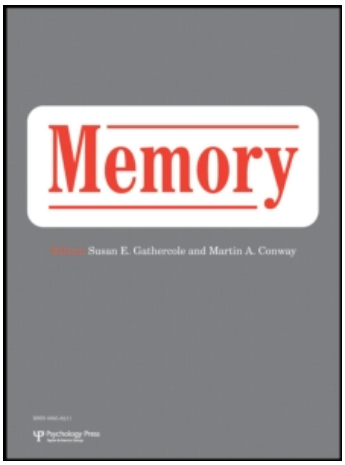

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The role of item similarity in part-list cueing impairment

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The role of item similarity in part-list cueing impairment

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The presentation of a subset of studied items as retrieval cues can have detrimental effects on recall of the remaining (target) items. In three experiments we examined whether such part-list cueing impairment depends on the similarity between cue and target items. Item similarity was manipulated by making use of pre-experimental semantic similarities between cue and target items (Experiments 1 and 2), or was episodically induced through a similarity-encoding task, in which participants were asked to interrelate cue and target items in a meaningful way (Experiment 3). In all three experiments reliable part-list cueing impairment arose when the similarity between cues and targets was low, but no impairment was found when the similarity between cues and targets was high. Inhibitory as well as non-inhibitory explanations of the findings are discussed.

Keywords: Episodic memory; Part-list cueing impairment; Item similarity; Inhibition; Feature suppression; Retrieval competition.

The literature on cueing effects in episodic memory demonstrates impressively that cueing can have strong beneficial effects on recall (e.g., Tulving, 1974). However, there is also a dark side of cueing which indicates that cueing can be detrimental. This evidence comes from studies on part-list cueing impairment in which it is demonstrated that the presentation of a subset of previously studied items as retrieval cues at test can impair recall of the remaining (target) items (Roediger, 1973; Slamecka, 1968). Part-list cueing impairment has proven to be a very general phenomenon and to occur in a variety of experimental contexts (for reviews, see Bäuml, 2007, 2008; Nickerson, 1984; Roediger & Neely, 1982). In fact, detrimental effects of part-list cues have been found in categorised and uncategorised lists (e.g., Slamecka, 1968), with incidental and intentional learning (Peynircioğlu & Moro, 1995), with intralist and extralist cues (e.g., Watkins, 1975), and in veridical and false memory settings (e.g., Reysen & Nairne, 2002). Part-list cueing impairment has also been found in different groups of participants, including children (Zellner & Bäuml, 2005), older adults (Marsh, Dolan, Balota, & Roediger, 2004), amnesic patients (Bäuml, Kissler, & Rak, 2002), and people with schizophrenia (Kissler & Bäuml, 2005).

Several explanations of part-list cueing impairment have been suggested over the years (see Bäuml, 2007; Nickerson, 1984; Roediger & Neely, 1982). For instance, it has been proposed that the presentation of part-list cues strengthens these items' representation so that, during attempts to recall the target items, the stronger cue items come to mind persistently and thus block access to the (weaker) target items (Roediger, 1973; Rundus, 1973). It has also been suggested that providing part-list cues disrupts participants' subjective retrieval plans and thus makes the retrieval of the target items less efficient (Basden & Basden, 1995; Basden, Basden, & Galloway,

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1977). Although these explanations differ in the specific mechanism supposed to underlie the impairment, they share the view that part-list cueing leaves the memory representation of the target items unaffected.

THE INHIBITION ACCOUNT OF PART-LIST CUEING IMPAIRMENT

A more recent account of part-list cueing impairment is *retrieval inhibition* (Bäuml & Aslan, 2004; see also Anderson, Bjork, & Bjork, 1994). At the heart of this account is the proposal that the presentation of part-list cues at test leads to early covert retrieval of the cue items. This covert retrieval is then assumed to trigger inhibitory processes on the target items in a very similar way to how overt retrieval has been shown to cause inhibition of non-retrieved items in retrieval-induced forgetting (for a review of retrieval-induced forgetting, see Anderson, 2003). Crucially, in contrast to previous non-inhibitory accounts of part-list cueing impairment, retrieval inhibition attributes the impairment to changes in the memory representation of the target items themselves.

That part-list cueing impairment is not due to the strengthening of the cue items, but may in fact involve retrieval-based inhibition of the target items themselves, is indicated by a recent study by Bäuml and Aslan (2004). In this study participants learned category exemplars consisting of target and non-target items. Immediately before the recall test, non-target items were re-processed in one of three ways: two groups of participants were presented the non-targets intact and were either instructed to study the items further (*part-list relearning*), or to use them as retrieval cues for recall of the remaining (target) items (*part-list cueing*); a third group was given the word stems of the non-targets and asked to retrieve the corresponding items from memory (*part-list retrieval*). In both the part-list cueing and the part-list retrieval condition, but not in the relearning condition, re-processing of non-targets impaired target recall (for similar results, see Anderson, Bjork, & Bjork, 2000a; Bäuml, 2002; Ciranni & Shimamura, 1999). The finding that cueing differs from relearning indicates that part-list cueing impairment reflects an instructional effect and is not simply due to the strengthening of the cue items. Bäuml and Aslan argued that the instruction to use items as retrieval cues induces covert retrieval of these items, which then causes retrieval-induced inhibition of the target material.

The proposal that cueing initiates covert retrieval of the cue items is not a new one (Roediger, 1973) and is also part of previous non-inhibitory accounts of the effect (Rundus, 1973). It may still appear counterintuitive that people should retrieve items that are already provided. In the Bäuml and Aslan (2004) study, part-list cues were provided before test and were not present during recall of the targets. Thus, to comply with the instruction and use the provided items as retrieval cues, participants had to (covertly) retrieve the cue items from memory (for similar demonstrations, see Oswald, Serra, & Krishna, 2006; Roediger, Stellon, & Tulving, 1977). However, covert retrieval may also be involved if the part-list cues are provided at test and are present during target recall. Indeed, participants may not always look on the recall sheet, but rather may reinstate the cue items periodically from memory, which may be accomplished by covert retrieval.

Consistent with the inhibition account and the view that part-list cueing impairment reflects a (covert) variant of retrieval-induced forgetting, several studies compared the effects of cueing and retrieval directly within single experiments and 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 cueing/retrieval and the recall test (Bäuml & Aslan, 2004), and children's episodic memory (Zellner & Bäuml, 2005). Support for the inhibition view also comes from the finding that part-list cueing impairment is not restricted to ''free'' recall tests, but generalises to tests of word completion (e.g., Bäuml et al., 2002) and item recognition (e.g., Todres & Watkins, 1981). Indeed, because the inhibitory view assumes that cueing affects the memory representation of the target items itself, the detrimental effect of cueing should be observable over a wide range of memory tests.

Consistently, part-list cueing impairment has recently been reported with so-called independent probes as retrieval cues, i.e., probes not used until the test phase of the experiment (Aslan, Bäuml, & Grundgeiger, 2007). In this study part-list cueing impairment was examined in a repeated testing situation. Participants studied exemplars from several semantic categories and were given two successive cued recall tests, separated by a

distractor task of several minutes. Part-list cues (e.g., *pig*) were provided in the first test but not the second. Recall of non-cue target items (e.g., *zebra*) was tested using the studied category cues (*same probes*; e.g., *MAMMALS*) in the first test, but novel, unstudied retrieval cues (*independent probes*; e.g., *AFRICA*) in the second. Detrimental effects of part-list cues were found in both the first, same-probe test and the second, independent-probe test. These results indicate that part-list cueing impairment can be lasting and is not eliminated with independent probes, thus supporting the view that the impairment is caused by retrieval inhibition.

ITEM SIMILARITY AND PART-LIST CUEING

The goal of the present study was to further evaluate the inhibitory account of part-list cueing impairment by testing a prediction of a refined variant of inhibition called *feature suppression*, a model originally applied to research on retrieval-induced forgetting (Anderson, Green, & McCulloch, 2000b; Anderson & Spellman, 1995; Bäuml & Hartinger, 2002; Bäuml & Kuhbandner, 2003). The feature suppression model assumes that items are represented as sets of features, and that, as a result of retrieval processes, both activatory and inhibitory processes operate on these item features. Applied to part-list cueing impairment, the model assumes that cueing with an item—i.e., the covert retrieval of the item—activates those features of a target item that it shares with the cue item, and suppresses those features of the target item that it does not share with the cue item (see Figure 1). Thus the model makes a clear-cut prediction on the role of item similarity in part-list cueing impairment: cueing with an item (e.g., *lion*) should impair recall of those targets that are relatively dissimilar to the cue item (e.g., *zebra*), but should not impair recall of targets that are highly similar to the cue item (e.g., *tiger*). This follows because, compared to low-similar targets, a high-similar target should share a greater number of features with the cue item, and thus should benefit more from the co-activation of its shared features and suffer less from the inhibition of its unique features.

Prior work on retrieval-induced forgetting examined the prediction of feature suppression on the role of item similarity by manipulating the pre-experimental semantic similarity between (overtly) retrieved and non-retrieved items

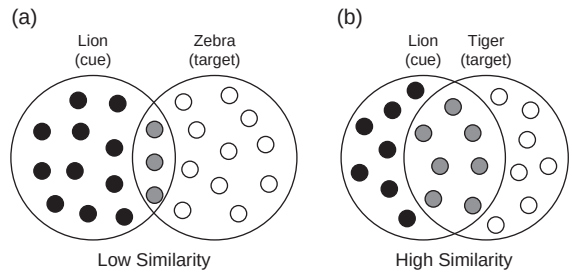

Figure 1. The feature suppression model: larger circles represent items, smaller circles represent item features. Presentation of a cue item activates all of its features (small black and small grey circles); features that a target item shares with the cue item are (co)activated (small grey circles); features that a target item does not share with the cue item are suppressed (small white circles). (a) Low-similarity condition: *Zebra* shares relatively few features with *lion*. Cueing with the item *lion* thus (co)activates few, but inhibits many, features of the item *zebra*, causing significant forgetting. (b) High-similarity condition: *Tiger* shares many features with *lion*. Cueing with the item *lion* thus (co)activates many, but inhibits few, features of the item *tiger*, causing less forgetting, or no forgetting at all.

(Bäuml & Hartinger, 2002; Bäuml & Kuhbandner, 2003), and by establishing a high degree of similarity between the two types of items episodically through a similarity-encoding task (Anderson et al., 2000b). Consistent with feature suppression, in all three studies significant retrieval-induced forgetting arose only when the degree of similarity between retrieved and non-retrieved items was low, but no forgetting was observed when the similarity was high. The feature suppression model has also proven consistent with other findings in retrieval-induced forgetting, including cross-category and second-order inhibition effects (see Anderson & Spellman, 1995, for details).

THE PRESENT STUDY

The present study tests the adequacy of the feature suppression model for part-list cueing impairment by examining the effects of item similarity on this form of episodic forgetting. In three experiments participants studied categorised lists of items and were later given a category-cued recall test on target items, in either the presence (*part-list cueing condition*) or the absence (*control condition*) of a subset of the categories' items serving as additional retrieval cues. The to-be-remembered target items showed either a low degree or a high degree of similarity to the provided part-list cues. Following prior work on retrieval-induced forgetting, similarity

between cue and target items was manipulated by making use of pre-experimental semantic associations in Experiments 1 and 2 (Bäuml & Hartinger, 2002), and was episodically induced through a similarity-encoding task in Experiment 3 (Anderson et al., 2000b). On the basis of the feature suppression model, we expected part-list cueing impairment to arise in the case of a low degree of similarity between cue and target items, but to be reduced or eliminated in the case of a high degree of similarity between the two types of items. The experiments arrive at a time when the role of item similarity in part-list cueing impairment has not yet been investigated.

EXPERIMENT 1

Method

Participants. A total of 36 students at Regensburg University participated in the experiment. They were tested individually.

Materials. Two study lists were constructed, each consisting of words from two semantic categories. Each category contained 12 items drawn from several published norms (Battig & Montague, 1969; Mannhaupt, 1983; Scheithe & Bäuml, 1995). The 12 items of a category were selected such that 6 items each belonged to a different subcategory. For instance, the category *ANIMAL* contained six items belonging to the subcategory *CARNIVORE* (*panther, lion, wolf, cheetah, tiger, fox*) and six items belonging to the subcategory *HERBIVORE* (*deer, zebra, rabbit, cow, donkey, sheep*). The six items of a subcategory were randomly divided into three target and three non-target items. Only non-target items were used as part-list cues. English translations of the originally German items are available on request via e-mail (for the use of related material in prior work, see Bäuml & Hartinger, 2002, or Bäuml, Zellner, & Vilimek, 2005).

Design. The experiment consisted of two parts, each comprising a study phase and a test phase. The two parts differed in which of the two lists had to be learned and whether part-list cues were provided at test, or not (part-list cueing vs control condition). Target items from the same subcategory as the provided part-list cues are referred to as *high-similar items*, and target items from the category's other subcategory as *low-similar items* in the following; target items in the control condition are referred to as *control items.* The order of the part-list cueing and the control condition was counterbalanced across participants, as was the assignment of list to condition.

Procedure: Study phase. The 24 items of a list were presented successively at a 5-second rate on index cards. Presentation order was random with the restriction that no more than two items from the same subcategory were presented adjacently. Each item was provided together with its category and its subcategory name (e.g., *ANIMAL – CARNIVORE – tiger*). Participants were asked to encode each item in relation to both its category and subcategory name. The study phase ended with a 1-minute backward counting task as a recency control.

Test phase. In the control condition participants performed a category-cued recall test. For each of the two categories, the category name was given on top of the sheet and participants were asked to write down all of the previously studied items of that category. Thereafter the list's second category was tested in the same way. The part-list cueing condition differed in that, in addition to the category name, participants were provided with the three non-target items from one of the two subcategories in random order as additional (part-list) cues. They were instructed to read the three items aloud and use them as retrieval cues for recall of the category's remaining items. Participants were given 80 seconds to recall a category's items in any order they wished. After a 3-minute break, the other part of the experiment was carried out. Across participants, the material was counterbalanced such that each target item served equally often as a control, a low-similar, and a high-similar item.

Results

Recall performance for the target items is shown in Figure 2a. A one-way analysis of variance yielded a significant main effect of item type (control items, low-similar items, high-similar items), $F(2, 70) = 4.7$, $MSE = .036$, $p = .012$, partial $\eta^2 = .12$. Single comparisons revealed that participants recalled significantly fewer low-similar items (56.0%) than both control items (66.2%), $t(35) = 2.5$, $SE = 0.039$, $p = .018$, $d = 0.41$, and high-similar items (69.0%), $t(35) = 2.5$, $SE = 0.052$, $p = .018$, $d = 0.41$.

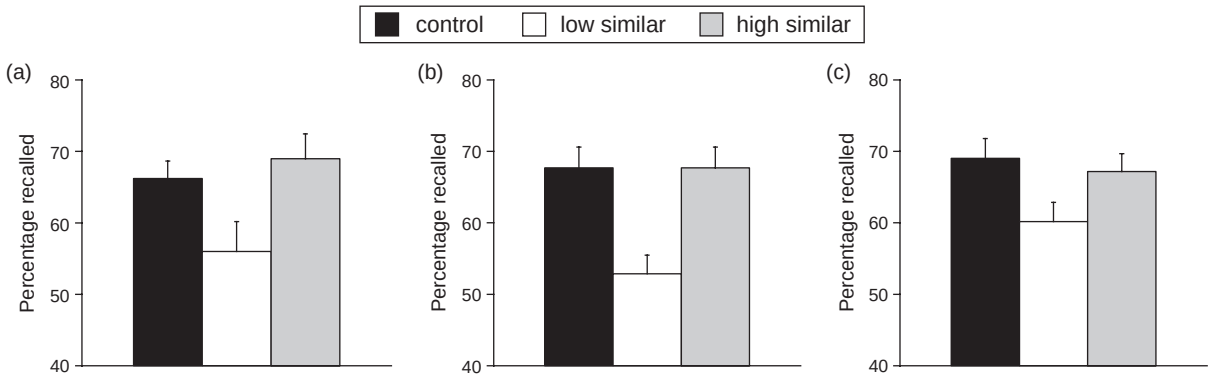

Figure 2. (a) Experiment 1: Mean percentage of recalled target items on a category-cued recall test as a function of item type (*control*, *low similar*, *high similar*). *Control*: target items from categories in which no part-list cues were provided; *low similar*: target items that belonged to the same category, but a different subcategory, as the provided part-list cues; *high similar*: target items that belonged to the same category and subcategory as the provided part-list cues. (b) Experiment 2: Mean percentage of recalled target items on a category-plus-initial-letter-cued recall test as a function of item type (*control*, *low similar*, *high similar*). *Control*: target items from categories in which no part-list cues were provided; *low similar*: target items that belonged to the same category, but a different subcategory, as the provided part-list cues; *high similar*: target items that belonged to the same category and subcategory as the provided part-list cues. (c) Experiment 3: Mean percentage of recalled target items on a category-plus-initial-letter-cued recall test as a function of item type (*control*, *low similar*, *high similar*). *Control*: target items from categories in which no part-list cues were provided; *low similar*: target items that belonged to the same category, but a different, episodically established subset of items, as the provided part-list cues; *high similar*: target items that belonged to the same category and the same, episodically established subset of items as the provided part-list cues. All error bars represent standard errors.

Recall of control items and high-similar items did not differ from each other, $t(35) < 1$.

We further examined the effect of item similarity on participants' recall order in the part-list cueing condition. To this end, we calculated an output order index for each participant by dividing the mean output position of high-similar items by the sum of mean high-similar item and mean low-similar item output positions. The resulting index ranges between 0.0 and 1.0, with higher values reflecting later high similar item recall, and lower values reflecting earlier high-similar item recall. A value of 0.50 indicates that, on average, high-similar and low-similar items have the same mean output position in the recall sequence (see Bäuml & Aslan, 2006). As it turned out, the index for high-similar items was significantly smaller than 0.50 (0.44; $t(28) = 3.1$, $SE = 0.018$, $p = .005$, $d = 0.57$), indicating that participants tended to start their recall with items from the same subcategory as the provided part-list cues.[1]

Discussion

The results of Experiment 1 indicate that part-list cueing impairment depends on item similarity. The presentation of part-list cues impaired recall of target items that showed a low degree of similarity to the cue items, but did not impair recall of target items that showed a high degree of similarity to the cue items. This finding is consistent with the view that part-list cueing impairment is caused by inhibition and, in particular, agrees with the feature inhibition account (Anderson & Spellman, 1995). According to this account, part-list cueing impairment should arise in case of a low degree of similarity between cue and target items, but should be reduced or eliminated in case of a high degree of similarity. The finding also mimics the role of item similarity in retrieval-induced forgetting, in which a high degree of semantic similarity between retrieved and non-retrieved items was found to protect the non-retrieved items from being forgotten (Bäuml & Hartinger, 2002).

In Experiment 1 participants were free to recall the target items in any order they wished. Although standard in part-list cueing studies, this non-control of output order might have influenced the results of Experiment 1. Indeed, analysis of output order revealed that participants

[1] Seven participants had to be excluded from this analysis because they failed to recall at least one high-similar or one low-similar item. In such a case the mean recall position of items is not defined.

in the part-list cueing condition tended to start their recall with high-similar items. This tendency may have led to a recall disadvantage for low-similar compared to high-similar items, because recall chances may decline with the items' output position (e.g., Anderson et al., 1994; Bäuml & Hartinger, 2002). Thus, in principle, the effect of item similarity in Experiment 1 might reflect an effect of output order at test, rather than a "real", direct effect of item similarity. We addressed this issue in Experiment 2.

EXPERIMENT 2

As in Experiment 1, Experiment 2 examined the role of item similarity in part-list cueing impairment by manipulating the pre-experimental semantic associations between cue and target items. One goal of Experiment 2 was to replicate the results of Experiment 1 with a different set of materials. However, the primary goal of Experiment 2 was to replicate the results of Experiment 1 under conditions that exclude output order biases at test. To achieve this, in Experiment 2 participants' recall order was controlled by testing the target items in the presence of item-specific initial-letter cues.

Method

Participants. A total of 48 students at Regensburg University participated in the experiment. They were tested individually.

Materials. A study list consisting of 48 items from six semantic categories was constructed. The items were drawn from the same pool of items as was used in Experiment 1. This time, however, the items were selected such that each of a category's eight items had a unique first letter. As in Experiment 1, each category comprised items from two different semantic subcategories, and each subcategory was randomly divided into two target and two non-target items.

Design. The design was similar to that of Experiment 1 except for the following two changes: First, the three item types (control items, high-similar items, low-similar items) were realised within a single study list. This was achieved by assigning four categories to the part-list cueing condition, and two categories to the control condition. Second, at test only target items were to be recalled given item-specific category-plus-initial-letter cues. The order of the part-list cueing and the control condition at test was counterbalanced across participants, as was the assignment of category to condition.

Procedure: Study phase. The 48 items of the study list were presented successively at a 5-second rate on a computer screen, each item together with its category and subcategory name (e.g., *BIRD – RAPTOR – eagle*). Participants were asked to encode each item in relation to the category and subcategory name. Presentation order was blocked randomised. Each block consisted of one randomly selected exemplar from each of the six categories, with the restriction that a block's last item never belonged to the same category as the next block's first item. The resulting sequence was presented to half of the participants; the other half were given the same sequence but in reversed order. The study phase ended with a 3-minute distractor task in which participants rated the attractiveness of famous faces.

Test phase. The recall test was blocked by category. In the control condition a category's four target items were tested successively by providing the category name and the unique first letter of the to-be-remembered item. Participants were asked to recall a studied word that fit the category-plus-initial-letter cue within 6 seconds. The verbal responses were noted by the experimenter. The part-list cueing condition differed only in that, immediately prior to recall of a category's targets, the two non-targets from one of the category's two subcategories were provided as retrieval cues. The two non-targets were presented successively and in random order together with the category name at a 3-second rate on the computer screen. Participants were instructed to read the items aloud and use them as retrieval cues for recall of the to-be-remembered (target) items of the category (for a related procedure, see Bäuml & Aslan, 2004; Oswald et al., 2006; Roediger et al., 1977). Following the test of a category's last target item, the next category was tested in the same way. In both the part-list cueing and the control conditions the testing order of the four target items was random.

Results and discussion

Recall performance for the target items is shown in Figure 2b. A one-way analysis of variance

yielded a significant main effect of item type (control items, low-similar items, high-similar items), $F(2, 94) = 11.2$, $MSE = 0.032$, $p < .001$, partial $\eta^2 = .19$. Single comparisons revealed that participants recalled significantly fewer low-similar items (52.9%) than both control items (67.7%), $t(47) = 4.0$, $SE = 0.037$, $p < .001$, $d = 0.57$, and high-similar items (67.7%), $t(47) = 4.4$, $SE = 0.033$, $p < .001$, $d = 0.64$. Recall of control items and high-similar items did not differ from each other, $t(47) < 1$.

Experiment 1 suggested that a high degree of similarity between cue and target items can eliminate the detrimental effect of part-list cueing. In Experiment 2 we replicated this finding using a different set of materials and a different testing procedure. Importantly, by providing item-specific initial-letter cues at test—and thus controlling participants' output order—we ruled out the possibility that the effect of item similarity was simply the result of output order biases at test, thus indicating that the similarity between cue and target items in itself protected the target items from being forgotten in Experiments 1 and 2. This suggested role of semantic similarity between cue and target items in part-list cueing impairment mimics the role of semantic similarity between retrieved and non-retrieved items in retrieval-induced forgetting (Bäuml & Hartinger, 2002), thus adding to the list of parallels between the two types of episodic forgetting. In particular, the results of Experiment 2 indicate that part-list cueing impairment is caused by retrieval inhibition.

EXPERIMENT 3

Manipulating item similarity by means of pre-experimental associations, Experiments 1 and 2 provided evidence that a high degree of semantic similarity between cue and target items represents a boundary condition on part-list cueing impairment. The goal of Experiment 3 was to examine whether this finding generalises to a manipulation of item similarity that does not rely on pre-experimental associations between cue and target items, but is established episodically within the experiment. To achieve this goal we followed the procedure used by Anderson et al. (2000b) when examining the role of item similarity in retrieval-induced forgetting, and manipulated item similarity by asking participants after an initial study phase to find similarities between studied cue and target items.

Method

Participants. A total of 48 students at Regensburg University participated in the experiment. They were tested individually.

Materials. The study material consisted of 48 items from six semantic categories drawn from the same item pool as was used in the previous two experiments. In contrast to Experiments 1 and 2, however, the categories did not consist of items from two different semantic subcategories. Rather, the eight items of a category were arbitrarily divided into two subsets of four items—subset A and subset B—each of which was further randomly divided into two target and two non-target items. Within a category, no two items began with the same first letter.

Design. The main difference from Experiment 2 was that the similarity manipulation did not rely on pre-experimental associations between cue and target items, but rather was episodically induced within the experiment. To this end an intermediate similarity-encoding phase was inserted between the initial study phase and the test phase. In this similarity-encoding phase, participants were successively provided with the single subsets of items from the list—subset A and subset B from each of the six categories—and were asked to find similarities between a subset's two target and two non-target items. Analogous to Experiment 2, target items that belonged to the same subset as the provided cue items are called *high-similar items* and target items that belonged to a category's other subset are called *low-similar items*; target items in the control condition are referred to as *control items.*[2]

[2] One might like to argue that, in the 7-second exposure condition of Experiment 3, seeing the items together in the similarity phase might have led to them being associated to each other, rather than increasing the similarity between the single items. While this associative view on the effects provides an interesting alternative to the presently preferred similarity view, for the sake of intra- and inter-study consistency, we used the same labels in Experiment 3 as in Experiments 1 and 2, and as have been used in the related prior work (Anderson et al., 2000b; Bäuml & Hartinger, 2002).

Procedure. Initial study phase. The 48 items of the study list were presented successively at a 2-second rate on a computer screen, each item together with its category name (e.g., *VEGETABLE – bean*). Participants were asked to encode each item in relation to the category name. Presentation order was block randomised.

Similarity-encoding phase. Subsequent to initial encoding, participants engaged in a similarity-encoding task. Following Anderson et al. (2000b), in this task participants were presented with the single subsets of items consisting of two target and two non-target items, and were asked to find as many similarities between the four items as possible. Specifically, the four items were simultaneously presented for 7 seconds on the computer screen and participants were told to think of characteristics that the items had in common beyond the property of sharing the same semantic category. After each subset, participants were asked to indicate on a 3-point scale how many similarities they had found (0 = *no similarities*; 1 = *one similarity*; 2 = *more than one similarity*).[3] After the rating, the next subset was presented. The order of the four items within a subset was random. The order of the 12 (6×2) subsets was also random with the only restriction that the two subsets of the same category were not presented adjacently. The study phase ended with a 3-minute distractor task in which participants rated the attractiveness of famous faces.

Test phase. The test phase was identical to Experiment 2.

Results and discussion

Recall performance for the target items is shown in Figure 2c. A one-way analysis of variance revealed a significant main effect of item type (control items, low-similar items, high-similar items), $F(2, 94) = 4.2$, $MSE = 0.025$, $p = .018$, partial $\eta^2 = .08$. Single comparisons revealed that participants recalled significantly fewer low-similar items (60.2%) than both control items (69.0%), $t(47) = 2.6$, $SE = 0.035$, $p = .013$, $d = 0.38$, and high-similar items (67.2%), $t(47) = 2.6$, $SE = 0.027$, $p = .012$, $d = 0.38$. Recall of control items and high-similar items did not differ from each other, $t(47) < 1$.

Manipulating item similarity episodically rather than semantically, the results of Experiment 3 replicate the findings of Experiments 1 and 2. Again, significant part-list cueing impairment arose when cue and target items showed a low degree of similarity, but no impairment was found when the degree of similarity between the two types of items was high. As in Experiment 2, these results showed up when output order at test was controlled, indicating that the similarity between cue and target items in itself created the pattern of results. The suggested role of episodically induced similarity between cue and target items in part-list cueing impairment mimics the role of episodically induced similarity between retrieved and non-retrieved items in retrieval-induced forgetting (Anderson et al., 2000b). In particular, it supports the view that part-list cueing impairment is caused by retrieval inhibition.

GENERAL DISCUSSION

The goal of the present study was to investigate the role of item similarity in part-list cueing impairment. Consistently across three experiments we found reliable part-list cueing impairment when the degree of similarity between cue and target items was low, but found no part-list cueing impairment when the degree of similarity between cue and target items was high. This pattern of results held both when the similarity between cue and target items was manipulated through pre-experimental semantic associations, and when it was episodically established through a similarity-encoding task.

Inhibitory view of part-list cueing impairment

The present results are consistent with the inhibitory view of part-list cueing impairment, which assumes that the presentation of part-list cues at test leads to early covert retrieval of the cue items, and that this covert retrieval triggers inhibitory processes that affect the memory representation of the target items themselves (Bäuml & Aslan, 2004; see also Anderson et al., 1994). In particular, the present results support a variant of inhibition called feature suppression

[3] On average, participants reported 1.16 ($SD = 0.35$) similarities per subset, a value well comparable to reports from prior work (Anderson et al., 2000b, Experiment 1).

(e.g., Anderson & Spellman, 1995). Applied to part-list cueing impairment, the feature suppression model assumes that items are represented as sets of features, and that features that the target items share with the cue items are activated rather than inhibited. Following this view, a low degree of similarity between cue and target items should lead to a low degree of feature overlap between the two types of items and thus to a relatively high amount of part-list cueing impairment; in contrast, a high degree of similarity between cue and target items should induce a high degree of feature overlap, and thus induce a low amount of impairment, or no impairment at all. This is exactly what the results of the three experiments show.

The present results parallel those from prior work on retrieval-induced forgetting. This prior work reported that retrieval practice on a subset of previously studied items causes reliable forgetting of the non-retrieved items when the degree of similarity between retrieved and non-retrieved items is low, but does not cause forgetting when the degree of similarity between the two types of items is high. As in the present study, this finding was demonstrated by manipulating the pre-experimental semantic similarity between retrieved and non-retrieved items (Bäuml & Hartinger, 2002; Bäuml & Kuhbandner, 2003) and by establishing a high degree of similarity between the two types of items episodically through a similarity-encoding task (Anderson et al., 2000b). This equivalent role of item similarity in part-list cueing impairment and retrieval-induced forgetting adds to a series of parallels reported in recent work on the two types of episodic forgetting (Bäuml & Aslan, 2004; Bäuml & Kuhbandner, 2003; Zellner & Bäuml, 2005), thus strengthening the view that similar mechanisms mediate the two types of episodic forgetting.

Non-inhibitory views of part-list cueing impairment

Although the present results fit nicely with the inhibitory feature suppression model, on their own they do not rule out the alternative retrieval competition view of part-list cueing impairment. Retrieval competition assumes that the re-exposure of the cue items at test strengthens these items' representation and makes them stronger competitors for the target items. During attempts to recall the target items, the (relatively) stronger cue items come to mind persistently and thus block access to the (relatively) weaker target items (Roediger, 1973; Rundus, 1973). Such retrieval competition can account for the present impairment in low-similar item recall, but it may account for the present non-impairment in high-similar item recall as well. This holds if one assumes that the part-list cues first of all provided access to the high-similar items' subcategories (Hudson & Austin, 1970), and that this facilitatory effect outweighed possible subsequent blocking effects for these items. Of course this explanation makes more sense for Experiments 1 and 2, in which the items' subcategory labels were provided in the study phase, than for Experiment 3, in which no subcategory labels were present.

Although retrieval competition seems basically consistent with the present results, findings from several recent studies challenge the view as an adequate account of part-list cueing impairment. The challenge arises from the fact that part-list cueing impairment is not only observed in tests with a putatively high degree of retrieval competition, such as free or category-cued recall, but is also found in tests in which retrieval competition should be largely reduced or be even eliminated, such as word completion (Bäuml & Aslan, 2004), speeded recognition (Oswald et al., 2006), and independent-probe testing (Aslan et al., 2007). Indeed, blocking effects are typically absent in word completion (Anderson et al., 2000a; Bäuml, 1997, 2002; Bäuml & Aslan, 2004; Johansson, Aslan, Bäuml, Gäbel, & Mecklinger, 2007) or recognition testing (Ratcliff, Clark, & Shiffrin, 1990). Finding significant part-list cueing impairment in the low-similar conditions of Experiments 2 and 3, in which unique initial-letter cues were provided, thus disagrees with the retrieval competition account of part-list cueing impairment.

The results of the present study also appear to be in conflict with the strategy disruption account of part-list cueing impairment. Strategy disruption assumes that the presentation of part-list cues at test disrupts retrieval by forcing a serial recall order that disagrees with the participant's subjective organisation of the list (Basden & Basden, 1995; Basden et al., 1977). However, forcing participants to use experimenter-provided (random) "retrieval strategies", as is done in item-specific tests employing category-plus-initial-letter cues, should disrupt participants' subjective strategies irrespective of whether additional part-list cues are provided, or not (Aslan & Bäuml, 2007;

Peynircioğlu, 1989). Finding part-list cueing impairment in the presence of item-specific memory probes in the low-similar conditions of Experiments 2 and 3, therefore, also challenges strategy disruption as an explanation of the present results.

Part-list cueing ''versus'' partial category cueing

Prior work on the detrimental effects of cueing examined not only effects of part-list cueing but also effects of partial category cueing. In partial category cueing, participants study a list of categorised items and, at test, are provided with a subset of the category names as retrieval cues; no additional category instances are provided. The typical finding in such experiments is that partial category cueing improves recall from the cued categories, but impairs recall from the uncued categories (Parker & Warren, 1974; Roediger, 1978). Although partial category cueing may bear some resemblance to part-list cueing, a closer look reveals important differences between the two forms of cueing. First, whereas partial category cueing seems to facilitate item recall in the cued categories, the present experiments indicate that part-list cueing does not lead to such facilitatory effects. Second, there is evidence that partial category cueing reduces the accessibility of the uncued categories, but leaves the availability of the category instances unaffected (Parker & Warren, 1974; Roediger, 1978). In contrast, in part-list cueing the category instances themselves are affected, possibly by means of an effect on the memory representation of the items itself (Aslan et al., 2007; Bäuml & Aslan, 2004; Oswald et al., 2006). Partial category cueing and part-list cueing therefore do not appear equivalent and rather seem to differ in their facilitatory and detrimental effects.

Conclusions

In three experiments we have shown that the detrimental effect of part-list cues depends on the degree of similarity between cue and target items, and is higher in the case of a low degree of similarity between cue and target items than in the case of high degree of similarity. This pattern of results agrees well with the inhibitory feature suppression model of part-list cueing impairment, although on its own the pattern does not rule out retrieval competition. The results provide further evidence for the view that part-list cueing impairment and retrieval-induced forgetting are functionally equivalent. While such a proposal may not hold for all types of encoding situations (see Aslan & Bäuml, 2007; Bäuml & Aslan, 2006), it captures a long list of parallels between the two types of episodic forgetting.

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