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Reduced cognitive capacity impairs the malleability of older adults' negative attitudes to stigmatized individuals

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ABSTRACT

Background: Although engaging explicit regulatory strategies may reduce negative bias toward outgroup members, these strategies are cognitively demanding and thus may not be effective for older adults (OA) who have reduced cognitive resources. The current study therefore examines whether individual differences in cognitive capacity disrupt OA' ability to explicitly regulate their bias to stigmatized individuals. *Methods*: Young and OA were instructed to explicitly regulate their negative bias toward stigmatized individuals by using an explicit reappraisal strategy. Regulatory success was assessed as a function of age and individual differences in cognitive capacity (Experiment 1). In Experiment 2, the role of executive function in implementing cognitive reappraisal strategies was examined by using a divided attention manipulation. *Results*: Results from Experiment 1 revealed that individual differences in OA' cognitive capacity disrupted their ability to regulate their negative emotional response to stigma. In Experiment 2, it was found that dividing attention in young adults (YA) significantly reduced their regulatory success as compared to YA' regulatory capacity in the full attention condition. As expected, dividing YA' attention made their performance similar to OA with relatively preserved cognitive capacity. *Conclusion*: Together, the results from this study demonstrated that individual differences in cognitive capacity predicted OA' ability to explicitly regulate their negative bias to a range of stigmatized individuals.

It has been widely demonstrated that stigmatized individuals elicit negative emotions, including disgust, anger, and pity (Pryor, Reeder, Yeadon, & Hesson-McInnis, 2004; Schmidt & Weiner, 1988). Importantly, the magnitude of individuals' negative emotional response to different stigmatized individuals predicts their bias to those individuals (e.g., Fiske, Cuddy & Glick, 2007). An emerging body of research has begun to examine the role of engaging explicit regulatory strategies to reduce negative bias toward outgroup members. Intriguingly, these studies suggest that giving participants explicit instructions to reduce their bias can result in long-term prejudice reduction (e.g., Devine, Forscher, Austin & Cox, 2012), provided that participants generate internally meaningful strategies to reduce their bias (e.g., Legault, Gutsell & Inzlicht, 2011). However, because regulating bias is cognitively demanding (Amodio, Harmon-Jones, Devine, Curtin, Hartley, & Covert, 2004; Cunningham et al., 2004; Krendl, Macrae, Kelley, Fugelsang & Heatherton, 2006; Krendl, Kensinger & Ambady, 2011; Payne, 2005; Richeson et al., 2003), these strategies may not be effective for older adults (OA) who have impaired cognitive capacity (Anderson & Craik, 2000; Moscovitch & Winocur, 1995).

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Thus, the current study examines whether individual differences in cognitive capacity disrupt OA' ability to explicitly regulate their bias to stigmatized individuals by using an emotion regulation paradigm.

Emerging research suggests that individual differences in cognitive capacity predict OA' expression of negative bias toward outgroup members by disrupting their ability to regulate their bias (Gonsalkorale, Sherman & Klauer, 2009; Krendl, Heatherton & Kensinger, 2009; Krendl & Wolford, 2013; Stewart, Von Hippel & Radvansky, 2009; Von Hippel, Silver & Lynch, 2000). However, it remains an open question whether interventions in which OA are instructed to explicitly regulate their negative bias will be successful in reducing their bias. On the one hand, OA have been shown to be highly effective in explicitly regulating their negative emotions to non-stigmatized targets (e.g., Phillips, Henry, Hosie & Milne, 2008; Shiota & Levenson, 2009; but see Opitz, Rauch, Terry & Urry, 2012). On the other hand, explicitly regulating one's negative emotional response is cognitively demanding (e.g., Krendl et al., 2009), particularly when individuals regulate their negative bias toward stigmatized individuals (e.g., Krendl et al., 2011).

The current investigation examines whether impaired cognitive capacity disrupts OA' ability to regulate their negative emotional response to images of stigmatized individuals by using an emotion regulation paradigm. Both young and OA were instructed to explicitly decrease their negative emotional response to stigmatized individuals (e.g., substance abusers, individuals who are homeless, and individuals with disfigurements). Of interest was whether existing individual differences in OA' cognitive capacity (Experiment 1) and experimentally inducing deficits in cognitive capacity (Experiment 2) predicted the extent to which participants were able to explicitly regulate their negative bias to stigmatized individuals.

There are several reasons why an emotion regulation paradigm is an effective way to examine whether impaired cognitive capacity reduces the malleability of OA' attitudes toward outgroup members. Reappraisal strategies in emotion regulation paradigms have been widely demonstrated to be effective in reducing negative emotional responses for both young adults (YA) (for review, see Gross, 2002) and OA (e.g., Phillips et al., 2008; Shiota & Levenson, 2009; but see Opitz et al., 2012). For instance, Shiota and Levenson (2009) found that OA are more successful than YA at reducing their negative emotions to negative non-stigmatized images (e.g., a couple at a cemetery, an angry dog) when they use positive-based reappraisal strategies (e.g., reevaluating the negative image in a positive light). Indeed, this result is consistent with extensive literature demonstrating that OA may be more effective at regulating their emotions as compared to YA (Birditt & Fingerman, 2005; Blanchard-Fields, Mienaltowski & Seay, 2007; Carstensen, Pasupathi, Mayr & Nesselroade, 2000; Scheibe & Blanchard-Fields, 2009; but see Opitz et al., 2012).

According to the socioemotional selectivity theory (Carstensen, Isaacowitz, & Charles, 1999), a key aspect to OA' emotion regulation success is that they are motivated to regulate their emotions in order to improve their overall emotional satisfaction. Together, these findings suggest that emotion regulation is a domain in which OA are well practiced. Because OA can successfully engage these strategies, it is therefore unlikely that any observed age-related performance decrements in the current study would be due to differences in familiarity with the task, or ability to develop effective strategies. However, cognitive control has been widely implicated as playing an important role in OA' emotion regulatory success (e.g., Mather & Knight, 2005). Thus, if individual differences in individual differences in cognitive capacity predict deficits in

OA' ability to regulate their bias toward stigmatized individuals, it would implicate cognitive deficits in regulatory failure.

In order to further isolate the effects of individual differences in cognitive capacity on regulatory capacity, Experiment 2 used a divided attention task to temporarily impair YA' cognitive capacity. Previous research has demonstrated that dividing attention impairs performance on consciously controlled cognitive tasks (e.g., Jennings & Jacoby, 1993). If regulatory decline impairs participants' abilities to explicitly regulate their negative bias (which is expected), then YA under divided attention should be more impaired in regulating their negative bias than YA under full attention. Thus, in the current investigation, a group of YA and OA performed the regulation task under full attention (Experiment 1), and a separate group of YA' attention was divided during the regulation task (Experiment 2).

An important consideration in using the emotion regulation paradigm to evaluate how negative bias toward stigmatized individuals is explicitly regulated is the type of stigmatized group that is evaluated. YA (who have come of age at a time when society is less tolerant of racial discrimination) may have an easier time regulating their negative bias to certain stigmatized groups (e.g., individuals who are Black) than OA. Thus, the current investigation evaluates attitudes toward individuals who are socially stigmatized—people who are homeless, substance abusers, and individuals who are disfigured. These groups were stigmatized when OA were coming of age (e.g., Goffman, 1963) and are still stigmatized in modern day (e.g., Fiske et al., 2007; Harris & Fiske, 2006, 2007). Moreover, the study will examine the effects of cognitive decline as a predictor of reappraisal success. Thus, if cognitive decline predicts impairments in OA' ability to use reappraisal strategies to regulate their negative emotions to stigmatized individuals, it would implicate cognitive decline, not cohort differences, in reducing reappraisal success.

There were four experimental groups in the current investigation—Experiment 1 includes YA with full attention, OA with relatively preserved cognitive function, and OA with relatively impaired cognitive function; Experiment 2 extends the findings from Experiment 1 to a group of YA with divided attention. All groups performed an emotion regulation task using images of stigmatized individuals (people who are homeless, substance abusers, and individuals who are disfigured). Of primary interest was whether cognitive decline impaired OA' ability to explicitly regulate their bias using reappraisal strategies.

Methods

Participants

A total of 47 OA (M_{age} = 74.20 years, SD = 5.46, 32 female) were recruited from the Boston metropolitan area via e-mail and newspaper advertisements. They possessed similar levels of education to one another and none reported medical conditions in a preliminary health screening (e.g., history of stroke or recent heart attack) that could independently influence cognitive function. A total of 44 YA (M_{age} = 21.43 years, SD = 3.02, 33 female), who were all undergraduates, were recruited via campus announcements from university communities in

Indiana and Boston.[1] Every effort was made to ensure that an equal number of participants were run in each group to provide sufficient power. Participants received monetary compensation or academic credit for participating in the study. All OA and YA in the current study scored above 26 on the Mini-Mental State Exam, suggesting that they were normal functioning.

Measures

In order to quantify the magnitude of OA' cognitive decline, we evaluated their overall executive function capacity. We also evaluated cognitive capacity for a subset of YA in the full and divided attention conditions for comparison.[2] We chose to assess executive function capacity for several reasons. First, previous research on aging has implicated executive function systems (e.g., regulation) in OA' increased expression of negative bias toward outgroup members (Gonsalkorale et al., 2009; Krendl et al., 2009; Stewart et al., 2009; Von Hippel et al., 2000). Specifically, Krendl et al. (2009) found that global declines in executive function impaired OA' ability to implicitly regulate their negative bias toward stigmatized individuals. Second, emotion regulation engages executive function systems (for review, see Zelazo & Cunningham, 2007; see also Krendl et al., 2011).

Participants completed five diagnostic measures to assess executive function: Wisconsin Card Sorting Task, FAS word fluency, WAIS-R mental arithmetic, WMS-R mental control, and WMS-R backward digit span. These tasks are widely used as valid measures of executive function (for validation, see Glisky, Polster & Routhieaux, 1995). This measure has been used in previous studies to assess the effects of individual differences in cognitive capacity on OA' expression of bias toward outgroup members (e.g., Apfelbaum, Krendl & Ambady, 2010; Krendl et al., 2009; Krendl & Wolford, 2013). Performance on each measure was *z*-scored and weighted according to Glisky et al. (1995), resulting in one global executive function value per participant (see Table 1 for individual group performance by task).

Procedure

Stigmatized targets included images of substance abusers, homeless individuals, amputees, and children with facial deformities. These pictures have been previously shown to elicit aversive response from participants, including OA (e.g., Krendl et al., 2009). Participants were instructed to reappraise their negative emotional response to 32

[1]The first wave of young adult data for both Experiments 1 and 2 were collected in Boston (N = 40; M_{age} = 19.28 years, SD = 1.09; 23 female), but executive function scores were not collected on this sample. In order to collect these data and replicate the original results, a separate group of young adults participated in both the full and divided attention studies at Indiana University (N = 105; M_{age} = 20.61 years, SD = 2.19; 71 female). In order to validate the data between the two disparate geographic samples, we compared the regulatory success scores in the full attention and divided attention conditions. There was no significant difference between the two populations in either condition: (full attention: M_{Boston}: .62, SD = .56; $M_{Indiana}$ = .80, SD = .69; $t(98) = 1.08$, $p = .28$; divided attention: M_{Boston}: .34, SD = .51; $M_{Indiana}$ = .44, SD = .58; $t(43) = .57$, $p = .57$). We therefore collapsed across these two samples in the reported analyses. However, analyses using executive function scores are only for the Indiana population.

[2]See footnote 1.

Table 1. Average performance by young adults, OA with relatively impaired cognitive function, and OA with relatively preserved cognitive function on sub-measures of the executive function tasks.

	Mental math	Mental control	FAS	Backward digit span	WCST
Young adults	15.6 (2.2)	29.4 (4.8)	45.4 (7.8)	9.7 (2.5)	5.9 (.3)
OA with relatively intact function	17.2 (2.2)	28.7 (5.0)	53.2 (12.8)	9.0 (2.2)	5.9 (1.1)
OA with relatively impaired function	10.2 (2.5)	23.4 (5.5)	42.8 (12.9)	8.7 (1.7)	3.5 (1.2)

WCST: Wisconsin Card Sorting Task; the values of SD are in ().

images of stigmatized targets, maintain their negative emotional response to 32 images of stigmatized targets, and maintain their negative emotional response to 16 images of non-stigmatized targets (e.g., neutral images of people with no visible stigmas). Images and task instruction were presented in a pseudorandom order such that the task instruction and image type varied trial by trial. The presentation order differed for each participant. However, task instructions were counterbalanced across participants such that half the participants were instructed to reappraise their negative emotional response to the same set of images, whereas the other half were instructed to maintain their negative emotional response to those images (and vice versa with the maintain condition). Emotion regulation paradigms, like the one used in this study, have been widely validated as being effective in reducing participants' negative emotional responses (for review, see Gross, 2002; Urry & Gross, 2010; see also Krendl et al., 2011; Ochsner, Bunge, Gross & Gabrieli, 2002).

Each image appeared in the center of the screen for 4 s with a prompt at the bottom of the screen instructing participants to "view" the image. Here, participants passively viewed the image. Then, the prompt changed to "decrease" or "attend," and the same image remained on the screen for an additional 8 s with the new prompt. During this window, participants either "decreased" their emotional response by actively regulating their negative emotional response to the image (using reappraisal strategies, more on this below), or "attended" to the image by actively maintaining (i.e., not changing) their emotional response to the image. After the 8-s presentation interval elapsed, participants rated the relative strength of their negative emotions to the image (1 = very weak negative emotion, 7 = very strong negative emotion). Participants had a 3-s rest period between each trial.

All participants underwent extensive training with the experimenter (who was also trained at giving instructions) prior to the task to ensure that they could effectively reappraise the images to reduce their negative emotional response. During this training, participants were told that effective reappraisal strategies included thinking of the image as a picture in a magazine, envisioning individuals with injuries as becoming cured, or placing the person in the image in a different context that was not directly threatening to them. Participants completed a series of practice trials with the experimenter to ensure that they could effectively reappraise their negative emotional response and successfully perform the task.

Results

Attend conditions and group effects

Previous research has demonstrated that YA and OA may differ in how they make ratings during evaluative tasks (for review, see Danzinger, 1980). In order to minimize this possibility, we conducted a *t*-test to compare YA and OA ratings for the control faces

in the attend condition. Results revealed no significant difference in ratings ($t < 1$), suggesting that there was no difference in the average ratings each group made toward the control images (YA: 1.97, SD = .77; OA: 1.89, SD = .99; 95% CI [−.48, .25]).

Effects of task instruction and age on ratings

A 2 (instruction: decrease or attend) × 2 (group: YA or OA) ANOVA, with instruction as a within subject factor, was used to examine the effects of task performance as a function of age and task instruction. Results revealed a main effect of instruction ($F(1,89) = 69.28$, $p < .001$, $\eta^2_{\text{partial}} = .44$), a trend toward a main effect of group ($F(1,89) = 3.18$, $p = .08$, $\eta^2_{\text{partial}} = .03$), as well as an instruction × group interaction ($F(2,89) = 13.44$, $p < .001$, $\eta^2_{\text{partial}} = .13$).

The effect of instruction emerged because overall ratings were lower (indicating less negative emotions) in the decrease condition as compared to the attend condition ($M_{\text{Attend}} = 3.94$, SD = .95; $M_{\text{Decrease}} = 3.54$, SD = .99; $t(90) = 7.69$, $p < .001$; 95% CI [.30, .51]). Thus, participants were able to reduce their negative affect toward stigmatized individuals when they used reappraisal strategies. Overall, OA' ratings in both the attend and decrease condition were higher than YA' (resulting in the trend toward an effect of group), but this difference was only significant in the decrease condition. Specifically, the two groups did not differ in their ratings in the attend condition (YA: $M_{\text{Attend}} = 3.86$, SD = .96; OA: $M_{\text{Attend}} = 4.02$, SD = .95; $t < 1$; 95% CI [−.23, .56]). However, OA' ratings in the decrease condition were significantly higher (e.g., more negative) than YA' ratings (YA: $M_{\text{Decrease}} = 3.27$, SD = .97; OA: $M_{\text{Decrease}} = 3.79$, SD = .95; $t(89) = 2.62$, $p = .01$; 95% CI [.13, .93]).

It is important to note that both OA and YA had significantly lower ratings in the decrease condition as compared to the attend condition ($t(46) = 3.44$, $p = .001$; 95% CI [−.10, .36]; $t(43) = 8.11$, $p < .001$, respectively; 95% CI [.44, .74]), suggesting that the reappraisal strategies were effective for both groups in reducing their negative affect. However, the fact that YA' ratings were lower than OA' in the decrease condition suggests that their strategies were more effective than OA' in reducing their negative affective response. This result suggests that OA were not reducing their bias as effectively as YA.

Role of executive function in regulating negative emotions

The results from the above analyses suggest that aging may reduce the ability to regulate negative bias to stigmatized individuals. The next set of analyses examines the role of individual differences in cognitive capacity in predicting this impairment. An overall reappraisal success score (attend—decrease) was calculated for each participant to examine whether executive function decline impairs OA' ability to reappraise the images of stigmatized individuals and regulate their negative bias. Regulatory success was used as a dependent variable in a linear regression with age and executive function as predictor variables. Replicating the ANOVA results above, age was a significant predictor of regulatory success ($\beta = .26$, $p < .04$), and executive function moderately predicted regulatory success ($\beta = .22$, $p = .08$). The overall model fit was $R^2 = .13$.

However, one confound in this model was that overall, YA had higher executive function scores than OA ($t(69) = 3.41$, $p = .001$; 95% CI [.23, .88]). Thus, age effects and executive function effects were not independent. Moreover, there was greater variability among the range of OA executive function scores (>3 SDs) as compared to YA executive function

Table 2. Average rating participants gave the stigmatized images in the attend and decrease conditions by group (young adults with full attention, young adults with divided attention, older adults with relatively preserved cognitive function, and older adults with relatively impaired cognitive function).

	Young adults (full attention)	Young adults (divided attention)	High functioning OA	Low functioning OA
Attend	3.83 (.93)	3.56 (.91)	3.79 (.98)	4.10 (.81)
Decrease	3.06 (.90)	3.18 (.86)	3.47 (.90)	4.04 (.90)
Regulatory success	.76 (.67)	.40 (.55)	.33 (.08)	.06 (.47)

Regulatory success was calculated through a difference score between the average ratings in the attend condition minus the average ratings in the decrease condition, collapsed across image type. Higher values indicate more negative emotions. The values of SD are in ().

scores (<2 SDs; see Table 1 for individual group performance by task). Thus, one additional way to separate effects of executive function on OA' regulatory success would be to divide OA into relatively high and relatively low cognitive function and then evaluate whether those two groups differ in reappraisal success. For this analysis, four OA were excluded because their executive function scores were at the midpoint range and therefore could not be meaningfully separated into "relatively high" or "relatively low" performers. This overall approach has previously been used to identify effects of executive function on social cognition (e.g., Krendl & Wolford, 2013; Apfelbaum, Krendl, & Ambady, 2010; Krendl & Ambady, 2010; Krendl et al., 2009). In the resulting analysis, reappraisal success was the dependent variable, and group (3: YA, OA with relatively low executive function, and OA with relatively high executive function) was the independent variable. Results revealed a significant main effect of group ($F(2,86) = 9.73$, $p < .001$), which was further qualified by a significant weighted linear contrast ($F(1,86) = 7.71$, $p < .001$). Subsequent *t*-tests revealed that YA had significantly greater regulatory success as compared to OA with relatively high executive function ($t(64) = 2.23$, $p < .03$; 95% CI [.02, .50]). More importantly, however, OA with relatively high executive function had significantly greater regulatory success as compared to OA with relatively low executive function ($t(42) = 2.08$, $p < .05$; 95% CI [.01, .53]) (see Table 2).

Discussion

The results from Experiment 1 demonstrated that OA with lower executive function capacity were less successful in regulating their negative emotional response as compared to YA and OA with relatively preserved executive function capacity. This result was demonstrated both by using a regression analysis with executive function as a continuous variable, and through an ANOVA in which OA were divided *a priori* into relatively high and relatively low executive function groups, based on their performance on the executive function tasks. However, if executive function decline impairs OA' ability to successfully regulate their negative explicit bias toward stigmatized individuals, why was this not the case for YA? One possibility is that YA did not have sufficient variability in their executive function scores to reveal individual differences. Alternatively, it may be the case that executive function decline did not play a causal role in reducing regulatory success. Thus, in order to examine whether executive function decline does indeed reduce OA' ability to explicitly regulate their negative emotional response to stigma, we experimentally impaired a group of YA' executive function using a divided attention paradigm (Experiment 2).

Experiment 2

Previous research has demonstrated that dividing attention temporarily impairs performance on consciously controlled cognitive tasks that rely on executive function (e.g., Jennings & Jacoby, 1993). For instance, Craik and colleagues (1996) examined the effect of divided attention on memory. They found that dividing attention during encoding, a process that relies on conscious control and attention, impaired subsequent memory performance. Dividing attention may therefore be an effective way of isolating the effect of cognitive control on regulatory capacity. Simply put, if executive function decline impairs participants' abilities to explicitly regulate their negative bias as expected, then YA under divided attention should be more impaired in regulating their negative bias, unlike YA under full attention.

Methods

In Experiment 2, a total of 101 YA (56 YA in full attention M_{age} = 20.18 years, SD = 1.08, 38 female; 45 YA in divided attention: M_{age} = 19.20 years, SD = 1.00, 23 female) were recruited from university communities in Indiana and Boston.[3] Participants received monetary compensation or academic credit for participating in the study. Here, we used a large sample of participants to ensure that the sample sizes across the two experiments were equivalent. As with Experiment 1, we evaluated cognitive capacity for a subset of the divided attention participants in order to determine if divided attention predicted regulatory success when it was depleted.[4]

In the full attention condition, the task was the exact same as described in Experiment 1. In the divided attention condition, the task was the same as in Experiment 1 with one critical difference: during the 8-s time frame in which participants "attended" or "decreased" their negative emotional response, they concurrently performed an auditory discrimination task. The auditory discrimination task consisted of two distinct rhythmic patterns. The patterns alternated four to seven times during the 8-s block. Participants were instructed to indicate via keypress each time the auditory pattern changed. They completed a series of practice trials prior to the beginning of the task in order to familiarize themselves with the two auditory patterns, as well as to practice discriminating when the patterns changed.

Results

A 2 (instruction: decrease or attend) × 2 (attention: full attention YA or divided attention YA) ANOVA with instruction as a within subject factor was used to examine the effects of task performance as a function of attention and task instruction. Results revealed a main effect of instruction ($F(1,99) = 91.48$, $p < .001$, $\eta^2_{partial} = .48$), an instruction × attention interaction ($F(1,99) = 13.76$, $p < .001$, $\eta^2_{partial} = .12$), but no main effect of attention ($F < 1$).

[3]See footnote 1.
[4]See footnote 1.

The main effect of instruction emerged because YA in both the full and divided attention conditions were able to successfully reduce their negative emotional response in the reappraise as compared to attend conditions (full attention: M_{attend} = 3.80, SD = .92; $M_{Decrease}$ = 2.90, SD = .82; $t(55) = 8.80$, $p < .001$; 95% CI [.69, 1.10]; divided attention: M_{attend} = 3.58, SD = .91; $M_{Decrease}$ = 3.18, SD = .86; $t(44) = 4.86$, $p < .001$; 95% CI [.23, .56]). The interaction emerged because YA in the full and divided attention conditions did not differ in their negative bias toward stigmatized individuals during the attend condition ($t(99) = 1.24$, $p = .22$; 95% CI [−.59, .14]), but YA in the divided attention condition had a trend toward higher negative bias toward stigmatized individuals in the reappraise condition as compared to YA in the full attention condition ($t(99) = 1.65$, $p = .10$; 95% CI [−.05, .61]).

Critically, a direct comparison of the regulatory success scores (attend—decrease) for YA in the full attention ($M_{success}$ = .90, SD = .77) and YA in the divided attention ($M_{success}$ = .40, SD = .55) conditions revealed that divided attention significantly reduced YA' regulatory success ($t(99) = 3.71$, $p < .001$; 95% CI [.23, .77]). Finally, executive function did not predict divided attention participants' regulatory success ($r(24) = -.07$, $p = .75$). However, it is important to note that, as with Experiment 1, there was relatively minimal variability among the range of YA executive function scores (<2 SDs).

Regulatory success compared across Experiments 1 and 2

Since our main interest was to examine whether dividing attention impaired YA' reappraisal success, a one-way ANOVA was used to compare the reappraisal success of the four groups across Experiments 1 and 2 (YA with full attention in Experiments 1 and 2, YA with divided attention, OA with relatively high executive function, and OA with relatively low executive function). Results revealed a significant omnibus effect between the four groups ($F(3,188) = 11.21$, $p < .001$), which was further characterized by a significant weighted linear contrast ($F(1, 188) = 31.77$, $p < .001$). Closer examination of this effect demonstrated that dividing YA' attention had the expected effect on their reappraisal success scores—it was significantly less than YA with full attention ($t(143) = 3.22$, $p < .005$; 95% CI [.14, .59]), rendering their scores to be similar to those of OA with relatively preserved executive function ($t < 1$). However, as expected, YA' reappraisal success scores in the divided attention condition were significantly greater than the reappraisal success score of OA with relatively impaired executive function ($t(64) = 2.45$, $p < .02$; 95% CI [.06, .62]), and see Table 2 for means).

Discussion

Together, the results of Experiment 2 suggest that executive function is critical for regulating explicit bias toward stigmatized individuals. Specifically, this experiment demonstrated that when YA' executive function is temporarily disrupted by a divided attention task, they have reduced regulatory success.

General discussion

The results from this study suggest that impaired cognitive capacity disrupts OA' ability to explicitly regulate their negative bias to outgroup members as compared to YA. Indeed, OA with relatively impaired cognitive capacity were less successful in explicitly regulating

their negative affective response to stigmatized individuals as compared to OA with relatively preserved cognitive capacity. In turn, YA in the full attention condition (whose overall executive function was higher than OA') were the most successful in regulating their negative bias to stigmatized individuals. Critically, when YA completed the same task under divided attention, they were less successful in regulating their negative bias as compared to YA in full attention.

These findings extend previous research on the effects of individual differences in cognitive capacity on negative bias toward outgroup members in two important ways. First, extending previous findings that impaired cognitive capacity exacerbates implicit bias toward outgroup members (e.g., Gonsalkorale et al., 2009; Stewart et al., 2009; Von Hippel et al., 2000); the present study demonstrates that impaired cognitive capacity also disrupts OA' ability to explicitly regulate their negative bias toward outgroup members. Second, it demonstrates that impaired cognitive capacity disrupts OA' ability to explicitly regulate negative bias toward a wide range of stigmatized groups—not just Black individuals, which has primarily been examined in prior studies (Gonsalkorale et al., 2009; Stewart et al., 2009; Von Hippel et al., 2000).

An important caveat to these findings is that the executive function capacities of OA with relatively preserved cognitive capacity and YA did not differ. However, OA with relatively preserved cognitive capacity did have significantly less regulatory success as compared to YA in the task. One possibility for this finding may be cohort differences. That is, YA have come of age in an environment in which they have been instructed not to be prejudiced. This is not necessarily the case with OA. Although OA have likely been exposed to similar messages in recent years, the fact that YA have consistently been instructed not to be prejudiced when evaluating outgroup members may have resulted in their having a more extreme regulatory responses. Consistent with this assertion is the fact that YA' overall ratings to stigmatized individuals were lower as compared to OA', regardless of instruction condition. However, this was not the case for their ratings in the control condition (which suggests that the disparity in the ratings was not an artifact of scaling differences). Future research should examine whether early exposure to controlling prejudice may have disparate effects on overriding discrimination.

Additionally, the fact that OA with relatively impaired cognitive capacity did not have lower ratings in the decrease as compared to the attend condition suggests that they may not have complied with the task instructions. However, the fact that regulatory success correlated with executive function suggests that regulatory ability is not a matter of can or cannot. Rather, there are gradations of regulatory ability that are predicted by executive function. This may also explain why executive function did not predict YA' regulatory success (in either Experiment 1 or Experiment 2). Simply put, there was substantially less variability in YA' executive function scores in both Experiment 1 and Experiment 2 (less than 2 SDs), as compared to OA' (greater than 3 SDs). As a result, individual differences in variability in regulatory success may have been more difficult to assess among YA by using executive function decline. It is worth noting, however, that YA overall had higher SDs in their regulatory success scores (in both full and divided attention) as compared to OA. Future research should investigate why that might be.

Regardless, the overall results from this study suggest that impaired cognitive capacity disrupts OA' ability to explicitly regulate their negative bias to a range of stigmatized individuals. This interpretation is further reinforced by the fact that the

divided attention task (which disrupted cognitive control) impaired YA' regulatory success. However, an important limitation to these results is that although divided attention reduced YA' overall regulatory success (relative to the full attention condition), there was only a marginal difference between YA' divided and full attention conditions in the attend condition. Although the pattern of results in the two attend conditions was in the same direction as it was in the YA' overall regulatory success score, the fact that the results were marginal here means that these results should be interpreted with caution.

At least one potential implication of these findings is that OA' social well-being could be negatively impacted when they interact with stigmatized individuals, for cognitive decline may disrupt their ability to regulate their expression of bias. These findings also have important implications for developing effective interventions to enhance OA' ability to minimize their expression of negative bias. Specifically, they suggest that interventions should focus on how OA regulate their bias, not on how they form impressions of outgroup members.

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References

Amodio, D. M., Harmon-Jones, E., Devine, P. G., Curtin, J. J. S, & Covert, A. E. (2004). Neural signals for the detection of unintentional race bias. *Psychological Science*, *15*(2), 88–93. doi:10.1111/j.0963-7214.2004.01502003.x

Anderson, N. D., & Craik, F. I. M. (2000). *Memory in the aging brain*. New York, NY: Oxford University Press.

Apfelbaum, E. P., Krendl, A. C., & Ambady, N. (2010). Age-related decline in executive function predicts better advice-giving in unnerving social contexts. *Journal of Experimental & Social Psychology*, *46*(6), 1074–1077. doi:10.1016/j.jesp.2010.07.017

Birditt, K. S., & Fingerman, K. L. (2005). Do we get better at picking our battles? Age group differences in descriptions of behavioral reactions to interpersonal tensions. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *60*(3), P121–P128. doi:10.1093/geronb/60.3.P121

Blanchard-Fields, F., Mienaltowski, A., & Seay, R. B. (2007). Age differences in everyday problem-solving effectiveness: Older adults select more effective strategies for interpersonal problems. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *62*(1), P61–P64. doi:10.1093/geronb/62.1.P61

Carstensen, L. L., Pasupathi, M., Mayr, U., & Nesselroade, J. R. (2000). Emotional experience in everyday life across the adult life span. *Journal of Personality and Social Psychology*, *79*(4), 644. doi:10.1037/0022-3514.79.4.644

Craik, F. I., Govoni, R., Naveh-Benjamin, M., & Anderson, N. D. (1996). The effects of divided attention on encoding and retrieval processes in human memory. *Journal of Experimental Psychology: General*, *125*(2), 159. doi:10.1037/0096-3445.125.2.159

Cunningham, W. A., Johnson, M. K., Raye, C. L., Gatenby, C. J., Gore, J. C., & Banaji, M. R. (2004). Separable neural components in the processing of black and white faces. *Psychol Sci*, *15*(12), 806–813. doi:10.1111/j.0956-7976.2004.00760.x

Danzinger, W. L. (1980). Measurements of response bias in aging research. In L. W. Poon (Eds.), *Aging in the 1980s: Psychological issues* (pp. 552–557). Washington, D.C.: American Psychological Association.

Devine, P. G., Forscher, P. S., Austin, A. J., & Cox, W. T. (2012). Long- term reduction in implicit race bias: A prejudice habit-breaking intervention. *Journal of Experimental Social Psychology*, *48*(6), 1267–1278. doi:10.1016/j.jesp.2012.06.003

Fiske, S. T., Cuddy, A. J., & Glick, P. (2007). Universal dimensions of social cognition: Warmth and competence. *Trends in Cognitive Sciences*, *11*(2), 77–83. doi:10.1016/j.tics.2006.11.005

Glisky, E. L., Polster, M. R., & Routhieaux, B. C. (1995). Double dissociation between item and source memory. *Neuropsychology*, *9*(2), 229–235. doi:10.1037/0894-4105.9.2.229

Goffman, E. (1963). *Stigma: Notes on the management of spoiled identity*. New York, NY: Simon & Schuster.

Gonsalkorale, K., Sherman, J. W., & Klauer, K. C. (2009). Aging and prejudice: Diminished regulation of automatic race bias among older adults. *Journal of Experimental Social Psychology*, *45*(2), 410–414. doi:10.1016/j.jesp.2008.11.004

Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, *39*(3), 281–291. doi:10.1017/S0048577201393198

Harris, L. T., & Fiske, S. T. (2006). Dehumanizing the lowest of the low: Neuroimaging responses to extreme out-groups. *Psychological Science*, *17*(10), 847–853. doi:10.1111/j.1467-9280.2006.01793.x

Harris, L. T., & Fiske, S. T. (2007). Social groups that elicit disgust are differentially processed in mPFC. *Social Cognitive and Affective Neuroscience*, *2*(1), 45–51. doi:10.1093/scan/nsl037

Jennings, J. M., & Jacoby, L. L. (1993). Automatic versus intentional uses of memory: Aging, attention, and control. *Psychology and Aging*, *8*(2), 283–293. doi:10.1037/0882-7974.8.2.283

Krendl, A. C., & Ambady, N. (2010). Older adults' decoding of emotions: Role of dynamic versus static cues and age-related cognitive decline. *Psychology and Aging*, *25*(4), 788.

Krendl, A. C., Heatherton, T. F., & Kensinger, E. A. (2009). Aging minds twisting attitudes: An fMRI investigation of age differences in inhibiting prejudice. *Psychology & Aging*, *24*(3), 530–541. doi:10.1037/a0016065

Krendl, A. C., Kensinger, E. A., & Ambady, N. (2011). How does the brain regulate negative bias to stigma? *Social Cognitive & Affective Neuroscience*. advanced online access. doi:10.1093/scan/nsr046

Krendl, A. C., Macrae, C. N., Kelley, W. M., Fugelsang, J. F., & Heatherton, T. F. (2006). The good, the bad, and the ugly: An fMRI investigation of the functional anatomic correlates of stigma. *Social Neuroscience*, *1*(1), 5–15. doi:10.1080/17470910600670579

Krendl, A. C., & Wolford, G. (2013). Cognitive decline and older adults' perception of stigma controllability. *Journal of Gerontology B Series: Psychological Sciences*, *68*(3), 333–336. doi:10.1093/geronb/gbs070

Legault, L., Gutsell, J. N., & Inzlicht, M. (2011). Ironic effects of antiprejudice messages how motivational interventions can reduce (but also increase) prejudice. *Psychological Science*, *22*(12), 1472–1477. doi:10.1177/0956797611427918

Mather, M., & Knight, M. (2005). Goal-directed memory: The role of cognitive control in older adults' emotional memory. *Psychology and Aging*, *20*(4), 554. doi:10.1037/0882-7974.20.4.554

Moscovitch, M., & Winocur, G. (1995). Frontal lobes, memory and aging. *Annals of the New York Academy of Sciences*, 119–151. doi:10.1111/j.1749-6632.1995.tb38135.x

Ochsner, K. N., Bunge, S. A., Gross, J. J., & Gabrieli, J. D. (2002). Rethinking feelings: An fMRI study of the cognitive regulation of emotion. *Journal of Cognitive Neuroscience*, *14*(8), 1215–1229. doi:10.1162/089892902760807212

Opitz, P. C., Rauch, L. C., Terry, D. P., & Urry, H. L. (2012). Prefrontal mediation of age differences in cognitive reappraisal. *Neurobiology of Aging*, *33*(4), 645–655. doi:10.1016/j.neurobiolaging.2010.06.004

Payne, B. K. (2005). Conceptualizing control in social cognition: How executive functioning modulates the expression of automatic stereotyping. *Journal of Personality and Social Psychology*, *89*(4), 488.

Phillips, L., Henry, J., Hosie, J., & Milne, A. (2008). Effective regulation of the experience and expression of negative affect in old age. *Journals Gerontology*, *63B*, 138–145. doi:10.1093/geronb/63.3.P138

Pryor, J. B., Reeder, G. D., Yeadon, C., & Hesson-Mclnnis, M. (2004). A dual-process model of reactions to perceived stigma. *Journal of Personality and Social Psychology*, *87*(4), 436–452. doi:10.1037/0022-3514.87.4.436

Richeson, J. A., Baird, A. A., Gordon, H. L., Heatherton, T. F., Wyland, C. L., Trawalter, S., & Shelton, J. N. (2003). An fMRI investigation of the impact of interracial contact on executive function. *Nat Neurosci*, *6*(12), 1323–1328. doi:10.1038/nn1156

Scheibe, S., & Blanchard-Fields, F. (2009). Effects of regulating emotions on cognitive performance: What is costly for young adults is not so costly for older adults. *Psychology and Aging*, *24*(1), 217. doi:10.1037/a0013807

Schmidt, G., & Weiner, B. (1988). An attribution-affect-action theory of behavior: Replications of judgments of help-giving. *Personality and Social Psychology Bulletin*, *14*(3), 610–621. doi:10.1177/0146167288143021

Shiota, M. N., & Levenson, R. W. (2009). Effects of aging on experimentally instructed detached reappraisal, positive reappraisal, and emotional behavior suppression. *Psychology and Aging*, *24*(4), 890. doi:10.1037/a0017896

Stewart, B. D., Von Hippel, W., & Radvansky, G. A. (2009). Age, race, and implicit prejudice: Using process dissociation to separate the underlying components. *Psychological Science*, *20*(2), 164–168. doi:10.1111/j.1467-9280.2009.02274.x

Urry, H. L., & Gross, J. J. (2010). Emotion regulation in older age. *Current Directions in Psychological Science*, *19*(6), 352–357. doi:10.1177/0963721410388395

Von Hippel, W., Silver, L. A., & Lynch, M. E. (2000). Stereotyping against your will: The role of inhibitory ability in stereotyping and prejudice among the elderly. *Personality and Social Psychology Bulletin*, *26*(5), 523–532. doi:10.1177/0146167200267001

Zelazo, P. D., & Cunningham, W. A. (2007). Executive function: Mechanisms underlying emotion regulation. In J. J. Gross (Ed.), *Handbook of emotion regulation*. New York, NY: Guildford Press.