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# Effects of Executive Ability on Bias and Ingroup Perceptions in Aging

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Prior work on aging and prejudice has identified that declining executive ability underlies older adults' (OA') increased anti-outgroup bias. The current work, however, suggests that there may also be a motivational reason. Here, we explored the possibility that for OA with relatively lower executive ability, anti-outgroup bias may serve an ironic purpose of maximizing a fundamental social goal: maintaining ingroup positivity. OA are more motivated than young adults (YA) to maximize positivity in everyday life. This process, however, can be cognitively effortful. We tested the novel predictions that (a) OA' executive ability positively predicts their evaluations of ingroup members and (b) OA might preserve positive ingroup perceptions through anti-outgroup bias if they have lower executive ability. The present work tested these predictions using a timely example of an outgroup: Muslims. Study 1 verified that non-Muslim YA and OA identified with non-Muslims (vs. Muslims) as an ingroup. Study 2 then had 3 key findings. First, we replicated work showing a negative relationship between OA' executive ability and their anti-outgroup bias by showing a negative relationship with their anti-Muslim bias. Second, OA' higher executive ability related to their having more positive perceptions of ingroup non-Muslims. Finally, OA with lower executive ability had higher ingroup positivity by having higher anti-Muslim bias. These findings suggest that when OA lack the executive ability to directly maintain a motivational goal of being positive about themselves and their ingroups, they maintain positivity at the expense of others.

*Keywords:* aging, ingroup positivity, prejudice, executive ability, Islamophobia

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Older adults (OA) with lower executive ability exhibit higher levels of bias against outgroup members (Cassidy, Lee, & Krendl, 2016; Gonsalkorale, Sherman, & Klauer, 2009; Krendl, 2018; Radvansky, Copeland, & von Hippel, 2010; von Hippel, Silver, & Lynch, 2000). This work has been key to understand the increased bias OA express toward Black Americans and other stigmatized groups (e.g., people who are homeless or addicted to drugs; Krendl, 2018; Krendl, Heatherton, & Kensinger, 2009), suggesting a broad negative relationship between OA' executive ability and

their bias. A key contribution of this work has been to identify executive ability as a mechanistic reason for OA' outgroup bias. Specifically, OA' lower executive ability disrupts their ability to regulate their bias (e.g., von Hippel et al., 2000), thereby suggesting that lower executive ability exacerbates it (e.g., Krendl, 2018). The current work explored the possibility that there may also be a motivational reason for outgroup bias: to achieve a fundamental sociocognitive goal of increasing ingroup positivity.

Socioemotional selectivity theory (Carstensen, Isaacowitz, & Charles, 1999) posits that OA are strongly motivated by the goal of maintaining positivity, whereas younger adults (YA) are motivated by knowledge seeking. Consistent with this theory, OA versus YA report having higher quality ingroup interactions (e.g., with family members; Birditt, Fingerman, & Almeida, 2005). Executive ability helps OA achieve their goal of maintaining positivity because it allows them to downregulate negative responses (Williams et al., 2006) and focus on goals emphasizing emotional satisfaction and meaning (Knight et al., 2007). Here, we extend OA' motivational goal of maintaining positivity to a fundamental social goal: maintaining ingroup positivity. Several decades of social psychology research have shown that preserving ingroup positivity (e.g., preferring members of one's own group over members of any other group) is a fundamental motivator in social interactions for people of all ages (e.g., social identity theory research; Allport, 1954; Tajfel & Turner, 1979). For example, to feel positively about themselves and ingroup members, people often evaluate outgroup members in derogatory ways particularly

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when that outgroup is perceived as threatening (Branscombe & Wann, 1994). Ingroup positivity is important because it helps people maintain positive social identities by preserving their positive moods in response to setbacks (Knowles & Gardner, 2008).

In the current work, we explored the novel hypothesis that OA may be motivated to have more positive perceptions of ingroup members to reach their motivational goal of maximizing socioemotional satisfaction. If this is the case, then OA' higher executive ability should relate to their having positive ingroup perceptions. That is, because higher executive ability often allows OA to maximize their positive socioemotional experiences (Carstensen & Mikels, 2005; Mather & Carstensen, 2005), it should also relate to OA' having more positive ingroup perceptions. If this relationship emerges, OA with relatively lower executive ability might not be able to achieve this motivational goal as effectively because, despite having the same motivations as OA with relatively higher executive ability, they lack the cognitive resources to achieve the same goal. This possibility raises the intriguing question of how OA with lower executive ability might achieve the goal of having more ingroup positivity. The current work examined one possibility informed by extensive social psychological research: OA with relatively lower executive ability might have more ingroup positivity through having higher outgroup bias.

Having higher outgroup bias allows people to feel more positively about themselves and those with whom they affiliate (Abrams & Hogg, 1988; Collange, Fiske, & Sanitioso, 2009; Fein & Spencer, 1997; Rubin & Hewstone, 1998; Weaver & Bosson, 2011). Indeed, outgroup derogation increases ingroup cohesion (Brewer, 1999) and increases self-esteem especially when people perceive an outgroup as threatening (Branscombe & Wann, 1994). Thus, because OA with relatively lower executive ability might not have the resources to directly maintain positivity, we predicted that they might indirectly maintain it by having more outgroup bias to enhance perceptions of themselves and their ingroups (e.g., Fein & Spencer, 1997). Because YA are not motivated to maximize positivity overall (Reed, Chan, & Mikels, 2014), mere affiliation should be enough to elicit YA' ingroup positivity (Hornsey, 2008). As a result, we expected a direct relationship between executive ability and positive ingroup perceptions and an indirect relationship through outgroup bias to be specific to OA. See Figure 1 for a theoretical model.

To explore these questions, we focused on anti-Muslim bias. Muslims have been increasingly subjected to derogation in the

United States since the events of 9/11 (Imhoff & Recker, 2012), with about half of Americans harboring anti-Muslim bias (Deane & Fears, 2006). White Americans, for example, are more likely to label crimes committed by Muslims (vs. non-Muslims) as "terrorism" (West & Lloyd, 2017) and hold more negative associations with Muslims than other stigmatized groups (e.g., Black Americans; Park, Felix, & Lee, 2007). Suggesting that anti-Muslim bias is becoming more normative (Crandall, Eshleman, & O'Brien, 2002), increased anti-Muslim bias has been observed over time (Modood & Ahmad, 2007; Sheridan, 2006).

Examining consequences of lower functioning OA' increased bias via their anti-Muslim bias offers two main benefits. First, because anti-Muslim bias might be more socially acceptable than bias against other stigmatized outgroups (Dovidio & Gaertner, 2004), identifying a negative relationship between OA' executive ability and their anti-Muslim bias would suggest this relationship's truly broad nature. Thus, our first hypothesis was that OA' executive ability would negatively relate to their anti-Muslim bias. The second benefit of exploring this question through anti-Muslim bias is that anti-Muslim bias is widespread and prevalent in the United States (Strabac & Listhaug, 2008). This suggests that the extent to which non-Muslim versus Muslim status confers ingroup versus outgroup membership (Khan, 2014) might not differ by age because both YA and OA have been broadly exposed to it. Simply put, if OA and YA have similar levels of anti-Muslim bias, then age differences in mechanisms connecting anti-Muslim bias to ingroup positivity should not be attributable to the intergroup context itself. These benefits make Muslim status a well-suited intergroup context to examine how the negative relationship between OA' executive ability and their anti-outgroup bias might mediate their ingroup positivity.

We examined YA' and OA' ingroup perceptions defined by non-Muslim status across two studies. We first confirmed that Muslims comprise an outgroup to non-Muslims across the life span in Study 1. This was important to test the hypothesis that lower functioning OA' higher anti-Muslim bias mediates their ingroup positivity (Study 2). To verify the negativity associated with Muslims' outgroup status, we next confirmed that people perceive widespread anti-Muslim bias in the United States and that Muslims are stereotypically perceived as threatening. Establishing these relationships allowed us to test if a negative relationship between OA' executive ability and their anti-outgroup bias extends to anti-Muslim bias in Study 2. Further, these relationships al-

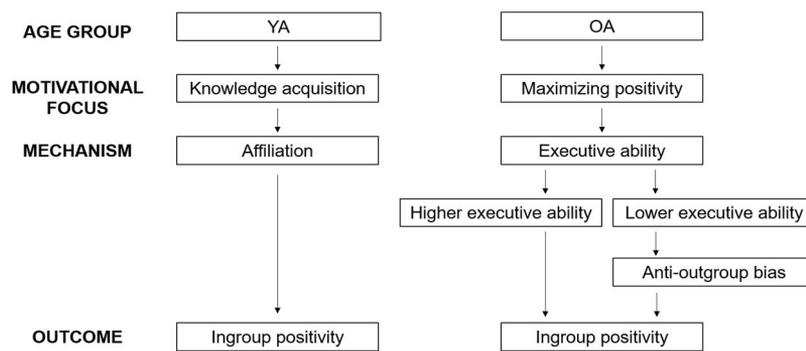


Figure 1. Theoretical model predicting mechanisms for executive ability effects on ingroup positivity for older adults (OA) but not young adults (YA).

lowed us to simultaneously test if OA' higher executive ability directly related to their having more positive ingroup perceptions and if their anti-Muslim bias mediated this relationship. This work thus expands the current mechanistic understanding of OA' outgroup bias.

### Study 1

The goal of Study 1 was to extend work on the prevalence and acceptability of anti-Muslim bias in the United States (e.g., Imhoff & Recker, 2012; Strabac & Listhaug, 2008) to a sample comprising a wide age range. To this end, we first established that a sample of YA, middle-aged, and OA non-Muslims identified Muslims as being outgroup members. Here, we tested whether non-Muslims perceive non-Muslims more than Muslims as similar to their self because the self-other overlap is a commonly used measure of group identification (Tropp & Wright, 2001; Hypothesis 1). Second, we conceptually replicated work (e.g., Imhoff & Recker, 2012) showing that people perceive growing anti-Muslim bias in the United States (Hypothesis 2). Critically, our goal was to show this finding across a broad age range. Finally, because outgroup derogation contributes to ingroup positivity especially when outgroups are perceived to be threatening (Branscombe & Wann, 1994), we characterized the negative nature of Muslims' outgroup status by showing that Muslims are associated with threat (Hypothesis 3).

### Method

**Participants.** Two-hundred participants from Amazon Mechanical Turk participated. Power analyses (*G\*Power*; Faul, Erdfelder, Lang, & Buchner, 2007) using  $d = .25$  indicated 128 participants were needed to detect intergroup context (a difference between self-non-Muslim and self-Muslim overlaps; see below). We oversampled given potential quality issues (e.g., duplicate responses). We excluded 35 participants with duplicate GPS coordinates potentially indicating duplicate responses created by "bots." The analyzed sample comprised 165 adults well-representing different age groups across the life span ( $M_{age} = 36.61$  years,  $SD = 11.75$ , range = 19–67 [33 < = 30 years; 79 31–54 years; 18 55 + years]; 75 females; 121 White, 17 Black, 15 Asian, eight multiracial, one American Indian, one Native Hawaiian/Pacific Islander, one unknown). No participants identified as Muslim (84 Christian, 76 atheist/agnostic/other, three Hindu, one Jewish, one Buddhist). One-hundred seven participants reported

that they knew a Muslim and 67 reported that they had a Muslim friend. Eighty-five participants identified as members of any stereotyped group. The Indiana University's Institutional Review Board approved all studies.

**Procedure.** Participants responded to four items, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) in the following order: "Anti-Muslim bias is growing in the United States," "Anti-Muslim bias is worse now than it was 50 years ago," "Anti-Muslim bias is worse now than it was 25 years ago," and "Threat is a stereotype associated with Muslims in the United States." The first three items confirmed that people across a wide age range perceived growing anti-Muslim bias in the United States. The fourth item confirmed that Muslim individuals are perceived not only as outgroup members, but also as outgroup members associated with threat.

After responding to the anti-Muslim bias items, participants completed two inclusion of the other in self scales (Aron, Aron, & Smollan, 1992) for non-Muslims and Muslims using 7-point scales, ranging from 1 (*no overlap*) to 7 (*almost complete overlap*). Scale order was random. A larger difference between self-non-Muslim versus self-Muslim overlaps suggests non-Muslims and Muslims reflect, respectively, ingroups and outgroups to non-Muslim participants. In other words, a larger difference reflected greater perceived disparity between one's ingroup (non-Muslim) and outgroup (Muslim).

### Results

See Table 1 for descriptive statistics and intercorrelations between age, anti-Muslim bias items, and inclusion of self in other scales. Because we conducted seven *t* tests on the anti-Muslim bias items and inclusion of self in other scales, we used a Bonferroni corrected  $p = .007$ .

**Hypothesis 1: Muslim status is an intergroup cue to non-Muslims.** Supporting Hypothesis 1, a paired *t* test revealed that people were more likely to include non-Muslims than Muslims with the self,  $t(164) = 8.98$ ,  $p < .001$ ,  $d = .78$ . To further characterize this difference, we verified that only non-Muslims had at least moderate inclusion with the self. One-sample *t* tests comparing mean responses to the scale midpoint (4) showed that non-Muslims had moderate inclusion with the self,  $t(164) = 1.45$ ,  $p = .14$ ,  $d = .11$ , whereas Muslims had less than moderate inclusion,  $t(164) = 8.86$ ,  $p < .001$ ,  $d = .69$ . Exploratory analyses revealed that age negatively related to including groups with the

Table 1  
Means, Standard Deviations, and Intercorrelations (*R*) Between Participant Age, Perceptions of Anti-Muslim Bias, and Inclusion of Self in Other Measures in Study 1

Measure	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7
1. Participant age	36.61	11.75	—						
2. Anti-Muslim bias is growing	5.12	1.42	.05	—					
3. Anti-Muslim bias worse than 50 years ago	5.40	1.54	.18*	.48***	—				
4. Anti-Muslim bias worse than 25 years ago	5.41	1.56	.18*	.56***	.88***	—			
5. Threat is a stereotype of Muslims	5.75	1.22	.08	.40***	.43***	.48***	—		
6. Self-non-Muslim overlap	4.20	1.76	-.21**	-.12	-.02	-.01	.01	—	
7. Self-Muslim overlap	2.87	1.64	-.20**	.11	.004	-.02	-.10	.37***	—

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

self. Age did not affect the extent of non-Muslim versus Muslim inclusion with the self,  $r(163) = -.02, p = .77$ .

**Hypothesis 2: People perceive growing anti-Muslim bias in the United States.** We next confirmed perceptions of growing anti-Muslim bias in the United States by comparing mean responses to the anti-Muslim bias items to the scale midpoint (4). Supporting Hypothesis 2, people perceived growing anti-Muslim bias,  $t(164) = 10.09, p < .001, d = .79$ . People also perceived anti-Muslim bias to be worse now than it was 50,  $t(164) = 11.70, p < .001, d = .91$ , and 25,  $t(164) = 11.60, p < .001, d = .90$ , years ago. Knowing a Muslim person, having a Muslim friend, or being a stereotyped group member did not affect these perceptions. Exploratory analyses showed that age (treated continuously) did not relate to perceptions of overall growing anti-Muslim bias. However, age positively related to perceptions of more anti-Muslim bias now than 50 and 25 years ago.

**Hypothesis 3: Muslims are associated with threat.** Supporting Hypothesis 3 and signifying the negative nature of their outgroup status, people perceived threat stereotypically associated with Muslims,  $t(164) = 18.42, p < .001, d = 1.43$ . Age, knowing a Muslim person, having a Muslim friend, or being a stereotyped group member did not affect this perception.

## Discussion

Study 1 supported the theoretical premise of Study 2 in three ways. First, non-Muslims across a wide age range perceived Muslims to be outgroup members by showing that relative to non-Muslims, Muslims were less similar to the self. Indeed, inclusion of a group with the self suggests that people identify that group as an ingroup that is part of their identity (Tropp & Wright, 2001). More inclusion of one group versus another with the self suggests ingroup versus outgroup status (Schubert & Otten, 2002). Age negatively related to inclusion overall. These relationships could, speculatively, reflect OA' narrowing social networks (English & Carstensen, 2014). Importantly, age did not affect the disparity in the similarity to self for non-Muslims relative to Muslims. Thus, Muslim status is a suitable context in which to examine if a consequence of lower executive ability relating to increased anti-Muslim bias in OA is their more positive ingroup (non-Muslim) perceptions. Because the order of the anti-Muslim bias items and the self-inclusion scales were fixed, however, responding to the anti-Muslim bias items first could have artificially inflated the perceived separation between self and Muslims. Study 2 thus provided an important conceptual replication of this finding.

Second, people across a wide age range perceived there to be growing anti-Muslim bias in the United States and indicated that bias is higher now than it was 50 and 25 years ago. These findings parallel that anti-Muslim bias is currently pervasive in Western culture (e.g., Strabac & Listhaug, 2008), suggesting that adults are aware of and exposed to this bias regardless of their age. Indeed, perceptions of overall-anti-Muslim bias were age-invariant, consistent with work showing people to have similar stereotype knowledge even if potentially differing in their endorsement of it (Devine, 1989). Age positively related to perceptions of there being more anti-Muslim bias now than 50 and 25 years ago. Speculatively, these findings could reflect that only older participants had firsthand knowledge of Muslims' past treatment. Younger participants might assume that current anti-Muslim bias

is more longstanding. Perceptions of overall growing anti-Muslim bias might not vary with age because most participants were present for rhetoric related to more recent events affecting perceptions of Muslims in society, if not the events themselves (e.g., 9/11; Imhoff & Recker, 2012). Broadly, this finding suggested that anti-Muslim bias is salient for people across a broad age range.

Third, people perceived that Muslims are stereotypically associated with threat. These perceptions were age-invariant. This finding signified perceptions of the negative nature of Muslims' outgroup status to non-Muslims, confirming that Muslims comprise a salient negative outgroup to non-Muslims. Further, this finding supported the possibility that anti-Muslim bias might relate to more positive ingroup perceptions in OA with lower executive ability because derogation of threat-relevant outgroups positively relates to self-esteem (Branscombe & Wann, 1994).

## Study 2

Building on Study 1, Study 2 had three goals. First, we sought to conceptually replicate Study 1 using an older sample of OA. We expected non-Muslims would be perceived more positively than Muslims (Hypothesis 1). Second, we tested whether OA' executive ability negatively related to their anti-Muslim bias (Hypothesis 2). Third, we tested how OA' anti-Muslim bias affected their ingroup positivity. Based on socioemotional selectivity theory (Carstensen & Mikels, 2005), we expected higher executive ability to relate to OA' having more positive ingroup perceptions (Hypothesis 3a). Moreover, we expected higher anti-Muslim bias in among OA with lower executive ability would mediate their having more positive ingroup perceptions (Hypothesis 3b). Because YA do not have the motivational goal to maximize positivity (Carstensen et al., 1999), their relative executive ability is less relevant in this context. To avoid attributions of OA' perceptions to differences in scale use and not their actual perceptions, we used a reverse correlation paradigm to quantify ingroup positivity.

*Reverse correlation* estimates how people represent traits in faces without explicit endorsement (for details, see Dotsch & Todorov, 2012). Reverse correlation paradigms are becoming more popular in social cognition research because they can reveal top-down biases in social cognition that perceivers might not be aware of or might be hesitant to explicitly report. For example, more anti-outgroup bias relates to more negative traits perceived in mental representations of outgroup faces (Dotsch, Wigboldus, Langner, & van Knippenberg, 2008). Relevant here, people exhibit ingroup positivity by generating representations of ingroup versus outgroup faces that look more positive (e.g., Ratner, Dotsch, Wigboldus, van Knippenberg, & Amodio, 2014). The current study is among the first (see also Ethier-Majcher, Joubert, & Gosselin, 2013) to examine OA' social cognition using this method. We used reverse correlation to generate face representations that were rated for positivity. Because OA' positivity in face perception emerges in their more positive evaluations of negative traits (e.g., Zebrowitz, Franklin, Hillman, & Boc, 2013), we examined ingroup positivity via ratings of how threatening face representations looked. Threat representations of ingroup non-Muslim faces are well-suited for this task because threat positively relates to anti-Muslim bias (Imhoff & Recker, 2012). Consistent with this finding, Study 1 showed that people perceive Muslims as

being associated with threat. Here, ingroup positivity is reflected by ingroup face representations that appear less threatening.

## Method

**Participants.** Forty-seven YA ( $M_{age} = 19.06$  years,  $SD = 1.09$ , range = 18–22, 31 female) and 33 OA ( $M_{age} = 74.85$  years,  $SD = 6.75$ , range = 64–90, 20 female) from Indiana University and the surrounding community participated. Relationships between OA' executive ability and bias and OA' executive ability and positivity are well-established (e.g., Cassidy et al., 2016; Mather & Knight, 2005). YA and OA sample sizes were thus selected based on samples in work showing that OA' executive ability relates to their bias (e.g., von Hippel et al., 2000), that OA' executive ability relates to their positivity (Isaacowitz, Allard, Murphy, & Schlangel, 2009; Mather et al., 2004), and OA' positivity in face perception (e.g., Zebrowitz, Franklin, Hillman, & Boc, 2013). More YA were recruited due to their greater availability when data collection took place. In addition, power analyses using  $r = -.65$  (the correlation between OA' executive ability and anti-Black bias from Cassidy et al., 2016) indicated 16 OA should be targeted to detect a relationship between executive ability and bias. Because OA were recruited from the same pool as was used in that study, 33 OA were considered sufficient for examining our hypotheses.

OA ( $M = 16.67$ ,  $SD = 2.57$ ) had more years of education than YA ( $M = 12.66$ ,  $SD = 1.69$ ),  $t(78) = 9.60$ ,  $p < .001$ ,  $d = 1.84$ . OA had an average Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975) score of 29.03 ( $SD = 1.13$ ). Chi-square tests suggested that YA and OA did not differ in political orientation,  $\chi^2(3, N = 79) = 2.34$ ,  $p = .51$ , religious ideology,  $\chi^2(4, N = 79) = 3.76$ ,  $p = .44$ , or frequency of attending religious services,  $\chi^2(6, N = 79) = 7.73$ ,  $p = .26$ . No participants identified as Muslim. Chi-square tests revealed a significant relationship between age and knowing Muslims,  $\chi^2(1, N = 79) = 4.75$ ,  $p = .03$ , such that a larger proportion of OA than YA reported not knowing Muslims, and age and having a Muslim friend,  $\chi^2(3, N = 79) = 3.84$ ,  $p = .05$ , such that a larger proportion of YA than OA reported having a Muslim friend (see the online supplemental materials). One OA did not report political orientation, religious ideology, and frequency or contact with Muslims.

**Executive ability.** Participants completed a standard battery of executive ability scored with established conventions (Glisky, Polster, & Routhieaux, 1995) that has been used in related work (e.g., Krendl, 2018; Krendl et al., 2009). The battery consisted of the Wisconsin Card Sorting Task, FAS word fluency, mental arithmetic (Wechsler Adult Intelligence Scale—revised), mental control, and backward digit span (Wechsler Memory Scale—revised). Higher composite scores reflect higher executive ability. See Table 2 for statistics describing YA' and OA' composite and component measure scores.

**Anti-Muslim bias.** Participants used 5-point scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) to complete the Scale for Islamoprejudice and Secular Critique of Islam (SIPSCI; Imhoff & Recker, 2012). Higher average scores indicate higher bias. The first subscale, Islamoprejudice (e.g., "It is completely legitimate to exclude Muslims from certain key positions as our society is essentially Christian"), reflects prejudice linked to perceptions of Muslims as threatening. The second, Secular Critique (e.g., "We should support those liberal Muslims who distance themselves from fundamentalist interpretations of Islam"), reflects a critical view of Islam. Islamoprejudice positively relates to explicit and implicit prejudice measures associating Muslims with threat (Imhoff & Recker, 2012).

To verify that Islamoprejudice reflected anti-Muslim bias, participants completed the Attitude toward Muslim Proximity Index (AMPI; Brockett, Village, & Francis, 2009). Participants responded to six items (e.g., "How do you feel about Muslims living in your city?") using a 5-point scale, ranging from 1 (*extremely happy*) to 5 (*extremely unhappy*). Higher scores reflect more anti-Muslim bias via social distancing. One YA did not respond. Analyses focused on Islamoprejudice because it measured explicit endorsement of anti-Muslim attitudes.

**Generating mental representations of faces.** We generated ingroup non-Muslim and outgroup Muslim face representations for each participant using reverse correlation. Reverse correlation paradigms consist of two phases (see below for details) that quantify how people represent traits in faces without their self-reports (Dotsch & Todorov, 2012). Because these paradigms do not use self-reported trait evaluations, reverse correlation is a data-driven approach that ensures that differences in traits per-

Table 2  
Means and Standard Deviations for Executive Ability and Bias Measures in Study 2

Measure	YA		OA		<i>t</i>	<i>p</i>	<i>d</i> [95% CI]
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Executive ability (composite score)	.29	.47	.17	.52	1.13	.26	.25 [–.20, .69]
WCST categories	5.70	.75	5.58	.97	.66	.51	.14 [–.30, .59]
FAS word fluency	37.00	10.61	48.94	11.57	4.78	<.001	1.07 [.60, 1.56]
Mental arithmetic	14.34	2.90	11.61	3.77	3.67	<.001	.83 [.38, 1.30]
Mental control	28.02	5.59	28.03	6.09	–.001	.99	.001 [–.45, .44]
Backward digit span	9.34	2.22	9.18	2.26	.31	.76	.07 [–.37, .52]
Islamoprejudice (SIPSCI)	2.43	.52	2.60	.59	1.32	.19	.31 [–.76, .14]
Secular critique (SIPSCI)	3.41	.45	3.69	.49	2.61	.01	.60 [.14, 1.05]
AMPI	2.33	.86	2.76	.87	2.13	.04	.50 [.04, .95]

Note. YA = young adults; OA = older adults; CI = confidence interval; WCST = Wisconsin Card Sorting Task; SIPSCI = Scale for Islamoprejudice and Secular Critique of Islam; AMPI = Attitude toward Muslim Proximity Index.

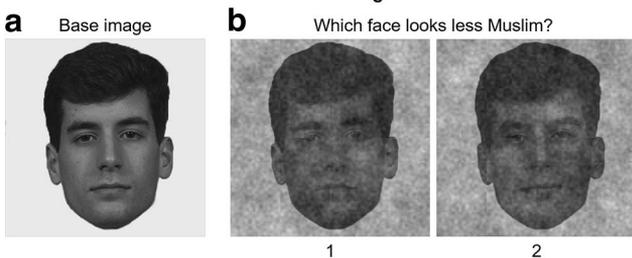
ceived in participants' face representations cannot be attributed to scale use or social norm sensitivity.

**Part 1: Face classification phase.** The first phase of a reverse correlation paradigm is a face classification phase that is completed by participants. This phase generates unique face classification images (CLIs) for each participant based on their choices. These unique CLIs are used in the second phase of a reverse correlation paradigm to obtain unique trait representations in CLIs for each participant (see below for details). In the face classification phase, participants were told that people can predict religion from faces, and that the purpose of the task was to determine if people could predict religion from blurry faces. Participants were randomly assigned to choose which of two faces looked less ( $N_{YA} = 23$ ,  $N_{OA} = 16$ ) or more ( $N_{YA} = 24$ ,  $N_{OA} = 17$ ) Muslim. Because participants were non-Muslim, faces selected as more Muslim elicited outgroup representations, whereas faces selected as less Muslim elicited ingroup representations. This assignment controlled for OA' tendency to be excessively positive when evaluating faces (established using ingroup faces; e.g., Zebrowitz et al., 2013), because participants' choices would not be expected to default to the more positive looking image on each trial. Further, this assignment ensured that any emergent differences might not be attributed to intentionality to think in a specific way about one group. There was no effect of choice assignment on how threatening non-Muslim and Muslim faces appeared (see the online supplemental materials).

**Stimuli.** Stimuli were generated from a neutrally expressive gray-scale image of a White male (Figure 2a; Phillips, Wechsler, Huang, & Rauss, 1998). Randomly generated noise patterns were layered over each image (for details, see Dotsch & Todorov, 2012). An image layered with a noise pattern and an image layered with that pattern's inverse was generated for each of 100 trials, totaling 200 images. The same noise patterns were used across participants. Portions of the research in this paper use the FERET database of facial images collected under the FERET program, sponsored by the DOD Counterdrug Technology Development Program Office.

**Task.** The task had 100 trials (e.g., Hehman, Flake, & Freeman, 2015) in which two images were presented side-by-side (Figure 2b) until participants responded. Depending on version,

**Reverse Correlation Part 1: Face classification task generates perceivers' classification images**



**Figure 2.** Base image (a) and an example trial (b) in the first phase of the reverse correlation paradigm in Study 2. In the first phase, participants selected faces to answer a prompt. Noise patterns overlaid on selected and unselected faces were averaged to create, respectively, ingroup (non-Muslim) and outgroup (Muslim) classification images for each participant. Portions of the research in this paper use the FERET database of facial images.

participants selected the image that looked more or less Muslim on each trial. A blank screen appeared for 250 ms between trials.

**Image processing.** Two unique CLIs were generated for each participant. Averaging each participant's 100 selected noise patterns and superimposing that average on the base image generated the first. These images reflected ingroup representations when choosing less Muslim faces and outgroup representations when choosing more Muslim faces. Averaging each participant's 100 *not* selected patterns generated the second. Overlaying this average on the base image yields CLIs on the other end of an intended dimension (e.g., a trustworthy CLI when untrustworthy faces were selected; Dotsch & Todorov, 2012). These images reflected ingroup representations when choosing more Muslim faces and outgroup representations when choosing less Muslim faces. We generated 160 CLIs (80 ingroup and 80 outgroup) reflecting participants' mental representations (e.g., how a participant perceived an ingroup face). See Figure 3 for average ingroup and outgroup representations by age. These CLIs were used in the second phase of the reverse correlation paradigm.

**Part 2: Face ratings phase.** The second phase of a reverse correlation paradigm is a face ratings phase that is completed by an independent group of naïve raters who did not complete the first phase and who rate CLIs on attributes of interest. This second phase obtains the original participants' unique representations of traits in faces. Naïve raters are unaware of how the CLIs were generated. Here, they rated CLIs from the first phase on how threatening they appeared. Their ratings reflect the original participants' representations of threat in faces that can be linked to participant characteristics like bias (e.g., Dotsch et al., 2008).

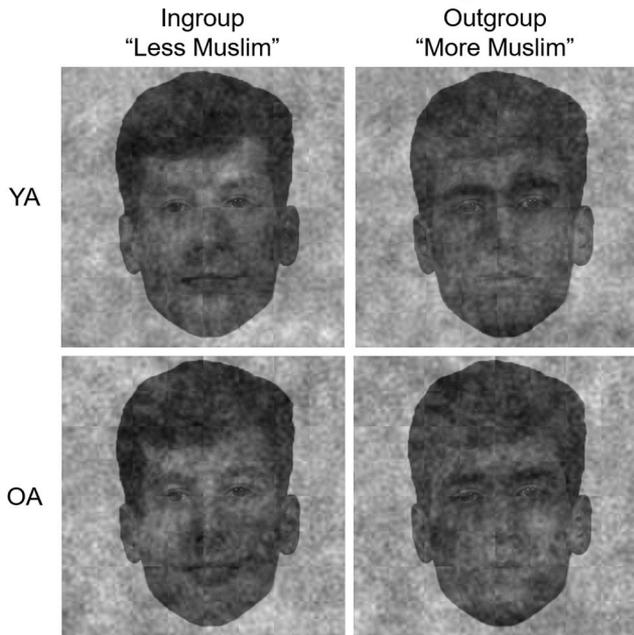
Here, participants' unique representations of threat in faces were estimated by the ratings of 35 naïve non-Muslims ( $M_{age} = 36.51$  years,  $SD = 10.29$ , range = 24–62 [14 ≤ 30 years; 20 31–54 years; 1 55 + years]; 15 females; 29 White, three Black, two Asian, one multiracial) recruited from Amazon Mechanical Turk. These naïve raters rated each randomly presented CLI ("How threatening does this face look?") over one block using a scale ranging from 1 (*not at all threatening*) to 7 (*extremely threatening*). The number of raters was selected on the basis of past work (e.g., Krendl & Freeman, 2017). Raters were naïve as to how the faces were generated, meaning that they were unaware that the images that they were ratings were participants' CLIs reflecting their ingroup non-Muslim and outgroup Muslim representations. Ingroup ratings ranged from 2.83 to 4.91 ( $M = 3.88$ ,  $SD = .46$ ) and outgroup ratings ranged from 3.49 to 5.26 ( $M = 4.35$ ,  $SD = .39$ ). These ratings were entered into a regression predicting participants' ingroup non-Muslim threat representations from their executive ability, anti-Muslim bias, and age group. Because CLIs were rated on their threat, lower ratings reflect higher positivity.

## Results

**Characterizing executive ability and Anti-Muslim bias.** YA and OA did not differ in executive ability or Islamoprejudice. OA had higher Secular Critique and AMPI scores than YA. See Table 2.

**Verifying that Islamoprejudice reflects anti-Muslim bias.** We confirmed that Islamoprejudice reflected anti-Muslim bias controlling for contributions of Secular Critique by regressing

**Reverse Correlation Part 2: Perceivers' mental representations estimated by independent ratings of their classification images**



*Figure 3.* Average ingroup and outgroup classification images from young adults (YA) and older adults (OA) in Study 2. In the second phase of the reverse correlation paradigm, threat ratings of each classification image from naïve raters estimated how threatening each participant's mental representations of ingroup and outgroup members appeared. These participant-unique threat representations were then linked to each participant's executive ability and anti-Muslim bias. Portions of the research in this paper use the FERET database of facial images.

AMPI scores on the SIPSCI subscale scores (collapsing across YA and OA). The model was significant,  $F(2, 75) = 34.76, p < .001, R^2 = .49$ . A positive effect of Islamoprejudice supported that higher Islamoprejudice reflects higher anti-Muslim bias,  $b = 1.11, SE = .14, t = 8.21, p < .001$ . Secular Critique was not significantly related to AMPI scores,  $b = -.17, SE = .15, t = 1.09, p = .28$ . Also supporting that Islamoprejudice reflects anti-Muslim bias, Islamoprejudice positively correlated with AMPI scores among YA and OA. See Table 3 for intercorre-

lations between executive ability, bias measures, and ingroup threat representations for YA and OA.

**Hypothesis 1: Reflecting ingroup positivity, non-Muslim versus Muslim representations will be more positive.** Providing a conceptual replication of Study 1, we examined whether YA and OA had more positive (i.e., less threatening) representations of non-Muslim than of Muslim faces. This finding would confirm that non-Muslim faces were seen as being ingroup members, whereas Muslim faces were seen as outgroup members. Here, we entered threat ratings of ingroup and outgroup CLIs into a 2 (age: YA, OA)  $\times$  2 (group: non-Muslim, Muslim) analysis of variance. Supporting Hypothesis 1, there was a main effect of Group,  $F(1, 78) = 29.59, p < .001, \eta_p^2 = .28$ . Non-Muslim ( $M = 3.88, SD = .46$ ) versus Muslim ( $M = 4.35, SD = .39$ ) CLIs were more positive (i.e., less threatening). Like Study 1, this effect was age-invariant in that there was no interaction between age and group,  $F(1, 78) = .13, p = .72, \eta_p^2 = .002$ , and no age effect,  $F(1, 78) = .40, p = .53, \eta_p^2 = .005$ .

**Effects of executive ability on bias and ingroup perceptions with age.** Key goals of Study 2 were to examine (a) if executive ability negatively related to OA' anti-Muslim bias (Hypothesis 2), and (b) how executive ability affects non-Muslim perceptions (Hypothesis 3). We expected executive ability to affect OA' ingroup non-Muslim representations in two ways. First, we expected OA' higher executive ability to directly relate to more positive non-Muslim representations (Hypothesis 3a). Because lower functioning OA should still be motivated to maximize positivity, they could indirectly generate positive representations. Here, we tested for moderated mediation. We tested if OA,' and not YA' anti-Muslim bias (i.e., Islamoprejudice) mediated the relationship between executive ability and the positivity of their ingroup representations (Hypothesis 3b). We expected OA-specific relationships because YA do not have the motivational goal to maximize positivity (Carstensen et al., 1999).

We simultaneously addressed these hypotheses in a conditional process model on threat ratings of ingroup non-Muslim representations using Model 59 in PROCESS for SPSS (Hayes, 2012) with 5,000 bootstrap samples for bias-corrected confidence intervals (CIs) and where age was dummy-coded (0 = YA and 1 = OA). See Figure 4a for model visualization and coefficients. See the online supplemental materials for

**Table 3**  
*Intercorrelations (R) for Executive Ability, Bias Measures, and Threat Rating of Each Participant's Ingroup Classification Image (CI) in Study 2 as a Function of Age Group*

Measure	1	2	3	4	5
1. Executive ability (composite score)	—	.001	.21	-.04	.09
2. Islamoprejudice (SIPSCI)	-.45**	—	.07	.64***	.13
3. Secular critique (SIPSCI)	.39*	-.27	—	-.05	.16
4. AMPI	-.36*	.72***	-.35	—	.14
5. Threat rating of ingroup CI	-.09	-.47**	.38	.25	—

*Note.* SIPSCI = Scale for Islamoprejudice and Secular Critique of Islam; AMPI = Attitude toward Muslim Proximity Index. Intercorrelations for young adults are presented above the diagonal, and intercorrelations for older adults are presented below the diagonal.

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

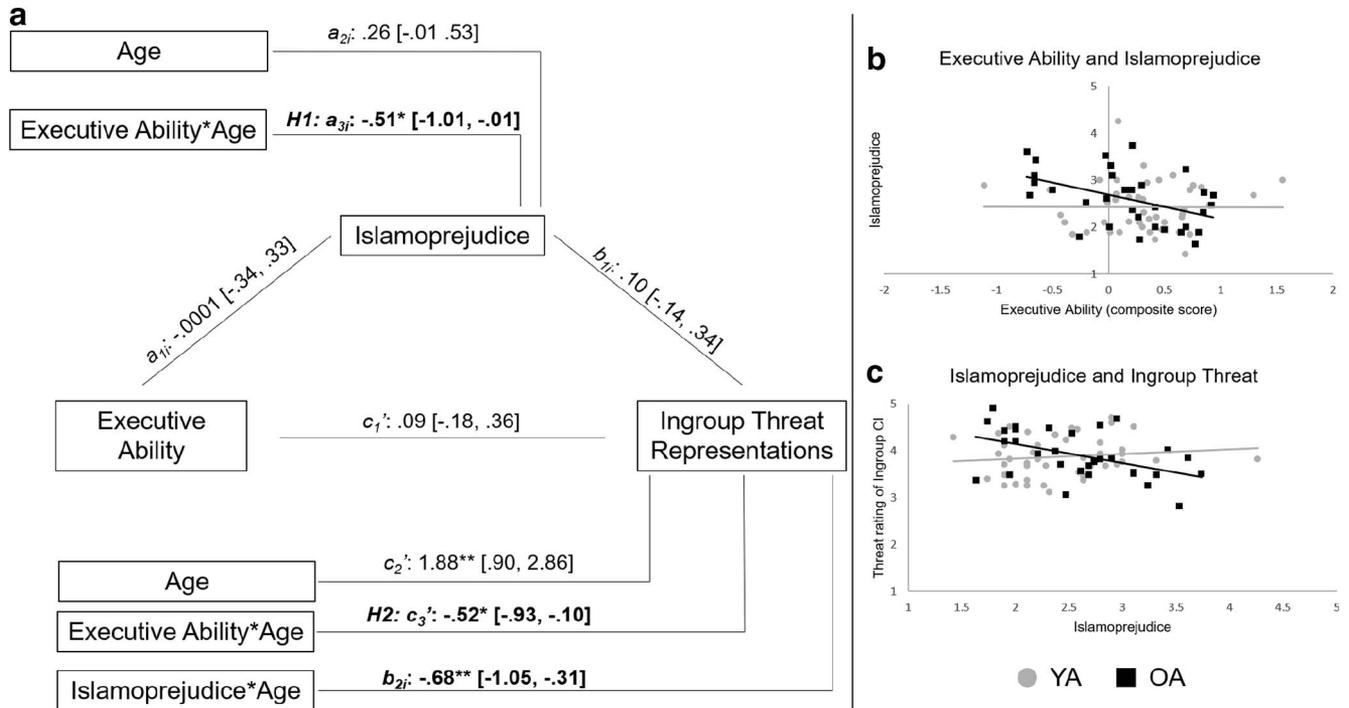


Figure 4. Coefficients from the model predicting ingroup threat representations from executive ability, Islamoprejudice, and moderation of these factors by age group (a). Coefficients supporting the hypotheses that OA' executive ability would negatively relate to their Islamoprejudice (path  $a_{3i}$ ), that OA' executive ability would negatively relate to their ingroup threat representations (path  $c_3$ ) and that OA' Islamoprejudice would negatively relate to their ingroup threat representations (path  $b_{2i}$ ) are in bold. Numbers in brackets are 95% confidence intervals of the coefficients. Scatterplots show that the relationships between OA' executive ability and Islamoprejudice (b) and OA' Islamoprejudice and their ingroup threat representations (c) were not outlier-driven. \*  $p < .05$ . \*\*  $p < .01$ .

exploratory analyses on outgroup Muslim threat representations.

**Hypothesis 2: Executive ability will negatively relate to OA' anti-Muslim bias.** To test whether OA' executive ability negatively relates to their anti-Muslim bias, we examined the "a" path of the model. Executive ability did not predict Islamoprejudice (path  $a_{1i}$ ). However, there was an interaction between executive ability and age (path  $a_{3i}$ ),  $b = -.51$ ,  $SE = .25$ ,  $t = 2.05$ ,  $p = .04$ . Supporting Hypothesis 2, OA' executive ability negatively predicted their Islamoprejudice,  $b = -.51$ ,  $SE = .18$ ,  $t = 2.80$ ,  $p = .007$ . This was not true for YA,  $b = -.001$ ,  $SE = .17$ ,  $t = .0004$ ,  $p = .99$ . Examination of the significant correlation between OA' executive ability and their Islamoprejudice and a nonsignificant correlation among YA (see Table 3 and Figure 4b) suggested that these relationships were not outlier-driven.

**Hypothesis 3a: Executive ability will positively relate to OA' having more positive ingroup representations.** To test whether OA' higher executive ability relates to their having more positive representations of ingroup non-Muslim faces, we tested if age moderated the direct effect by which executive ability affected ingroup threat representations (i.e., the  $c'$  path). Supporting Hypothesis 3a, age moderated the relationship between executive ability and non-Muslim threat representations (controlling for Islamoprejudice; path  $c_3$ ),  $b = -.52$ ,  $SE = .21$ ,  $t = 2.46$ ,  $p = .02$ .

Executive ability related to having more positive (i.e., less threatening) non-Muslim representations for OA,  $b = -.43$ ,  $SE = .16$ ,  $t = 2.65$ ,  $p = .01$ , but not YA,  $b = .09$ ,  $SE = .13$ ,  $t = .66$ ,  $p = .51$ . OA' higher executive ability did not significantly relate to their having more positive (i.e., less threatening) non-Muslim representations unless controlling for their Islamoprejudice (see Table 3), suggesting that controlling for bias is important to characterize the relationship between OA' executive ability and their positivity in intergroup contexts.

**Hypothesis 3b: Lower executive ability will relate to OA having more positive ingroup representations through higher outgroup bias.** To test if having higher outgroup bias mediates OA with lower executive ability generating more positive ingroup representations, we tested for moderated mediation. Specifically, we tested whether OA, but not YA, Islamoprejudice mediated a relationship between executive ability and having positive ingroup representations. The index of moderated mediation was significant,  $b = .30$ ,  $SE = .11$ , 95% CI [.09, .54]. Supporting Hypothesis 3b, Islamoprejudice mediated the relationship between executive ability and positive (i.e., less threatening) ingroup representations for OA,  $b = .30$ ,  $SE = .11$ , 95% CI [.10, .53], but not YA,  $b = -.0001$ ,  $SE = .02$ , 95% CI [-.04, .05]. To further characterize this mediation, we examined the "b" path. Age moderated the relationship between Islamoprejudice and positive (i.e., less

threatening) ingroup representations (path  $b_{2i}$ ),  $b = -.68$ ,  $SE = .19$ ,  $t = 3.66$ ,  $p = .005$ . Islamoprejudice positively related to more positive (i.e., less threatening) representations for OA,  $b = -.58$ ,  $SE = .14$ ,  $t = 4.06$ ,  $p < .001$ , but not YA,  $b = .10$ ,  $SE = .12$ ,  $t = .84$ ,  $p = .40$ . Further examination of the significant correlation between OA' Islamoprejudice and their less threatening ingroup representations and a nonsignificant correlation among YA (see Table 3 and Figure 4c) suggested that these relationships were not outlier-driven.

## Discussion

Study 2 extended the literature in three ways. First, YA and OA had more positive (i.e., less threatening) representations of non-Muslim than Muslim faces. This finding conceptually replicated Study 1 and prior work (e.g., Ratner et al., 2014), suggesting that YA and OA have similar mental representations to one another of ingroup and outgroup faces that are defined by their Muslim status. Second, OA' executive ability negatively related to their anti-Muslim bias. This finding replicated work using other outgroups (e.g., Black Americans; Cassidy et al., 2016), highlighting the broad nature of this relationship using a timely example of a group experiencing growing stigma in the United States. Third, this work was the first to consider a consequence of lower functioning OA' higher bias for how they perceive ingroup members. Specifically, it suggested that OA with lower executive ability might indirectly attain their motivational goal of positivity by expressing more anti-outgroup bias.

Lower executive ability did not relate to higher anti-Muslim bias among YA, which might be expected based on meta-analytic work (Hodson & Dhont, 2015) and work showing that regulation negatively relates to interaction quality with Muslims (Gonsalkorale, von Hippel, Sherman, & Klauer, 2009). There are several possibilities explaining why this relationship did not emerge. One is that although YA engage executive ability to exaggerate their positive responses toward and interactions with stigmatized others (Mendes & Koslov, 2013), they may only engage those resources to satisfy norms that might apply less to Muslims in certain situations (e.g., interacting in front of other people vs. filling out a questionnaire alone). Other possibilities are that whereas higher executive ability might be critical for OA to express lower bias, additional processes (e.g., the positivity of intergroup contact) could affect YA' bias when considered jointly with their executive ability. Although the present work focused on the established relationship between OA' executive ability and bias, it would be worthwhile for future work to consider these possibilities for YA.

In Studies 1a and 1b, both YA and OA expressed more positivity toward non-Muslims than Muslims. However, an open question from Study 2 regards what about these faces elicited ingroup positivity. One possibility, informed by work showing categorization to elicit ingroup favoritism (Hornsey, 2008), is that non-Muslim versus Muslim representations look less categorically Muslim. Other work suggests that emotional resemblance (e.g., a face resembling happiness or anger) drives expressively neutral faces to appear more positive or negative (Said, Sebe, & Todorov, 2009). More positivity of non-Muslim versus Muslim representations could thus stem from non-Muslim representations appearing happier. Notably, category labels shift faces to be represented in line with valence-consistent impressions of social groups (Cassidy

& Krendl, 2018). Future work should thus consider if one or both of these possibilities explain what about faces drive non-Muslim representations to be more positive.

Despite similar representations across age, mechanisms for OA' and YA' ingroup perceptions were different. Socioemotional selectivity theory posits that OA can attain an age-specific goal of maximizing positivity by down-regulating negative responses (Mather & Knight, 2005). Following this idea, OA' higher executive ability related to their non-Muslim face representations appearing more positive. Some work, however, suggests that because OA might be "experts" at maintaining positivity, down-regulating negative responses is not as cognitively costly for them as it is for YA (Scheibe & Blanchard-Fields, 2009). Why then, might executive ability affect OA' ingroup perceptions? One possibility is that because social information elicits more complex processing than emotional information (Sakaki, Niki, & Mather, 2012), down-regulating more complex social (vs. emotional) responses requires more executive ability. For YA, who do not have a motivational goal of maximizing positivity, mere affiliation might elicit positive perceptions (e.g., Ratner et al., 2014), consistent with social psychological research on social identity theory (Tajfel, 1970; Tajfel & Turner, 1979). Indeed, the task suggested group demarcation (supported by Study 1) by having participants identify faces that appeared to be "less" or "more" Muslim. Whereas affiliation should also enhance OA' ingroup positivity, their motivational goal might necessitate the engagement of executive ability to become even more positive.

OA' anti-Muslim bias mediated the relationship between their executive ability and their positive ingroup perceptions. This pattern suggests that OA with lower executive ability might maintain their motivational goal of self and ingroup positivity through outgroup derogation (e.g., Fein & Spencer, 1997). One possibility is that negative stereotypes contributing to outgroup derogation might be least likely to be down-regulated by OA with lower executive ability, allowing such derogation to exert a stronger effect on their ingroup perceptions. Although the outcome of positivity might seem to benefit OA' well-being, this outcome might be superficially positive for OA with lower executive ability if it comes at the expense of expressing higher outgroup bias. Higher outgroup bias, for example, could result in outgroup members avoiding interactions with OA (Richeson & Shelton, 2007), potentially limiting access to the caregiving that improves OA' quality of life (Newsom & Schulz, 1996). Indeed, minorities provide about 25% of the long-term care needed by the growing population of OA in the United States (Lowell, Martin, & Stone, 2010). This finding highlights a need to comprehensively examine mechanisms for OA' social cognition even when outcomes appear to benefit them in some way.

YA' higher anti-Muslim bias did not significantly relate to the positivity of their non-Muslim perceptions. This relationship might be expected given past work (Dotsch et al., 2008). A third variable, however, might again explain variance in this relationship. Notably, more YA than OA reported having a Muslim friend. Although it is beyond the scope of this work, the nature or quality of these relationships could affect the relationship between bias and how YA represent ingroup faces.

Although means were in an expected direction of YA having higher executive ability than OA, YA and OA did not differ in their overall executive ability. One possibility is that because OA

in Study 2 were highly educated, they might be especially active and high-functioning (van Hooren et al., 2007). However, the fact that these OA' executive ability negatively related to their anti-Muslim bias highlights the strength of this relationship. More extreme impairment may not be necessary for OA' executive ability to negatively relate to their anti-outgroup bias. The absence of an overall age difference also does not undermine the hypothesis that only OA' executive ability will relate to the positivity of their ingroup perceptions. OA' goal of maximizing positivity does not depend on executive ability differences with age. It instead relies on the assumption of a well-documented motivational shift (Carstensen et al., 1999).

YA and OA did not differ in Islamoprejudice, although means were in an expected direction of OA having higher bias than YA. OA, however, had higher anti-Muslim bias than YA as measured by AMPI scores, and had higher secular critique. Higher anti-Muslim bias via AMPI scores in OA could reflect OA more likely endorsing anti-Muslim bias when it is indirectly assessed through social distancing rather than through overt statements against Muslims. Speculatively, OA' higher scores on secular critique could reflect their higher social expertise than YA (Leclerc & Hess, 2007) in that some OA might be more likely to consider ramifications of religion not being separated from state more than YA. Age differences in secular critique did not affect interpretations of Study 2 because secular critique was unrelated to anti-Muslim bias.

It is also worth noting that both YA' and OA' anti-Muslim bias was not especially high, nor were their ingroup and outgroup threat representations especially threatening. Study 2 may thus reflect effects that are not reserved for people who more extremely endorse anti-Muslim sentiment. Likewise, extreme perceptions of traits in faces are not necessary to predict downstream consequences for targets. Because even subtle differences in facial characteristics evoke tangible differences in target outcomes (e.g., Wilson & Rule, 2015), characterizing consequences of subtle differences in OA' anti-outgroup bias for subtle differences in how OA mentally represent faces is important to better understand intergroup behavior in healthy aging.

Intergroup social cognition is important to study in aging, as maximizing positive ingroup relationships is one way that OA maintain their well-being (Ha, Kahng, & Choi, 2017). By linking OA' bias to their ingroup perceptions, the present work creates a foundation by which mechanisms for OA' positivity can be broadened from examinations of attention and memory (Mather & Carstensen, 2005; Murphy & Isaacowitz, 2008) to the positive perceptions they might have in intergroup contexts. Understanding mechanisms for OA' bias and the underexplored consequences of their bias will be important to develop strategies that help OA to behave equitably and to maintain relationships relevant to their motivational goals.

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