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Citation for the original published paper (version of record):

Nilsson, L., Nyberg, L., Kormi-Nouri, R., Rönnlund, M. (1995)

Dissociative effects of elaboration on memory of enacted and non-enacted events: A case of negative effect.

Scandinavian Journal of Psychology, 36: 225-231

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<http://urn.kb.se/resolve?urn=urn:nbn:se:oru:diva-45614>

SHORT NOTE

Dissociative effects of elaboration on memory of enacted and non-enacted events: A case of a negative effect

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Nilsson, L.-G., Nyberg, L., Kormi Nouri, R. K. & Rönnlund, M. (1995). Dissociative effects of elaboration on memory of enacted and non-enacted events: A case of negative effect. *Scandinavian Journal of Psychology*, 36, 225–231.

One experiment compared the effect of elaboration on enacted and non-enacted events. The commands were either presented in a basic form (e.g., “wave your hands”) or in an enriched form. The commands were enriched by adding statements to the commands of how to perform the actions (e.g., “wave your hands as a conductor”). Free- and cued-recall data showed elaboration to have a dissociative effect on enacted and non-enacted events. Memory for the non-enacted events benefited from enrichment, whereas simple enacted events were remembered to a higher extent than complex enacted events. Lack of benefit from elaboration on memory of enacted events is suggested to be due to enactment leading to a sufficient degree of item-specific processing, and a negative effect of elaboration is suggested to occur when the way of manipulating item complexity decreases the familiarity of the actions. Familiarity ratings of the items by two independent groups of subjects supported this interpretation.

Key words: Memory, enactment, elaboration, familiarity, distinctiveness.

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Research on human memory during recent years have seen a growing interest in using other paradigms than the traditional verbal learning paradigm. One of these, developed not long ago (Cohen, 1981; Engelkamp & Krumnacker, 1980), is generally referred to as action memory. In this paradigm, subjects are presented with verbal commands (*break the match, roll the ball*) to remember for a subsequent recall or recognition test. Subjects are either asked to perform the actions indicated by the commands (SPT, for subject performed task), or are simply instructed to read or listen to the commands without performing them (VT, for verbal task). The results in SPT experiments typically show that subjects, who have performed the acts, remember the commands more accurately than those who have only read or heard the commands. This effect is generally referred to as the *SPT-effect*, and as noted in a review article by Cohen (1989), the effect is a stable one obtained in a variety of experimental settings.

Three main theoretical notions have been proposed to account for the superiority in recall and recognition performance after enactment. The first of these explained the SPT effect by suggesting that a critical aspect of SPT learning is that it involves an optimal encoding without the use of strategies to encode the information (Cohen, 1981, 1983). The second notion, put forward by Bäckman and Nilsson (1984, 1985), referred to the richer encoding in the case of SPTs, and emphasized the importance of factors such as multimodality and

richness of aspects within each modality. The third notion stressed the importance of the motor component (Engelkamp & Zimmer, 1985), and suggested that motor encoding provides excellent item-specific information (Engelkamp, 1990).

In addition to the fact that the SPT effect is a stable finding, a curious data pattern has emerged in experiments testing the reliability of well established verbal memory phenomena. In a recent review, Nilsson and Bäckman (1989) listed several cases in which well known verbal memory findings were replicated for the condition in which subjects are requested to remember the verbal commands without any action (VT), whereas the particular phenomenon was not obtained for the condition in which subjects were requested to perform the actions indicated by the commands (SPT). For example, the generation effect (Slamecka & Graf, 1978) and the levels-of-processing effect (Craik & Lockhart, 1972) have been demonstrated to hold true for VTs, but not for SPTs (Cohen, 1981; Nilsson & Cohen, 1988). One additional striking example is that subjects in a SPT condition do not show any facilitating effect of *elaboration* of encoding (Nilsson & Cohen, 1988).

The original finding demonstrated by Craik and Tulving (1975) was that subjects recalled more items after having been instructed to encode the information in an elaborated way than in a condition in which no such instructions were given. One manipulation made by Craik and Tulving (1975) was that of enrichment of the study items. They demonstrated that subjects were better at recalling a word, for example the word WATCH, if at study, this word had been embedded in a complex sentence such as "The old man hobbled across the room and picked up the valuable WATCH from the mahogany table", than if it had been presented in a relatively simple sentence such as "He dropped the WATCH". This finding was explained by supposing that the complex sentence yielded more elaborate encodings of the target words.

Nilsson and Cohen (1988) used a modified version of this procedure to study the effect of enrichment in action memory. A simple item contained one verb and one noun, e.g., "roll the ball" or "break the match". A complex sentence was enriched with respect to the motor action involved, e.g. "roll the ball with one hand and catch it with the other" or "break the match and pile the parts in front of you". Nilsson and Cohen (1988) found that the simple SPTs were recalled better than the complex SPTs. This result suggested that elaboration has a *negative effect* in the case of SPTs (see also Cohen, 1989).

When interpreting the negative effect of elaboration on SPTs in the Nilsson and Cohen (1988) study, it should be noted that there was no positive effects of enrichment in the VT-conditions either. Simple VTs were recalled to a higher extent than were complex VTs. This result is at odds with the usual elaboration effect in verbal memory experiments (Craik & Tulving, 1975), and prevents strong conclusions to be drawn from the finding of a negative effect of elaboration in the case of enactment.

Further, an interpretative difficulty with the finding of negative effects of elaboration in the case of SPTs is that this effect has not been replicated. Instead, previous comparisons between recall of simple and complex SPTs have not reported any differences in memorability for these two types of SPTs (Helstrup, 1987; Zimmer, 1986). A possible explanation to this discrepancy in results is the way of varying complexity (cf., Cohen, 1989). Nilsson and Cohen (1988) varied complexity in both the instructions and in the movement patterns, whereas Zimmer (1986) and Helstrup (1987) only manipulated complexity in the movement patterns.

For example, a simple SPT in the Helstrup (1987) study like "light a match" was conducted by presenting the command to the subject and give him/her a match and a matchbox. In the complex version, subjects had to open the box, take out a match, close the

box, and then light the match—but the instruction (“light the match”) was the same in both the simple and the complex version. In contrast, in the Nilsson and Cohen (1988) study enrichment of a simple SPT (“break the match”) involved modification of the instruction also (“break the match and pile the parts in front of you”). It is possible that the more complicated command used in this latter study merely provided a case for higher memory load rather than providing a more elaborated encoding.

In sum, the finding by Nilsson and Cohen (1988) that simple SPTs were remembered better than complex SPTs provides a puzzle not yet solved. It was the purpose of the present research to try to provide some possible solutions. In particular, we wanted to obtain the standard elaboration effect in verbal conditions that Nilsson and Cohen (1988) failed to demonstrate. Only after having a positive effect of elaboration in the verbal condition, is it possible to draw conclusions about the effects of elaboration on enactment. In order to obtain an elaboration effect in the VT-condition, we modified the form of elaboration and the instruction used by Nilsson and Cohen (1988).

Starting with the form of elaboration, we used elaborations that should be directly geared at the actions involved. Instead of adding additional movements (e.g., “pile the parts in front of you”) to the basic command (“break the match”), we specified how to perform the action. For example, if the basic form of a command was “wave your hands”, the elaborated form was “wave your hand like a conductor”. To avoid negative effects of memory load, subjects were instructed to try to remember the basic form only. It was hypothesized that the complex sentence would provide more elaborate encodings of the basic command (cf., Craik & Tulving, 1975), resulting in a higher memory performance of complex sentences than simple sentences for VTs. For SPTs, it was predicted that simple commands would be recalled to a higher extent than enriched commands (cf., Nilsson & Cohen, 1988).

METHOD

Subjects. Subjects were 32 paid volunteers with a mean age of 21.8 years (16–36). All subjects were tested individually.

Design. The experimental design followed was a 2 (SPT vs. VT) $\times$ 2 (basic vs. elaborated) between-subjects design.

Materials. Twenty-four sentences in imperative form were selected with the restriction that each sentence should have a unique verb and a unique noun. Half of the sentences involved performance with body parts as objects (e.g., “Wave your hands”), and the other half involved performance with external articles as objects (e.g., “Hold the gun”). In the condition involving elaborated encoding, a specification of how to perform each task accompanied each sentence (e.g., “Wave your hands like a conductor”; “Hold the gun as a soldier”).

Procedure. Subjects were randomly assigned to one of the four experimental conditions. The experimental session started with presentation of the study list. The imperatives were presented by means of a slide projector at a rate of 8 s per sentence. The noun in each sentence was underlined. Subjects in the SPT-conditions were instructed to, for each sentence, perform according to the command presented on the screen, and to try to remember the verb and noun from each sentence. (The specification given in the elaborated encoding-condition of *how* to perform each action was not to be remembered.) Subjects in the VT-conditions were instructed to read each sentence, and, as in the SPT-conditions, to try to remember as many verb-noun pairs as possible.

After the presentation, subjects were given a 7-min word comprehension test. The primary purpose of administering this test was to avoid ceiling effects by creating a retention interval between study and test.

Following this retention interval, subjects were instructed to try to free recall (FR) as many nouns as possible from the study list in any order. Five minutes were allowed for this task.

Finally, subjects were given a cued recall (CR) test. The CR-test involved presentation of the verb from each sentence, and subjects were instructed to try to recall the nouns (e.g., “wave your _____”). Four minutes were allowed for the CR-test.

RESULTS AND DISCUSSION

The results from the free recall test are summarized in Table 1. It can be seen that there was a reasonably large SPT-effect. Also, in line with the prediction, the basic encoding was found to lead to a higher memory performance than the elaborated encoding for SPTs, whereas the opposite pattern of results was found for VTs.

A 2×2 ANOVA of the FR-data confirmed the impression from the table of a significant SPT-effect by showing a main effect of materials $F(1, 28) = 18.4$, $MSe = 8.3$, $p < 0.01$. The critical interaction between materials and form of encoding was, however, not significant $p > 0.10$.

The cued recall data are depicted in the lower part of the table. As in free recall, SPTs were remembered to a much higher extent than VTs, and elaboration had an opposite effect on SPTs and VTs.

A 2×2 ANOVA of the CR-data revealed a significant main effect of materials $F(1, 28) = 59.4$, $MSe = 8.4$, $p < 0.01$, and in this test the cross-over interaction between materials and form of encoding reached statistical significance $F(1, 28) = 5.4$, $MSe = 8.4$, $p < 0.05$. Least-significant-difference among means was 0.12, showing that significantly more simple SPTs than complex SPTs were recalled and that the difference between the VT-conditions did not reach statistical significance.

In contrast to the Nilsson and Cohen (1988) study, the results from both the free- and cued-recall tests showed a positive effect of elaboration on VT-memory. Admittedly, the effect was weak and non-significant, but nevertheless there was a numerical advantage in memory performance of complex items over simple items. This pattern of results is consistent with the usual elaboration effect in verbal memory experiments (Craig & Tulving, 1975). However, in spite of this positive effect of elaboration on VT-memory, recall of simple SPTs exceeded recall of complex SPTs. The negative effect of elaboration on SPT memory did only show up significantly in cued recall, although the tendency was the same in free recall. Thus, it seems rather safe to conclude that elaboration in the form of enrichment does not *improve* memory of SPTs (cf., Helstrup, 1987; Zimmer, 1986), and may even *impair* performance (cf., Nilsson & Craig, 1988). Next, we will turn to a possible explanation of why item complexity sometimes has a negative effect on SPT memory and sometimes no effect. In closing, a tentative explanation to the dissociative effect of elaboration on SPT- and VT-memory will be offered.

Increasing item complexity reduces item familiarity and thereby memorability

It seems reasonable to argue that a negative effect of elaboration reflects a decrease in item familiarity. As described in the introduction, Helstrup (1987) manipulated only the move-

Table 1. Mean proportion recalled nouns in free- and cued-recall as a function of materials and type of commands

Materials	Type of command		
	Simple	Complex	Total
Free recall			
SPT	0.57	0.54	0.55
VT	0.35	0.39	0.37
Cued recall			
SPT	0.88	0.73	0.80
VT	0.45	0.50	0.48

box, and then light the match—but the instruction (“light the match”) was the same in both the simple and the complex version. In contrast, in the Nilsson and Cohen (1988) study enrichment of a simple SPT (“break the match”) involved modification of the instruction also (“break the match and pile the parts in front of you”). It is possible that the more complicated command used in this latter study merely provided a case for higher memory load rather than providing a more elaborated encoding.

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ment patterns; the instruction was the same in the simple and in the complex condition. In contrast, in the present study and in the Nilsson and Cohen (1988) study both the instructions and the movement patterns were manipulated. Simple instructions like "break the match" and "wave your hands" were modified like "break the match and pile the parts in front of you" and "wave your hands like a conductor". It is suggested that the way of modifying the commands used here made the actions less familiar to the subjects. Since familiarity has been shown to be an important determinant of SPT recall (Knopf, 1991; Knopf & Neidhardt, 1989), a *decreased* memory performance for the complex commands is consistent with previous data patterns. If SPTs are enriched without reducing familiarity, as in the Helstrup (1987) study, *no* effect of enrichment is to be expected.

To confirm the validity of the suggestion that the present way of modifying the commands made the actions less familiar, familiarity ratings of the simple and complex commands were collected. One group of twelve subjects were given the items in a simple form (*simple*) and another twelve subjects were given the commands in an elaborated form (*complex*). The mean age of the subjects in the simple group was 24 years and the mean age of the subjects in the complex group was 23 years. A seventy-item multiple-choice antonym test revealed that the groups were comparable with respect to verbal ability ($M = 24.0$ vs 24.2).

In both groups, subjects were instructed to rate, on a five-point scale, how often they performed the actions in their daily life (1 = never; 5 = every day). The mean level of ratings in the simple group was 2.77, and the mean level of rating in the complex group was 2.41. Thus, the complex commands were rated to be less familiar than the simple commands. A *t*-test revealed that this difference was significant, $t(22) = 2.09$, $p < 0.05$. This outcome supports the present interpretation that the lower memory performance in the SPT-condition for complex commands was due to a decrease in item familiarity. If elaboration is accomplished without affecting the familiarity of the materials (e.g., Helstrup, 1987), *no* effect of elaboration on SPT-memory is to be expected. We will now turn to one possible explanation why this is so.

Enactment leads to a sufficient degree of item-specific processing

It is generally agreed that elaboration helps memory performance by improving item-specific processing, which in turn increases the distinctiveness of the memory traces (see e.g., Hunt & Einstein, 1981). In a similar vein, one cause of the SPT-effect has been suggested to be that enactment adds item-specific information to the memory traces (cf., Engelkamp, 1990; Nyberg, 1993). Given the assumption that enactment improves item-specific processing, the lack of effect of elaboration on memory of enacted events can be explained within the framework proposed by Nilsson and Craik (1990). That is, no effect on SPT-memory is to be expected of variables that induce the same type of information that is contributed by enactment (i.e., item-specific information). A similar conclusion was recently offered by Helstrup to explain lack of effect of item-specific contexts on SPT memory: "...the high distinctiveness of action events means that item-specific contexts have limited opportunity to assist further differentiation" (1993, p. 25).

CONCLUSION

The purpose of the present research was to investigate whether a negative effect of elaboration on SPT memory is found also in the presence of a positive effect of elaboration on VT-memory. In both free- and cued-recall there was a numerical advantage of the number of recalled complex VTs over the number of recalled simple VTs, but still recall of simple SPTs was found to exceed recall of complex SPTs. Such a negative effect of elaboration is

suggested to occur when the complex commands are less familiar than the simple commands, and this interpretation was supported by familiarity ratings of the simple and complex items. VTs have been found not to be as affected as SPTs by manipulations of familiarity (Knopf, 1991), and the possible reduction in recall performance for VTs caused by the decrease in familiarity should have been overturned by the improvement in item-specific processing following elaboration (note, though, that the magnitude of the elaboration effect on VT-recall may have been reduced by the decrease in item-familiarity). Additionally improved item-specific processing for SPTs should, however, be minimally helpful in further improving memory performance. This is because enactment should lead to a sufficient degree of item-specific processing.

This research was supported by a grant to Lars-Göran Nilsson from the Swedish Council for Research in the Humanities and Social Sciences. We are grateful to two anonymous reviewers for their comments on an earlier draft. Parts of this research were presented at the International Conference on Memory, Lancaster, England, 1991.

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Received 24 May 1993

Accepted 17 January 1994