Original Article

# The dissociable effects of stereotype threat on older adults' memory encoding and retrieval

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## ARTICLE INFO

## ABSTRACT

The present study asks how subliminal exposure to negative stereotypes about age-related memory deficits affects older adults' memory performance. Whereas prior research has focused on the effect of "stereotype threat" on older adults' memory for neutral material, the present study additionally examines the effect on memory for positive and negative words, as well as whether the subliminal "threat" has a larger impact on memory performance when it occurs prior to encoding or prior to retrieval (as compared to a control condition). Results revealed that older adults' memory impairments were most pronounced when the threat was placed prior to retrieval as compared to when the threat was placed prior to encoding or no threat occurred. Moreover, the threat specifically increased false memory rates, particularly for neutral items compared to positive and negative ones. These results emphasize that stereotype threat effects vary depending upon the phase of memory it impacts.

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An emerging body of research has demonstrated that age-related memory deficits (reviewed by Kausler, 1994; Kensinger & Corkin, 2003; Light, 1991) are exacerbated when older adults are reminded of general beliefs that aging impairs memory (e.g., Chasteen, Bhattacharyya, Horhota, Tam, & Hasher, 2005; Hess, Auman, Colcombe, & Rahhal, 2003; Hess, Hinson, & Statham, 2004), a phenomenon referred to as stereotype threat (Steele & Aronson, 1995). However, the mechanism by which stereotype threat disrupts older adults' memory is poorly understood. Specifically, when does stereotype threat impair older adults' memory, and what mechanisms are disrupted during the threat? Answering these questions will facilitate developing interventions that effectively reduce the pernicious outcomes of threat. In the current study, we investigated when threat affected memory by examining whether stereotype threat had a more pronounced impact on memory performance when it was introduced prior to encoding or when it was introduced prior to retrieval. We also investigated the mechanism by examining whether the threat disrupted automatic or controlled processes engaged in memory.

Stereotype threat refers to the notion that negative stereotypes about one's social group (e.g., older adults) in a specific domain (e.g., memory performance) impair individual performance on related tasks (e.g., Steele & Aronson, 1995). For instance, when women are reminded of putative gender differences in math ability, they underperform on subsequent math tests (Spencer, Quinn, & Steele, 1999). Importantly, stereotype threat exacerbates older adults' memory deficits (e.g., Hess et al., 2003, 2004; Thomas & Dubois, 2011). For instance, Hess and colleagues (2003) found that reminding older adults (but not young adults) that aging is associated with memory deficits impaired their subsequent performance on a recall test as compared to a control condition.

A key question that has emerged in stereotype threat and aging research is how stereotype threat disrupts older adults' memory. Memory can be examined as three key processes: encoding, storage, and retrieval. When an individual fails to accurately remember information, this could be due to the fact that the information was not properly encoded or stored into memory. Alternatively, it could be due to the fact that the individual is unable to retrieve information from memory, despite the fact that it was encoded. Memory research demonstrates that there are distinct processes by which information is encoded and retrieved from memory (e.g., Nyberg, Cabeza, & Tulving, 1996; Tulving, Kapur, Craik, Moscovitz, & Houle, 1994). However, it remains an open question whether stereotype

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threat impairs memory by disrupting encoding or retrieval processes. The current study investigated this question.

The majority of studies that examine the effect of stereotype threat on older adults' memory have introduced stereotype threat prior to encoding, and found that it negatively impacts subsequent memory (e.g., Chasteen et al., 2005, Experiment 3; Hess, Emery, & Queen, 2009; Hess et al., 2004). These studies cannot isolate the effects of threat to the encoding phase, however, because activating threat prior to encoding could not only disrupt encoding processes but also continue to disrupt processes at retrieval.

One of the key reasons it may be beneficial to determine whether stereotype threat disrupts encoding or retrieval processes is so that we may identify the mechanism by which threat reduces memory performance. Stereotype threat could impair memory performance in several different ways. For instance, stereotype threat could reduce attention during learning (thereby reducing the strength with which individual items are encoded). Alternatively, stereotype threat could reduce monitoring at retrieval by disrupting controlled processes.

Prior research examining the mechanism by which stereotype threat disrupts older adults' memory performance has yielded mixed results. For instance, Hess and colleagues (2003) found that stereotype threat disrupted recall performance, and this effect was magnified when older adults were highly invested in their memory ability. The authors suggested that stereotype threat may trigger heightened anxiety or lowered expectations, although it remained an open question on whether those processes would disrupt attention during encoding, or monitoring processes at retrieval. However, emerging theories of stereotype threat suggest that it may disrupt controlled processes by shifting older adults' mindset and motivations during the task (Barber & Mather, 2013, 2014). A few prior findings are consistent with this interpretation. Hess et al. (2009) found that older adults' overall recollection declined only when they were given time constraints on the memory task to make their responses. The authors suggested that stereotype threat might disrupt retrieval under a time constraint because this speeded decision-making places increased demands on processing resources. Thus, stereotype threat might divert necessary cognitive resources away from the already cognitively demanding task, thereby resulting in diminished performance. Thomas and Dubois (2011) also presented suggestive evidence that stereotype threat disrupts controlled processes. Specifically, they found that introducing stereotype threat prior to retrieval increased the number of false alarms that older adults made toward lure items on a subsequent test. Because false memories have been widely associated with failures in monitoring (e.g. Kelley & Sahakyan, 2003; Roediger & McDermott, 1995), Thomas and Dubois' finding suggests that stereotype threat may impair controlled (e.g., monitoring) processes during retrieval. Although these studies suggest that stereotype threat impairs memory by disrupting controlled processes, it remains an open question whether these processes are disproportionately disrupted during encoding or retrieval. Due to the fact that prior studies introduced the threat either prior to encoding (e.g., Hess et al., 2003), or prior to retrieval (e.g., Hess et al., 2009; Thomas & Dubois, 2011), this question remains unanswered.

If stereotype threat disrupts controlled processes by reducing attention during encoding, then threat prior to encoding should have a larger impact on memory than threat prior to retrieval, and this impact may primarily be on the hit rates to studied items. If, however, stereotype threat disrupts controlled processes by disrupting monitoring processes at retrieval, then threat prior to retrieval should have the larger impact on memory, and this disruption could be revealed as an inflation of false alarm rates (because the threat would disrupt the memory-monitoring processes needed to reduce false alarms; Curran, Schacter, Norman, &

Galluccio, 1997; Kelley & Sahakyan, 2003; Roediger & McDermott, 1995).

We also took an additional approach to examine how stereotype threat may disrupt controlled processes by examining the impact of threat on older adults' memory for emotional information. Extensive research has demonstrated that emotional memory is relatively preserved with age (for review, see Kensinger, 2008), particularly when the emotional information is positively valenced (Mather & Carstensen, 2005). Older adults' preferential retention of positive relative to negative information has been linked to controlled processes (Reed & Carstensen, 2012), and so if stereotype threat affects these controlled processes, it could affect older adults' memory for this emotional information. The effect of the threat could also dissociate depending on whether it occurs prior to encoding or prior to retrieval. When placed prior to encoding, it could disrupt the controlled allocation of attention needed for the enhanced learning of positive relative to negative information (e.g., Mather & Knight, 2005). Alternatively, stereotype threat prior to retrieval could disrupt the processes that sometimes lead older adults to have a bias to endorse positive items as having been studied, which would result in fewer false alarms to positive as compared to negative items (e.g. Spaniol, Voss, & Grady, 2008; Werheid et al., 2010). By examining memory for emotional as well as neutral words, this study also extends previous research on stereotype threat, which has only examined the effect of threat on memory for neutral words (e.g., Hess et al., 2003, 2004; Horton, Baker, Pearce, & Deakin, 2008; Thomas & Dubois, 2011; but see Kang & Chasteen, 2009).

An additional consideration in understanding how stereotype threat disrupts older adults' memory is the manner in which the threats are introduced (e.g., subliminally or supraliminally). Supraliminal cues may cause participants to actively invoke strategies to counteract the stereotype (e.g., Hess et al., 2004), which may make it harder to identify deficits when using that type of threat. Indeed, in only study directly comparing the impact of supraliminal to subliminal threat cues introduced prior to encoding, Hess and colleagues (2004) found that subliminal threat cues caused greater memory decrements than supraliminal cues (but see Meisner, 2012). The current study therefore investigates the effect of stereotype threat (when introduced using subliminal cues prior to encoding or prior to retrieval) on older adults' memory for positive, negative, and neutral information both as a function of threat placement and by examining the influence on hit rates and false alarm rates.

## 1. Methods

A total of 92 older adults ($M_{age}$ = 75.1 years, $SD$ = 6.8 years; 60 female) were recruited from the Boston area through newspaper advertisements to participate in the current study. They participated in exchange for monetary compensation. In addition, 77 young adults ($M_{age}$ = 19.1 years, $SD$ = 1.0 years; 42 female) were recruited from undergraduate populations to participate in the current study.[1] All participants underwent a health screening to ensure they did not have a physical affliction that could affect cognitive function (e.g., untreated high blood pressure, history of stroke).

### 1.1. Task design

Threat placement (control, subliminal threat at encoding, and subliminal threat at retrieval) was manipulated between subjects such that each older or young adult completed the task under only one of the three threat conditions. Regardless of condition, we

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[1] In an earlier version of this manuscript, we reported data that were collected