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Reminders Through Association

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Abstract

People often fail to follow through on good intentions. While limited self-control is frequently the culprit, another cause is simply forgetting to enact intentions when opportunities arise. We introduce a novel, potent approach to facilitating follow-through: the *reminders-through-association* approach. This approach involves associating intentions (e.g., to mail a letter on your desk tomorrow) with distinctive cues that will capture attention when you have opportunities to act on those intentions (e.g., Valentine's Day flowers that arrived late yesterday, which are sitting on your desk). We showed that cue-based reminders are more potent when the cues they employ are distinctive relative to (a) other regularly encountered stimuli and (b) other stimuli encountered concurrently. Further, they can be more effective than written or electronic reminder messages, and they are undervalued and underused. The reminders-through-association approach, developed by integrating and expanding on past research on self-control, reminders, and prospective memory, can be a powerful tool for policymakers and individuals.

Keywords

decision making, memory, policymaking, self-control, open data, open materials

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Imagine that just before drifting off to sleep one night, you suddenly remember that an important application is buried under a stack of papers on your desk at work, and you need to mail it tomorrow. How will you ensure that you remember? Forming an intention is easy; following through is hard. In this research, we tested a novel approach to bridging memory gaps and facilitating follow-through. The approach relies on (a) identifying distinctive cues that will capture attention when intentions (e.g., to mail the application) can be enacted and (b) cognitively associating those cues with the intentions. For instance, when lying awake worrying about the important application buried on your desk, you might deliberately contemplate what distinctive cues near your desk are likely to catch your eye tomorrow when you arrive at work. You may recall that a bouquet of Valentine's Day flowers arrived late yesterday afternoon and are now decorating your desk—and that they are especially distinctive because flowers rarely grace your desk. The *reminders-through-association* approach that we introduce here involves cognitively associating mailing the application (buried on your desk) with the sight of the distinctive roses (also on your desk). This association deliberately turns the flowers into a reminder to mail in the application.

Six laboratory and field experiments showed that the reminders-through-association approach can dramatically increase people's success at following through on their intentions. Cue-based reminders are (a) more potent when they are distinctive relative to other cues encountered concurrently, (b) more potent when they are distinctive relative to other cues encountered in the recent past, (c) more potent than written reminders when encountered in environments with other written signage, and (d) undervalued and underused. This last finding suggests that while some people are sophisticated about the value of reminders through association, many others are naive about the benefits of this approach to overcoming remembering challenges. In addition to introducing and evaluating a new tool for facilitating follow-through

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with clear applications for individuals and policymakers (Thaler & Sunstein, 2003), we also report findings that highlight the two dimensions of cue distinctiveness that increase the impact of reminders, offer new insights into the workings of prospective memory, and extend knowledge about actors' self-awareness of their own limits and willingness to act on that self-awareness (O'Donoghue & Rabin, 1999).

Follow-Through Failures

Many important problems can be attributed, at least in part, to failures to enact one's intentions. For instance, despite good intentions, people often eat poorly, fail to exercise or vote in elections, and neglect to complete and return tax forms, savings forms, and homework assignments. Unanticipated obstacles sometimes contribute to follow-through failures, and self-control failures can also prevent success (e.g., Ariely & Wertenbroch, 2002; Milkman, Chugh, & Bazerman, 2009; Read, Loewenstein, & Kalyanaraman, 1999; Read & Van Leeuwen, 1998; Rogers & Bazerman, 2008; Soman & Cheema, 2011). However, most pertinent to the reminders-through-association approach to remembering is the fact that people sometimes simply fail to remember to enact their intentions (e.g., get a flu shot) at opportune moments (e.g., on the day when flu shots are offered at work).

Self-control research provides a useful framework for understanding people's sophistication (or lack thereof) about the psychological frailties that can produce follow-through failures. Some people are more sophisticated than others about the struggles they will face successfully exerting self-control in the future (O'Donoghue & Rabin, 2001). Sophisticated individuals can, and often do, take steps to overcome limited self-control. Anticipating that they may not follow through on their intentions, they value and adopt commitment devices, which increase the future costs of failing to follow through (e.g., taking the medication Antabuse in the morning to induce vomiting if alcohol is consumed later in the day; Ashraf, Karlan, & Yin, 2006; Milkman, Minson, & Volpp, 2014; Rogers, Milkman, & Volpp, 2014; Schwartz et al., 2014).

People can also be sophisticated about the risk that future memory failures will undermine their efforts to follow through on good intentions (Ericson, 2011). One strategy sophisticates can deploy to solve this problem is to set up reminders, or strategic tools that will direct their attention in the future to their previously formed intentions. Traditional reminders deploy messages shortly before intentions can be enacted and have been shown to effectively facilitate follow-through in a wide range of contexts, from medical care (Shea, DuMouchel, & Bahamonde, 1996) to savings (Karlan, Ratan, & Zinman, 2014). However, to be highly effective, reminders must have at least two features that are often challenging to achieve. First, they must be delivered at precisely the relevant future moment when a previously formed intention can be enacted, as arriving even a few minutes before action is possible can render reminders ineffective (Austin, Sigurdsson, & Rubin, 2006). Second, they must capture people's limited attention in that future moment (Bazerman, 2014; Simons & Chabris, 1999). In light of these challenges, traditional reminder messages are sometimes not effective (e.g., Austin et al., 2006; Nickerson, 2007).

We introduce a new approach to remembering that should be valued by *memory sophisticates*—people who recognize that memory failures may obstruct their ability to follow through on some intentions. The reminders-through-association approach builds on the success of traditional reminders but differs because the only technology it requires is human memory. Cue-based reminders through association are "delivered" precisely at the relevant future moment by design: Notable cues encountered in the moment when intentions can be enacted are repurposed to serve as reminders, with associative memory serving as the delivery technology. Examples of reminders through association include telling yourself you will (a) get a flu shot on the day when you first see Halloween candy on sale at your local pharmacy, (b) remember to pay your utility bill online when you change the month on the calendar in your kitchen, and (c) get your running shorts out of the dryer in the morning to bring to work when you see the kitchen stool placed in front of the door to your garage.

Past memory research suggests that reminders through association should reduce follow-through failures. First, cues linked with a memory induce recall of that memory; many argue that there can be no recall without cues (James, 1890; Jones, 1979; Tulving, 1974). A cue is any prompt that triggers memory recall. Cues can be as explicit as verbal reminders—"Remember to click 'YES' on the next page"—or they can be nonverbal (e.g., the smell of cookies baking may remind you of childhood). The reminders-through-association approach involves deliberately associating your intentions—which can be thought of as memories to be recalled in a specific future moment—with a cue that will be situated in the future moment when your intentions can be enacted.

The reminders-through-association approach builds on past research examining how the distinctiveness of cues that are noticed affects recall of associated memories. Past research suggests that cue distinctiveness is a function of how rarely a cue has been encountered historically and how noticeable a cue is when it is encountered. Cues that have rarely been encountered before are more likely than cues that are more common to trigger accurate recall of an associated memory. This is because rarer cues will have relatively fewer other associations

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that might be triggered when they are noticed (Anderson, 1983). However, even relatively common cues can be made more or less distinctive by considering the contexts in which they are encountered. Cues that are relatively dissimilar from other stimuli that are encountered concurrently, or that have been encountered in the recent past, are more likely to trigger the recall of associated memories (Brandimonte & Passolunghi, 1994; McDaniel & Einstein, 1993).

In six experiments, we explored the benefits and limitations of, and the demand for, the reminders-through-association approach to remembering. We showed that the distinctiveness of cues moderates the effectiveness of reminders through association (Studies 2a and 2b), that using reminders through association can be more effective than using written reminder messages in environments cluttered with other written signage (Study 3), that reminders through association can meaningfully increase follow-through in the field (Study 4), and, in at least some settings, people undervalue and underuse reminders through association (Study 5).

Study 1: Can Reminders Through Association Facilitate Follow-Through?

Study 1 examined whether reminders through association can successfully facilitate follow-through on intentions in a laboratory setting.

Method

Participants. This study was embedded within a series of other laboratory studies conducted by other researchers. For those studies, 87 people were recruited through advertisements in campus newspapers at several large Northeastern universities to participate in a paid, hour-long series of studies. The sample size was determined on the basis of the needs of the researchers coordinating the laboratory session.

Procedure. Participants completed an hour-long session in a computer laboratory. Each participant was randomly assigned by the survey platform to one of two experimental conditions: the reminder-through-association condition or the control condition. All participants first viewed a page on their computer terminal that read as follows:

> As you collect your payment at the end of this [name of research laboratory] session, you will have an opportunity to have an additional $1 donated to Greater Boston Food Bank on your behalf. This will be extra and will not affect your direct cash compensation. There will be a small stack of paper clips on the counter as you are leaving. In order for $1 to be donated, you will need to silently pick up one of these paper clips and take it with you. Do you intend to do this action when you leave in order for Greater Boston Food Bank to receive the $1 donation?

In subsequent analyses, we included only participants who reported intending to take the action needed to have the money donated to the Greater Boston Food Bank (89% reported having the intention). Results were unaffected by including those who did not have this intention. We excluded these individuals because our primary research question focused on the use of the reminders-through-association approach specifically to help people follow through on their intentions. Since experimental conditions were assigned independently of responses to the intention question, the proportion of participants having that intention unsurprisingly did not differ by condition, $t(85) = 1.23$, $p = .22$.

After indicating whether they intended to have the money donated to Greater Boston Food Bank, participants advanced to a second screen. Those in the reminder-through-association condition read "Thank you! To remind you to pick up a paper clip, an elephant statuette will be sitting on the counter as you collect your payment." This message was followed by a picture of the elephant statuette (Fig. 1). Those in the control condition simply read "Thank you!"[1] Participants collected their payment at the end of the session from a lab manager who stood behind a counter on which both the paper clips and the elephant statuette were displayed. The lab manager recorded which participants picked up a paper clip.

Results and discussion

As described above, only those 77 participants who reported intending to perform the behavior required to make the donation were included in our study. Those in the reminder-through-association condition performed the intended behavior at a significantly higher rate (74%, 29 out of 39) than did those in the control condition (42%, 16 out of 38), $\chi^2(1, N = 77) = 8.2$, $p = .004$. Study 1 confirmed that the reminders-through-association approach can reduce follow-through failures.

Next, we conducted a two-part study to examine whether more distinctive cues produce more effective reminders when using the reminders-through-association approach, as hypothesized on the basis of past prospective-memory research (Anderson, 1983; Dismukes, 2012; McDaniel & Einstein, 1993). Study 2a examined how what we call *sequential distinctiveness* influences the effectiveness of cues employed as reminders using this approach. We define a cue as sequentially distinctive when it differs

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Fig. 1. Study 1: picture of the elephant statuette used as a reminder through association to prompt participants in the reminder-through-association condition to remember to donate.

from other cues encountered in the recent past. Study 2b examined how what we call *concurrent distinctiveness* influences the effectiveness of cues employed as reminders in the reminders-through-association approach. We define a cue as concurrently distinctive when it differs meaningfully from other stimuli encountered simultaneously (e.g., in the same environment). Together, these studies yielded two findings. First, cues used as reminders through association are more effective when they are more distinctive. Second, a cue's distinctive is affected by at least two aspects of the cue's context: what is encountered before it and what is encountered simultaneously.

Study 2a: Sequentially Distinctive Cues Employed as Reminders

Method

Participants. Participants were recruited through Amazon's Mechanical Turk (MTurk) to complete a 10-min online survey for which they were paid $0.75 each. Only MTurk workers located in the United States who had not participated in previous similar studies were eligible. The aim was to recruit 900 participants, a sample size chosen ex ante on the basis of expected effect sizes from a pilot study. A total of 920 participants (53% male, 47% female; mean age = 33 years) completed the study before it was closed.

Procedure. Each participant was randomly assigned by the survey platform to one of two experimental conditions: the distinctive-cue condition or the indistinctive-cue condition. All participants first read the following message:

> In this survey, you will have an opportunity to support a charitable organization called Gardens for Health that provides lasting agricultural solutions to address the problem of chronic childhood malnutrition. Do you plan to follow the directions to support the charity? You will not lose any compensation for doing so.

As with Study 1, we included in subsequent analyses only participants who reported intending to take the action needed to have the money donated to charity (72% reported having the intention). Results were unaffected by including those who did not have this intention. Because experimental conditions were assigned independently of responses to the intention question, the proportion of participants having that intention unsurprisingly did not differ by condition, $t(918) = 1.05$, $p = .29$. The second page participants saw contained the following information:

> In this survey, you will have an opportunity to support a charitable organization called Gardens for Health that provides lasting agricultural solutions to address the problem of chronic childhood malnutrition. On the 12th page of this survey, please choose answer "A" for the last question on that page, no matter your opinion. The previous page is Page 1. You are now on Page 2. The next page is Page 3. The picture below [see Fig. 2] will be on top of the NEXT button on the 12th page. You are now on Page 2. The next page is Page 3. This is intended to remind you to select answer "A" for the last question on that page. If you follow these directions, we will donate $0.30 to Gardens for Health.

Participants then answered 10 pages of survey questions copied from another study as a filler task. In order to retain participant attention in the filler survey, we told participants that "some of the questions in this survey have correct answers. You will earn a $.03 bonus for each correct answer. These questions will be marked with a '$$' before the question." Five of these questions were included in the 10-page survey.

For participants assigned to the distinctive-cue condition, the "next" button on the first 9 of these pages was covered by one of a set of cartoonish animals, none of which were elephants. The specific cartoon elephant associated with the intention to donate replaced the "next" button on the tenth page of the filler survey (12th page overall). For participants assigned to the indistinctive-cue condition, the "next" button on the first 9 of the filler-survey pages was covered by one of a set of cartoonish elephants, each of which differed from the specific elephant image associated with the donation intention. For both groups, the specific cartoon elephant associated with the intention to donate replaced the "next" button on the 10th page of the filler survey (12th page overall). In

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Fig. 2. Study 2a: cartoon elephant used as a reminder through association to prompt participants in both the distinctive-cue and indistinctive-cue conditions to remember to donate. Image © maypldigitalart (www.maypldigitalart.etsy.com); used with permission.

this way, animals overlaid the "next" button for the first nine pages of the filler survey in both conditions. Because the animals in the indistinctive-cue condition were all different variations of cartoonish elephants, the specific elephant image associated with the intention to donate was rendered relatively indistinctive. Because the animals in the distinctive-cue condition were all nonelephants, the specific elephant image associated with the intention to donate was rendered relatively distinctive (sequentially distinctive, to be precise). See Figure 3 for the 10 images used in each condition.

Results

Seventy-four percent of participants in the distinctive-cue condition (252 out of 342) performed the intended behavior, whereas 53% of those in the indistinctive-cue condition (170 out of 319) followed through, $\chi^2(1, N = 661) = 29.73$, $p < .001$.

Study 2b: Concurrently Distinctive Cues Employed as Reminders

Method

Participants. Participants were recruited through MTurk to complete a 5-min online survey for which they were paid $0.50 each. Only MTurk workers located in the United States, who had not participated in previous similar studies, had an MTurk approval rating of 95%, and had completed 1,000 or more approved MTurk tasks were eligible. The goal was to recruit 400 participants, a sample size chosen ex ante on the basis of expected effect sizes from a pilot study. Four hundred twelve participants (48% male, 52% female; mean age = 31 years) completed the study.

Procedure. All participants first saw the same screen as in Study 2a. Only participants who reported intending to take the action needed to have money donated to Gardens for Health advanced to the next screen (80% reported having the intention). Those who did not report having the intention were not permitted to continue with the survey. Each participant was then randomly assigned by the survey platform to one of two conditions: the distinctive-cue condition or the indistinctive-cue condition. The next screen presented the following information to participants in both conditions:

> In this survey you will have an opportunity to support a charitable organization called Gardens for Health that provides lasting agricultural solutions to address the problem of chronic childhood malnutrition. After this page you will begin a survey composed of 10 pages. The pages are not numbered. Each page contains one image and one question about that image. We will donate $0.30 to Gardens for Health if you select the response option "none of the above" on the 10th page. To help you remember to click "none of the above" on the 10th page, the following stuffed animal will be part of the image [see Fig. 4].

Participants then answered 9 pages of survey questions that were copied from another study as a filler task. The filler task included one image per page and one question about that image on the same page. A variety of stuffed animals was included in images on 4 of the 9 filler

Fig. 3. Sequence of the 10 cues seen by participants in the (a) distinctive-cue condition and (b) indistinctive-cue condition of Study 2a. Images © maypldigitalart (www.maypldigitalart.etsy.com); used with permission.

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Fig. 4. Study 2b: picture of the stuffed animal used as a reminder through association to prompt participants in the distinctive-cue and indistinctive-cue conditions to donate.

pages. None of the stuffed animals appeared more than once on the filler pages.

In both experimental conditions, the 10th page included the cue employed as a reminder through association (the stuffed bear) and an image of a cash register at a coffee shop adorned by the stuffed bear. Also near the register were a sign that read "Cash Only/For all purchases under/$10" and another, blurry sign. Participants were asked which of the following items they could most likely order from this cashier: coffee, beer, a smoothie, or none of the above. If participants remembered the directions from their intention to donate, they would choose "none of the above."

The difference between conditions in this experiment was whether or not additional stuffed-animal stimuli surrounded the cash register besides the stuffed bear (see Fig. 5 for photos). In the indistinctive-cue condition, four other stuffed animals that had appeared in images supplied on previous filler pages also adorned the cash register; this rendered the specific stuffed animal associated with the intention to donate relatively indistinctive from other simultaneously occurring stimuli. In the distinctive-cue condition, the bear was the only stuffed animal in the image on the 10th page, which rendered the specific stuffed animal associated with the intention to donate relatively distinctive from other simultaneously occurring stimuli.

Results and discussion

Eighty-two percent of participants in the distinctive-cue condition performed the intended behavior, whereas 70% of those in the indistinctive-cue condition followed through, $\chi^2(1, N = 328) = 5.72$, $p < .017$. Which cues are employed as reminders influences the effectiveness of the reminders-through-association approach to remembering.

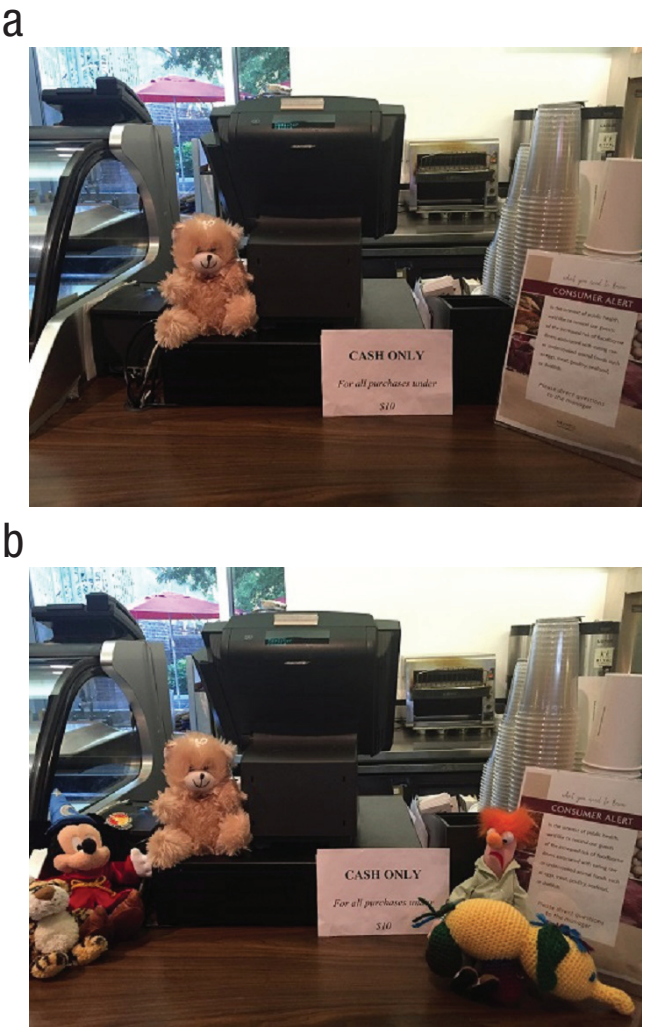

Fig. 5. Study 2b: pictures of the cash-register area shown to participants in the (a) distinctive-cue and (b) indistinctive-cue conditions.

Studies 2a and 2b examined two types of cue distinctiveness and revealed that more distinctive cues make more effective reminders-through-association. We propose that distinctiveness increases cues' likelihoods of being noticed, which increases the effectiveness of those cues when they are used as reminders through association. These studies also shed light on whether reminders through association work entirely because of what occurs when intentions are associated with cues (during the encoding process). Each study associated an intention with a cue in exactly the same way across experimental conditions. Each study's experimental conditions differed only in how distinctive the cue ended up being when participants later encountered it. This shows that the effectiveness of reminders through association is not entirely driven by the encoding process, but rather it is at least in part a result of improving people's recall of their intentions.

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Study 3: Reminders Through Association Can Be More Effective Than Written Reminders

Traditional written reminder messages can effectively promote follow-through sometimes (e.g., Karlan et al., 2014) but not always (e.g., Nickerson, 2007). While in some cases, written reminders may render the reminders-through-association approach unnecessary, one context in which traditional written reminders may be less valuable than reminders through association is when they are posted in environments with many other similar, written signs that compete for attention (i.e., when they are not concurrently distinctive). In Study 3, we compared reminders through association with traditional, written reminder messages in a visual context crowded with many other written messages.

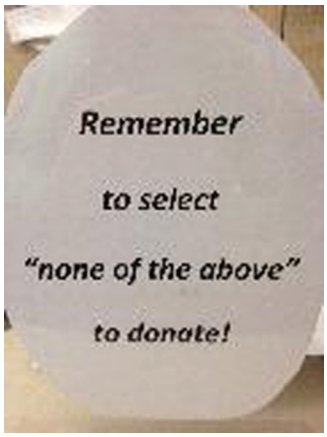

Fig. 6. Study 3: picture of the sign shown to participants in the written-reminder condition.

Method

Participants. Participants were recruited through MTurk to complete a 5-min online survey for which they were paid $0.50 each. Only MTurk workers located in the United States who had not participated in previous similar studies were eligible. The study was opened to 250 participants, a sample size that was predetermined on the basis of pilot testing. Two hundred forty-nine participants (59% male, 41% female; mean age = 32 years) completed the study before it was closed.

Method. All participants first read the same message about Gardens for Health that was used in Studies 2a and 2b. Only participants who reported intending to take the action needed to donate to Gardens for Health were included in the study (76% reported having the intention). Those who did not report that they intended to donate were not permitted to continue with the survey. Each participant was then randomly assigned by the survey platform to one of three experimental conditions: the reminder-through-association condition, the written-reminder condition, or the control condition. Participants in the control condition then read the following information:

> In this survey you will have an opportunity to support a charitable organization called Gardens for Health that provides lasting agricultural solutions to address the problem of chronic childhood malnutrition. After this page, you will begin a survey of 10 questions. On the 10th question, please choose the answer "none of the above," no matter your opinion. If you follow these directions, we will donate $0.30 to Gardens for Health.

Participants in the two treatment conditions read the same text as those in the control condition, except that before the final line of text they were told that either a sign (written-reminder condition; Fig. 6) or an image (reminder-through-association condition; Fig. 7) would be a reminder to answer "none of the above."

All participants then viewed the same 9 pages, each with a picture of a store checkout counter and a single survey question about the picture. Six of these pictures of store checkout counters included visible written signs. The picture on the 10th page also featured a checkout counter with a cash register, but the contents of the counter differed across conditions (see Fig. 8 for photos). The counter in the control condition contained no reminder message and no flyers or promotional signs. The counter in the written-reminder condition contained a written reminder message as well as other flyers and promotional signs. The counter in the reminder-through-association condition contained the same flyers and promotional signs as in the written-reminder condition, except that in place of the written reminder message was the distinctive-cue image that had been associated with

Fig. 7. Study 3: picture of the alien stuffed toy shown to participants in the reminder-through-association condition.

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Fig. 8. Pictures of the checkout counter in each of the three conditions of Study 3: (a) control condition, (b) written-reminder condition, and (c) reminder-through-association condition.

the intention to click the "none of the above" option (the alien). The question asked on this page was "Can you pay with a credit card at this store?" and the response options were "yes," "no," and "none of the above."

The alien cue in the reminder-through-association condition was more sequentially and concurrently distinctive than the written reminder posted in the written-reminder condition. This was because 6 of the preceding 9 pages of images included written messages, whereas none of the 9 preceding images included aliens or stuffed animals. Additionally, because the 10th image included several irrelevant written messages across treatment conditions, the alien cue in the reminder-through-association condition was more concurrently distinctive than the written reminder in the written-reminder condition.

Results and discussion

Participants in the reminder-through-association condition performed the intended behavior at a higher rate (92%) than those in both the written-reminder condition (78%), $\chi^2(1, N = 126) = 5.02$, $p = .025$, and those in the control condition (71%), $\chi^2(1, N = 126) = 8.99$, $p = .003$. There was no significant difference in the rate of follow-through between participants in the control condition and the written-reminder condition, $\chi^2(1, N = 126) = 0.670$, $p = .413$. While written reminders can sometimes be highly effective (e.g., Karlan et al., 2014), in environments with many stimuli competing for attention, reminders through association can be more effective than written reminder messages.

Study 4: The Reminders-Through-Association Approach in a Field Setting

Study 4 was a field experiment examining the efficacy of reminders through association in a stimulus-rich environment: a coffee shop.

Method

Participants. Participants were 500 customers of Crema Café (a coffee shop located in Cambridge, Massachusetts) who exited the café between the hours of 7 a.m. and 2 p.m. on Tuesday, May 14, 2014. Participants were recruited, in coordination with the café's owner, by two research assistants who stood outside of the café handing out coupons attached with a paper clip to a flyer that contained condition-specific information. Five hundred flyers and coupons were printed before the study began on the basis of estimates of how many patrons visit the coffee shop on a typical day before midafternoon. The café's records show that there were 807 total checks during the time the coupons were distributed.

Procedure. When a customer walked out of the café, a research assistant asked, "Would you like $1 off your purchase on Thursday?" If the customer said yes, he or she received a $1-off coupon paper-clipped to a flyer. The vast majority of customers approached accepted the coupon. Among those who declined, the most common explanations provided to the research assistants were that they would not be coming to the café on the following Thursday

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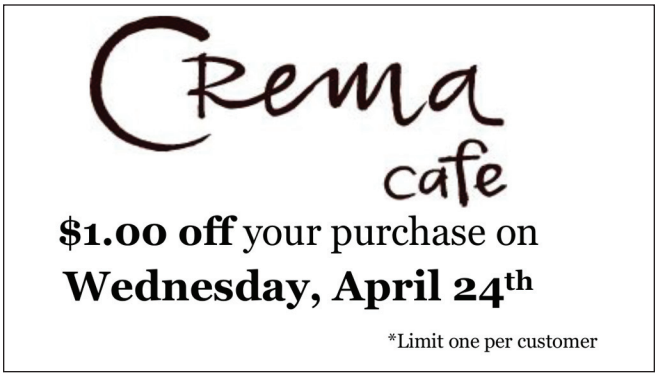

Fig. 9. Study 4: coupon presented to participants.

or that they did not want to stop as they were exiting the café. Customers were not exposed to experimental materials until after they agreed to accept a coupon.

Every customer received the same coupon, which explained that they would receive $1 off their purchase on Thursday (see Fig. 9), which was 2 days in the future. The flyer to which the coupon was affixed varied by experimental condition. Each participant received one of two flyers that were randomly sorted. Both flyers provided the following reminder: "When you see the cash register on Thursday, remember to use this coupon." Both flyers also thanked participants for being a customer and reminded them to recycle their flyer. The reminder-through-association flyer (see Fig. 10a, n = 246) differed from the control flyer (see Fig. 10b, n = 254) in that it also featured a picture of a stuffed alien and the text, "To remind you Thursday, this will be on the cash register." Thus, participants who received the reminder-through-association flyer were instructed to cognitively associate the stuffed alien with their intention to use the coupon, whereas those who received the control flyer were not.

Two days later, on the Thursday when coupons could be redeemed, the same stuffed alien pictured on the reminder-through-association flyer was placed on both of the cash registers in the café (see Fig. 11). This made the stuffed alien visible to all customers as they paid for their purchases, but it served as a reminder to use the coupon only for those who received the reminder-through-association flyer. Customers who presented a coupon to the cashier received $1 off their purchase.

Results and discussion

Twenty-four percent of customers who received a reminder-through-association flyer redeemed the coupon for $1 off their purchase on the following Thursday, compared with just 17% of customers who received the control flyer, $\chi^2(1, N = 500) = 3.01$, $p = .083$. We found that this 36% increase in coupon use was marginally significant using a two-tailed test and that it reached standard levels of significance using a one-tailed hypothesis test. While a one-tailed test may be most appropriate given that theory and the results of the previous studies suggested a directional hypothesis, we report the more conservative test here.

This study showed how the reminders-through-association approach to remembering can be harnessed by firms (or policymakers) to help people follow through on their intentions in the field. By ensuring that distinctive cues are appropriately placed, informing people in advance about the cues, and creating an association between the cues and intentions, organizations can reduce follow-through failures in the people they serve.

Study 5: Are People Sophisticated About the Usefulness of Reminders Through Association?

In Study 5, we sought to understand people's sophistication (or lack thereof) about their limited memory, building

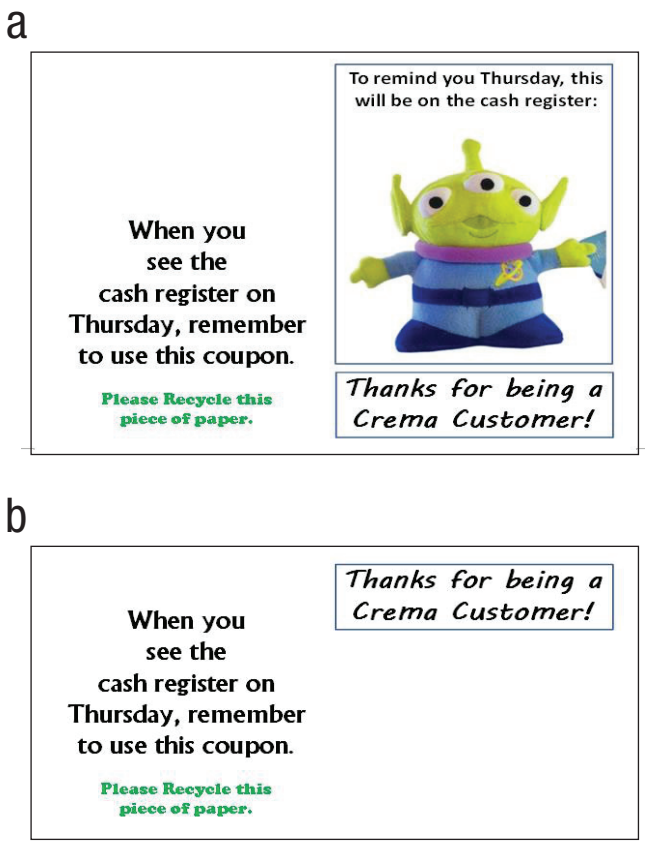

Fig. 10. Study 4: text of the flyers given to participants in the (a) reminder-through-association condition and (b) control condition. Coupons were attached to the flyer in both conditions.

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Fig. 11. Study 4: counter area near the cash register in Crema Café where the stuffed alien toy was displayed as a reminder through association for participants in the reminder-through-association condition.

on work showing that many people are sophisticated about another psychological failing: their limited self-control (O'Donoghue & Rabin, 1999). People who are sophisticated about their limited memory should value reminders through association, whereas people who are naive should not.

Method

Participants. Six hundred five participants were recruited through MTurk to complete a 15-min online survey (56% male, 44% female; mean age = 34 years) for which they were paid $1.00 each. Only MTurk workers located in the United States who had not participated in previous similar studies were eligible. The unique design of this study (involving participants paying for reminders through association) meant that the other studies reported in this article were of little help in estimating the sample size needed for this study. Pilot tests were used to determine the study's sample size, and they suggested that at least 600 participants were needed.

Procedure. All participants were given a $0.06 payment at the beginning of the study. They then completed two pages of filler questions in a single, lengthy survey. One of these questions explained that "some of the questions in this survey have correct answers. You will earn a $.03 bonus for each correct answer. These questions will be marked with a '$$' before the question." There were four such bonus questions included to ensure that participants paid attention to the questions they were asked on the survey and put effort into answering them. All participants were then told that they could earn a $0.60 bonus if they selected Choice "E" on the last question of page 11 of the survey.

Each participant was then randomly assigned by the survey platform to one of four experimental conditions to assess the extent to which they valued and benefitted from cue-based reminders. The first two experimental conditions resembled the experimental conditions in the previous studies. Participants in the forced-reminder-through-association condition read that an image of an elephant (which was displayed on the page) would appear at the bottom of page 11 of their survey to remind them to select Choice "E." Participants in the none condition were not told about, offered, or provided with any reminders. This none condition provided a baseline assessment of what proportion of the sample would follow through without any reminders. Contrasting the none condition with the forced-reminder-through-association condition allowed us to replicate the basic design of the previous studies, in which cue-based reminders were either made available to no one or to everyone.

There were two new conditions in this study. Participants in the costly-reminder-through-association condition were offered the opportunity to pay $0.03 to have the image of the elephant (which was displayed on the page) replace the "next" button at the bottom of page 11 of their survey in order to remind them to select Choice "E." This condition was used to assess the proportion of participants who were sophisticated about the value of the reminders-through-association approach. Finally, participants in the free-reminder-through-association condition saw a page on which they were offered the opportunity, at no cost, to opt into having the image of the elephant (which was displayed on the page) at the bottom of page 11 of their survey in order to remind them to select Choice "E." This condition was used to assess how many participants would proactively use reminders through association if cue-based reminders were provided free of charge. The free-reminder-through-association and forced-reminder-through-association conditions differed in that participants assigned to the former had to actively choose to use reminders through association, whereas participants assigned to the forced-reminder-through-association condition were universally exposed to the cue-based reminder. Contrasting take-up of the cue-based reminders in the free-reminder-through-association condition with take-up in the costly-reminder-through-association condition allowed us to compare demand for cue-based reminders at two prices ($0.03 and $0.00). All participants proceeded through the questionnaire after being exposed to information about what to expect on page 11.

Results

Table 1 shows the percentage of participants in each condition who used the elephant cue and who earned the

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Table 1. Study 5: Choices and Outcomes

Experimental condition	Participants who used distinctive cue	Participants who earned $0.60 bonus	Average earnings per participant
Forced-reminder-through-association (n = 152)	100% (n = 152)	87% (n = 132)	$0.52 ($SE$ = $0.02)
None (n = 153)	—[a]	59% (n = 90)	$0.35 ($SE$ = $0.02)
Costly-reminder-through-association (n = 144)	53% (n = 77)	74% (n = 106)	$0.43 ($SE$ = $0.02)
Free-reminder-through-association (n = 156)	92% (n = 143)	90% (n = 141)	$0.54 ($SE$ = $0.02)

[a]No cue was made available to participants in this condition.

bonus on the survey's 11th page. Study 5 first replicated the results of the previous studies, finding that participants are more likely to follow through when they are assigned a cue-based reminder (in the forced-reminder-through-association condition, 87%) than when no cue-based reminder is available (none condition, 59%), $\chi^2(1, N = 305) = 30.22$, $p < .001$.

This study also showed that some participants valued reminders created through associations with distinctive cues enough that they were willing to pay for them: 53% of participants in the costly-reminder-through-association condition paid for the elephant cue (a significantly higher fraction than zero; one-sample z-test of percentage, $z = 2 \times 10^9$; $p < .001$; $\beta = 0.53$, $p < .001$). This shows that some people are sophisticated about the value of the reminders created through associations.

Further, enough participants were sophisticated about the value of reminders created through associations that the availability of those (costly) cues increased follow-through and created value. That is, those in the costly-reminder-through-association condition were not only more likely to earn the bonus (74%) than those in the none condition (59%), $\chi^2(1, N = 297) = 7.23$, $p = .007$, but they also earned more profit: Participants earned $0.43 on average in the costly-reminder-through-association condition (SE = 0.022) compared with $0.35 on average in the none condition (SE = 0.024), $t(295) = -2.22$, $p = .027$.

Finally, we found that at least some of the 47% of participants in the costly-reminder-through-association condition who did not elect to pay for the reminder created through association made a mistake. We can infer this by comparing earnings in this condition to the earnings of participants in the free-reminder-through-association condition (92% of whom elected to use the distinctive cue) if they had each paid $0.03 for the cue. In that case, the average participant in the free-reminder-through-association condition would have earned $0.51 ($SE$ = 0.014) compared with the average of $0.43 in the costly-reminder-through-association condition (SE = 0.022), $t(298) = 3.36$, $p = .001$. This means that participants in the costly-reminder-through-association condition would have earned 20% more money had they been fully sophisticated and opted out of receiving the distinctive cue-based reminder for reasons other than its cost.

Discussion

In Study 5, people underanticipated the costliness of their limited memory. Just as a lack of sophistication about limited self-control means people undervalue potentially helpful commitment devices, a lack of sophistication about limited prospective memory means that people undervalue potentially helpful cue-based reminders.

General Discussion

In these studies, we tested a new approach to increasing follow-through: creating reminders by associating intentions (e.g., get a flu shot) with distinctive cues that will capture attention when and where those intentions can be enacted (e.g., when you first notice Halloween candy on sale at your local pharmacy). The reminders-through-association approach to remembering dramatically increases follow-through on intentions (Studies 1–5), is more potent when intentions are associated with more distinctive cues (Studies 2a and 2b), and can be more effective than traditional written reminder messages in environments with other written signage (Study 3). Moreover, some people are sophisticated about their limited prospective memory, which leads them to value the reminders-through-association approach; but many are naive and so undervalue and underuse the reminders-through-association approach (Study 5).

Policymakers can use the reminders-through-association approach as a welfare-enhancing tool (Thaler & Sunstein, 2003), similar to strategic defaults (Chapman, Li, Colby, & Yoon, 2010; Madrian & Shea, 2000) or social

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norms (Gerber & Rogers, 2009; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). As Study 4 demonstrated, policymakers can harness this approach by ensuring that (a) distinctive cues (visual, auditory, olfactory, gustatory, or tactile) are present in environments where good intentions can be enacted, and (b) people associate these cues with their good intentions. For example, many airports require travelers to pay their parking fees before returning to the parking facility. When travelers are issued parking cards as they arrive at the airport, they could be shown a rare, distinctive cue—a large statue of an alien, perhaps—and be told that it will be visible next to the location of the payment carrels when they later return to the facility. This cue would be sequentially distinctive because statues of aliens will likely not have been encountered in the travelers' recent past (Study 2a), and concurrently distinctive because there would not be other strange statues visible in the area where it is encountered (Study 2b). This distinctive cue would likely be noticed (presumably with higher likelihood than a written reminder message), triggering travelers to remember that they must pay for parking before reentering the parking facility. Because this cue would be located at the payment carrels, travelers would remember to pay for their parking at the exact moment when they could act.

The reminders-through-association approach is one of several reminder strategies that individuals can employ to remember to follow through on their intentions. Well-placed written reminders (like those examined in Study 3) and scheduled digital reminders are other examples. We posit that reminders through association are especially well-suited for remembering challenges with particular characteristics. For example, they may be more useful than scheduled digital reminders when digital technology is not available in the moment (a) when it is necessary to create the reminder or (b) when follow-through can occur (e.g., when mindfully working or socializing, in meetings or at meals, when preparing for bed or exercising). The reminders-through-association approach is also well suited for remembering to opportunistically perform a behavior when follow-through can occur only at an unknown future time. For example, you might want to remember to buy diapers the next time you happen to be in CVS, or to ask a friend about how a medical appointment went the next time he or she calls. An additional study we conducted (see Study S1 in the Supplemental Material available online) illustrates this point. It shows that reminders through association can be more effective than scheduled, digital reminders for following through on intentions that are to be performed when people encounter a specific context at an unknown future time. However, given the cognitive effort that may be needed to create and use reminders through association, digital reminders may be a superior technology in some contexts.

The research presented in this article complements past work on implementation intentions, which has shown the power of forming concrete "if . . . then" plans for fulfilling intentions. Forming implementation plans increases people's likelihoods of following through on their intentions (Gollwitzer & Sheeran, 2006; Milkman, Beshears, Choi, Laibson, & Madrian, 2011, 2013; Nickerson & Rogers, 2010; Rogers, Milkman, John, & Norton, in press). The current research extends this literature by demonstrating that the specific features of performance environments that intentions are linked to affects the likelihood of intentions being enacted—distinctive cues are more likely than nondistinctive cues to trigger follow-through (Studies 2a and 2b). The current research also extends work on prospective memory by integrating research and theory on reminders, memory, and self-control.

In introducing and testing a novel strategy to facilitate follow-through, this research builds on past work on sophistication and naiveté, showing that these concepts apply not only to limited self-control but also to limited memory. A similar sophistication-naiveté framework could extend to people's vulnerabilities to other cognitive biases. While bias-blindspot research shows that people tend to underestimate their own biases (Pronin, Lin, & Ross, 2002), some subsets of people may be especially sophisticated about bias. Sophistication about overconfidence, the planning fallacy, or loss aversion, for example, may help people proactively circumvent consequences of these biases without eliminating the biases themselves. This could be a rich vein for further basic and interventional research. Future research could also disentangle how the processes of encoding and recall of intentions contribute to the effectiveness of the reminders-through-association approach to remembering. Studies 2a and 2b show that the reminders-through-association approach works, in part, because it improves intention recall at the appropriate time. Future research could further explore this finding, as well as other mechanisms, such as whether associating intentions with distinctive cues (the encoding process) strengthens people's commitments to their intentions.

Action Editor

Gretchen B. Chapman served as action editor for this article.

Author Contributions

T. Rogers and K. L. Milkman developed the concept and designed the studies. T. Rogers conducted the studies and analyzed the data. T. Rogers and K. L. Milkman wrote the manuscript.

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The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Note

1. A superior design would have included the statement, "Thank you, please remember to pick up your paper clip," in the control condition to be more parallel with the text in the reminder condition. This imperfection in Study 1's design was addressed in the subsequent studies, in which more parallel instructions were maintained across conditions.

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