,* 74–82.

Tulving, E., & Arbuckle, T. Y. (1966). Input and output interference in short-term associative memory. *Journal of Experimental Psychology, 72,* 89–104.

Veling, H., & van Knippenberg, A. (2004). Remembering can cause inhibition: Retrieval-induced inhibition as cue independent process. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 30,* 315–318.

Watkins, M. J. (1975). Inhibition in recall with extralist "cues." *Journal of Verbal Learning and Verbal Behavior, 14,* 294–303.

Wixted, J. T., Ghadisha, H., & Vera, R. (1997). Recall latency following pure- and mixed-strength lists: A direct test of the relative strength model of free recall. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23,* 523–538.

Zellner, M., & Bäuml, K.-H. (2004). Retrieval inhibition in episodic recall. In A. Mecklinger, H. Zimmer, & U. Lindenberger (Eds.), *Bound in memory: Insights from behavioral and neuropsychological studies* (pp. 1–26). Aachen, Germany: Shaker Verlag.

Zellner, M., & Bäuml, K.-H. (2005). Intact retrieval inhibition in children's episodic recall. *Memory & Cognition, 33,* 396–404.

Received May 10, 2005
Revision received July 29, 2005
Accepted September 7, 2005 ■

Copyright of Journal of Experimental Psychology / Learning, Memory & Cognition is the property of American Psychological Association and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.