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BRIEF REPORT

Can Goal Reminders Reduce the Stroop Effect in Older Adults?

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Previous research has demonstrated robust age-related differences in the Stroop effect. Such differences are often attributed to deficits in cognitive control processes, such as goal maintenance ability. Previous research in younger adults has reliably demonstrated that the magnitude of the Stroop effect, particularly for those lower in working memory capacity, can be reduced by providing periodic goal reminders. The present study tested if this benefit of goal reminders extends to another group with reduced goal maintenance ability, older adults. Younger ($N = 80$) and older ($N = 78$) adults completed a vocal color-word Stroop task in which most trials were congruent, a condition which induces goal neglect and exacerbates Stroop effects. Critically, half of the participants in each age group were stopped every 24 trials to vocalize either a goal-reminder statement ("The goal is to name the color, not the word") or a nongoal statement ("This is part of my psychology study"). The key finding was that the goal reminders benefitted older adults as evidenced by a reduced Stroop effect in reaction time for the goal condition compared with the nongoal condition. This pattern was not observed for younger adults. Error rate analyses suggested that the benefits of goal reminders were short-lived, with errors primarily reduced in the first half of the run (e.g., 12 trials) following goal reminders. We suggest that goal reminders can be a useful intervention to momentarily improve cognitive control in older adults. We discuss the implications of this finding for theories of cognitive control that implicate reductions in goal maintenance at the center of age-related cognitive decline.

Public Significance Statement
Cognitive control decline in older adults, such as the ability to attend to goal-relevant information in the face of distractions, is well-documented. However, techniques to improve cognitive control in older adults are limited. Our results suggest that a simple intervention, having participants periodically remind themselves of the task goal, can improve cognitive control for older adults. This finding suggests that targeting goal maintenance ability may be critical for further improving cognitive control in older adults.

Keywords: Stroop interference, goal neglect, age-related differences, cognitive control

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One of the most well-established findings regarding cognitive decline is that healthy older adults have poorer cognitive (i.e., executive; attentional) control compared to younger adults (Salthouse, 2009; but see Verhaeghen, 2011). One critical component of cognitive control is the ability to attend to goal-relevant information in the face of distraction (i.e., irrelevant information), and one of the most common tasks used to assess cognitive control is the Stroop task (Stroop, 1935). In this task, participants name the color in which a to-be-ignored word is presented. The Stroop effect is the robust pattern whereby participants are slower, and sometimes more error-prone, when naming the color on incongruent trials (e.g., RED in blue) as compared to congruent trials (e.g., BLUE in blue; for a review, see MacLeod, 1991).

Many studies have demonstrated an age-related increase in the Stroop effect (Cohn et al., 1984; Comalli et al., 1962; Hartley, 1993; West, 2004), even when general slowing is accounted for (Bugg et al., 2007; Jackson & Balota, 2013; Li & Bosman, 1996; Nicosia & Balota, 2020; Spieler et al., 1996; West & Baylis, 1998). Recent meta-analytic estimates of age-related differences in the Stroop effect range from Cohen's *d* of 0.29 (for accuracy) to 1.01 (for raw reaction time [RT] Nicosia et al., 2021; but see Rey-Mermet & Gade, 2018; Verhaeghen, 2011). Several theoretical views have been proposed to explain the robust age-related increase in the Stroop effect. Some theories propose that the Stroop effect is exacerbated in older adults due to the increased difficulty with age in inhibiting the more habitual response of reading the word (Daigneault et al., 1992; Hasher et al., 2008; West & Alain, 2000). Another view, the dual mechanisms of control account (DMC; Braver, 2012) posits instead that age-related increases in the Stroop effect reflect deficits in proactive control, which involves actively maintaining goal representations in the prefrontal cortex to bias attention in favor of goal-relevant information (see Ball et al., 2023; Braver et al., 2005; Bugg, 2014a, 2014b for supportive evidence). Age-related deficits in proactive control (which are akin to goal maintenance ability) have been demonstrated in the AX-Continuous Performance Task (Braver et al., 2005; Paxton et al., 2008; Rush et al., 2006), Flanker (Erb et al., 2020), and task-switching paradigms (De Jong, 2001; Jimura & Braver, 2010).

Given this evidence, it is imperative to ask whether there are interventions targeting cognitive control that might benefit older adults during tasks in which goal maintenance demands are high. Recent work in younger adults has demonstrated that simply providing periodic goal reminders during a Stroop task can reduce Stroop errors particularly for those with lower working memory capacity (WMC). Individuals lower in WMC, in contrast to those higher in WMC, are more susceptible to periodic lapses of attention and goal neglect and less effective at maintaining task goals in contexts that elicit conflict and require overriding habitual responding (Engle, 2002; Kane & Engle, 2003). Hood and Hutchison (2021; see also Hood et al., 2022) had younger adults complete a Stroop task comprised of mostly congruent trials. Critically, mostly congruent lists place high demands on participants to maintain the task goal because most trials (e.g., 75%) do not reinforce the task goal. As such, the task set (color naming) is likely to degrade over time and the likelihood of goal neglect rises (Kane & Engle, 2003). This results in an exacerbation of the Stroop effect (relatively to mostly incongruent lists) as participants respond slower and are more prone to errors on rare incongruent trials (for a review of studies showing Stroop effects are larger in such lists compared with lists comprising mostly incongruent trials, see (Bugg & Crump, 2012). Participants also completed the operation span for a measure of WMC. During the Stroop task, some participants received, and vocalized, a reminder of the task goal (*the goal is to name the color, not the word*; the goal condition) every 12 trials (every 24 trials in Hood et al., 2022) while others received and vocalized a task-irrelevant statement (*this task is for my intro psychology class*; the nongoal condition). Hood and Hutchison found that WMC was significantly correlated with Stroop errors in the nongoal condition, such that lower WMC was associated with more Stroop errors, replicating previous work (Entel & Tzelgov, 2020; Kane & Engle, 2003; Morey et al., 2012). Critically, however, WMC was not related to Stroop errors in the goal condition meaning that providing periodic goal reminders gave lower WMC individuals a temporary boost in goal maintenance such that they performed like higher WMC individuals. A subsequent replication additionally showed that the benefit of goal reminders on Stroop performance was observed selectively for those lower in WMC (Hood et al., 2022), raising the possibility that goal reminders may be especially effective for individuals who are most prone to goal neglect.

The Present Study

The aim of the present study was to extend the recent work of Hood and colleagues (Hood & Hutchison, 2021; Hood et al., 2022) by examining the novel question of whether periodic goal reminders (vs. periodic nongoal statements) would enhance the performance of older adults on the Stroop task. In other words, rather than trying to further replicate previous work showing that individuals with low WMC benefit from goal reminders, we aimed to examine the effects of reminders in a different group of participants that is also generally known to have reduced cognitive control and goal maintenance ability, namely healthy older adults (De Jong, 2001; Paxton et al., 2008). We hypothesized that providing goal reminders would allow older adults to maintain, or more readily reinstate, the goal of the task, thereby reducing the Stroop effect in RT and Stroop errors compared to older adults in a control condition. Although this was our primary aim, we also included younger adults. This enabled us to confirm that our older adult sample indeed showed the typical pattern of an increased Stroop effect compared with younger adults, consistent with our assumption that they have reduced control and goal maintenance ability. With respect to the reminder manipulation, we assumed younger adults in general would not have reduced control/goal maintenance ability and thus may not need nor benefit from goal reminders.

Method

Participants

An a priori power analysis conducted in G*Power 3.1 (Faul et al., 2009) indicated that we would need a total of 158 participants for a 2 × 2 between-subjects analysis of variance (based on the primary effects of interest, e.g., age, condition, and the interaction) with an effect size of Cohen's $f = .25$, $\alpha = .05$, and power = .80. Thus, we planned to collect data from 160 participants, 40 in each cell of the 2 (age) × 2 (goal condition) between-subjects design.

Participants were recruited from two sources. Younger adults (age requirement 18–35 years old) were recruited from the Montana State University undergraduate research pool and completed the study for partial course credit. Older adults (age requirement ≥ 65 years old) were recruited from the St. Louis metropolitan area. Older adults were recruited to take part in a larger study investigating age-related differences in other aspects of attention and memory including mind wandering and prospective memory and were paid $25 for completing a 1.5-hr session. All participants were required to have English as their first language, normal or corrected vision, and full-color vision.

We collected data from 82 younger adults and 94 older adults. Consistent with Hood et al. (2022), we dropped data from participants with >10% scratch trials during the Stroop task; this resulted in removing two younger adults and 14 older adults. Additionally, we dropped data from two older adults who scored outside the normal range (>4) on the Short Blessed Test (Katzman et al., 1983). All other older adults scored in the "normal range" of 0–4. The final sample consisted of 80 younger adults (40 in each goal and nongoal conditions; $M_{\text{age}} = 19.05$ years old, $SD = 2.09$, range = 18–32; $N = 53$ Female) and 78 older adults (39 in each goal and nongoal conditions; $M_{\text{age}} = 73.22$ years old, $SD = 4.44$, range = 65–83; $N = 57$ Female). Older adults did not differ in age between the nongoal ($M = 73.85$, $SD = 4.73$) and goal ($M = 72.59$, $SD = 4.10$) conditions, $t(74.53) = 1.236$, $p = .214$. Younger adults also did not differ in age between the nongoal ($M = 19.08$, $SD = 1.91$) and goal ($M = 19.03$, $SD = 2.28$) conditions, $t(75.71) = 0.106$, $p = .916$. Older adults in the two conditions did not differ in their Shipley's Vocabulary score, $M_{\text{nongoal}} = 29.67$ ($SD = 4.31$) versus $M_{\text{goal}} = 30.95$ ($SD = 4.82$), $t(75.07) = -1.238$, $p = .220$; Trail Making A completion time, $M_{\text{nongoal}} = 38.87$ ($SD = 10.43$) versus $M_{\text{goal}} = 37.23$ ($SD = 14.77$), $t(68.35) = 0.567$, $p = .573$; or their Trail Making B, $M_{\text{nongoal}} = 74.56$ ($SD = 17.43$) versus $M_{\text{goal}} = 82.16$ ($SD = 48.20$), $t(46.30) = -0.915$, $p = .365$, completion times.

Older adults were highly educated with 4% completing high school, 23% completing at least some college, 28% having a bachelor's degree, 36% having a master's degree, and 9% holding a doctoral degree. Older adults were primarily White (91%), followed by Black (6%) or multiracial (3%). Racial information was not collected at Montana State University. Both sites received Institutional Rreview Board approval (Washington University Human Research Protection Study Title: "Controlling Attention and Memory," Protocol Number: #202301108; Montana State Institutional Rreview Board study title: "Attentional Selection and Inhibition," Protocol Number 2024-1290).

Stimuli, Design, and Procedure

Participants completed a mostly congruent version of the Stroop task in which 75% of trials are congruent (e.g., RED in red) and 25% are incongruent (e.g., BLUE in red), similar to the previous work (Hood & Hutchison, 2021; Hood et al., 2022). The Stroop task was programmed and administered in E-prime 2.0. Participants were instructed to respond quickly and accurately by speaking the color of the stimulus into the microphone, which recorded the response time associated with the vocalization. Stimuli were one of three words (RED, GREEN, BLUE) presented in one of three colors (red, green, blue) on a black background. The stimulus lists are available on the Open Science Framework (https://osf.io/a8s4p/?view_only=92b9d364f9ba4fd5bf594aa1f0d76e75). Stimuli were presented in the center of the screen for 3,000 ms or until response. After the participant vocalized a response, an experimenter coded the response on an attached keyboard by pressing a key corresponding to the response emitted by the participant (so that accuracy could be later derived) or a key indicating it was a scratch trial (e.g., microphone errors, coughing, unintelligible speech). Following the coding of the response by the experimenter, there was a 1,000 ms blank interstimulus interval before the next stimulus appeared.

Participants first completed a practice block of 12 trials. Upon completion of the practice block, participants were informed that they would see and vocalize one of two statements (based on condition) throughout the Stroop task. In the goal condition, participants were told they would periodically be shown a screen with the following phrase "The goal is to name the _____, not the ______." Participants were told that they would fill in the blanks with *color* and *word*, respectively. During the task, participants vocalized the full phrase ("The goal is to name the color, not the word"). In the nongoal condition, participants were given the phrase "This is part of my ________ ______" and were instructed to fill in the blanks with *psychology study*. Participants vocalized the full phrase ("This is part of my psychology study"). The test trials of the Stroop task began immediately after and comprised 384 trials. Participants were prompted to vocalize their assigned phrase every 24 trials. The experimenter confirmed they were able to do this accurately throughout the task.

All participants provided informed consent at the beginning of the session. Procedures differed slightly between the two data collection sites, but all participants were randomly assigned to either the goal or nongoal condition. Younger adults only completed the Stroop task and provided demographic information during the experimental session. Older adults completed two neuropsychological tasks to characterize their general cognitive health, the Short Blessed Test (Katzman et al., 1983) and Trail Making A and B (Armitage, 1946), before completing the Stroop task. Older adults then completed two other cognitive tasks.[1] Upon completion, participants received compensation or credit and were debriefed.

Statistical Analyses

Our preregistered analytic approach followed closely to that of Hood et al. (2022, Study 2). Specifically, we used linear mixed effect models to predict RT with fixed effects of age (young vs. old; dummy-coded 0 and 1, respectively), trial type (congruent vs. incongruent; effect-coded −1 and 1, respectively), goal condition (nongoal vs. goal; dummy-coded 0 and 1, respectively), and trial number (1–24 entered as a continuous variable). For accuracy analyses, we used a generalized linear mixed effect model given the binomial nature of the outcome.

Transparency and Openness

We report all data inclusion and exclusion criteria and all measures of interest for the study (Simmons et al., 2012). Data processing and analyses were performed in R (R Core Team, 2024)

[1] These two tasks were unrelated to the aims of the present article and will be reported elsewhere.

using *tidyverse* (Wickham et al., 2019). All analyses were conducted using the *lme4* package (Bates et al., 2015) and *p*-values were calculated using the *lmerTest* package (Kuznetsova et al., 2017). Code for all analyses is available on the Open Science Framework (https://osf.io/a8s4p/?view_only=92b9d364f9ba4fd5bf594aa1f0d76e75). Unless otherwise specified, all analyses were preregistered.

Results

RT Cleaning

As preregistered, we followed the cleaning procedures described in Hood et al. (2022). First, RT analyses were conducted on trials that were >50 ms (which removed <.2% of trials across all participants) and correct trials (which removed another 1.7% of trials across all participants). Next, we used a nonrecursive method to remove outliers (Van Selst & Jolicoeur, 1994) using the *trimr* package (Grange, 2022), which removed another 2.4% of trials across all participants. We report analyses on the raw RTs because we are primarily interested in the benefit of reminders within each age group which is a deviation from our preregistration. Reported effects are unstandardized and thus can be interpreted as differences in RT in milliseconds.

Stroop RTs

Table 1 provides the raw mean RTs for each age group, by goal condition, and trial type. For brevity, we report significant effects in the main text (output from the model can be found in Supplemental Material along with analyses on *z*-scored RTs to account for generalized slowing when comparing younger and older adults).

First, we report analyses that include age as a factor to confirm that typical patterns of age-related differences in the Stroop effect were observed. There was a significant main effect of trial type ($b = 84.86$, $SE = 2.272$, $t = 31.192$, $p < .001$) as incongruent trials ($M = 876$ ms) were slower than congruent trials ($M = 670$ ms). There was also a significant main effect of age ($b = 227.72$, $SE = 21.825$, $t = 10.434$, $p < .001$) with older adults being roughly 228 ms slower than younger adults.[2] More importantly, there was a significant two-way interaction between trial type and age ($b = 42.70$, $SE = 3.892$, $t = 10.971$, $p < .001$) confirming that the Stroop effect in older adults (243 ms) was larger than the Stroop effect in younger adults (169 ms).[3] There was also a significant two-way interaction between age and goal condition ($b = -61.82$, $SE = 30.864$, $t = -2.003$, $p = .047$).[4] For older adults, RTs were faster in the goal condition ($M = 850$ ms) than the nongoal condition ($M = 894$ ms), $p = .044$. In contrast, for younger adults, RTs did not differ between the two conditions, $p = .424$, though nominally they were slower in the goal condition (nongoal $M = 665$ ms vs. goal $M = 682$ ms). The three-way interaction between age, trial type, and goal condition was not significant.

We next performed a targeted analysis within each age group to examine the effect of goal reminders (see Figure 1), with particular interest in the benefits of goal reminders on older adults' Stroop performance. Here, we ran a linear mixed effect model predicting RT from trial type, goal condition, and trial number separately for each age group.

Beginning first with the older adults, who were of greatest interest with respect to our primary aim, there was a significant effect of trial type ($b = 127.56$, $SE = 2.959$, $t = 43.110$, $p < .001$) with incongruent trials ($M = 994$) being slower than congruent trials ($M = 751$ ms). Critically, this effect was qualified by a Trial Type × Goal Condition interaction ($b = -11.55$, $SE = 4.189$, $t = -2.756$, $p = .006$). Older adults who periodically vocalized the goal reminder demonstrated a smaller Stroop effect (239 ms) compared to older adults who vocalized the nongoal statement (251 ms). No other effects were significant (*ps* > .058).

For younger adults, there was only a significant effect of trial type ($b = 84.861$, $SE = 2.547$, $t = 33.342$, $p < .001$) such that incongruent trials (758 ms) were slower than congruent trials (589 ms). No other effects were significant (*ps* > .071; see Supplemental Material for full model output).

Stroop Errors

We also analyzed error rates (see Table 1 for error rates in each age group, split by goal condition and trial type). Again, for brevity, we only report the significant effects in the main text. There was a main effect of trial type ($b = 1.327$, $SE = .151$, $OR = 3.771$, $z = 8.778$, $p < .001$), as participants made more errors on incongruent (vs. congruent) trials. The only significant interaction was Goal Condition × Trial Number ($b = .034$, $SE = .016$, $OR = 1.035$, $z = 2.107$, $p = .035$), demonstrating that participants who vocalized the goal reminder (vs. the nongoal statement) made fewer errors earlier in the run of trials, especially over the first 12 trials following the reminder (Figure 2).

Discussion

The primary aim of the present study was to examine whether periodic goal reminders reduce the Stroop effect in older adults. We hypothesized that older adults who vocalized the goal reminder statement would show a reduced Stroop effect compared to older adults who vocalized a nongoal statement. Additionally, we hypothesized that younger adults, in comparison, might not show the same advantage because of their relatively intact control and goal maintenance ability. The results largely supported our hypothesis. Specifically, older adults who vocalized periodic reminders of the goal ("The goal is to name the color, not the word") benefitted from the reminders by showing a reduced Stroop RT effect compared to older adults who vocalized a nongoal statement. This finding demonstrates that periodic goal reminders can help older adults perform well in tasks that themselves do not encourage goal maintenance (i.e., mostly congruent Stroop task). Although this effect was demonstrated in older adults, it was not found for younger adults, which we will discuss momentarily.

The evidence for a benefit of goal reminders for older adults aligns with previous theoretical views highlighting the decline in goal-maintenance abilities at the heart of age-related cognitive decline such as the DMC account (Braver et al., 2005; Paxton et al., 2008). One possibility is that providing older adults with the periodic goal reminder directly boosted goal maintenance or helped

[2] In *z*-scores, the two age groups did not differ in their overall RT ($p = .059$).

[3] The two-way trial type × age interaction was also significant in the *z*-scores analysis ($p < .001$), confirming the age-related increase in the Stroop effect after accounting for generalized slowing.

[4] This interaction was not significant in the *z*-scores analysis ($p = .874$).

Table 1
Means (and Standard Deviations) for RT and Error Rates as a Function of Age Group, Trial Type, and Goal Condition

	Older adult				Younger adult			
	Goal condition (N = 39)		Nongoal condition (N = 39)		Goal condition (N = 40)		Nongoal condition (N = 40)	
Variable	Congruent	Incongruent	Congruent	Incongruent	Congruent	Incongruent	Congruent	Incongruent
RT	731 (109)	970 (145)	770 (119)	1,021 (145)	599 (67)	765 (91)	579 (65)	751 (102)
Errors	.008 (.005)	.039 (.034)	.005 (.006)	.038 (.047)	.004 (.004)	.066 (.053)	.004 (.005)	.071 (.054)

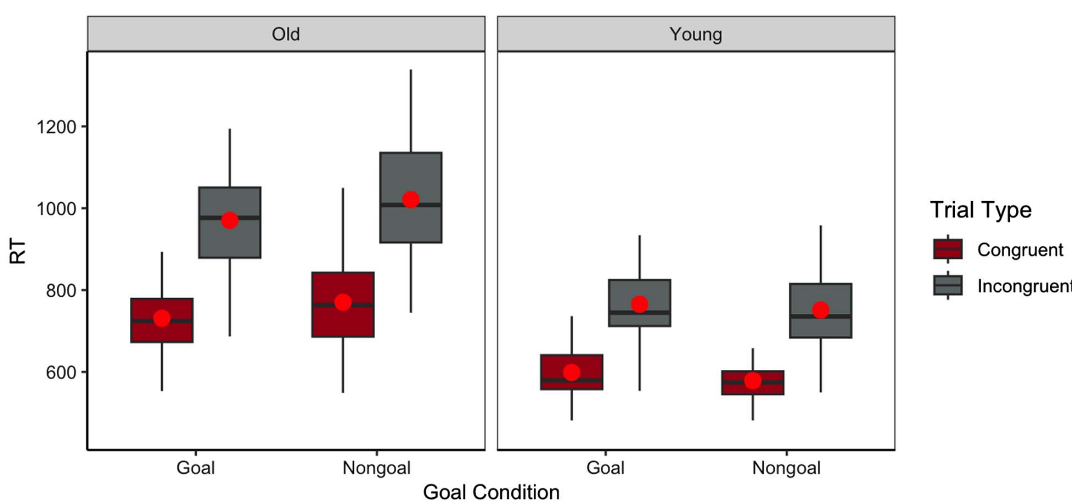
Note. RT = raw reaction time; Errors = error rate.

them compensate for declining proactive control (see Ball et al., 2023; Bugg, 2014a, for evidence in the Stroop task) by enabling them to outsource goal maintenance to an external source (Spieler et al., 2006), which was not possible in the nongoal condition. Another possibility is that the goal reminders enhanced older adults' ability to engage reactive control when the rare incongruent trials occurred. Although the DMC account assumes that reactive control is relatively spared with age (see Bugg, 2014b, for evidence in a Stroop task), older adults who received the goal reminders may have been able to more readily reinstate the task goal when conflict was encountered compared to older adults who vocalized the nongoal statements, possibly because the goal reminders enhanced accessibility of the goal (making it easier to retrieve when needed on incongruent trials). Future work should explore if, and how, goal reminders help older adults in contexts that vary reliance on proactive or reactive control.

In addition, we found that the effect of goal reminders on Stroop errors was most evident during the first half of trials (i.e., first 12 trials) following the reminder statement. Participants in the goal condition made fewer errors after vocalizing the reminder, but their error rates were similar to the nongoal condition during the latter half of the run (i.e., next 12 trials). This may suggest that goal reminders are effective in temporarily boosting goal maintenance, but not in sustaining it fully. The error rate pattern also appears consistent with an explanation based on the outsourcing of goal maintenance, which anticipates benefits to be greatest for trials that are in closer proximity to the occurrence of the reminder. It is interesting that this pattern was not observed for RT; however, the processes contributing to errors (e.g., loss of goal) and slowed RTs (e.g., conflict resolution processes) are not identical.

An important target for future research is to increase the strength of the goal reminder manipulation. One obvious idea is to present goal reminders more frequently. In the present study, reminders occurred every 24 trials, but they were only effective on the first 12 trials following the reminder in the error rate analyses. Doubling the reminders such that they occur every 12 trials might lead to a more pronounced effect on error rate and an even greater reduction in the Stroop effect in RT for older adults. Another idea is to switch from a passive reminder of the goal to a more active commitment to the goal via implementation intentions (e.g., "I will name the ink color and not the word"), which may be more effective. Indeed, previous work has shown that implementation intentions can improve cognitive control in the context of task-switching and Simon paradigms (Cohen et al., 2008). Finally, to examine the generality of the benefits of goal reminders for older adults, future research should determine whether goal reminders improve performance in other

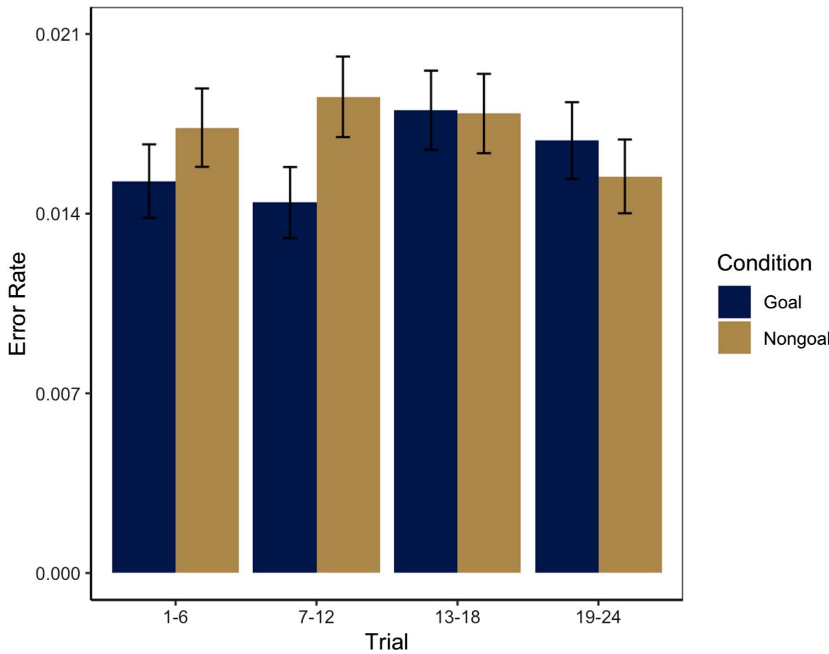
Figure 1
Box Plots Showing RT for Each Trial Type Within Each Goal Condition for Both Age Groups



Note. Horizontal black bars represent the median RT for each condition and whiskers extend to the first and third quartiles for each condition. Red dots represent the condition means. RT = reaction times. See the online article for the color version of this figure.

Figure 2

Mean Error Rates for Each Goal Condition for Six-Trial Bins Following Goal or Nongoal Statements



Note. Error bars depict standard errors of the means. Trial was treated as a continuous predictor in the model but is displayed in six-trial bins as in Hood et al. (2022). See the online article for the color version of this figure.

tasks that older adults typically perform worse on such as Flanker (Erb et al., 2020), AX-Continuous Performance Task (Paxton et al., 2008), and task-switching paradigms (Kray & Lindenberger, 2000).

Although our primary focus was on the effect of goal reminders for older adults, we also collected data from a sample of younger adults and did not find evidence for a significant benefit of goal reminders. This is consistent with prior research (Hood & Hutchison, 2021; Hood et al., 2022), which did not find an overall benefit of reminders for younger adults, but rather an interaction with WMC, such that goal reminders were selectively beneficial for younger adults with lower WMC. In the present study, we did not examine individual differences in WMC. This choice was by design as WMC-related effects of goal reminders in younger adults had already been reliably observed (Hood & Hutchison, 2021; Hood et al., 2022). The selective benefit for lower WMC younger adults in these prior studies is exactly why we predicted that older adults, another group with reduced cognitive control and goal maintenance ability, should benefit from goal reminders relative to nongoal statements when performing the Stroop task.

Conclusions

Maintenance of goals is more challenging for older adults and associated with age-related decline in a variety of tasks indexing cognitive control, including the Stroop task. It is unknown whether interventions might boost older adults' performance on such tasks. We investigated the potential benefits of periodic goal reminders, an intervention shown previously to improve the performance of younger adults with low WMC. Our findings demonstrated for the first time that older adults who vocalized the goal reminders performed better on a Stroop task (i.e., a smaller Stroop RT effect) compared to older adults who did not receive goal reminders. As expected, this benefit was not observed for younger adults. However, goal reminders reduced errors for all participants after vocalizing the statement for roughly 12 trials. Taken together with prior research (Hood & Hutchison, 2021; Hood et al., 2022), the findings suggest that goal reminders may be especially effective for groups that have impaired goal maintenance ability, and future research should examine ways to strengthen the effects of this simple intervention.

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