The Intention Interference Effect:

The Difficulty of Ignoring What You Intend to Do

Anna-Lisa Cohen[1], Justin Kantner[2], Roger A. Dixon[3], & D. Stephen Lindsay[2]

[1]Department of Psychology, Yeshiva University, New York, USA

[2]Department of Psychology, University of Victoria, Victoria, BC, Canada

[3]Department of Psychology, University of Alberta, Edmonton, AB, Canada

Corresponding author:

Anna-Lisa Cohen, PhD
Dept of Psychology
Room C05H, Belfer Hall
Yeshiva University
2495 Amsterdam Ave
New York, NY, 10033
email: acohen11@yu.edu
phone: 212-960-5400 ext 5910
Fax: 212-960-0846

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Abstract

Intentions have been shown to be more accessible (e.g., more quickly and accurately recalled) compared to other sorts of to-be-remembered information; a result termed an *intention superiority effect* (Goschke & Kuhl, 1993). In the current study, we demonstrate an *intention interference effect* (IIE) in which colour-naming performance in a Stroop task was slower for words belonging to an intention that participants had to remember to carry out (Do the Task condition) versus an intention that did not have to be executed (Ignore the Task condition). In previous work (e.g., Cohen et al., 2005), having a prospective intention in mind was confounded with carrying a memory load. In Experiment 1, we added a digit-retention task to control for effects of cognitive load. In Experiment 2, we eliminated the memory confound in a new way, by comparing intention-related and control words within each trial. Results from both Experiments 1 and 2 revealed an intention interference effect suggesting that interference is very specific to the intention, not just to a memory load.

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When we form an intention, it is supposed that we form a representation of that goal and the means for attaining it. If an intention must be delayed due to situational constraints, then we intend to recollect the intention when the appropriate time arrives or conditions pertain (e.g., remembering to buy milk on the way home from work). Memory for delayed intentions is referred to as *prospective memory* (see Burgess, Scott, & Frith, 2003, for a set of characteristics). Our goal was to investigate one aspect of prospective memory functioning, the representational state of intentions during the retention interval (i.e., after individuals form an intention and before they have a chance to perform it).

Prior research shows that information related to delayed intentions can be highly accessible compared to information that is not future-oriented. For example, Goschke and Kuhl (1993) showed that material from a script that was to be performed later by the participants was processed faster and more accurately on an intervening yes/no recognition memory test, as compared to material from a control script. Goschke and Kuhl (1993) required their participants to learn a series of four scripts (e.g., making coffee). The scripts were learned as pairs with one script being prospective and the other neutral. There were two types of prospective scripts: one script was to be executed by the participant and the other was only to be executed by the experimenter. Participants received the instruction as to which script had to be performed only after they had already learned the scripts. On a subsequent recognition test, participants were exposed to all of the words associated with the two scripts. Participants recognized more quickly and accurately words related to the to-be-executed script than words related to the neutral script. Goschke and Kuhl (1993) concluded that having an intention to perform an action increases the activation of its declarative representation in memory. Goschke and Kuhl (1993) called this effect the *intention superiority effect* (for replications of this effect by other researchers see Marsh, Hicks, & Landau, 1998, using a lexical-decision task; Marsh, Hicks, & Bryan, 1999, with unrelated materials; Dockree & Ellis, 2001, for self-initiated intentions; Freeman & Ellis, 2003; Marsh, Hicks, & Watson, 2002; Maylor, Darby, & Della Sala, 2000, for naturally occurring intentions; Badets, Blandin, Bouquet, & Shea, 2006, in motor skill learning; and Kazen, Kaschel, & Kuhl, 2008, examining the role of individual differences).

The first study on the intention superiority effect was published in 1993 and since that time there have only been a handful of published studies investigating this phenomenon. In the previously mentioned studies, the effects of delayed intentions were examined using facilitation paradigms. Facilitation paradigms such as the lexical decision task and recognition memory tasks show that attending selectively to relevant stimuli facilitates performance on later tasks that benefit from the processing of that information. Another method of demonstrating attentional bias is to show that performance can suffer as a result of attending selectively to relevant stimuli. Task interference occurs in prospective memory tasks when an intention negatively affects performance on an ongoing activity in some way. The advantage of an interference task over a facilitation task is that it creates an incentive against being influenced by the intention (because the direction of the influence is toward poorer performance on the ongoing task). Thus interference effects are unlikely to reflect deliberate or strategic use of memories for intentions.

Cohen, Dixon, and Lindsay (2005) used a Stroop (1935) colour-naming task to examine the automatic influences of delayed intentions. Classic Stroop interference refers to the dramatic slowing of colour-naming performance on incongruent colour-name words (e.g., RED in black) relative to control strings (e.g., XXX in black), but any common word can slow colour-naming performance relative to colour-only control items (e.g., slower to name the colour of

TOP than of XXX; e.g., Regan, 1978). Cohen et al. (2005) predicted that material related to an intention that had not yet been completed would have an increased accessibility in mind, leading to the activation of its semantic meaning and causing greater interference with colour naming relative to material related to a cancelled intention. They reported two experiments that revealed an *intention interference effect* for both young and older adults. On each of a number of trials, the participant was given a simple action-based task (e.g., "Put the marble in the plastic bag") and they were told either that they would have to remember to perform that task (Do the Task condition) or that they could ignore that task (Ignore the Task condition). The participant then performed an intervening Stroop colour-naming task that, along with filler words, included three critical, task-related words (e.g., marble, plastic, and bag). The key finding was that colour-naming performance was slower for words belonging to an intention that participants intended to carry out versus an intention that did not have to be executed (for other examples of interference procedures in the prospective memory literature, see Einstein et al., 2005; Scullin, Einstein, & McDaniel, 2009; Knight, Meeks, Marsh, Cook, Brewer, & Hicks, in press). This study provided evidence for the automaticity of spontaneous reminding because participants tried to *not* think about the intention-related words that were presented in the Stroop task. Furthermore, there were no interactions with age group—older adults exhibited the same pattern of performance (albeit slower) as young adults. The fact that older adults displayed an intention interference effect similar in magnitude to younger adults is further evidence for automatic processing because age effects tend to be absent in tasks that rely on automatic processing.

In Cohen et al. (2005), having to hold an intention in mind was confounded with carrying a memory load. Therefore, interference could have been due to a general memory load rather than the intention itself. In the present study, we shed new light on prospective memory using improved versions of the intention-interference procedure.

Current Study

As mentioned previously, in Cohen et al. (2005) holding an intention in mind was confounded with carrying a memory load. In Experiment 1, we eliminate that confound by adding a task-irrelevant 3-digit memory load during ignore-the-task trials. That is, when in the Ignore condition subjects were asked to remember a 3-digit number that they had to recall at the end of the Stroop task. Thus, participants carried a memory load both on do-the-task trials and on ignore-the-task trials. Not only did this modification eliminate the memory load confound, it may also have increased the likelihood that subjects followed the instruction to forget the task (by giving them something else to think about). In Experiment 2, participants memorized two intentions and then were informed that they would only have to execute one of them and could feel free to completely forget the other intention. In the subsequent Stroop task, critical words from both intentions appeared in the Stroop list. This experiment allowed us to compare two conditions that were matched in every respect except for intention relevance.

We also made several other modifications to the IIE paradigm. First, in Cohen et al. (2005) critical items and filler items were not counterbalanced. In this experiment, we introduce a computerized and completely counterbalanced version of the intention interference experimental design. Second, in the tasks used by Cohen et al. (2005), some critical words were nouns, others were verbs, and yet others were adjectives (e.g., “Fold the napkin three times” had as critical words “fold,” “napkin,” and “three”). To eliminate grammatical type as a source of noise, in this experiment all critical items were concrete nouns. Third, we used intentions that were more complex. This is important because efficiently carrying out our daily activity requires us to juggle a wide variety of different goals and intentions ("I need to pick up the dry cleaning, mail a package, and book a train ticket"). The intentions in the current study involved two or three actions such as: "Open the magazine, put a spoon on one page, and place a bracelet on the other page." Also, whereas in Cohen et al. (2005) the objects involved in each task were physically clustered (e.g., a marble beside a plastic bag), in the current experiment all 72 critical objects and 72 fillers were quasi-randomized on a large table, substantially increasing the memory demands of the task (see Appendix for picture of objects). We felt that it was important to explore the limits of the intention interference effect as to whether the representational state of more complex intentions would yield a similar outcome to the simpler intentions that were used in previous studies. Everyday prospective intentions are often complex, multi-component tasks, so our use of such tasks increases the extent to which we can generalize our findings.

Experiment 1

In Experiment 1, subjects read and memorized a description of an action and were then given instructions to either "Do the Task" or to "Ignore the Task." During the instruction phase, participants in the Ignore the Task condition were also asked to memorize a 3-digit number that they had to recall at the end of the Stroop list. Following the instruction phase, all participants completed a short Stroop task that included a number of filler words, three critical words from the intention, and three control words. We predicted that participants would exhibit longer reaction times to critical intention words when they held an intention to perform the task than when they had been told that they could ignore the task.

Method

Participants

Thirty-three undergraduate students from the University of Victoria participated in exchange for optional extra credit in an introductory psychology course. One subject was dropped because of failure to follow instructions.

Materials and Design

Participants performed the following sequence of steps on each of 24 trials. First, subjects read and memorized an intention task (e.g. 'Place two paperclips in the folder and balance the marble on top.'). Next, the task was removed from the screen and subjects received instructions to the effect that they would later 'Do the task' (12 trials) or that they could 'Ignore the task' (12 trials). For Ignore the Task trials, participants were given a 3-digit number to memorize and report at the end of the trial. Then, participants performed a Stroop task in which they were asked to name as quickly and accurately as possible the colour of a series of words presented one at a time on a computer screen. Finally, participants were tested on the delayed intention or digit-report task. All task materials were located on an adjacent table.

The Stroop task used five colours and consisted of 24 words in total. The same colour was never used on consecutive Stroop trials. There were 11 congruent colour words (e.g, the word BLUE in blue font), 7 filler words, 3 critical task words and 3 control words for a total of 24 words. The Stroop list began with 7 randomly ordered colour-congruent words, followed by 3 randomly selected filler words, then either the 3 task words or the 3 control words in order of their appearance in the task, then 4 randomly selected filler words, then the 3 task words or the 3 control words, whichever had not been presented earlier, then 4 colour congruent words. Assignment of words to critical items or control items was fully counterbalanced between subjects. Thus, for half the participants control items served as critical items and for the other half they served as control items. That way, our critical word stimuli were completely counterbalanced. The three critical words were consecutive in the Stroop list (whereas in Cohen et al., 2005, at least one filler word intervened between each task-related word).

The design was a 2 (Instructions: Do the task, Ignore the task) x 4 (Word Type: critical, control, filler, congruent colour) repeated measures design with Instructions and Word Type as within-subject variables. The dependent variable was latency of correct colour-naming responses.

Procedure

Participants were tested individually in +/- 45-minute sessions. Participants were seated in front of the computer monitor with the experimenter sitting off to one side. The study was described to participants by the experimenter. The intention encoding phase was presented on the computer using E-Prime software. Participants were shown the task instruction, which remained on the center of the screen until the participant told the experimenter that they had committed it comfortably to memory. Then a new screen appeared in which they were told whether or not they would have to do the task later. If they didn't have to do the task later, the screen indicated a 3-digit number to memorize instead. On both Do and Ignore trials, the screen stayed up for 3000 ms. Then the participant received a screen with instructions for the Stroop task and pressed the spacebar to initiate the Stroop task. As each word appeared, the subject responded as quickly as possible by saying the colour of the word into a microphone integrated with a Psychology Software Tools response box. Three asterisks appeared on either side of the word to indicate that the microphone had picked up a response. The experimenter then keyed that response in. That initiated a 1000-ms pause during which the screen was blank, followed by the next word in the Stroop list. At the end of the Stroop list, subjects were to remember to execute the task (in a Do condition) using the objects on an adjacent table or recall the 3-letter word (in an Ignore condition). The experimenter keyed in the accuracy using a 1-4 scale for the task (1=remembered and executed the task completely correctly, 2 = remembered and executed two of the three components of the task correctly, 3 = remembered and executed one of the three components of the task correctly, 4 = forgot task/completely) or a 0 or 1 scale (0=wrong, 1=right) for the number recall. Each participant cycled through these steps 24 times; ordering of Do versus Ignore trials was randomized anew for each subject.

Results and Discussion

Data from an entire trial were excluded if the subject did not remember the intention (an average of 0.09 Do the task trials per subject) or the 3-digit number (an average of 0.50 Ignore the task trials per subject) associated with that trial. Prior to analysis, the remaining RT data were trimmed by deleting individual colour-naming responses with (a) RTs less than 250 ms, (b) incorrect colour-naming, or (c) extraordinarily long RTs (following a technique outlined by Baayen and Milin [in press]). Collectively, these three data-trimming steps removed 3.8% of the individual RTs.

Memory for Tasks

As mentioned previously, at the end of each Stroop list subjects had to execute the task (in Do the Task conditions). The experimenter keyed in the accuracy using a 1-4 scale. Out of 384 total trials, 361 trials (94.0%) received a one score (remembered the intention perfectly), 20 trials (5.2%) received a two score (two of the three elements were remembered/performed correctly), 2 trials (0.5%) received a three score (one of the three elements was remembered/performed correctly), and 1 trial (0.3%) received a four score (forgot the intention completely).

Stroop Task Latencies

Response latencies were examined using a 2 x 4 analysis of variance (ANOVA) that included Instructions (Do the Task, Ignore the Task) and Word Type (critical, control, filler, colour) as within-subjects factors. A main effect of Instructions was observed, $F(1, 31) = 18.79$, $p < .01$, $\eta^2 = .38$, showing that colour naming was significantly slower in “Do the Task” trials (M = 696 ms, SD = 104) compared to “Ignore the Task” trials (M = 678 ms, SD = 100). Analyses also revealed a main effect of Word Type, $F(3, 93) = 141.77$, $p < .001$, $\eta^2 = .82$. Pairwise comparisons revealed that colour naming was slowest for critical words (M = 743 ms, SD = 123), which were significantly slower (p = .03) than filler words (M = 725 ms, SD = 83) and significantly slower (p < .01) than colour words (M = 551 ms, SD = 67). Latencies for control words (M = 728 ms, SD = 111) were not significantly different from critical items (p = .07) or filler words (p = .56). The interaction between Instructions and Word Type was significant, $F(3, 93) = 3.45$, $p < .05$, $\eta^2 = .10$. We conducted a contrast analysis to more closely examine the nature of this interaction. We compared critical items with control and filler items (i.e., contrast 2, -1, -1, respectively) for both the do and the ignore instructions conditions. Then we ran a simple paired t-test on these two contrasts and the analysis yielded a significant test, $t(31) = 2.101$, $p < .05$. This result indicates that there was a greater difference between latencies for critical items compared to control and filler items on Do the task trials compared to latencies on Ignore the task trials (see Figure 1).

In the next analysis, response latencies were evaluated using a 2 (Instructions: Do the Task, Ignore the Task) × 3 (Critical Item Order: first, second, third) repeated measures ANOVA. The dependent variable was response latencies on critical items. There was a main effect of Instructions, $F(1, 31) = 14.79$, $p < .01$, $\eta 2 = .32$, showing that colour naming was slower in “Do the Task” (M = 759 ms, SD =118) compared to “Ignore the Task” (M = 726 ms, SD = 116) trials. There was a main effect of Critical Item Order, $F(2, 62) = 5.96$, $p < .05$, $\eta 2 = .16$, revealing that latencies for the second (M = 754 ms, SD = 110) and third (M = 750, SD = 109) critical items were slower (both ps < .05) compared to the first (M = 723, SD = 119). The second and third critical items were not significantly different from each other (p = .695). The Task Instructions × Critical Item Order interaction was marginally significant, $F(2, 62) = 2.73$, $p = .07$, $\eta 2 = .08$, showing a tendency for responses in the Do the task condition to be slowest on the second and third critical item relative to the first critical item. This pattern was not as pronounced for performance in the Ignore condition (see Figure 2).

In this experiment, filler RTs on Do trials (M = 732 ms, SD = 97) continued to be significantly higher, $t(31) = 2.83$, $p < .05$, than filler RTs on Ignore trials (M = 718 ms, SD = 94), despite the fact that participants were given a memory load on Ignore trials as well as Do trials. Arguably, however, memorizing a 3-digit number is not as cognitively demanding as remembering a to-be-executed task. Therefore, in Experiment 2, we had participants encode two intentions and then they were informed that they would only have to execute one of them and could feel free to completely forget the other intention. They then encountered words related to both tasks in the subsequent Stroop phase.

Experiment 2

This design was similar to manipulations by Goschke and Kuhl (1993) and Marsh et al. (1998) in which participants had to memorize two scripts and then were instructed to execute one of them. That is, participants received two tasks on each trial and were told which task they would have to execute and which they could ignore. Another modification was that the subsequent Stroop list included both the critical items from the Do and Ignore intentions within the same Stroop list. This design allowed us to create conditions in which participants were under an identical cognitive load whether they had to execute or ignore an intention, allowing us to analyze Do the task words, Ignore the task words, and filler items under equivalent conditions. Moreover, these conditions allowed for a stronger test of the intention interference effect than has been reported previously; demonstrating the effect when to-be-done and to-be-ignored tasks must be encoded simultaneously and Do and Ignore critical items both appear in each Stroop list more thoroughly isolates the effects of intention on colour naming from those of selective rehearsal and memory load.

Method

Participants

Thirty-four undergraduate students from the University of Victoria participated in exchange for optional extra credit in an introductory psychology course. Four participants were dropped prior to analysis: two for inability to memorize the task instructions sufficiently, one for very poor Stroop performance, and one for not following the instruction to memorize both tasks on some trials.

Materials and Design

Materials were identical to those used in Experiment 1. The design was a one-way within-subject design with four levels. We compared performance on: critical items (Do the Task trials), critical items (Ignore the Task trials), filler items and congruent colour items. The dependent variable was latency of correct colour-naming responses.

Procedure

The procedure was similar to that of Experiment 1 except that on each trial, subjects received two tasks and were asked to memorize both. After participants indicated sufficient memory for the two tasks, the tasks were removed from the computer screen and participants were told which task they would have to execute and which task they could ignore. Importantly, and in contrast to the previous experiment, both the Do task words and the Ignore task words appeared in the subsequent Stroop stream. Therefore, we didn't use separate control words in this experiment because the critical items for the Ignore task served as the ideal comparison. In addition, there were two significant differences between these instructions and those of Experiment 1. The first was an increased emphasis on doing one's best on the Stroop task; participants were told to focus on this goal and were told to put the intention out of their minds so as to do their best on the Stroop task. Second, to motivate participants to that effect we presented their mean RT for the Stroop list at the end of each list (after the task had been executed and before the next trial was to begin). During the instructions phase, participants were told to try to better this mean RT with each new Stroop list (again, by truly focusing on it and putting the intention out of one's mind).

Results and Discussion

The same trimming procedures were applied as in Experiment 1, with an average of 0.83 trials per subject removed due to the forgetting of the intention and 4.1% of RTs eliminated thereafter. This increased number of deleted trials was a consequence of the difficulty of memorizing two tasks with three elements each instead of just one, which led to more errors in executing the tasks (presumably because they were not retained as well).

Memory for Tasks

Out of 740 total trials, 657 trials (88.8%) received a one score (remembered intention perfectly), 57 trials (7.7%) received a two score (two of the three elements were remembered/performed correctly), 13 trials (1.8%) received a three score (one of the three elements was remembered/performed correctly), and 13 trials (1.8%) received a four score (forgot the intention completely).

Stroop Task Latencies

Response latencies were examined using a one-way within-subject ANOVA with four levels. We compared performance on: critical words (Do the Task instructions), control words (critical items that were to be ignored), filler words, and congruent colour words. There was a significant main effect of Word Type, $F(3, 87) = 154.05$, $p < .001$, $\eta^2 = .84$. Pairwise comparisons revealed that colour naming was slowest for critical words in Do the Task instructions ($M = 670$ ms, $SD = 121$), which were significantly slower, $t(29) = 3.39$, $p < .05$, than control words ($M = 651$ ms, $SD = 111$), which were significantly slower $t(29) = 2.64$, $p < .05$, than filler words ($M = 632$

ms, *SD* = 88) which were significantly slower t(29) = 17.09, $p < .05$, than congruent colour words (*M* = 466 ms, *SD* = 50). Therefore, all pairwise comparisons indicated significant differences (see Figure 3). The significant difference in response latencies between critical items and control items complements the significant interaction between instructions and word type from Experiment 1. Both of these results suggest that participants were unable to suppress intention-related processing when words related to postponed intentions were encountered.

In the next analysis, response latencies were evaluated using a 2 (Instructions: Do the Task, Ignore the Task) × 3 (Critical Item Order: first, second, third) repeated measures ANOVA with the dependent variable being response latencies on critical items. There was a main effect of Instructions, $F(1, 29) = 11.46$, $p < .01$, $\eta 2 = .28$, showing that colour naming was slower when participants were instructed to "Do the Task" (*M* = 670 ms, *SD* =118) compared to "Ignore the Task" (*M* = 651 ms, *SD* = 116). There was a main effect of Critical Item Order, $F(2, 58) = 12.60$, $p < .01$, $\eta 2 = .30$, revealing that latencies for the second (*M* = 672 ms, *SD* = 129) and third (*M* = 671 ms, *SD* = 114) positions were both significantly slower (both *p*s < .001) compared to latencies for the first critical item position (*M* = 637 ms, *SD* = 109). Latencies for critical items in positions 2 and 3 were not significantly different ($p = .884$) from each other. The interaction between Instructions and Critical Item Order was not significant [(*F* < 1), see Figure 4].

As mentioned previously, there was a significant main effect of Word Type demonstrating that RTs were slowest for critical words in to-be-executed intentions which were significantly slower than critical words in to-be-ignored intentions which were significantly slower than latencies for filler words. This result suggests that words from the intention that was to be ignored may have still garnered some type of advantage in memory as compared to filler items. This suggests that subjects did not perfectly purge their memories of the to-be-ignored task and that some confusion may have arisen. Our result was similar to findings by

West, McNerney, and Travers (2007). In their study, participants received a different prospective memory cue before each block of a semantic judgment task and were instructed to either perform the prospective memory task or to forget about it for that block. Results revealed longer latencies to the prospective memory cue than to a control word during both perform and forget blocks. The remarkable thing is not that to-be-forgotten tasks have a lingering effect when task-related words are encountered minutes later, but that already that effect is much smaller than that for to-be-done tasks.

General Discussion

Results from the current line of studies extend previous research on the intention interference effect in several important ways. First, we introduce a newly revised interference paradigm and replicate and extend previous findings from Cohen et al. (2005). Second, results from Experiments 1 and 2 both provide evidence as to the way intention-related information is maintained during the performance interval. The significant interaction between Instructions and Word Type from Experiment 1 and the significant difference in response latencies between critical items (i.e., words related to a to-be-executed intention) and control items (i.e., words related to a to-be-ignored intention) from Experiment 2 indicate that participants were unable to suppress intention-related processing when intention-related words appeared during the Stroop task. Interestingly, participants knew that they did not have to execute the intention during the Stroop task yet they still suffered interference to color naming when these words occurred. When participants form an intention, it may be that they form a goal-directed attentional set to treat certain stimuli differently. Therefore, items belonging to the to-be-executed intention may be “tagged” in some way which causes them to be spontaneously retrieved when those items are later encountered. This need to resolve the identity or meaning of the intention-related words leads to an increase in latencies. Our results are in line with

Scullin, Einstein, and McDaniel (2009) who argue that in addition to monitoring, intentions may be spontaneously retrieved. In their study, participants performed an image-rating task in which a prospective memory task was embedded that required them to press a "Q" key when a pre-specified PM cue appeared. Then, participants were told that their intention was finished or suspended. Finally, participants performed a lexical decision task in which each target (and a matched control) word appeared. RTs were slower to target words than to control words when the intention was suspended but not when it was finished. These results suggest that target cues associated with suspended intentions can spontaneously trigger remembering. The finding that participants responded more slowly to prospective memory target words in the suspended condition supports the multiprocess theory (McDaniel & Einstein, 2000). Thus, an intention-related item may trigger retrieval even when no attentional resources are being devoted to monitoring for the target cue or maintaining the intention. We assume that this is the case in the current Stroop task because there is no reason that participants should be monitoring for intention words since they only have to execute the intention after the Stroop task.

One of the most interesting contributions of the current set of experiments stems from our analyses of critical item order (see Figures 2 and 4). As mentioned previously, a goal of these experiments was to understand how intention-related information is represented and stored in memory. In both experiments the main effect of critical item order was significant showing slowing on the second and third critical item relative to the first. In Experiment 1, the interaction between instructions (Do or Ignore the Task) and critical item order was marginally significant and although we don't want to make too much of a marginal effect it is worth discussing. This marginal interaction is suggestive that the effect of critical item order was more pronounced for performance in Do the Task trials compared to Ignore trials. An interesting possibility is that this order effect speaks to details of the mechanisms underlying the intention interference effect. It may be that the first critical word serves to remind participants of the remaining elements of the intention. This results in the remaining critical items being retrieved from long-term memory and transferred to working memory which in turn leads to increased interference when the second critical item is presented on the Stroop task. It may also be that the notion that there is “something to do” is brought to awareness after the first critical word causes a reinstatement of processing that had occurred at encoding. The data are quite noisy, as one would expect given the small number of observations per cell, so the patterns must be interpreted with caution, but we view them as provocative.

Our data suggest that encountering a prospective memory word in the Stroop task results in the significance of the item, leading to spontaneous retrieval of the intention. Similar ideas were articulated by Meier, Zimmermann, and Perrig (2006). In Experiment 1 of their study, priming improved prospective memory performance and this performance increase was accompanied by an increase in “pop up” experiences. They interpreted their results as consistent with the spontaneous retrieval notion of prospective memory and the multi-process framework (Einstein & McDaniel, 1996; Einstein et al., 2005; McDaniel & Einstein, 2000). The effect of critical item order was more pronounced for Do trials compared to Ignore trials in Experiment 1 whereas this was not the case for Experiment 2. This discrepancy may be due to the experimental design of Experiment 2 which required subjects to encode the Do and Ignore instructions more closely in time.

It may be that the effects reported by Goschke and Kuhl (1993) and by Marsh et al. (1998, 1999) also reflected automatic effects of intentions. But it is possible that subjects performing a facilitation task (a) notice that some test items correspond to study materials and then (b) consciously and deliberately use their memories of the study materials to facilitate performance. If subjects are more likely to notice the relationship and/or to be able to deliberately recall studied items under Do than Ignore conditions, this strategic mechanism could lead to an intention superiority effect.

In the current experiments, critical items in the Stroop list were presented in the same order as in the intentions. Future research might benefit from manipulating item order to examine whether the intention interference effect would be influenced. In addition, another question for future research concerns the colour items in the Stroop list. Our Stroop lists contained congruent colour-name words, but no incongruent colour-name words. We did this to increase the extent to which participants would be open to influence from words. That is, prior research indicates that Stroop effects increase as the proportion of incongruent items decrease (Jacoby, Lindsay, & Hessels, 1993; Melara & Algom, 2003; Toth, 2003), so we speculated that including congruent (but no incongruent) colour-name words would increase the extent to which participants would be sensitive to the semantics of the task-related critical words. Thus an intention interference effect might not be observed if, for example, most of the items in the Stroop lists were incongruent colour-name words. Note, however, that it is unlikely that participants in our experiments strategically used word meanings to perform the Stroop colour-naming task; the majority of the items in each list were non-colour-name words for which such a strategy would backfire, and participants almost never erred by saying a non-colour-name word rather than naming its colour.

To sum up, these data extend what is currently known within the literature on the "intention superiority effect". The current results indicate that intention-related stimuli are processed differently than stimuli that are not future oriented (i.e., stimuli from to-be-ignored trials and filler stimuli). Furthermore, these intention-related items interfere with performance in a Stroop task where the intention is not a part of the actual task. This result suggests that some intention-related processes of cue detection are automatic. Importantly, findings from both experiments show that the intention interference effect is specific to the intention, not just to a memory load. Our results suggest that you may be able to ignore what you intend to do, until something reminds you of it.

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Appendix


WRITING TABLET
TABLETTE DE PAPIER À ÉCRIRE
THE MASK OF ZORRO
Colgate

Figure Captions

Figure 1. Reaction time performance on the Stroop task in Experiment 1 as a function of Word Type and Instructions. Bars represent standard error.

Figure 2. Reaction time performance on the Stroop task in Experiment 1 as a function of Critical Item Order and Instructions. Bars represent standard error.

Figure 3. Reaction time performance on the Stroop task in Experiment 2 as a function of Word Type. Bars represent standard error.

Figure 4. Reaction time performance on the Stroop task in Experiment 2 as a function of Critical Item Order and Instructions. Bars represent standard error.

Figure 1

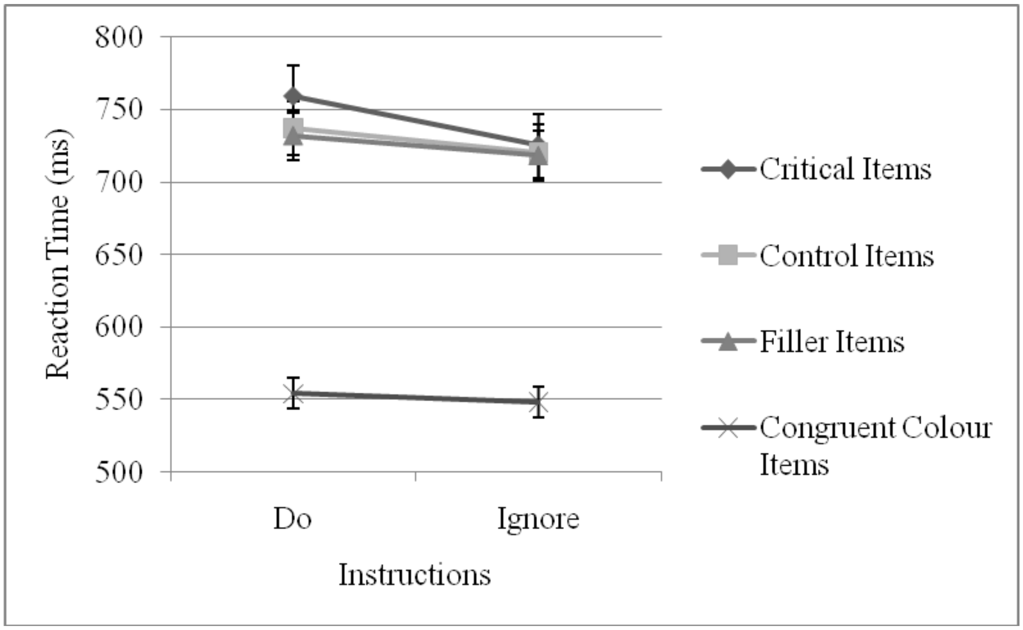

800
750
700
650
600
550
500
Reaction Time (ms)
Do
Ignore
Instructions
Critical Items
Control Items
Filler Items
Congruent Colour Items

Figure 2

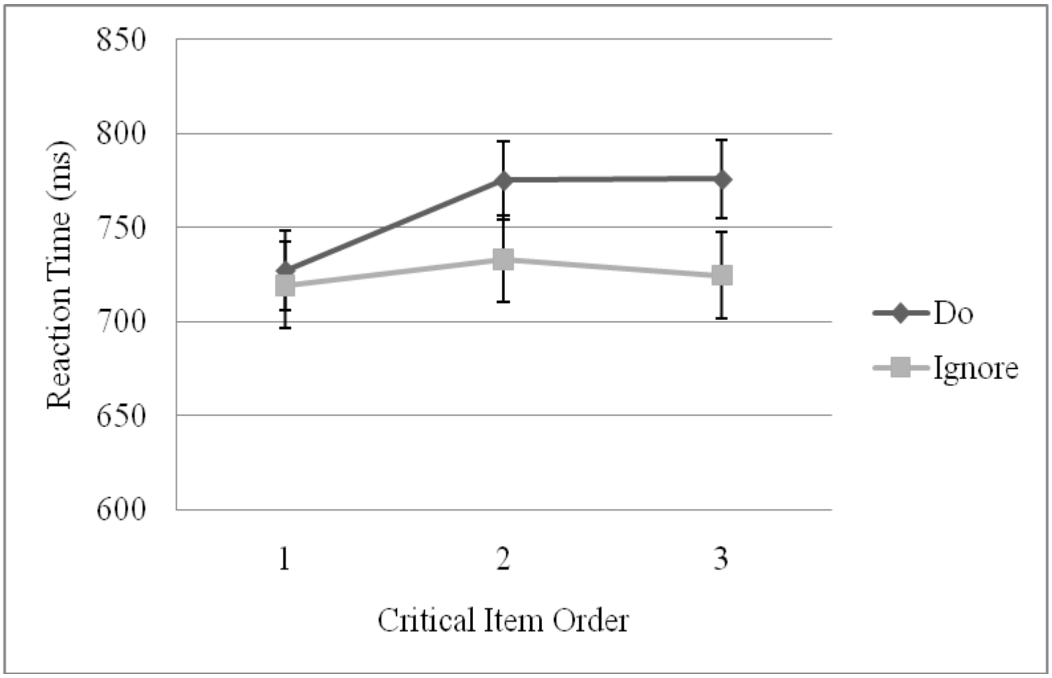
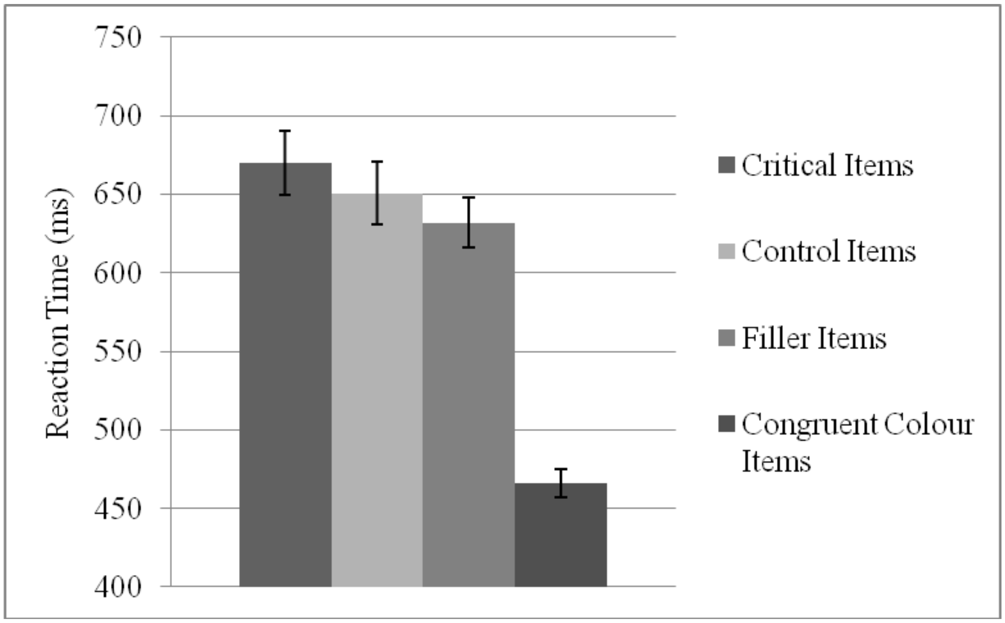
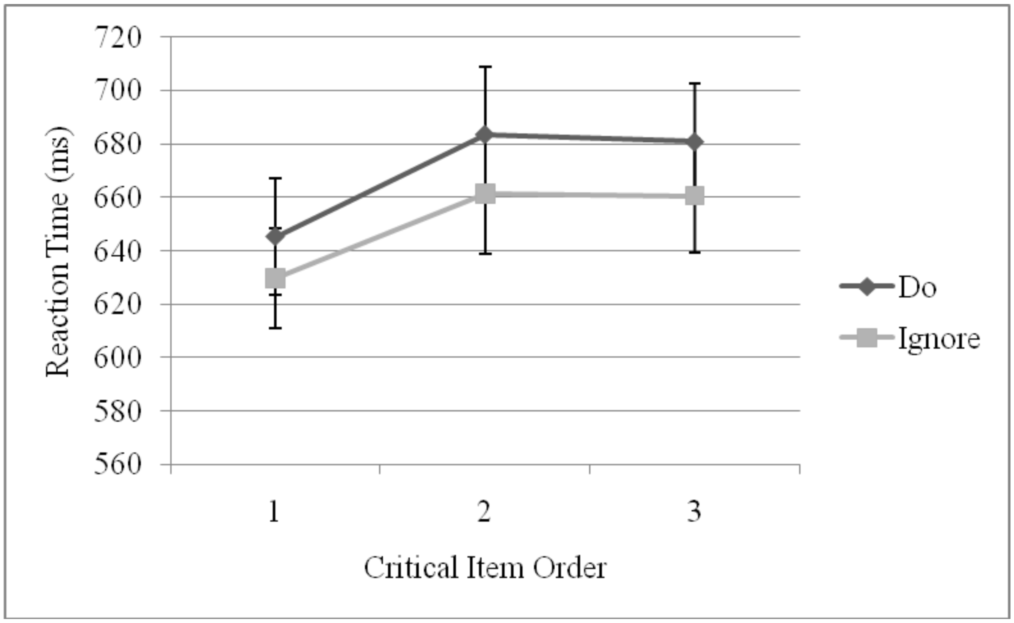

850
800
750
700
650
600
Reaction Time (ms)
1
2
3
Critical Item Order
Do
Ignore

Figure 3



750
700
650
600
550
500
450
400
Reaction Time (ms)
Critical Items
Control Items
Filler Items
Congruent Colour Items

Figure 4


720
700
680
660
640
620
600
580
560
Reaction Time (ms)
1
2
3
Critical Item Order
Do
Ignore