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Recognition for a black couple in a mock silver alert: Comparing couples presented together or separately with or without glasses

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Abstract
Demographic trends indicate an increasing elderly population accompanied by an increase in the prevalence of individuals with Alzheimer's disease (AD). These trends are likely to result in increasing numbers of elderly individuals who wander away from home or care facilities. There is limited research on the efficacy of systems for alerting the public about missing elderly individuals, such as Silver Alerts (SA). Previous research on SAs was limited to alerts featuring White senior citizens. The present study is the first to extend SA research to Black senior citizens. A sample of college students ($N = 210$) viewed a mock SA along with a short video of a "missing" couple and later attempted to recognize the two individuals from a series of photos. The male and female targets were shown in the SA either together or separately and with or without glasses, and participants were shown photos with and without glasses. The results indicated no effect of whether the couple was shown together or separately, but participants were more likely to recognize the missing male without glasses when he had been shown without glasses in the SA. The female target was recognized more often when wearing glasses than when not wearing glasses, irrespective of how she had been shown in the SA. The results suggest that the appearance of the target at encoding and at recognition may affect ability to identify the target, but that such effects may depend on individual characteristics.

Keywords African American · Silver alerts · Face recognition · Attitudes toward elderly · Conscientiousness

Humans are considered face recognition experts for people with whom we are familiar; however, studies have shown that recognition of faces is error-prone (Young & Burton, 2017a, 2017b). Unfamiliar faces of older adults who are seen in missing person alerts, such as Silver Alerts (SAs) are therefore hard for people to recognize.

In the present study, we investigate face recognition in the context of public alert systems intended to help locate individuals who have gone missing. Past studies on face recognition in relation to SAs have only used White targets (Gier, 2019; Gier & Kreiner, 2019; Gier & Kreiner, 2020; Gier, V. S., Kreiner, D. S. Recognition of a missing elderly couple in a Silver Alert (under review)); therefore, in the present study we investigated face recognition for a Black couple in a mock SA. Additionally, we tested whether wearing glasses has an effect on face recognition. Furthermore, we measured how recognition may vary with individual personality differences including Attitudes Towards Older Adults (ATOA), conscientiousness, experience with older adults, and confidence ratings in responses to target photos. SAs are not as well-known as AMBER alerts (AA) outside of the U.S.; therefore, we will describe SAs and the importance of having SA type programs worldwide.

Importance of Silver Alerts

Research on face recognition relating to a SA is particularly important as our population is aging and life expectancy is increasing (Petonito et al., 2013, p. 17). According to the U.S. Census Bureau (2019), the number of older Americans is expected to increase from 40.3 million (2010) to a predicted 85.7 million by 2050. According to a 2019 report by the United Nations, "Older people account for more than one fifth of the population in 17 countries today, and the United Nations Department of Economic and Social Affairs

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Population Division's projections to the end of the century indicate that this will be the case in 2100 for 155 countries, covering a majority (61 per cent) of the world's population" (United Nations, 2019, p. 5). These statistics are alarming when factoring in the number of older adults who will suffer from neurodegenerative diseases such as Alzheimer's disease (AD), Parkinson's disease, and Amyotrophic Lateral Sclerosis (ALS), and Huntington's disease (HD) (Lu et al., 2013).

Alzheimer's disease is a type of dementia that slowly deteriorates the person's brain, affecting memory as well as all bodily functions (Alzheimer's Organization, 2020). Over time, both the person with AD and their families suffer physical and emotional consequences of serious memory loss. It is important to note that not all older adults have dementia or AD. Many older adults living into their 90s are still cognitively alert; however, the National Institute on Aging (NIA) stated that "as many as 5.5 million Americans age 65 and older may have Alzheimer's" (National Institute on Aging/National Institute on Health, Feb 17, 2021). "An estimated 5.8 million Americans age 65 and older are living with Alzheimer's dementia in 2020 and 80% are age 75 or older" (Alzheimer's disease Organization, 2020). The Alzheimer's Association (2020) predicted that by "2050, one new case of AD is expected to develop every 33 seconds, resulting in nearly 1 million new cases per year" (np). Vespa et al. (2020) noted that by "2030, all Baby Boomers will be older than 65 and after 2050, all Baby Boomers will be older than age 85" (p.23).

One common symptom of AD and other forms of dementia is wandering and elopement. . One particular behavior associated with AD in the elderly is pacing. Pacing can then evolve into wandering which is a potentially life-threatening event. Thomas (1995) defined wandering as "a purposeful behavior that attempts to fulfill a particular need (from the context of the wanderer), is initiated by a cognitively impaired and disoriented individual, and is characterized by excessive ambulation that often leads to safety and/or nuisance-related problems" (p. 35). The act of wandering can especially lead to dangerous outcomes when the AD patient goes from simple wandering to elopement. Elopement, as stated by Aud (2004), "the act of wandering away safe residence, is very dangerous for the older adult with dementia" (p. 362).

Many people are familiar with programs for missing and abducted persons (e.g., AMBER alerts); however, SAs are relatively new in the U.S. compared to AMBER alerts.

Other names used for similar alert systems in the U.S. include Safe Return, Project Lifesaver, Missing Silver Alert, Mattie's Call (named after a 67 year old AD patient who wandered away from her home and was found deceased eight months later just feet from her home), and Golden Alert. Regardless of what the alert is called, all have the same goal of finding a missing older adult who is believed to be in immediate danger.

The aging of America's increasingly diverse population requires a revised narrative about the value of immigrants, refugees, and minorities to elders' well-being. The prevalence of AD appears significantly higher in Black people than in White people. Based on a meta-analysis, Steenland et al. (2016) concluded that the prevalence in the U.S of AD for individuals between the ages of 65 to 90 is 5.5% for White people, compared to 8.6% for Black people. Steenland et al. noted that the reasons for the difference in AD prevalence are not clear, but could be related "biological, psychological, and socioeconomic factors" (p.71). Reese (2015, np.) found that, "African-Americans are 64 percent more likely to develop AD than CA after adjusting for age, gender and education." The Alzheimer's Association (2019, np.) recently reported that, "for all adults 65 and older, African- Americans are about twice as likely to have Alzheimer's or other dementias as older Whites and Hispanics." Interestingly, "a higher estimated prevalence of AD in AAs versus CCs is consistent not only with higher incidence rates but also higher survival after AD diagnosis for AAs" (Steenland et al, p. 5). Four studies have found consistent evidence of an approximately 20% longer survival after AD diagnosis for Black individuals versus White individuals. These studies support the urgency to learn more about the ability of the public to recognize missing elderly Black individuals. Barriers for recognition of an older Black person who is missing in a SA include biases people have for recognizing faces of different groups of people.

Previous Research on Silver Alerts

Gier et al. (2017) conducted a 'mock' Silver Alert showing an older woman in her 80s and found that recognition rates were 6.8% when she was shown in typical (casual) clothing and 14.3% when she was shown in atypical clothing (wearing a nightgown), although the difference between conditions was not significant. However, recognition was significantly greater in comparison to a control condition in which the target did not appear in the SA. Gier et al. reported no significant differences in recognition related to participant gender or ethnicity.

Gier and Kreiner (2019) reported a much higher recognition rate (84.6%) in another SA study. In this study, the target was a White male in his 60's. Females had better recognition of the target than males, and those participants reporting higher experience with older adults were more likely to identify the target. Recognition of the target was not related to participant age, race, or measures of empathy or conscientiousness. The researchers replicated the study and added a scale measuring attitudes about older adults. Again, the recognition rate was high (83.90%).

Scores on the attitude scale were not related to recognition of the target; however, experience with elderly individuals was related to target recognition. Gier and Kreiner (2019) suggested that "Silver Alerts can be effective under certain circumstances" (p. 410) and more research is needed to investigate whether increasing experience with older adults increases the efficacy of Silver Alerts.

Gier and Kreiner (2020) had participants view an educational video on the importance of SA before viewing a SA showing a White female. This study also produced a high overall recognition rate (70%), with even higher recognition when participants had watched the educational video (79%). Furthermore, females correctly identified the missing woman more than males, and White participants correctly identified the missing woman more than Black participants. Experience with older adults was also related to recognition of the woman in the SA.

Gier (2019) conducted two studies on individual difference factors and the effect of an educational video on recognizing a man in a mock SA. In Study 1, college students viewed both a video of the missing man and an educational video on Silver Alerts before attempting to recognize the man. In Study 2, Gier experimentally manipulated whether participants viewed the educational video. Both studies resulted in high recognition rates (83.90% and 75.1%, respectively). Those who recognized the target had significantly higher empathy scores and metacognitive ratings (i.e., confidence) in both studies, with inconsistent differences on other individual difference variables. White participants were more likely than Black participants to recognize the White male target, consistent with previous research on Own-Race Bias in face recognition.

Gier and Kreiner (unpublished) used a SA featuring a White couple (in their 80s) who were videotaped together and viewed in a mock SA. They investigated recognition of the targets in relation to individual difference variables and whether the couple appeared together or separately in the SA. In study 1, participants correctly identified the missing female target 5.3% of the time and the missing male target 84.7% of the time. In study 2, the researchers replicated study 1 by adding a condition where participants viewed the targets either together or separately. Gier and Kreiner (unpublished) and found (56.7%) correctly recognized the female target while 75% correctly identified the male target. In both studies, participants' attitudes towards older adults were related to recognition of the targets. In order to understand why recognition for all face recognition studies, we will now discuss biases towards older adults.

Biases in Face Recognition

Own-Race Bias

The ORB has been found between multiple races. For example, a study by Wright et al. (2001) was conducted in South Africa and England, where both White and Black confederates approached both Black and White people in shopping centers who were later "asked to identify the confederate from both a sequential lineup, in which photographs are seen one at a time, and a forced-choice recognition test, where photographs are seen simultaneously. In both countries and with both identification tasks the confederates were better recognized by people of their own race" (Wright, et al, p. 119).

Researchers such as Bernstein et al. (2007), Fisk and Neuger (1990), and Rodin (1987) conducted studies focused on how faces are categorized as either being a member of an out-group versus in-group and how categorization can result in either deep processing (processing individuating features) of in-group faces compared to less effective processing of individuating features of out-group faces (Bernstein et al., 2007; Fisk & Neuberg, 1990; Rodin, 1987). "Thinking categorically about out-group members leads individuals to search for category-specifying features (e.g., skin tone) in cross-race faces, instead of the individuating features that distinguish one face from another (see also MacLin & Malpass, 2001, 2003)" (in Bernstein et al., 2007, p.706). In the present study, we investigate recognition for an adult Black couple in a mock SA. Although testing for ORB was not the purpose of the present study, it is important to consider that Black participants may show better overall performance that participants of other ethnicities in recognizing Black individuals shown in a SA.

Although there are a few published studies on missing older adults in mock SA, the target seniors in all of the previous studies were White (Gier, 2019; Gier et al., 2017; Gier & Kreiner, 2019; Gier & Kreiner, 2020). The present study is the first to our knowledge to investigate ability to recognize Black individuals in the context of a SA.

Own-Age Bias (OAB)

An OAB has been demonstrated with studies finding significant differences in accuracy depending on the relationship between the age of the participants and the age of the targets.

McKelvie (1987), for instance, has indicated superior recognition of faces of one's own gender relative to the other gender. Although the OAB has been recognized within face recognition research literature, the sample in the present study was comprised of college students; therefore, it was not practical to investigate OAB in our current study.

Own-Gender Bias (OGB)

The OGB occurs when one has better recognition and accuracy for one's own gender. Herlitz and Lovén (2013) found the bias is highly asymmetrical meaning the bias occurs

more commonly with females. Only a handful of studies have found the full crossover bias in both men and women (Ellis et al., 1973; Man & Hills, 2016; Wright & Sladden, 2003). There is strong evidence in the literature showing that females display an OGB more than males do. In studies focusing on OGB the participants view both males and females sequentially followed by a recognition phase where are presented with target face which was previously seen, or distractor faces (foils). The majority of face recognition studies following this type of research paradigm tend to show an OGB for females, but not for males (e.g. Herlitz et al., 1997; Herlitz et al., 2013; Shapiro & Penrod, 1986). Females tend to recognize faces of females more accurately and quickly than males recognize female faces. Interestingly, males and females performed similarly in recognizing male faces (Lewin & Herlitz, 2002), showing a lack of OGB for males.

We should keep in mind that many gender studies show more differences within genders than between genders (Burton et al., 2010; Darling et al., 2009; Herlitz & Lovén, 2013). Phenomena such as OGB present interesting challenges as people may identify with different genders apart from their biological sex. It may be important to distinguish between differences in genders as compared to differences between sexes.

Impact of Wearing Eyeglasses

In the interest of exploring factors that may impact ability to recognize missing individuals shown in SAs, we investigate the potential impact of showing the missing individuals with or without eyeglasses, both in the SAs and later in photos shown during a recognition test. Research has shown that eyeglasses can act as an occlusion, preventing face recognition (Graham & Ritchie, 2019). Graham and Ritchie (2019) found that wearing glasses and sunglasses can interfere with face recognition. Kramer and Ritchie (2016) found that wearing glasses can fool people who are not familiar with the person. Patterson and Baddeley (1977) conducted a face recognition study in which the targets were either wearing or not wearing glasses, as one of several stimulus changes in the study. They found that participants were more accurate if the encoding and recognition phase were the same, meaning that the individual wore glasses or did not wear glasses both at encoding and recognition. However, McKelvie (1993) found no difference in face recognition depending on whether the individuals were shown with glasses. McKelvie presented the faces for 3s each (20 faces, 10 with glasses & 10 faces without glasses) and had the participants return seven days later for the recognition phase of the study. Leder et al. (2011) found that wearing rimless glasses resulted in faces appearing less distinctive; however, rimless glassed increased perceived trustworthiness, but did not decrease attractiveness. Most importantly, they found that ability to match faces was significantly worse when one face was shown with glasses and one without.

Couples Presented Together vs. Separately

When a SAs of a missing couple is shown on the news as a special alert, the couples are typically first shown together, then sometimes, viewed separately. Although the SA context is not the same as conducting an eyewitness lineup, the number of individuals shown to participants may be an important factor in both contexts. Studies of eyewitnesses asked to pick a perpetrator of a lineup together versus separately have shown that sequential presentation appears to be the superior method, possibly because simultaneous presentation of the possible perpetrators tends to lead victims to compare the faces presented, often ending in false alarms when non-perpetrators are identified from the lineup (Patterson & Baddeley, 1977). In the present study, we manipulated whether the couple was shown together or separately in the SAs to determine whether that factor would affect ability to recognize the two people in the recognition phase.

Experience with Older Adults

In addition to investigating appearance factors (wearing glasses and appearing together vs. separately), we were also interested in differences among participants that might predict ability to recognize the missing individuals shown in a SA. Attitudes towards outgroups (e.g., ethnicity, age, gender), the amount of contact/experience one has with the group, and whether the contact is positive or negative can affect face recognition performance. Söderhamna et al. (2002) administered an instrument measuring attitudes toward elderly individuals to nursing students in Sweden at the beginning of their nursing program. The results supported earlier findings that limited positive experience with older adults predicted *less* favorable attitudes and feelings towards older adults. Gorelik et al. (2000) found that students who had contact with older adults and those who chose to take classes on aging reported more positive attitudes towards older adults. Other studies (Brown et al., 1999) found that overall positive experience and contact with older adults tended to predict more positive attitudes towards older adults compared to individuals who had negative experiences.

In a recent SA study (Gier & Kreiner, unpublished) the researchers administered the Attitudes Toward Older Adults scale (ATOA; Kogan, 1961). They hypothesized that more positive attitudes towards older adults would relate to increased face recognition of the elderly target individuals. Their hypothesis was supported for a female target, but not for a male target. That pattern of results may suggest

that recognition of missing females is subject to differences in observers' attitudes toward the target population to a greater extent than for men. However, we should be cautious about generalizing such findings when based on only one target of each gender, as any differences could be related to other characteristics of the targets. These results do imply that relationships between individual differences in observers and recognition of missing persons could depend on the characteristics of the missing person. We included the ATOA measure in the present study to explore whether attitudes toward the elderly would predict face recognition when the targets were Black individuals rather than White, as in the Gier and Kreiner (unpublished) study.

Conscientiousness

Another relevant individual difference variable is conscientiousness. Komarraju et al. (2011) stated that conscientiousness is related to fact retention, elaborative processing, and motivation. Fact retention, elaborative processing, and motivation are important factors in face recognition studies, especially if the faces are not the same age, gender, or ethnicity as the participants. Other researchers have described conscientious people as reliable, responsible, and persevering (McCrae and Costa, 1997), and to have a tendency to follow and adhere to ethical principles and moral activity (Blasi, 1980). Therefore, we hypothesized that individuals scoring higher in conscientiousness would be more motivated to pay close attention to details from the SAs and would tend to follow directions more than those scoring lower on conscientiousness. Participants high in conscientiousness may correctly identify the male and female in the SAs. In the recognition phase of the study, however, being conscientious, they may also question their confidence unless they were very sure their response was correct.

Metacognition and Face Recognition

Participants' confidence in their decisions about whether they have recognized a missing elderly individual are important in addition to whether they recognize the missing person or not. Fleming and Lau (2014) stated that, "metacognitive sensitivity refers to the ability of a person to discriminate between different levels of performance, such as correct or incorrect trials, also known as type 2 bias, over-or-under confidence or calibration" (Fleming & Lau, 2014, np). The complexity of the task can have an effect on whether a participant has a tendency to report either a high or low confidence level, regardless of performance (Mazancieux et al., 2018). An important metacognitive measurement in face recognition studies is Retrospective Confidence Judgments (RCJ). Gier and Kreiner (2020), in a SA study with a target male in his late-fifties, found high confidence for those accurately recognizing the target.

Purpose of the Present Study

The present study is the first research study, to our knowledge, to include a Black couple as the targets in a mock SA study. We located five previous studies on SAs; all five studies had White target individuals. Although we did not, in the present study, directly compare Black older adult face recognition to recognition of White older adults, it is of interest to determine whether recognition rates are similar to those found in previous studies. As the number of older adults are increasing rapidly, both in the U.S. as well as internationally, more SAs will be posted for those older adults with Alzheimer's who wander away from their residence, or even worse, who are elopers. As mentioned earlier, Black individuals have a relatively high prevalence of AD; therefore, it is important to add to literature on face recognition relating to SAs showing Black individuals.

A second purpose of the study was to investigate characteristics of the SAs that may affect ability to later recognize the individuals shown in the SAs. Older adults often wear glasses; however, if older adults with AD wander or elope, they may not be wearing their eyeglasses. Although this may not seem important, if someone in the public sees a missing older adult wearing glasses, but the SAs showed the older adult without glasses, the mismatch based on the presence of glasses may result in not recognize the missing older adult. In the present study, we manipulated whether the targets appeared in the SAs and video with or without glasses as well as in the recognition phase of the study. We hypothesized that recognition would be greater for the target wearing glasses when the person had been shown in the SA wearing glasses.

In the present study, the SAs and an accompanying video presented the Black couple either together or separately. Gier and Kreiner (2020, unpublished) found no difference in recognition of the older adults whether presented together or separately using White targets, thus we did not expect to find a difference in recognition depending on whether the older adults were presented together or separately.

In terms of individual differences across participants, we hypothesized that individuals who report greater contact with the elderly and who have more positive attitudes toward the elderly would be more likely to recognize the targets. Gier and Kreiner (unpublished) found that scores on the ATOA were related to recognition of a missing person shown in a SA. They presented both a White male and White female in their middle 80s and found that more favorable attitudes toward older adults were associated with better recognition of females, but not males. We hypothesized for

the present study that there would be a significant difference in ATOA scores related to target recognition, but possibly more likely for the female than the male in the study based on Gier and Kreiner's (unpublished) findings.

Finally, we hypothesized that those scoring higher on conscientiousness would more likely correctly recognize both the male and female in the Silver Alert. If a person scores high on the conscientious trait, we predicted they would more likely focus more closely on the faces and details in the study.

Method

Participants

The participants were recruited from a southeastern university using SONA, a research management system that allows students to sign up for research studies online and to obtain credit for participation. Of the 222 individuals who responded, 12 reported having technical difficulties (video and/or audio). Data from those individuals were excluded from the analyses, yielding a Sample size of 210. The sample size of 210 yielded a power greater than .90 for detecting medium size effects in a chi-square contingency test or two-way between subjects ANOVA. The majority of the sample identified as female (71.4%, $N = 150$), with 59 identifying as male (28.1%) and one identifying as transgender male (0.5%). The sample included 147 participants identifying as White (70.0%), 50 as Black participants (23.8%), 7 as Hispanic participants (3.3%), 4 as Asian participants (1.9%), and 2 as other ethnicities (1.0%). The mean age of participants was 20.07 years (SD =3.67, range of 18 to 45 years).

Design

The design of the study included both experimental and correlational components. We manipulated whether the SAs showed the couple together or separately (between-subjects). We also included a control condition which consisted of two different elderly Black individuals. This constituted a control condition in the sense that it provided a baseline recognition rate when the target individuals were not included in the SA; if participants in the four experimental conditions do not recognize the targets at a rate above that of the control condition, it would suggest that participants were performing at chance. The couple in the control condition SA did not appear in the recognition phase of the study. We manipulated whether the SAs showed the target individuals wearing glasses or not (between-subjects), and included photos in the recognition phase that showed the individuals wearing glasses or not (within-subjects, as all participants viewed all the recognition photos). Dependent variables were the dichotomous variable of response to the recognition photos (yes/no) and the continuous variable of confidence ratings in responses to the recognition photos. The correlational aspect of the design explored relationships between target recognition and the individual difference variables of participant scores on measures of contact with the elderly, attitudes toward the elderly, and conscientiousness scores (See Figure 1 for flowchart of the study).

Materials

The study was conducted using the online Qualtrics platform (https://www.qualtrics.com/). Mock SAs were created in a PowerPoint presentation that was programed to automatically progress during the slides. The SAs consisted of a photo of the target couples viewed separately (either with or without glasses) that included the physical descriptions of the male and female targets' age, height, weight, eye color, and hair color, as well as a home-video where the couples were videotaped separately in the SA (see Appendix A). A phone number was also provided to make the poster appear as realistic to a SA as possible. Another SA was created showing a photo of the couples together both in the SA as well as the home-video. The control condition consisted of a different Black elderly coupled viewed both together and separately in the SA and only together in the home-video wearing glasses (see Appendix B for couples together seen in the SA). Appendix C shows targets with and without glasses.

We created the SAs so that they would be similar to alerts in current use. We created a 42 second video of the SAs couple in the presence of the couple's son and daughter-in-law to make the couple feel comfortable conversing while being videotaped on a cell phone. This created a more relaxed, natural video of the couple than being videotaped alone by a stranger. In the condition where the targets were videotaped separately, the length of the videos was 21 seconds each for the target male and female. The videos were counterbalanced when the couple was shown separately so that half of the participants in that condition saw the SA male target first then the female target and then reversed with the female target first followed by the male target.

Before the recognition phase of the study we asked participants to complete surveys that included Kogan's (1961) Attitudes Towards Older Adults (ATOA) scale to measure participants' attitudes towards older adults. This instrument is intended to measure stereotypes of the aged and people's image of older adults. The scale consists of three domains: personal appearance, resemblance, and the nature of interpersonal relations across age generations. The scale consists of 34 questions in total with 17 positively worded and 17 negatively wording, using a 6-point response scale ranging from strongly agree (1) strongly agree to (6) strongly

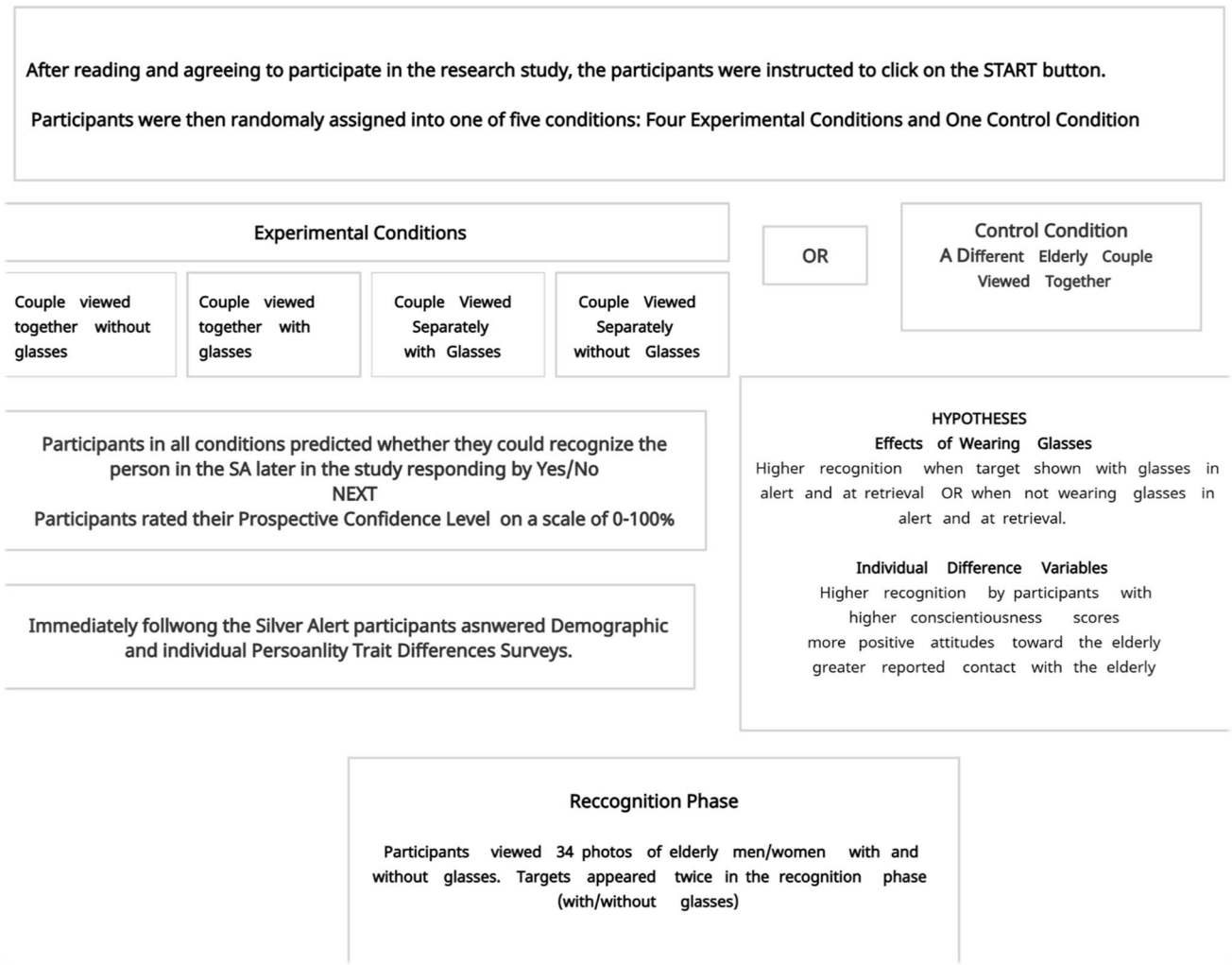

Fig. 1 Flowchart and hypotheses

disagree. Negatively worded items were reverse scored; thus, higher total scores on the ATOA indicated more negative attitudes towards older adults. Kogan (1961) reported the overall Cronbach's alpha reliability for the ATOA (Kogan, 1961) to be .81. Content and construct validity for the ATOA have been supported in more recent studies, such as a Chinese study with a reported construct validity of .92 (Yen et al., 2009) and a Turkish version of the scale at .94 (Küçükgüçlü et al., 2011).

We measured conscientiousness by using the International Personality Item Pool (IPIP, Goldberg et al., 2006). The participants were asked to rate 20 items on a 0 to 100 very inaccurate to very accurate scale. Scores for positively and negatively worded items were each averaged, then the overall conscientiousness score was calculated as the difference between the positive and negative scores. Cronbach's alpha for this scale ranges from .79 to .87 (Goldberg et al., 2006).

We also measured how much experience each participant reported with older adults. This measure was a 4-point response scale. The age ranges consisted of four age ranges (adults 50-59, 50-69, 70-79, and 80 and older). The prompt indicated, "Below is a list of different age ranges. We would like to know about your experience/contact with members of those groups. For each group, indicate how much experience you have interacting with those age ranges in the past five years. I have _____ experience interacting with adults this age" with the four options being *no/very little/moderate amount of/great deal of experience.* At the end of the study we asked the participants demographic questions that included the participant's age, race, gender, and whether they received AMBER Alerts or Silver Alerts on their cell phones. The surveys and demographic questions served as the retention interval of our study and took participants approximately 20 minutes to complete.

We used a total of 34 photos in the recognition phase of the study. Thirty were foils (meaning the photograph was

not the target male or female in the study). We included two different photos of each target, one wearing glasses and the other without glasses. The control couple wore glasses (See Appendix D). The target photos in the recognition phase were not the exact photos shown in the SAs. Past research, such as Wixted and Wells (2017), suggests that foil's faces should not look exactly like the description from the eyewitness (such as wearing the exact same clothing) as this can contribute to false recognitions. Foils should include important features of the perpetrator such as color of eyes or specific facial features. Therefore, in our study we included people looking somewhat similar to the missing target male and female, and some foils who were dissimilar in their appearance (see Appendix E). Similarity was determined by a panel of ten undergraduate students who viewed an array of 60 photos of AA elderly males and females. The photos were ranked by the judges, then the photos were arranged by ranking the most similar to photos not similar to the target couple. This process continued until we had 20 similar and 10 not similar photos.

The photos in the recognition phase displayed the targets separately, dressed differently, with one photo of each target wearing glasses and another photo without glasses (Appendix E). . Four photos of the target male and female seniors were presented (one photo with and without glasses), two photos of each of the targets wearing different clothes and in different background settings. The majority of the foils looked similar to the older AA couple; however, we also added foils who appeared physically different than the targets in the study, for example, differing in hair length, skin tone, and facial features such as having either a round or more square shaped jaw. For the females some facial features such as the cheekbones, eyebrows, and lip size (also including the color of lipstick) were different than the target female's facial features.

Procedure

Participants were randomly assigned to one of five conditions. Four of the conditions contained the target couple. These conditions consisted of the target couple shown together with glasses, together without glasses, separately with glasses, or separately without glasses. The fifth condition was a control condition in which a different elderly Black male and female appeared; these individuals did not appear in the recognition photos.

Once the participants agreed to participate in the study, they saw the following message: "You are now going to see a Silver Alert Poster. You may take your time to study the poster." The next screen showed a photo of the couple. Immediately following the photo of the missing senior citizens, the participants saw a slide of the description of the couple. Next, a message was presented to the participants which stated: "You are going to be watching a short video that lasts approximately 42 seconds. Please make sure the volume is turned down so as not to distract others (i.e. if you are in a computer lab or library participating in the study)." The video showed the participants sitting in a living room talking to their son and daughter-in-law (only the targets were in the video). Equal time was given to the couple to talk about their lives and about activities they had planned for their week.

After the participants viewed the video, they were then asked to respond to demographic questions and a short survey on the amount of contact they had with older adults' group in ages of 50-59, 60-69, 70-79, and 80+. Participants responded with the choices of the following: I have no contact with adults in this age range; I have very little contact with adults in this age range; I have a moderate amount of contact with this age range; and I have a great deal of contact with this age. The participants were then asked to respond to the IPIP (Goldberg et al., 2006) Conscientiousness items and the ATOA questionnaire (Kogan, 1961).

The recognition phase of the study was presented at the end of the study. We did not mention to participants that the targets may not be in the recognition phase. We presented photos of 34 elderly adults in their 80s, where 30 of the photos were foils. All 34 photos were presented in random order (in other words, the male and female photos were in random order such that each photo had an equal chance to be seen in each position from 1-34). Each photo appeared separately on the screen. The participants were asked to respond *Yes* or *No* to the question: "Was this male (or female) in the Silver Alert?" Next, the participants were asked to rate how confident they were in their decision of whether the person was in the Silver Alert or not on a visual analogue scale of 0-100, with 0 indicating they were not confident in their decision of whether or not the person was in the SA, and 100 meaning they were 100% confident the person in the photograph was one of the targets in the SA.

Results

Overall Recognition Rates

Each participant responded to four target photos: two for the female and two for the male, with one photo of each shown wearing glasses and one without. Overall recognition rates (percentage of participants responding Yes to the target) were as follows: female with glasses (57.6%); female without glasses (15.2%); male with glasses (33.3%); male without glasses (31.0%). Mean false alarm rates were 11.9% for female foils and 12.3% for male foils.

In order to determine whether participants could identify the targets at a rate above chance, we conducted a chi-square

test of independence for each of the four targets (female and male with and without glasses) to determine if proportions of *Yes* and *No* responses to the targets differed between the control condition and the four conditions (combined) in which the target couple appeared in the SAs.

For the female target wearing glasses, 41.4% of participants in the control condition responded *Yes,* compared to 62.6% in the other conditions, χ^2 (1, *N*=203) = 4.67, p = .031. For the female target without glasses, there was not a significant difference in identification, with 9.7% of those in the control condition responding *Yes* compared to 16.8% in the other conditions, χ^2 (1, *N*=204) = 1.00, p = .318. For the male target wearing glasses, 16.7% of those in the control condition responded Yes, compared to 37.8% in the other conditions, χ^2 (1, *N*=202) = 5.03, p = .025. For the male target without glasses, 12.9% of participants in the control condition responded Yes, compared to 35.5% in the other conditions, χ^2 (1, *N*=203) = 6.14, p = .013. In summary, participants who had seen the target in the Silver Alert identified the target at a significantly higher rate than those who had not, except for responses to the female target who was not wearing glasses**.**

Effect of Wearing Glasses

We compared recognition rates across the four target photos, using *z*-tests for dependent proportions, and excluding data from the control condition, in which the target male and female did not appear in the SA. Because the overall recognition rates indicated differences between the male and female targets, we did not collapse data for the male and female photos but report the results separately.

For male targets, the recognition rate was not significantly different when the target wore glasses in the photo (37.8%) than when the target did not wear glasses (35.5%), $z = 0.35$, p = .363. However, the female target was recognized significantly more often (62.6%) when the target wore glasses than without glasses (16.8%), $z = 7.90$, $p < .001$. When not wearing glasses, the male target was recognized more often than the female target, $z = 3.51$, $p < .001$, but when wearing glasses, the female target was recognized more often than the male target, $z = 3.35$, $p < .001$.

To test the relationship between whether the targets were shown in the SAs with or without glasses and whether they appeared in the recognition phase with or without glasses, we conducted a chi-square contingency test for each of the target photos (female and male with and without glasses) to compare frequencies of participants responding *Yes* and *No* in relation to whether the Silver Alert showed the target wearing glasses or not. As shown in Table 1, participants correctly responded *Yes* to the male target without glasses more often when the target appeared in the Silver Alert without glasses than when the target appeared with glasses in the Silver Alert. In other words, when the male senior citizen appeared without glasses in the Silver Alert, participants were more likely to correctly identify his photo when he was again shown without glasses. For the other three target photos, there was not a significant difference in recognition depending on whether the target was shown in the Silver Alert with glasses or not.

Table 1 Target recognition rates (%) by glasses condition and target gender

Glasses in Silver Alert					
		No	Yes	χ^2	p
Female Target	No Glasses	21.1	12.0	2.54	.111
	Glasses	61.8	63.5	0.06	.813
Male Target	No Glasses	50.0	20.2	16.63	<.001
	Glasses	36.4	39.3	0.16	.693

Percentages shown are percentage of participants responding "Yes" to the target photo.

Table 2 Target recognition rates (%) by whether the couple appeared together or separately in the silver alert

Couple Shown Together					
		No	Yes	χ^2	p
Female Target	No Glasses	14.3	17.9	0.36	.546
	Glasses	60.3	63.8	0.20	.658
Male Target	No Glasses	32.1	37.1	0.40	.527
	Glasses	31.5	40.7	1.33	.248

Percentages shown are percentage of participants responding "Yes" to the target photo.

Effect of Couple Shown Together or Separately

Table 2 shows parallel analyses comparing recognition rate between conditions with the target appearing together or separately in the Silver Alert. There was not a significant relationship between the Together-Separate condition and recognition of any of the four target photos.

Confidence Ratings

For each of the four targets, we compared participants' confidence ratings (on a scale of 0-100%) for their responses across the four conditions using 2 x 2 between subjects factorial ANOVAs, with the two factors being whether the Silver Alert showed the couple together or separately and whether it showed them with or without glasses. Table 3 shows mean confidence ratings across the four conditions. For the female target without glasses, there was a significant main effect of the Glasses condition, $F(1,168) = 7.59$, p =

Table 3 Mean target confidence ratings by glasses condition and whether targets appeared together or separately in the silver alert

		Couple Shown Together				Couple Shown Separately			
		No Glasses		Glasses		No Glasses		Glasses	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Female Target	No Glasses	67.93	24.23	82.32	19.44	73.15	25.98	80.82	25.50
	Glasses	67.37	25.52	73.58	24.32	71.92	23.86	74.67	23.69
Male Target	No Glasses	67.18	25.64	75.93	21.44	75.81	21.60	79.02	24.67
	Glasses	71.11	26.33	69.52	27.46	72.69	25.18	76.86	22.90

.007, η_p^2= .04, indicating significantly higher confidence ratings when the target had been shown with glasses than without in the Silver Alert. No other main effects or interactions were significant**.**

Individual Differences and Target Recognition

We compared recognition of the target across ethnicity group (Black, White, Other) to determine whether there was an advantage for Black participants in recognizing the Black targets. For all four targets, the chi-square did not approach significance, all *p*'s > .705.

We conducted a logistic regression analysis, using the Backward Wald method, to predict recognition of each of the four target photos from confidence rating to the target photo, confidence to same-gender distractor photos, participant age, IPIP conscientious score, ATOA score, and a total experience with the elderly score, which was calculated by summing responses for reported experience with each of the four age ranges (ages 50-59, 60-69, 70-79, and 80 or older), with higher totals representing greater amounts of reported experience with elderly individuals.

The logistic regression model was not significant for predicting recognition of the female wearing glasses in the recognition photo, as all predictors were eliminated from the model. The initial model including all predictors was not significant, χ^2 (6) = 3.17, p = .717, Nagelkerke R^2 = .021. Similarly, there were no significant predictors for recognition of the male not wearing glasses, χ^2 (6) = 4.03, p = .673, Nagelkerke R^2 = .028.

For predicting recognition of the female not wearing glasses in the recognition photo, the final logistic regression model included participant age (odds ratio = 1.12), with greater ages predicting higher likelihood of recognizing the target individual; ATOA (odds ratio = 0.96), with higher scores (indicating more negative attitudes toward the elderly) associated with lower likelihood of recognition; and confidence rating for the target photo (odds ratio = 0.98), with higher confidence ratings associated with lower likelihood of recognition. The final model containing those three predictors was significant, χ^2 (3) = 20.63, p < .001, Nagelkerke R^2 = .166.

For predicting recognition of the male wearing glasses, the final logistic regression model included participant age (odds ratio = 1.10), with greater ages predicting higher likelihood of recognizing the target individual; and confidence rating for the target photo (odds ratio = 0.98), with higher confidence ratings associated with lower likelihood of recognition. The final model containing those two predictors was significant, χ^2 (2) = 12.96, p = .002, Nagelkerke R^2 = .086. See Figure 2 for classification plots for the two significant logistic regression final models.

Discussion

We explored the recognition of an elderly Black couple shown in a mock Silver Alert in relation to whether the couple appeared together or separate in the Silver Alert and with or without glasses in the SAs, as well as the relationship between recognition and several individual difference variables. Notably, this is the first face recognition study using a mock SAs showing Black people. Previous studies on Silver Alerts (Gier et al., 2017; Gier & Kreiner, 2019a; Gier & Kreiner, 2019b; Gier, 2019) used White people as their target seniors. Black older adults are a minoritized and marginalized group in the U.S. which needs more representation in studies relating to AD. Black older adults are at the highest risk of developing AD (Steenland et al., 2016). Several studies have revealed that in the U.S, Blacks are the majority, rather than the minority, in many health-related illnesses such as diabetes (Blacks and Hispanics are over 50% more likely to have diabetes than non-Hispanic Whites, American Diabetes Association, 2020) and chronic kidney disease (Laster et al., 2018, p.3). Breathett et al. (2018) found not only that Blacks have the highest risk of heart failure, but "among patients admitted to an ICU for HF, African Americans were less likely than Caucasians to receive primary care by a cardiologist. Primary care by a cardiologist was associated with higher survival for both Caucasians and African Americans" (2018, p. 415). Healthcare and biases often prevent Black individuals from equal access. Health conditions, and age in general, can have negative effects on an older adult's vision, resulting in many older adults needing to wear eyeglasses. However, given that a missing older

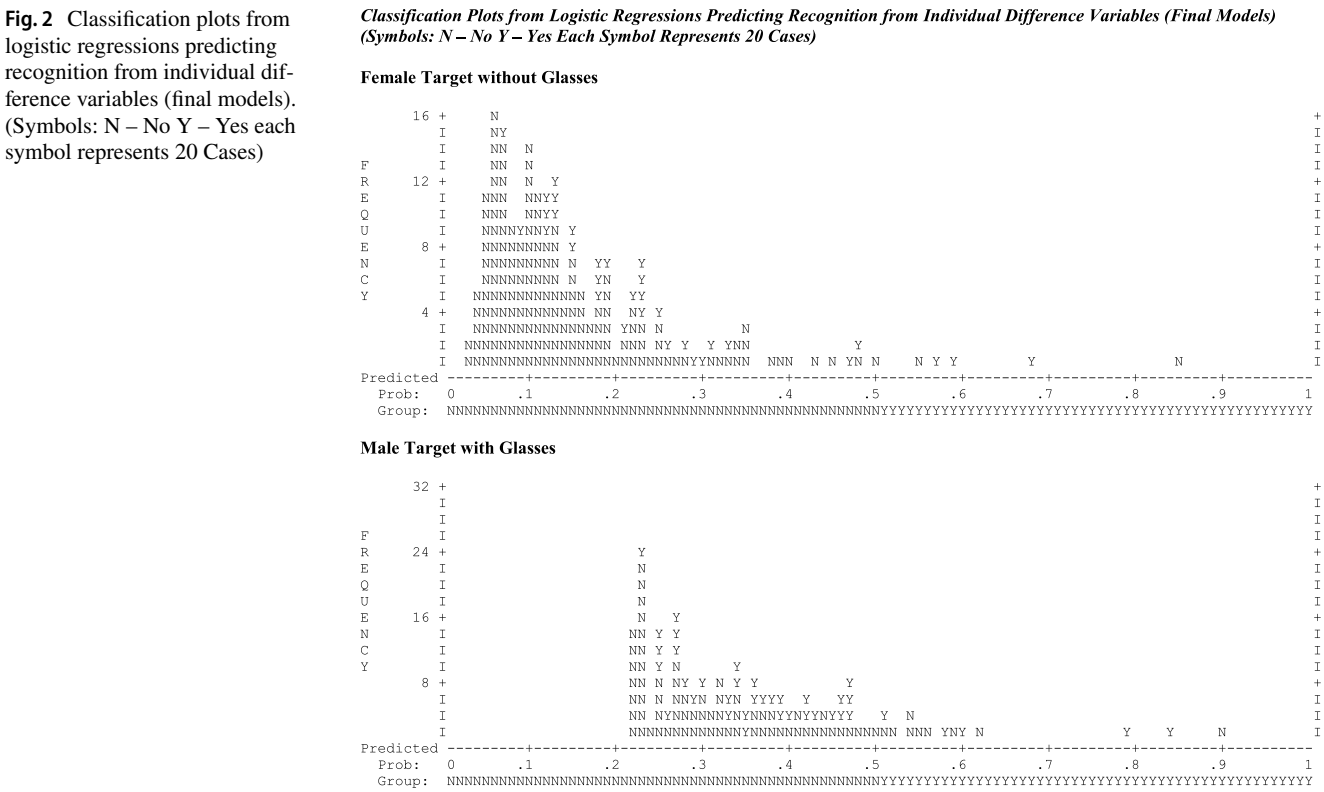

Fig. 2 Classification plots from logistic regressions predicting recognition from individual difference variables (final models). (Symbols: N – No Y – Yes each symbol represents 20 Cases)

adult may or may not be wearing glasses, more research is needed on whether that aspect of appearance has an effect on face recognition of Black individuals in a SA.

The results of the present study indicated that wearing glasses is an important consideration in the public's ability to recognize missing elderly individuals. However, there was only partial support for the matching hypothesis that recognition would be greatest when the target's appearance in the SAs matched the recognition photo (e.g., wearing glasses at both encoding and recognition). Matching appearance, in terms of wearing glasses, may only affect recognition in some situations, possibly dependent on unique factors associated with each individual face. It is also interesting to note that the results were not consistent with the idea that participants could rely entirely on the presence of the glasses as a visual cue to identify the target. The results suggest that we should not assume that individuals are equal or even similar in the likelihood that they will be recognized by the public, as ability to recognize them may depend on specific facial characteristics as well as how they appear in the SAs and when people are attempting to recognize them.

Previous research has indicated a variety of factors involving wearing glasses that could impact face recognition. Wearing glasses can reduce the accuracy of face recognition due to the emphasis on the eye region of the face (Graham & Ritchie, 2019). Other research has indicated that glasses can serve as an occlusion and produce the 'superman effect' (Ritchie & Kramer, 2016) meaning that a person, especially an unfamiliar individual, is harder to recognize if the target in the study phase of the study wore glasses, but in the recognition phase the target did not wear glasses (and vice-versa), than when the person wore glasses or did not wear glasses at both exposure and recognition. For the two individuals who appeared as targets in the present study, the male target was more likely to be recognized when not wearing glasses in the recognition photo when he had previously appeared in the SAs without glasses, but there was no such matching effect when he was wearing glasses, and this effect did not occur for the female target. However, the female target was more likely to be recognized when wearing glasses than when not wearing glasses, irrespective of how she appeared in the SAs. In fact, recognition of the target woman when she was shown without glasses was no better when she was shown in the SA than when she was not shown in the SA (control condition). These results suggest that the importance of whether the person appears with or without glasses at encoding and recognition may depend on characteristics of the particular person.

One possible explanation for the importance of the glasses is that observers may draw inferences about people based on whether they wear glasses or not. It is possible that when these inferences are made, they could affect memory for those individuals. For example, glasses can give a perception of intelligence (Fleischmann et al., 2019). An early study by Harris (1991) found that people wearing glasses were perceived as less attractive, more intelligent, and more

intense than those without glasses. Eggleston et al. (2020) found that ratings of intelligence were higher for people seen wearing glasses, even when the participants were instructed to ignore the glasses and when viewing time was very short. Gerger et al. (2017), Leder et al. (2011) found that individuals wearing glasses were rated higher on successfulness and intelligence than those not wearing glasses. These results suggest that people may make rapid inferences about an individual based on whether the person is wearing glasses. Fleischmann et al. (2019) conducted a study on the effect glasses have perception of intelligence for politicians running in an electoral race, both in the United States as well as in India. Politicians who wore glasses in the U.S. were viewed as being intelligent; however, the effect of glasses making the politician appear intelligent was not significant in India. Thus, the inferences that are drawn may vary across cultures. It is possible that any of these inferences about individual characteristics could serve as recall cues.

Participants seemed to find it especially difficult to recognize the female target when she was not wearing glasses. Overall, she was not recognized significantly more often when she appeared in the SAs than when she did not appear, suggesting that participants were not better than chance at identifying her photo during the recognition phase. We also found that participants who did identify the female target without glasses had a higher false alarm rate to foils than individuals who did not identify this particular target, implying that those who identified the target were just more likely to respond *Yes* in general, consistent with guessing.

Gier and Kreiner's study (unpublished) with a White older adult couple in their mid-80s presented the couples either together or separately. They found no significant differences between presenting the missing couple separately in the SA compared to presenting them together. Similarly, we found no evidence in the present study that whether the couple appeared separately or together in the SA affected later recognition. Those elderly adults who do wander from home are sometimes alone, but often are with their spouse or significant other who may or may not have AD (Examples of actual alerts can be seen in the Appendices A-E). The present results may be beneficial for those presenting SAs on TV, allowing the alert to be presented with the couple together, or separately as it does not appear to make a difference in recognition of the missing senior. However, we should keep in mind that the present results do not conclusively indicate the absence of a together-separate effect, just a lack of evidence to support such a difference.

In terms of individual's difference variables, we had hypothesized that attitudes toward the elderly, measured by ATOA scores, would predict greater likelihood of recognizing a missing senior citizen. Our results indicated that ATOA scores were predictive of recognition but only for the female target without glasses. Note that this target photo had the lowest recognition rate. It is possible that differences in attitudes toward the elderly become more important in relation to recognizing the missing person when particular characteristics of the person make it more challenging to make an identification. These results were partially consistent with those of Gier and Kreiner (2020, unpublished), who found that participants who recognized a White female or male scored significantly lower on the ATOA than those who did not (indicating lower levels of negative attitudes). We did not find significant differences based on target recognition in relation to conscientiousness scores or self-reported experience with the elderly.

SAs are relatively new compared to missing children alerts, such as AMBER alerts, but the two programs serve the same purpose: to alert the public of a missing person considered in possible grave danger and vulnerable due to age, and physical as well as psychological disabilities. Research on missing children in AMBER alerts has shown that people claim to look at missing people posters when in a supermarket, yet when this question was experimentally tested (Lampinen et al., 2009) the results showed participants had become complacent. Although customers reported that they believe AMBER alerts are very important, nearly none of the customers reported looking at the posters.

Researchers studying the fate of our older adults with dementia fear similar complacency. The U.S. Census Bureau (2019) reported that, "Older people are projected to outnumber children for first time in U.S. history." We encourage researchers to focus on face recognition older of adults with the same degree of importance of face recognition of missing children, runaway teens, and people with physical and/or mental disabilities.

We recommend that every state should have a campaign on educating the state residents on the different alert programs for people who are missing. Education on AMBER alerts and Silver Alerts could be incorporated in school assemblies, having someone from law enforcement, or someone working with relatives of missing people, speak to the students on the importance of all missing people alerts, including SAs.

Although our results did not provide support for the hypothesis that higher levels of contact with elderly people were associated with increased recognition, we did find some support for attitudes toward the elderly as a predictive variable for recognition. Burnes et al. (2019) conducted a meta-analysis on different interventions with older and younger people in order to reduce ageism. The researchers concluded "Interventions are associated with substantial reduction in ageism and should be part of an international strategy to improve perceptions of older people and the aging process" (American Journal of Public Health, np). We recommend that school systems consider incorporating programs designed to reduce ageism. Such programs could be

integrated into clubs, honor societies as well as incorporated into class service and volunteering projects. For example, older adults could be invited to visit classrooms to read to young children, or volunteer to tutor students if they have the academic background (e.g., a retired math teacher may enjoy tutoring struggling math students a few days per week).

As the world is suffering from COVID-19, older adults are especially isolated and becoming increasing overwhelmed as they cannot be in touch with their family; therefore, this would be an ideal time to create a virtual *Adopt a Grandparent* program. Once it is safe again to interact with older adults, then the meeting between the student and older adult could continue both in person as well as online. Perhaps a coordinator could match students and older adults' interests in order for their connection to have more meaning (e.g., a retired police officer, nurse, computer programmer; or interests such as playing chess, painting, video-gaming).

One limitation to the present study is that we only included one Black couple in their mid-80s. We picked that particular age range as most SA for both all races tend to be in their 80s; however, having multiple target ages could help us better understand what older adult ages are easier to recognize in a SA. Including individuals in the SAs of only one ethnicity is also a limitation. It is also important to consider that the majority of the participants in the study identified as White. This could have affected recognition of the Black couple as the ORE would predict relatively low recognition of Black individuals by White participants. However, the results did not indicate a significant difference in recognition according to participant ethnicity. The increasingly diverse population in the U.S. has brought attention to the value of all elders' well-being and safety. All couples of any race or ethnicity may go missing, including multiracial couples, and couples who have migrated from other countries.

Further, all of our participants were all from general psychology classes or careers in psychology classes. Thus, our sample was limited to college students taking particular classes, which also resulted in limited age variability of participants. The present study was also administered online. Although all of the research protocols were followed, and participants were randomly assigned to conditions, the results may differ if the study had been in-person, in the physical presence of a researcher.

In future research, it may be helpful to include an experience/contact scale specifically for Black seniors (or whatever race is used in the SA study) in addition in addition to the general contact/experience measures as we used in our study. Also, it would be important to explore the effects of different delay periods between viewing the SA and encountering the recognition photos, as there was a relatively short delay in the present study.

Hockley et al. (1999) found that, during the initial encoding of a face and the target is wearing glasses, less information may be available later during the recognition phase. However, during encoding, or the learning phase, if facial features are emphasized, such as any unique facial features other than the eyes, then participants may adapt to focusing on the central part of the face, not just the eyes. Based on Hockley et al. (1999) study, future mock SAs studies could include directing half of the participants to focus on specific areas of a targets face and no directions to the other half of participants. For example, participants could focus on whether the target has any unusual markings such as moles or freckles, or a noticeable facial feature as full lips, dimpled chin, or high forehead.

We encourage researchers from multiple disciplines to consider collaborating on face-recognition studies relating to SAs. For example, researchers from disciplines such as psychology, criminology, computer science, and graphic design could combine their skills to create SAs. Because there are so many venues for SAs (TV, online newspapers, social media, cellphone alerts, etc.), it could be beneficial to develop collaborative multidisciplinary programs to create SAs for different media outlets.

SA research has just begun to appear in journals, and with the population of the elderly increasing exponentially, even more research on how to help the public better recognize older adult faces from Silver Alerts is necessary. With the number of older adults over the age of 65 and older increasing at a high rate, further research on SAs is imperative. It is also important to note that Black people are at particularly high risk of Alzheimer's disease. Barnes et al. (2005) estimated that Black people are about twice as likely as White people to develop AD, although, once diagnosed, they may experience slower cognitive decline (Alzheimer's disease facts and figures, 2020). This pattern highlights the need for research on recognition of elderly Black individuals. In searching for examples of SA for a Black couple we were surprised to find how few alerts there were for missing Black couples. Research should be conducted to explore whether alerts are less likely to be issued for Black people than for other groups, especially in light of the risk of AD among Black people. The present study provides an initial step in extending the limited literature to recognition of an elderly Black couple.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s12144-021-02531-8.

Data Availability Data is Available at: https://osf.io/e3hwd/?view_only=a5184772978b4f1bb37cbc82715372bf

Declarations

Conflict of Interest We have no conflict of Interest to disclose.

Ethics Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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