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Response-category conflict improves target memory in a flanker paradigm

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ABSTRACT
Previous studies have shown that cognitive control demands and long-term memory interact in several ways. For example, trial-unique Stroop entities which consist of two perceptually distinct stimulus dimensions can enhance subsequent memory. In the present study, we investigated whether this effect generalises to a flanker paradigm. In the study phase, 60 participants had to classify target pictures which were flanked by pictures that were either congruent or incongruent to the target with regard to the response categories, thus manipulating response-category conflict. Then we assessed recognition memory. The results showed that the response-category conflict enhanced subsequent memory for incongruent targets, implying an up-regulation of top-down control that fostered memory encoding. The results demonstrate that the beneficial memory effect of a response-category conflict generalises to a flanker task.

Incongruent Stroop trials produce a conflict as they co-activate two dimensions which point to different responses (Botvinick et al., 2001; Egner & Hirsch, 2005). Encountering an incongruent Stroop stimulus leads to an up-regulation in top-down attention in order to reduce conflict and to avoid errors (Muhmenthaler & Meier, 2021). Previous studies have shown that this control mechanism not only slows down immediate task performance, it can also improve subsequent target memory (Krebs et al., 2015). To date, this effect has been shown using different variations of Stroop paradigms (Krebs et al., 2015; Muhmenthaler & Meier, 2021; Ptok et al., 2019; Rosner et al., 2015). The goal of the current study was to investigate whether this effect generalises to the flanker task, another often-used task to address cognitive conflict.

The Stroop (Stroop, 1935), the flanker (Eriksen & Eriksen, 1974) and the Simon task (Simon & Small, 1969) have long been used to investigate the impact of task-irrelevant information on the processing of task-relevant information. In all these interference paradigms, the congruent condition is not conflicting, whereas the incongruent condition triggers conflict. For example, in the Stroop task, participants are required to indicate the ink colour of a colour word (e.g., *red*) while ignoring the meaning of the word (e.g., *green*). The task is supposed to measure selective attention and inhibition. In contrast, in the flanker task, the participants encounter a row of characters and are required to classify the target in the centre while ignoring the flanking distractors in the periphery. The task is supposed to measure visual attention and performance strongly relies on perceptual processing (Akshoomoff et al., 2014). In the Simon task, participants are required to classify stimuli while ignoring the position of these stimuli on the screen. For example, a blue symbol is presented on the left side, and the task is to decide whether it is printed in red or blue by pressing a left key for *red* and a right key for *blue*. The task-irrelevant stimulus position interferes with the task-relevant stimulus colour, thus performance in the Simon task mostly relies on spatial processing. Although different aspects of executive functioning underlie the performance in these paradigms, all the incongruent conditions involve the co-activation of two representations that require different responses. According to the conflict-monitoring model (Botvinick et al., 2001), detecting a conflict serves as an internal signal for reinforcing top-down attention to task-relevant information. Egner and Hirsch (2005) provided evidence that cortical responses to targets are amplified when such a conflict is detected. Behaviourally, participants counteract the conflict by focusing attention on the target, which later can enhance subsequent memory for them (Krebs et al., 2015; Muhmenthaler & Meier, 2021; Rosner et al., 2015). As this conflict occurs in all of the interference paradigms introduced above, a beneficial effect on memory should generalise across paradigms.

In order to investigate memory effects, trial-unique stimuli are used, which consist of *two* perceptually distinct items. The resulting response-category conflict occurs when two items from different categories are present simultaneously (e.g., the label "male" or "female" presented superimposed over a male or a female face, cf. Krebs et al., 2015). This is the critical difference to a traditional Stroop stimulus which consists of *one* item only (e.g., the word "blue" printed in red). The detection of this conflict then leads to an up-regulation in top-down control which is associated with a benefit for target memory.

So far, the effect of a response-category conflict on memory has exclusively been investigated with Stroop-like paradigms. In a functional magnetic resonance imaging study by Krebs et al. (2015), the participants performed a gender discrimination task with male or female faces which were overlaid with the words *man, house* or *woman*, thus congruent, neutral and incongruent face-word stimuli were created. At study, the participants had to judge the gender of the face while ignoring the superimposed word. The incongruent condition triggered a response-category conflict as the face and the distractor word required different responses. In the subsequent recognition memory test, faces from incongruent trials resulted in better memory performance than faces from congruent or neutral trials, suggesting that the response-category conflict was critical for the memory enhancement and *not* the semantic mismatch which was also present in the neutral condition.

Jiménez et al. (2020) used a similar Stroop task as Krebs and colleagues (2015). They investigated whether the up-regulation of cognitive control produces recognition memory benefits for incongruent trials and the following trials. They found no evidence for congruence effects or for congruence sequence effects on memory performance. However, they found a memory benefit for incongruent trials following incongruent trials, suggesting that conflict over two successive trials might be necessary to boost memory.

In a study by Rosner et al. (2015), participants had to read the red word in a pair of red and green spatially interleaved words. They were instructed to read the red word aloud and to ignore the green distractor word. Half of the items were congruent (the interleaved words had the same identity), and the other half were incongruent (the interleaved words had different identities). Following the reading phase, participants completed a surprise recognition memory test. Also, here, a response-category conflict emerged in the incongruent condition as the target and the distractor word elicited two different responses, namely reading the target or the distractor word aloud. The results of the subsequent recognition test showed better memory performance for incongruent trials, in line with the assumption that only in this condition it was advantageous to selectively focus attention on the target word. In the congruent condition, focusing on the target word was unnecessary as reading the distractor word (which had the same identity as the target) would lead to the same correct response.

In our recent study, we extended this research using a task-switching protocol with two classification tasks in a series of experiments (Muhmenthaler & Meier, 2021). We used similar stimulus materials as Rosner and colleagues (2015). One word of the compound word stimuli had to be classified, and the other had to be ignored. In the congruent condition, the words were from the *same* category (e.g., two mammals), whereas in the incongruent condition, the two words were from *different* categories (e.g., a bird and a mammal). We used different words in both conditions in order to eliminate a confound between response-category conflict and perceptual load. The perceptual load is higher when different words are present than when identical words are present (Lavie et al., 2009). The results of one experiment showed that the emerging response-category conflict in the incongruent condition led to superior free recall performance, thereby also showing that the effect extends to other memory tests. However, this study also showed that the effect is small and boundary conditions were revealed: The memory benefit was only apparent when the stimuli were presented in two separate congruence blocks, that is, in an uninterrupted series of incongruent trials. When the congruence was intermixed, we did not find a beneficial effect on memory performance. Thus, our study showed that incongruent Stroop-like stimuli do not always enhance memory and that specific circumstances may be necessary to produce a reliably measurable effect (cf., Jiménez et al., 2020).

To sum up, all the studies which examined the response-category conflict were based on Stroop-like paradigms (Jiménez et al., 2020; Krebs et al., 2015; Muhmenthaler & Meier, 2021; Rosner et al., 2015). In the present study, we tested whether the memory benefit of a response-category conflict extends to a flanker task paradigm (Eriksen & Eriksen, 1974). In the traditional flanker task, participants are asked to respond to a target stimulus that is surrounded by flanker stimuli on each side. Letters or arrows are often-used as stimuli. Incongruent flankers produce interference that leads to slower and less accurate responses compared to the congruent condition. In the incongruent condition (e.g., "BAB"), two potential responses for "A" and "B" are simultaneously present, that is, it involves a response-category conflict. However, the incongruent condition also involves a higher perceptual load than the congruent condition (e.g., "AAA") as target and flankers have different physical features. Thus, in the incongruent condition, the perceptual load is confounded with the response-category conflict (Lavie et al., 2009; Sanders & Lamers, 2002; Yeh & Eriksen, 1984). As we were interested in the memory effects of a response-category conflict, we adapted the flanker task in order to eliminate this confound.

Toward this goal, we used trial-unique picture stimuli from different stimulus categories. A congruent trial

consisted of *different* target and flanker objects from *the same* category (e.g., mammals) triggering the *same* response. An incongruent trial also consisted of *different* targets and flanker objects, but from *different* categories (e.g., bird and mammal), triggering two *different* responses simultaneously. Critically, target and flanker objects were different in both conditions to hold the perceptual load constant (Lavie et al., 2009). However, only in the incongruent condition, target and flankers elicit a response-category conflict. With this design, possible memory effects rely on the response-category conflict and not on differences in perceptual load.

Notably, in a traditional flanker experiment, target and flankers are identical in the congruent condition, whereas they are different in the incongruent condition. Thus, task performance strongly relies on perceptual processing (Akshoomoff et al., 2014). In contrast, in our adaption of the flanker task, each trial consists of different pictures, and thus the category classification is rather based on semantic processing. As a consequence, flanker effects may be reduced at study, but conflict processing may still affect stimulus encoding processes which then affect subsequent memory performance (cf., Muhmenthaler & Meier, 2021).

In the present study, we investigated the memory effects in two classification tasks across two separate task blocks. In one task, the participants had to classify the targets as birds or as mammals. In the other task, the participants had to classify the targets as musical instruments or as kitchen utensils. After completing the study phase, we conducted a surprise recognition test. As incongruent flanker trials elicit a response-category conflict which leads to focused attention, we expected superior memory for targets encountered in incongruent trials (Botvinick et al., 2001; Krebs et al., 2015; Muhmenthaler & Meier, 2021; White et al., 2011).

Method

Participants

Sixty participants (*M* = 23.98 years, SD = 4.83, 26 males and 34 females) were recruited and tested by undergraduate students in the context of a research methods course. In an a priori power analysis (Cohen, 1988), we computed the sample size as a function of a power level of .90, a significance level of 0.05, and the expected effect size for response-category conflict of approximately (*f* = 0.35) based on prior work (Muhmenthaler & Meier, 2021). The resulting analysis computed a number of 63 participants as an optimal sample size. The study was approved by the local ethical committee, and all participants gave written consent.

Materials

For the experimental trials, the material consisted of 168 coloured photographs from the four categories mammal, bird, music instrument and kitchen utensil, 42 per category (cf. Muhmenthaler & Meier, 2021). The pictures were typical examples of the four categories and they were collected from a web search (Figure 1 for an illustration). The screen resolution was set to 1366 × 768 pixels and the size of the single pictures was approximately 4.2 × 4.2 cm. The distance between target and flankers was approximately 3 cm. The visual angle between target and flanker was therefore around 2.5°. Miller (1991) found that irrelevant flanker letters produce compatibility effects even when they are separated from relevant target letters by almost 5°.

One-third of the pictures were used as lures in the recognition test only (i.e., 56 pictures). Fifty-six pictures were used as targets, and 56 pictures were used as flankers. We combined them into 56 target-flanker pairs, which consisted of a target surrounded by two identical flankers. Half of the stimuli consisted of pictures of animals. They were either congruent (a target and two flankers from the same category, e.g., an eagle in the centre, flanked by two owls) or incongruent (a target and two flankers from a different category, e.g., a peacock in the centre, flanked by two dogs), an example is depicted in Figure 1. For the object task, 28 pictures of musical instruments and 28 pictures of kitchen utensils were combined to flanker stimuli accordingly. Eight more pictures were used for practice, two per category, which resulted in four more flanker stimuli.

Procedure

Study phase

Participants were tested individually. They were instructed to classify the picture in the centre and to ignore the two flanker pictures on the left and on the right as fast and accurately as possible. For the animal task, participants had to classify the target as mammal or bird, and for the object task, they had to classify the target as a musical instrument or kitchen utensil. The two tasks were presented in two separate blocks. The order of the task blocks was counterbalanced across participants. Within the block, the congruent and incongruent stimuli were presented in a randomised order in the centre of the screen. After a practice phase with two trials, participants performed the animal or the object task with 28 trials, and they were not instructed to memorise the stimuli. Then, they were instructed to perform the other task with two practice trials and 28 experimental trials. The participants responded on a standard computer keyboard using their index fingers. They had to press the *a*-key when the target picture was either a mammal or a musical instrument and the *l*-key when the stimulus was either a bird or a kitchen utensil. The stimuli were presented until a response key was pressed, then the next stimulus was presented after 200 ms of the blank screen. All the pictures appeared only once in the study phase. Following the

Congruent stimulus   **Incongruent stimulus**
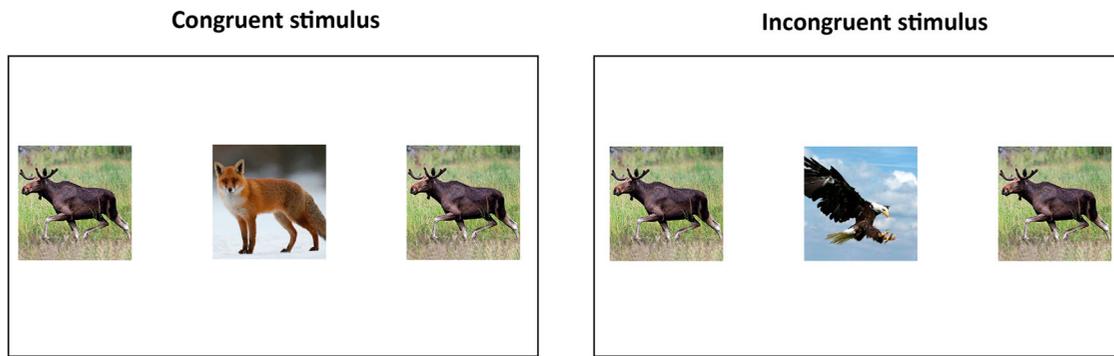
Figure 1. Left: Congruent stimulus with a target and two flankers, all triggering an *a*-key response. Right: Incongruent stimulus, the target requires the *l*-key, but the flankers trigger an *a*-key response.

study phase, participants counted backwards aloud by seven from 300 for a maximal time of 3 min. The main purpose of this task was to create a filled retention interval between the study and test phase.

Test phase

The third part of the experiment involved a surprise recognition memory test and an additional *remember/know* judgement (Tulving, 1985; Yonelinas, 2002). Participants had to indicate whether a picture was new or old (seen in the study phase). All 56 targets, 56 flankers and 56 lures were presented solely in the middle of the screen. The participants had to press the *j*-key for "old" stimuli and to press the *n*-key for "new" stimuli. In case of an "old"-response, they were required to give an additional *remember/know* judgement by pressing the *1*-key for "remember" or the *2*-key for "know" on the number pad. They were instructed to give a "remember" response when they were sure that they had seen the picture and to give a "know" response when they perceived a feeling of familiarity. For each trial, the stimulus was presented until a response key was pressed. The stimuli appeared in randomised order with a response stimulus interval of 200 ms. The entire experiment lasted about 25 min.

Statistical analyses

For the study phase, we conducted separate analyses on accuracy and RTs to test for a potential flanker effect as well as for a potential congruence sequence effect. For the analysis of accuracy, we first tested the flanker effect with a one-sided *t*-test including all trials and then a second test which excluded trials with reaction times below 150 ms and longer than 1500 ms. For the analyses of RTs, we used the trimmed data, excluded error trials and we also tested the flanker effect with a one-sided paired sample *t*-test. In order to test the congruence sequence effect, we conducted ANOVAs with current congruence (congruent vs. incongruent) and previous congruence (congruent vs. incongruent) on accuracy and RTs.

For the test phase, the hits (correctly recognised old pictures) and the false alarms for each participant were computed. As it is not possible to assign the false alarm rates to the congruent or incongruent condition, we used hit rates only as recognition scores (Ortiz-Tudela et al., 2017). Memory performance for congruent and incongruent targets and flankers were analyzed using a 2×2 ANOVA on congruence (congruent vs. incongruent) and picture type (target vs. flanker). In the next step, we compared memory performance for flankers and false alarms in order to test whether the flankers were remembered above chance. In addition, we conducted a 2×2 ANOVA on current and previous congruence on memory performance of the targets. Lastly, *remember* and *know* responses were analyzed using 2×2 ANOVAs with the repeated measures congruence and picture type.

As the order of the tasks was not significant in any of the statistical tests, we collapsed the data across the block variable. We excluded one participant with an accuracy of 50% in the study phase, which reflects chance level performance. An alpha level of 0.05 was used. Effect sizes are expressed as partial η^2 values or as Cohen's *d*, respectively.

Results

Study phase

Flanker effects

A first one-sided paired sample *t*-test including all trials showed that responses for congruent stimuli (*M* = .96, SE = .01) were more accurate than responses for incongruent stimuli (*M* = .95, SE = .01), *t*(1, 58) = 1.69, *p* = .049, *d* = 0.220, suggesting that incongruent stimuli were more conflicting. After removing trials with RTs below 150 ms or longer than 1500 ms (8.8% of the trials), congruent trials (*M* = .96, SE < .01) were still numerically more accurate than incongruent trials (*M* = .95, SE < .01), but the one-sided paired sample *t*-test revealed that this effect was statistically not significant, *F*(1, 58) = 1.48, *p* = .089, η_p^2 = .05. For the analysis of RT, only correct trials were included (4.45% error trials

were excluded). Although mean reaction times for congruent stimuli ($M = 760$ ms, SE = 15) were numerically faster than for incongruent stimuli ($M = 767$ ms, SE = 15), a one-sided paired sample t-test revealed that this effect was not significant, $F(1, 58) < 1$, $p = .204$, $\eta_p^2 = .01$.

Congruence sequence effects

We conducted 2×2 ANOVAs with current and previous congruence on accuracy and on RTs. The effects of current congruence[1] ($F(1, 58) = 2.97$, $p = .090$, $\eta_p^2 = .05$), previous congruence ($F(1, 58) < 1$, $p = .744$, $\eta_p^2 < .01$) and for the interaction between current and previous congruence ($F(1, 58) < 1$, $p = .347$, $\eta_p^2 = .02$) did not reach significance for the accuracy measure. Congruent trials ($M = 763$ ms, SE = 15) were numerically faster than incongruent trials ($M = 765$ ms, SE = 15), but this difference did not reach significance, $F(1, 58) < 1$, $p = .437$, $\eta_p^2 = .01$. The effect of previous congruence was significant, showing faster responses after congruent trials ($M = 756$ ms, SE = 15) than after incongruent trials ($M = 771$, ms, SE = 15), $F(1, 58) = 5.24$, $p = .026$, $\eta_p^2 = .08$. Thus, when the previous trial was incongruent, the participants responded slower, suggesting that they perceived the conflict (cf., Jiménez et al., 2020). The interaction between current and previous congruence did not reach significance, $F(1, 58) < 1$, $p = .780$, $\eta_p^2 < .01$.

Test phase

Flanker effects

Overall, the proportion of correctly recognised old target pictures (hits) was 71.8% and the proportion of false alarms was 19.6%. We conducted a 2×2 ANOVA on congruence (congruent vs. incongruent) and picture type (target vs. flanker) on memory performance. The hit rate for incongruent pictures ($M = .48$, SE = .01) was higher than the hit rate for congruent pictures ($M = .46$, SE = .02), $F(1, 58) = 8.40$, $p = .005$, $\eta_p^2 = .13$. The hit rate for targets ($M = .72$, SE = .02) was higher than the hit rate for flankers ($M = .22$, SE = .02), $F(1, 58) = 659.71$, $p < .001$, $\eta_p^2 = .92$. The interaction between congruence and picture type was not significant, $F(1, 58) < 1$, $p = .606$, $\eta_p^2 < .01$ (Figure 2).

In order to investigate whether the flankers were remembered above chance, we compared their hit rate with the false alarm rate. The hit rate for incongruent flankers ($M = .23$, SE = .15) and the false alarm rate ($M = .20$, SE = .01) differed significantly ($t(58) = 3.46$, $p < .001$, $d = .45$) whereas there was no difference for the hit rate for congruent flankers ($M = .21$, SE = .01) and the false alarm rate ($M = .20$, SE = .01). Thus, the incongruent flankers were remembered above chance whereas memory performance for congruent flankers was at chance level. This finding suggests that incongruent and congruent flankers were encoded differently.

Congruence sequence effects

We computed a 2×2 ANOVA on current and previous congruence of the targets. The results revealed that the effect of current congruence[2] ($F(1, 58) = 8.94$, $p = .004$, $\eta_p^2 = .13$) with better memory performance for incongruent targets ($M = .73$, SE = .02) than for congruent targets ($M = .69$, SE = .02). However, we found no effect for previous congruence (M incongruent $= .72$, vs. M congruent $= .71$, SE = .02), $F(1, 58) < 1$, $p = .343$, $\eta_p^2 = .02$. The
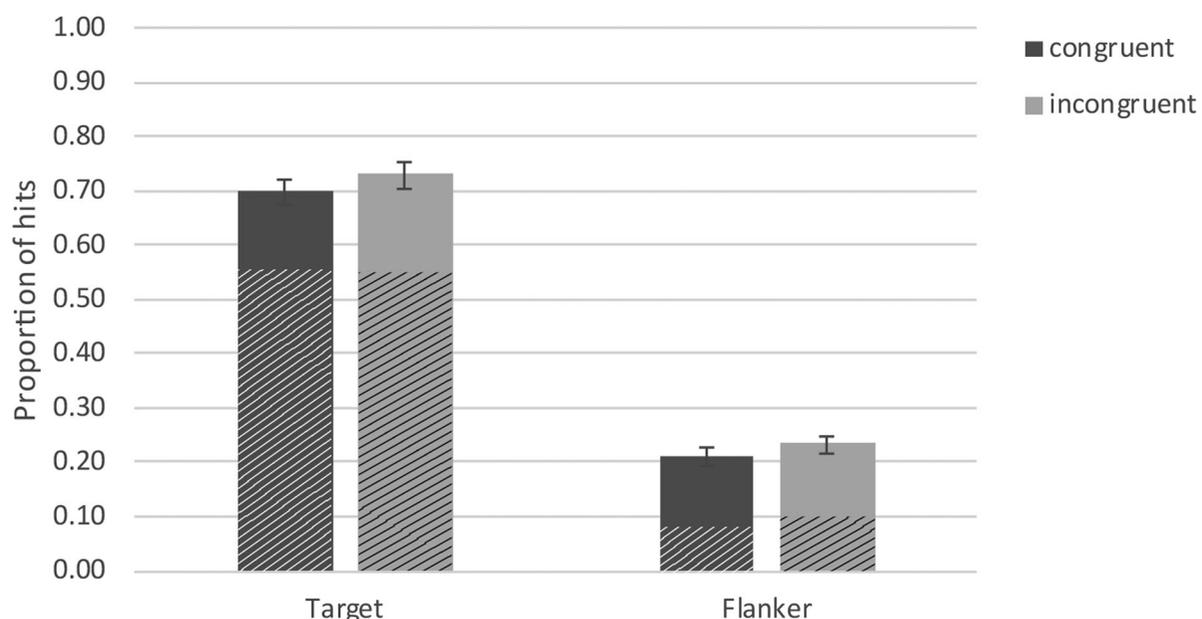
Figure 2. Memory performance as a function of congruency for targets and flanker pictures. The shaded areas reflect *remember*; the solid areas represent *know* responses. Error bars represent standard errors.

interaction between current and previous congruence was also not significant, $F(1, 58) < 1$ $p = .771$, $\eta_p^2 < .01$.

Remember / know responses

To assess the contribution of *remember* and *know* judgements on memory performance, additional ANOVAS with congruence and picture type as repeated measures were conducted. Slightly more *remember* responses were given for incongruent ($M = .33$, SE = .01) than for congruent pictures ($M = .32$, SE = .01), $F(1, 58) = 2.46$, $p = .122$, $\eta_p^2 = .04$. More remember responses were given for targets ($M = .56$, SE = .02) than for flankers ($M = .09$, SE = .02), $F(1, 58) = 591.61$, $p < .001$, $\eta_p^2 = .91$. The interaction between congruence and picture type was not significant, $F(1, 58) < 1$, $p = .387$, $\eta_p^2 = .01$.

The same ANOVA on *know* responses revealed that more *know* responses were given for incongruent ($M = .16$, SE = .01) than for congruent pictures ($M = .14$, SE = .01), $F(1, 58) = 4.73$, $p = .034$, $\eta_p^2 = .08$. Thus, although not many *know* responses were given, the difference in memory performance between congruent and incongruent trials was based on familiarity rather than recollection. More *know* responses were given for targets ($M = .16$, SE = .01) than for flankers ($M = .13$, SE = .01), $F(1, 58) = 8.79$, $p = .004$, $\eta_p^2 = .13$. The interaction between congruence and picture type was not significant, $F(1, 58) = 3.36$, $p = .060$, $\eta_p^2 = .06$. These results must be interpreted with caution due to potential floor effects for *know* responses.

Discussion

According to the conflict-monitoring hypothesis, conflict serves as a signal for reinforcing top-down attention to target stimuli (Botvinick et al., 2001; Egner, 2008). Using Stroop-like paradigms, recent studies have shown that this mechanism can improve memory for incongruent targets (Krebs et al., 2015; Muhmenthaler & Meier, 2021; Ptok et al., 2019; Rosner et al., 2015). In the present study, we investigated whether the memory-enhancing effect of a response-category conflict can be generalised to other paradigms than the Stroop paradigm. Towards this goal, we used a flanker task with trial-unique pictures at study, and we tested subsequent recognition memory.

The results showed better memory for incongruent compared to congruent targets, which confirmed our main hypothesis. We assume that at encoding, incongruent trials increased attention allocation. This resulted in better encoding and improved subsequent target memory. Interestingly, our results showed that the response-category conflict also affected encoding of the flanker pictures such that incongruent flankers were recognised above chance. Overall, the study confirms that a response-category conflict not only improves target memory in Stroop paradigms but also generalises to a flanker paradigm.

However, it must be noted that in the study phase, only a weak flanker effect emerged. Although reaction times for congruent trials were numerically faster than reaction times for incongruent trials, this difference was not statistically significant. Similarly, only weak evidence for the flanker effect was present in the accuracy data. However, the analysis of the congruence sequence effect revealed that participants slowed down performance after encountering an incongruent trial providing evidence for the presence of a flanker conflict (Bugg, 2008; Jiménez et al., 2020).

The weak flanker effect at study can be explained by the changes to the paradigm, which were necessary to test for subsequent memory. In a traditional flanker task, target and flankers are identical in congruent trials whereas they are different in incongruent trials. Thus, performance is based on perceptual processing (Akshoomoff et al., 2014). In contrast, in our adaption of the flanker task, each trial consisted of different pictures and picture classification is based on semantic processing. Moreover, in the traditional flanker task, the perceptual load is different for congruent and incongruent trials, while in our adaptation, the perceptual load was kept constant. Yeh and Eriksen (1984) provided evidence that the perceptual load elicited by different target and flanker stimuli plays a more important role for the flanker compatibility effect than the conflict on the response level.

Weak evidence for cognitive conflict in the study phase but asignificant expression in a subsequent memory test has also been found with other paradigms. For example, we found that a non-significant Stroop effect in the study phase nevertheless affected subsequent memory performance (Muhmenthaler & Meier, 2021). Moreover, several studies showed that the memory effects also vary in strength and some boundary conditions were revealed. In Ptok et al. (2019, 2021), participants had to classify a prime word and a later appearing target according to specific categories (e.g., gender, size). The prime word and the target were presented simultaneously for 1000 ms (e.g., "Anna" and "male"). The following recognition test for the prime words showed better memory for incongruent trials but only under specific circumstances. The prime and the target had to reflect two obviously incompatible stimulus categories (Anna – male; Whale – small). However, no effects were found for combinations, which did not reflect obviously incompatible stimulus categories (Anna – right; Chair-small). These results support our interpretation that presenting two stimulus categories requiring different responses simultaneously can produce a beneficial effect on memory under specific circumstances.

Other studies emphasised that even the memory effects are difficult to uncover. For example, Jiménez et al. (2020) did not find that incongruent trials enhanced memory. However, their results revealed that responding consecutively to two incongruent trials enhanced subsequent target memory. Thus, an increase in top-down

control produced by one single conflict trial might be too weak to be reliably measured, but two or more uninterrupted incongruent trials may lead to a cumulative effect by up-regulating cognitive control. We drew a similar conclusion from a recent study in which a series of incongruent trials was necessary to produce a measurable effect on memory (Muhmenthaler & Meier, 2021). In this study, the participants had to switch tasks and therefore, the cognitive control demands were very high in all conditions. Under these "aggravated" circumstances, the subtle effect of a response-category conflict seemed to be too weak to be measured. Notably, conditions that produce conflict at study can even hurt later memory. The potential memory effects strongly rely on the specific processing of the conflict stimuli and the task requirements (Meier & Muhmenthaler, 2021; Muhmenthaler & Meier, 2019; Richter & Yeung, 2012).

Conclusion

The present study tested whether conflict-enhanced memory generalises to a flanker task. We found evidence that incongruent flanker stimuli produce a memory advantage, that is, the co-activation of two incompatible response alternatives resulted in a memory advantage for incongruent targets (Krebs et al., 2015; Muhmenthaler & Meier, 2021; Ptok et al., 2019; Rosner et al., 2015). In line with the conflict-monitoring hypothesis, we assume that the presence of a response-category conflict signals a requirement to recruit top-down attention in order to produce a response that is not conflicting. Due to amplified cortical responses, this results in increased attention toward the target, which later improves long-term memory. The present study shows that this effect generalises from the Stroop to the flanker task and thus seems to be independent of the specific conflict paradigm.

Notes

1. First trial of each task block was excluded due to a lack of previous congruence.
2. The first trial of each task block was excluded due to a lack of previous congruence.

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Disclosure statement

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