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Strategic use of reminders: Influence of both domain-general and task-specific metacognitive confidence, independent of objective memory ability



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ABSTRACT

How do we decide whether to use external artifacts and reminders to remember delayed intentions, versus relying on unaided memory? Experiment 1 ($N = 400$) showed that participants' choice to forgo reminders in an experimental task was independently predicted by subjective confidence and objective ability, even when the two measures were themselves uncorrelated. Use of reminders improved performance, explaining significant variance in intention fulfilment even after controlling for unaided ability. Experiment 2 ($N = 303$) additionally investigated a pair of unrelated perceptual discrimination tasks, where the confidence and sensitivity of metacognitive judgments was decorrelated from objective performance using a staircase procedure. Participants with lower confidence in their perceptual judgments set more reminders in the delayed-intention task, even though confidence was unrelated to objective accuracy. However, memory confidence was a better predictor of reminder setting. Thus, propensity to set reminders was independently influenced by (a) domain-general metacognitive confidence; (b) task-specific confidence; and (c) objective ability.

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1. Introduction

Suppose you have decided to make a phone call at 2 pm tomorrow. To ensure that you do so, you might make a note in a diary, or leave a reminder taped to a noticeable place. If you have a smartphone or digital watch, you might set an alarm for the appropriate time. These are all ways of 'offloading' intentions into the external environment. Alternatively, you might simply rely on your unaided memory. How will you decide which strategy to use?

The question of how we decide whether or not to offload intentions is of both practical and theoretical significance. It is of practical significance because external artifacts and reminders can be effective tools for remembering delayed intentions (Allen, 2002; Henry, Rendell, Phillips, Dunlop, & Kliegel, 2012; Heylighen & Vidal, 2008; Maylor, 1990). If we are to understand how intentions are fulfilled in everyday life it is therefore important to understand how we decide whether or not to set reminders, and what interventions might affect these decisions. This is likely to become increasingly important as smartphones and wearable technologies become more commonplace (Migo et al., 2014; Svoboda, Rowe, & Murphy, 2012). It also has practical relevance to compensation for memory difficulties in the context of ageing, disease, and brain injury (Fish, Wilson, & Manly, 2010; Thöne-Otto & Walther, 2008; Wilson, Emslie, Quirk, & Evans, 2001).

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On a theoretical level, this question is important particularly due to its relationship with metacognition, i.e. the ability to represent and reason about our own mental states and processes (Metcalf, 1996). In deciding whether or not to offload an intention, it seems plausible that we reflect on the difficulty of its fulfillment, and our unaided ability, before deciding whether to use external support. This assumption will be investigated empirically below. Thus, investigating participants' decisions whether or not to offload intentions can help us to understand the relationship between metacognition, memory ability, and strategy use (Kvavilashvili & Ford, 2014; Meeks, Hicks, & Marsh, 2007; Meier, von Wartburg, Matter, Rothen, & Reber, 2011; Metcalfe, 2009; Rummel & Meiser, 2013; Schnitzspahn, Zeintl, Jäger, & Kliegel, 2011). While metacognition is often assumed to be an important factor for triggering strategic use of reminders for prospective memory (e.g. Arango-Muñoz, 2013; Knight, Harnett, & Titov, 2005; Phillips, Henry, & Martin, 2008), this assumption has received little empirical attention, due to the lack of experimental paradigms that allow participants' use of reminders to be systematically investigated.

Experimental paradigms for investigating prospective memory vary on a number of characteristics (McDaniel & Einstein, 2007). One dimension on which they vary is the way in which intentions are cued. In event-based tasks an intended behavior is cued when we notice a relevant stimulus (as in remembering to post a letter when we notice a mailbox). In time-based tasks an intended behavior is cued at a particular moment (as in remembering to attend a meeting at the appropriate time). Activity-based tasks, where an intention is triggered by the completion of a prior activity, are also possible. Another dimension on which paradigms vary is the delay between encoding an intention and acting on it. Outside the laboratory this can range from periods of seconds (e.g. going to the staff room to pick up one's mail, and intending to collect a milk bottle from the fridge on one's way back), to days, weeks, or longer (e.g. intending to attend a meeting scheduled months in advance). For practical reasons, laboratory studies typically use a seconds-to-minutes timeframe. A third dimension, at least in event-based tasks, is the salience of the cue to which an intention is attached; this relates to the distinction made by some theorists between "focal" and "non-focal" cues (McDaniel & Einstein, 2000). Despite these variations in experimental paradigms, one characteristic shared by virtually all studies is that participants are prevented from creating external reminders. This is in sharp contrast to everyday life, in which such strategies are commonplace.

In order to examine cognitive processes involved in setting external reminders, Gilbert (in press) investigated a web-based "intention offloading" task, in which participants fulfilled an intention on each trial, after a brief filled delay (see also Landsiedel & Gilbert, 2015, for a neuroimaging investigation of this task). On each trial, participants sequentially removed a set of numbered circles from a box, by dragging each circle in turn to the bottom edge (Fig. 1). They were instructed to remove target circles by dragging them to an alternative edge (e.g. "please drag 7 to the top instead"). Participants were given the option of setting an external reminder, by placing the target circles next to the intended edge at the start of the trial. When they did this, the intention was offloaded in the sense that it was now directly cued by the location of the target circle. Consequently, there was no need to mentally rehearse the intended behavior. An everyday analogy might be leaving an object in a noticeable position so that it cues an intended behavior, for example leaving something by the front door so that we remember to bring it with us when leaving the house.

Gilbert (in press) found that accuracy on this task predicted fulfillment of a real-world intention of visiting a specified weblink up to 7 days later to receive a small bonus payment, with greater predictive validity than more traditional time- and event-based prospective memory tasks. Thus, the task had significant external validity as a measure of fulfillment of delayed intentions (albeit with a weak effect size). Furthermore, when this task was matched in accuracy with a control task that did not permit external reminders but was otherwise identical, only the version permitting external reminders significantly predicted real-world behavior. Investigating performance of the intention-offloading task revealed three main findings. (1) Intention offloading promoted intention fulfillment: permitting this strategy boosted performance, and participants who set more reminders fulfilled more intentions. (2) Participants were more likely to offload intentions when they had three targets to remember rather than one. Thus, the decision to offload intentions was influenced by memory load. (3) Participants were more likely to offload intentions when they encountered an interruption in the ongoing task. Thus, the decision to offload intentions was also influenced by the ongoing task in which the memory load was embedded. The latter two findings show that participants offload intentions adaptively based on the difficulty of the task, seeing as a higher memory load and the presence of interruption both reduced intention fulfillment in a matched version of the task that disallowed intention offloading.

The results outlined above show that task-specific factors influenced participants' decisions whether to set reminders. However, even when the task was held constant, there was considerable variation between participants in this behavior. The present study aims to explore the factors that might underlie such individual differences in intention offloading. Why do some participants tend to rely on unaided memory, while others are more likely to set reminders? Note that the experimental paradigm under investigation involves intentions delayed for brief periods on the order of 5–15 s. Of course, intentions in everyday life operate over a variety of timescales, from brief interruptions (e.g. delaying a pending task for a few seconds, during periods of high workload) to hours, days, or longer. Although Gilbert (in press) found that the present intention-offloading task predicted fulfillment of real-world intentions up to one week later, it is not claimed in the present article that the processes involved in fulfilling delayed intentions over such different time periods necessarily overlap. Rather, it is hoped that studying the ways in which participants offload briefly-delayed intentions might serve as a useful first step to understanding metacognitive processes related to the use of reminders over a longer timescale.

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