The effect of weight loss/gain on the recognition of a long-term missing person

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Face recognition studies in psychology have contributed to understanding the effectiveness of presenting photos to the public in missing person alerts. Research on AMBER alerts found higher recognition for a missing child if the photo seen in the alert matched the condition the child was seen in public (e.g., a dirty, bruised, and sad child in an AMBER alert, but later appearing clean, healthy, and happy). Silver Alerts (SA) with missing older adults have also been studied, and it found that participants who were exposed to a brief educational video on the importance of SAs better recognised the missing person. To date, no research studies have addressed a scenario of a long-term missing person who went missing being either morbidly obese or normal weight and 10 years later having lost or gained over 130 lbs. This scenario is quite possible with weight loss surgery procedures on the rise worldwide. We conducted a between-subjects design where participants were randomly undergraduate participants into one of two missing person alerts. In one alert, the female is morbidly obese, with the other alert showing her at the thin-normal weight. In the recognition phase, participants were randomly assigned to either the target and foils being either obese or normal weight. We predicted that recognition would be significantly higher when participants viewed the target as the same weight as in the missing person alert. Our results supported our hypothesis.

Keywords: alert; cognition; face recognition; missing persons; weight change

Face recognition research has included areas in psychology from visual perception (e.g., Devue & Barsics, 2016); forensic psychology (e.g., Lee & Wilkinson, 2016; Royer et al., 2015); neuroscience (e.g., Wang et al., 2019), and metacognition (Ji & Woodward, 2021). Research on face recognition is helpful in locating criminals by local law enforcement (Anwarul & Dahiya, 2020), including the Federal Bureau of Investigation (FBI) (Lynch, 2020). The FBI and local law enforcement agencies (Genzel, 2021), as well as the public, both locally and nationally (Green et al., 2020), are often asked to be on the lookout for perpetrators who have abducted children, as in the case of AMBER alerts (Balcon, 2021; Fanarraga, 2020). Missing vulnerable older adults, such as those with dementia, Alzheimer's Disease, or any mental or physical disabilities, as in the case of Silver Alerts (SA), are those older adults thought to be in immediate, imminent danger. Alerts may occur in the media via emergency broadcasts on television, radio, and electronic billboards. With the advent of cell phones, most people over the age of 12 years of age can choose to have alerts sent to their cell phones in case of a missing person or a dangerous person of interest. For example, according to a recent article on the internet by CNN journalists (Chowdhury et al., Oct 27, 2023, para. 1), a 40-year-old male stormed into a bowling alley and restaurant, leaving 18 dead and 13 injured in Lewiston, Maine. Alerts of the man's face (due to surveillance videos) and cell phone photos were broadcast nationally. The residents lived in fear, hiding in their homes for two days before officers found him dead in a former place of employment. These types of shootings are happening at unprecedented rates both in the United States as well as in other countries, which has resulted in researchers collaborating from multiple disciplines, such as psychologists, criminologists, and computer science researchers.

Numerous studies are cited in research databases on the most effective way to find a missing person or a person of interest in the case of a law offender. For example, on November 16, 2023, on Google Scholar, there were 3,610,000 results in the search on face recognition for missing people. Two specific areas of face recognition research for vulnerable individuals include recognizing children in AMBER alerts and SA for adults over age 65 or who are thought to be in imminent danger. We will discuss a few published articles on each of these types of alerts. In our study, we explored the face recognition of a long-term missing woman at ages 29 (the age she was reported missing) and 39 (her current age).

AMBER alerts

In a study by Gier, Kreiner, and Hudnell (2009) entitled "Memory of Children's Faces by Adults: Appearance Does Matter," the researchers randomly assigned participants to one of four conditions. One photo of the missing children was like a school-type photo with a positive affect, referred to as the clean condition. A second photo of the child for the AMBER alert showed the children's faces dirtied with negative affect, followed by a recognition phase. In the recognition phase, participants saw photos of the missing children (two boys and two girls) either clean/dirty with positive or negative effects. However, the photos in the recognition phase of the study were different photos from the photos shown in the study phase of the study. The results of their study showed that "Accuracy and confidence were higher when the face at recognition was the same type as in the study phase" (Gier et al., 2009, p. 972). A follow-up study added four-time delay conditions when the study was replicated: 10-minute intervals (10-MI), 3, 6, or 12 weeks. Accuracy and confidence decreased over time, and the researchers found a significant interaction between face-at-study and face-at-recognition. Gier and Kreiner (2012) conducted another mock AMBER alert study where the AMBER alert was an episode from Criminal Minds used in the study to place a Mock AMBER alert in place of a commercial. Participants watched the video thinking they were rating how true-to-life the show was, believing the AMBER alert was real. Later in the study, participants were asked to pick out the four missing children in the alert. Their results showed that recognition accuracy and confidence were significantly lower when the faces differed in appearance (e.g., clean face in the alert, dirty face in recognition versus clean face in the alert, and another clean face in the recognition phase). They concluded that AMBER Alerts may be more effective if accompanied by more than one type of photograph of a missing child, particularly if a photograph is shown in which the child does not appear well-groomed and happy.

Another AMBER alert study was conducted in 2009 by Lampinen et al. (2009), where they conducted a missing children's study using ecological research conducted by conducting the study in an environment where missing children's posters are typically displayed, a local supermarket. Lampinen et al. (2009) study placed eight posters of missing children on bulletin boards in a local supermarket. The participants of the study were customers leaving the supermarket. They were approached by the researchers who asked if they would mind participating in a research study by answering some survey questions first, including the participant's demographic information, then asking participants to "indicate how long they spent looking at the pictures of missing children in the store if they formed a

specific intention to look for these missing children, and how important they believe the problem of missing children to be" (p. 410). Their results showed that participants felt AMBER alerts were important, but they did not look at the photos on the bulletin board for reasons such as being in a hurry or being preoccupied with their shopping lists. The researchers found, "More than 70% of customers indicated that they did not look at the posters at all, and more than 20% reported that they only looked briefly at the posters" (Lampinen et al., 2009, p. 413). These results are disheartening for anyone who has had a missing person in their lives, as it is hard to understand why shoppers would or could not stop for a few minutes to view the photos of the missing children from their community (these were real missing children).

Silver Alerts

Studies on face recognition of older adults with dementia, Alzheimer's Disease, or any physical or psychological conditions that could potentially cause harm to the older adult are few compared to other populations. We will briefly discuss three SA studies with interesting findings. First, it must be noted that the number of older adults worldwide has grown exponentially due to Baby Boomers whose ages range from the late 60s into their 80s. After World War 11, between 1946 and 1964, the number of newborns increased worldwide. They are commonly referred to as the post-war baby boom generation. According to the United States Census Bureau (2019), 'an estimated 73 million, this generation is the second-largest age group after their children, the millennials, born from 1982 to 2000' (para. 3). Additionally, European Baby Boomers have one of the highest proportions of older people in the world with 20.9% of its population being over 65 years of age in 2020, according to Eurostat (2020). "The EU-27 will increase significantly, from 90.5 million at the start of 2019 to 129.8 million by 2050. During this period, the number of people in the EU-27 aged 75-84 years is projected to expand by 56.1 %, while the number aged 65-74 years is projected to increase by 16.6 %" (Mambretti & Andreoni (2021). Note: "In 2022, the EU countries were Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden (EU-27)" (Kossioni, 2023, p. 304).

Since the number of older adults will be increasing at an exponential rate until 2050, this means the number of older adults with dementia and/or physical disabilities will contribute to the increasing number of older adults who will be reported missing either on their own accord or due to dementia where wandering away from their homes often leading to tragic endings. With the advent of SA (many states and countries refer to missing older adults by other names), older adults who are reported missing have a better chance of being found within a few hours of the alert (McDonald, 2023). The term Silver Alert (SA) will be used for the purpose of our paper, meaning an older adult (usually 60 or older) who is missing and is believed to be in imminent harm. Before SA, families had to rely on posters spread throughout the community and maybe a missing person alert on the evening news. The first published article using SA and face recognition was published in 2016 by Gier, Kreiner, and Lampinen. In their study, they created four videos of an older female (in her 80s) at a playground wandering around aimlessly with children playing on the playground with adult family members. In one condition, the target wore a nightgown; in the other, she wore casual clothing (a long-sleeved blouse and pants). There were two control conditions where one group of participants viewed the video without the target woman but was replaced by a foil target, and the second control condition did not have an older adult in the video. The researchers had predicted recognition would be higher for the condition where the target was wandering around in her nightgown, as one may assume would draw attention to the female; however, recognition was higher for the woman dressed in casual clothing. The researchers did not find any age, race, or gender effects. These results may not appear alarming; however, considering there were 330 participants and only 3% of the participants in the condition with the older adult in her nightgown wandering around aimlessly, obviously showing signs of dementia such as Alzheimer's, suggests that more people of all ages (the mean age was 21.34 years of age) need more exposure and training on what to do in a situation such as in the study. This was the first study that prompted several other SA studies.

In another SA study by Gier and Kreiner (2019), the researchers empirically tested whether viewing an educational video on the importance of SA before viewing the SA in the study would increase recognition of the target in the recognition phase of the study. The researchers also examined associations of target recognition with individual difference variables, including age, gender, ethnicity, Attitudes Towards Older People (ATOP), empathy, conscientiousness, and contact and experience with older adults. The results showed an advantage of the priming condition compared to the no-priming

condition for correctly identifying the missing woman. Additionally, females correctly identified the missing woman more than males (Own-Gender Difference), and Caucasian participants correctly identified the missing woman more than African American participants (Own-Race Difference). Lastly, participants who reported more experience with older adults were more likely to recognise the missing woman. The results suggest that presenting a short informational segment before showing an SA on television, stressing the alert's importance may increase the effectiveness of the alert. Further research was suggested by the researchers on how to investigate better how individual difference variables relate to the recognition of missing senior citizens. AMBER and Silver alerts (Neubauer, 2019) focus on specific populations, either the young or the older population, as they are considered two of the most vulnerable populations seen in missing people alerts, other than criminals who may be of any age; therefore, we decided to conduct a study on a middle-aged missing female presented in the missing alert as a long-term missing person.

In the present research, we explore whether face recognition differences and scores on the EAT-26, FPR, and COOL scales are directly related to accurately identifying the target female in a missing persons alert. Specifically, we expect those participants who score high on the COOL scale and lower scores on the EAT-26 and FPR scales to score higher in accuracy and lower in false alarm rates than those scoring low scores on the COOL scale and high on the EAT-26 and FPR scales. Additionally, we predicted Own-Gender Differences (OGD), with females accurately recognizing the missing woman more often than males, an Own-Age Difference (OAD), and (Own-Race/Ethnicity Differences) (ORD). Our paper used the term Difference over Bias (e.g., OAB, OGB, ORB). The terminology change is due to our analysis indicating differences in scores on accuracy and confidence and the psychological measurements used in the study (EAT-26, Fat Phobia scale, and COOL scale). We will briefly discuss the measurements used in our study.

Eating Attitudes Test (EAT-26)

The EAT-26 was developed by Garner et al. (1982) and has been cited in Google Scholar 7,460 times as of Nov 9, 2023. The scale was designed to determine whether a person might have an eating disorder that needs professional attention. The measurement was not designed as a diagnostic measure and can be helpful in determining whether further assessments or recommendations for counselling for eating disorders. The measurement may be taken online (https://psychology-tools.com/test/eat-26) on the psychology-tools website. Our participants took the EAT-26 in Qualtrics, an online tool for creating and distributing surveys, as the study was online. We chose the EAT-26 measure to test whether participants scoring high on the EAT-26 would score differently on recognizing a missing obese person in a missing person's alert.

Fat Phobia Revised Scale (FPR)

Obesity is one of the leading public health problems worldwide. Obese individuals are often stigmatized, and the psychosocial consequences of overweight and obesity are the subject of current research. Studies by Phul and Brownell (2001) have shown negative bias toward obese people in the workplace and school settings among professionals such as physicians, nurses, psychologists, and family members. In an article published in the American Journal of Public Health, Puhl and Heuer (2010) found that stigma and discrimination toward obese persons are pervasive and pose numerous consequences for their psychological and physical health. Additionally, numerous studies have documented harmful stereotypes of obese people regarding their perception of obese people being lazy, weak-willed, unsuccessful, and other discriminating characteristics such as lack of self-discipline and poor willpower (Robinson et al., 1993, p.457). Our study used the Fat Phobia Revised Scale (Bacon et al., 2001), the most used scale to measure fat phobia. This measure has been cited by 31,500 people on Google Scholar (Nov 9, 2023).

Compassion of Others' Lives scale (COOL)

According to Chang et al. (2014), the COOL scale showed implications that could be used within multidimensional educational fields where compassion for others is one of the most important personality traits. According to Chang et al. (2014), any profession where compassion is, or should be, a strong personality trait, such as in nursing and physicians in the medical field, all fields of psychological services and social work, as well as all levels of teaching professions (p.33). Additionally, the author stated, 'The COOL scale could help illustrate the compassionate abilities we have as humans'

(p.34). We wanted to know if those participants scoring high on the COOL scale would be more likely to recognise the missing woman from the alert.

Face-Recognition Differences (FRD)

The three face-recognition differences (FRD) commonly used in published research articles include the Own-Age Difference (OAD), Own-Gender Difference (OGD), and Own-Race Difference (ORD) (also known as Own-Age-Bias, Own Gender Bias, & Own-Race/Ethnicity Bias). We explored three face recognition differences, ORD, OGD, and OAD, commonly used in face recognition studies. In our study, we compared each Difference in relation to accuracy, false alarm rate, target confidence rating, foil confidence rating, and false alarm rates. Although our results showed no significant differences in face recognition differences, we will briefly discuss each Difference and our reasoning for including them in our study.

Own-Age- Difference (OAD) – also known as to as Own-AGE- Bias

The own-age bias has shown that participants are better able to recognise faces that are the same or similar in age than those who are in different age categories (Hills, 2012; Wright & Stroud, 2002). The own-age bias has been shown for older adults (Strickland-Hughes et al., 2020; Anastasi & Rhodes, 2005; Lamont et al., 2005; Perfect & Harris, 2003), young adults (Anastasi & Rhodes, 2006), and children (Anastasi & Rhodes, 2005; Hills & Lewis, 2011; Lindholm, 2005). Mukudi et al. (2019) found that as the number of outgroup facial features increased, the higher the scores were on OAB. The own-age bias also appears to be partially dependent on experience (Harrison & Hole, 2009). Faces that were once own-age become other-age, which indicates that a recent experience appears to moderate the bias more so than historical experience (Hills, 2012). Categorization of faces can bias both by categorizing a group as well as the individual (Rollins et al., 2020). The average effect size for this bias is r = 0.18, and Cohen's d=0.37 (Rhodes & Anastasi, 2012).

In the present study, we included the OAD; however, due to our population being undergraduate college students and our mean age of 19.6 years old, we may need more participants in different age categories to be significant.

Own-Gender Difference (OGD)- also called Own-Gender Bias or Own-Gender-Effect

The OGD has been shown to be robust across multiple research studies where females outperform males (Lewin & Herlitz, 2002; McClure, 2000), more so than the ORD and OAB (Herlitz et al., 1997; Herlitz & Yonker, 2002; Lewin et al., 2001; Wahlin et al., 1993). Some researchers have proposed a theory that women outperform males based on their verbal label ability (Herlitz et al., 1997; Herlitz & Yonker, 2002; Lewin et al., 2001; Wahlin et al., 1993), whereas other studies have reported female proficiency at recognizing other female faces (McKelvie, 1995). Researchers have offered multiple reasons for female OGB in addition to verbal label ability, such as females' exposure to the faces of other women due to reading magazines on fashion or hairstyles, which perhaps gives females an advantage over males in recognising female faces. Some studies have shown that females can even outperform males in face recognition of female faces, as well as recognizing male faces if no female photos are present (Herlitz & Lovén, 2013). We predicted in our current study that there would be an OGD with females outperforming males in the study.

Own-Age Difference (OAD)- commonly referred to as Own-Age-Bias

The earliest work on the OAB (e.g., Bäckman, 1991; Bartlett & Leslie, 1986) focused on differences in face recognition by older adults for young children and face recognition of older adults by children. They found robust results that people recognise those from their own age group (in-group) more than those in a different age group. Researchers searched for theories to explain this phenomenon, and many concluded that there is a social ageism, a bias based on chronological age, can occur toward any age group and is a credible factor for people misidentifying a person's face at any age (Fiorini et al. NP, 2023). Research has shown that young adults are better able to recognise faces from their own-age group, and older adults, people 60 years and older (Fiorini et al., 2023), not only recognise faces from their own-age group but are better overall at recognising faces due to the advantage of being exposed to faces from their childhood to their present age, and many with contact with those who are older (older adult parents, friends, & family). In a meta-analytic and theoretical review of OAB, the authors Rhodes and Anastasi (2012) reported a social-cognitive perspective on ingroup/outgroup face

recognition by Hugenberg et al. (2010) and Sporer (2001). Cassia et al. (2011) also reported that distant prior experiences may influence the OAB. Rhodes and Anastasi (2012) further stated, '...this might suggest that individuals with opportunities to develop expertise with other age faces by virtue of prior membership in such groups (e.g., older adults' prior experience as young adults) would be less likely to exhibit the OAB' (p. 148). In a current study, Pilz & Lou (2022) presented older and younger participants with photos of the same or different age photos, where two of the photographs were flanked photos, meaning different from the participant's age (either young or old). Their participants were 40 years older (64–69 years) and 43 younger adults (24–29). Interestingly, faces flanked with younger faces estimated the age of the target person as being younger, and if flanked with older faces, they were estimated older. Younger participants showed an OAD was found in younger participants when flanked with two older adult photographs; however, older adults did not show an OAD. The researchers attributed the results to older adults' many years of experience with faces of all ages versus younger adults. In our study, participants viewed the target at two different ages, 29 years of age or 39 years old. Since our target was not old (compared to someone 60+ years of age), we did not find an OAD. Own-age Bias research continues to be a popular research topic. According to Google Scholar, as of November 19, 2023, it has been searched approximately 4,870,000 times.

The current study proposed a unique question that has not been published based on searching in Google Scholar and PsycINFO (2023). What if a morbidly obese 29-year-old female, who had been missing for 10 years and, during that time, had either gained or lost 130lbs? Her missing person alert photo was of a morbidly obese person. Now imagine if this person had bariatric weight loss surgery and she lost 130 lbs. Would her family, let alone the public, be able to identify her from a 10-year-old photo when she had been morbidly obese? Similarly, what if a thin person was reported missing for 10 years and his/her missing person alert showed the person as thin but now, 10 years later, had gained 130 lbs.? Would the family and the public even consider this aspect of the person's possible appearance? Many families have age-progressed faces made to add to the original missing photo, and if a different possible weight for the person (now being morbidly obese or thin), could the family, let alone the public, be able to recognise her? Based on several AMBER alerts (Gier & Kreiner, 2009), studies showed that recognising a child is better when they are in the same state versus different. We hypothesized that the woman would be easier to identify in the recognition phase if the participants saw her at the same weight as in the alert. In our study, two missing person alerts were used: one of the missing women at 29 years of age, either obese or normal weight, and in the recognition phase, the participant would either see the woman in the same weight or a different weight. We predict participants will more often recognise the missing person when she is seen at the same weight. In addition, we predict confidence levels will be higher for a woman of the same weight than a different weight. Measurements we used included biases towards obese people using the Eating Attitudes Test (EAT-26) by Gardner et al. (1982), the Fat Phobia revised scale (Bacon et al., 2001), and the Compassion of Others Lives scale (Chang et al., 2014). Lastly, we tested for participant differences in face recognition accuracy by age, gender, and race.

METHODOLOGY

Participants

A total of 1,153 individuals accessed the study. We deleted data from individuals who completed less than 90% of the study (267) and those who reported technical difficulties, such as being unable to view photos (154), resulting in a sample size of 732. Participants ranged in age from 18 to 54 years, with a mean age of 19.62 years (*SD* = 3.86). Participants reported their race/ethnicity as follows: White 510 (6.97%), Black or African American 103 (14.1%), Asian 78 (10.7%), Hispanic or Latino 21 (2.9%), American Indian or Alaska Native 6 (0.8%), Native Hawaiian or Other Pacific Islander 3 (0.4%), Other 4(1.2%). The sample included 526 (71.9%) individuals identifying as female and 204 (27.9%) identifying as male.

Procedure

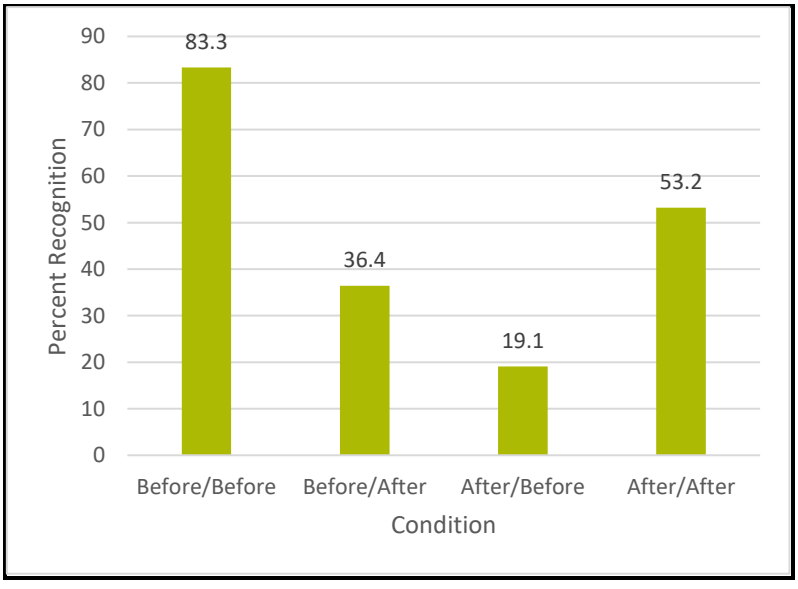
We recruited participants using Sona, a program for participants to sign up for research studies, typically from General Psychology classes. Additionally, we used Qualtrics, an online tool for creating and distributing surveys, to randomly assign participants to one of two missing person alert conditions. One condition consisted of the alert of a 29-year-old female who was morbidly obese, and the second missing alert consisted of the same female appearing thin in the alert. During the study, participants completed the following scales: The Eating Attitudes Test (EAT-26) (Garner et al., 1982) has been found to be highly reliable and valid (Garner et al., 1982; Lee et al., 2002; Mintz & O'Halloran,

2000). The EAT-26 questionnaire in general populations and patient samples has been shown to be highly reliable (e.g., Cronbach's alpha = 0.91 and Pearson r = 0.98) and valid (e.g., criterion validity = 0.90). We also used the Fat Phobia revised scale (Bacon et al., 2001). The 14-item shortened scale demonstrated excellent reliability in both the 1984 ± 1991 sample (Cronbach's a.0.87) and the 1999 sample (Cronbach's a.0.91). Lastly, we used the Compassion of Others Lives Scale (Chang et al., 2014). The COOL scale developed by Chang et al. in 2014 consisted of 26 items and two subscales: empathy (1-13 items) and alleviating suffering (14-26 items). The response format was a 7-point Likert scale (1 for strongly disagree, and 7 for strongly agree). In their study of two samples, Chang et al. found Cronbach's alpha scores of 0.872 and 0.894 (Chang et al., 2014). A demographic survey followed the surveys above. In the recognition phase of the study, participants were randomly assigned to one of two conditions: 1) Obese condition. In this condition, 10 foil photographs appeared similar to the target when she was obese, and one obese photo of the target (different than in the missing person alert). 2) Thin condition: In this condition, 10 foils appeared similar to the missing person when she was thin and a different thin photo of the target person. In both conditions, the photos appeared in random order. After each photo, the participants were asked: Was this female in the missing person alert? Their choices were "yes" or "no". They were then asked to rate their confidence in their decision using a visual analogue scale of 0–100. Following the recognition phase of the study, participants read the debriefing over the purpose of our study and then dismissed from the study (see Figure

RESULTS

Figure 1 shows the percentage of participants who correctly recognised the target in each of the four conditions corresponding to appearance in the alert (before or after the weight loss procedure) and appearance at recognition. A chi-square test of independence indicated a significant relationship between response to the target photo and condition, x^2 (N = 732) = 182.37, p < .001. We compared the recognition rates for each condition using the z-test for proportions; all four conditions differed significantly. Note that in the conditions in which appearance in the alert matched appearance at recognition (before/before or after/after), recognition rates were higher than when there was a mismatch in appearance (before/after or after/before).

Figure 1
Percent target recognition by condition



We conducted a logistic regression predicting target recognition (no = 0, yes = 1) from alert type (before/after), recognition type (before/after), and the interaction of alert and recognition. We also included as predictors the country of the participant (US or Philippines), FAT Phobia total score, EAT total score, COOL composite score, age, gender (male/female), and race/ethnicity. Due to small numbers in some race/ethnicity groups, we recoded to four groups: White (n = 510), Asian, Native

American, or Pacific Islander (n = 81), Black/African American (*n* = 103), and Hispanic (n = 21). The race/ethnicity variable was entered into the model as a set of three dummy variables. The regression model was significant, x^2 (12, *N* = 732) = 200.26, p < .001, Nagelkerke R2 = .326. As shown in Table 1, alert type, recognition type, and the alert by recognition interaction were all significant predictors of target recognition. None of the other predictor variables was a significant predictor.

Table 1

Logistic regression predicting target recognition

Predictor	*B*	*SE*	Wald	Exp(B)	*p*
Alert (Before/After)	–3.05	0.27	130.81	0.05	<.001
Recognition (Before/After)	–2.14	0.26	65.82	0.12	<.001
Alert *Recognition	3.7	0.36	108.91	40.47	<.001
Country	–0.1	0.3	0.1	0.91	.754
FAT Phobia Mean	–0.15	0.13	1.39	0.86	.238
EAT Total	0.0	0.01	0.01	1.0	.929
COOL Composite	0.03	0.07	0.18	1.03	.675
Age	0.03	0.02	1.57	1.03	.210
Gender (Male/Female)	0.11	0.21	0.28	1.12	.595
Race/Ethnicity			4.43		.221
Race (Asian/Nat. Amer./Pac Isl.)	–0.34	0.36	0.9	0.71	.342
Race (Black/African Amer.)	0.09	0.26	0.12	1.09	.732
Race (Hispanic)	–1.05	0.58	3.35	0.35	.067
Constant	1.29	0.87	2.22	3.64	.137

We conducted two-way between-subjects ANOVAs with alert type and recognition type as independent variables. The dependent variables were target confidence rating, foil confidence rating, and false alarm rates. For target confidence, there was a significant effect of alert type, $F(1,728) = 14.43$, $p < .001$, $\eta_p^2 = .02$, a significant effect of recognition type, $F(1,728) = 7.75$, $p = .006$, $h_p^2 = .01$, but no significant interaction, $F(1,728) = 0.46$, $p = .496$, $\eta_p^2 = .00$. As shown in Figure 2, target confidence was higher for before versions of the alert and for before versions of the recognition photo. For foil confidence, the effect of alert type was not significant, $F(1,728) = 0.30$, $p = .586$, $\eta_p^2 = .00$, there was a significant effect of recognition type, $F(1,728) = 5.65$, $p = .018$, $\eta_p^2 = .01$, and there was not a significant interaction, $F(1,728) = 1.08$, $p = .300$, $\eta_p^2 = .00$. As shown in Figure 3, foil confidence ratings were higher for participants who saw the before version of the recognition photo.

For false alarm rates, there was no significant effect of alert type, $F(1,728) = 2.59$, $p = .108$, $\eta_p^2 = .00$, a significant effect of recognition type, $F(1,728) = 12.35$, $p < .001$, $\eta_p^2 = .02$, and a non-significant interaction, $F(1,728) = 3.71$, $p = .054$, $\eta_p^2 = .01$. As shown in Figure 4, false alarm rates were higher for participants who saw the after version of the recognition photo.

Figure 2
Mean target confidence rating by condition

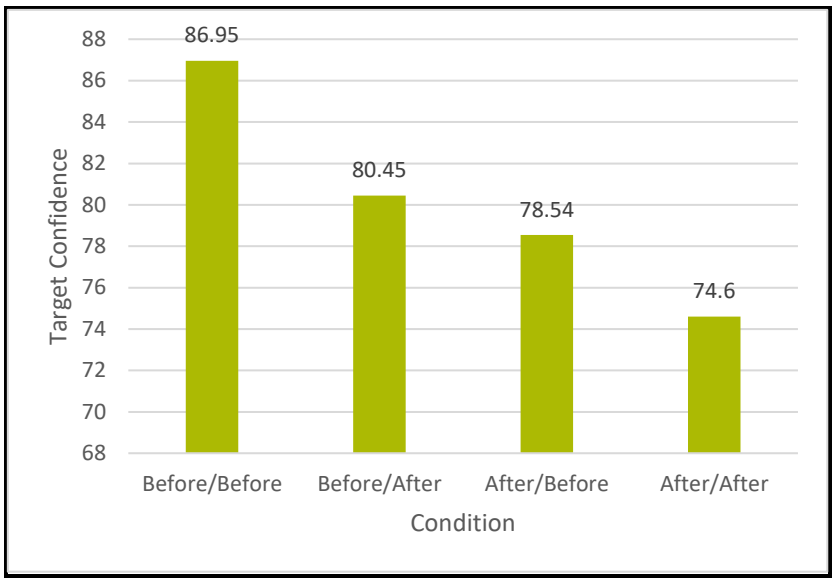


Figure 3
Mean foil confidence rating by condition

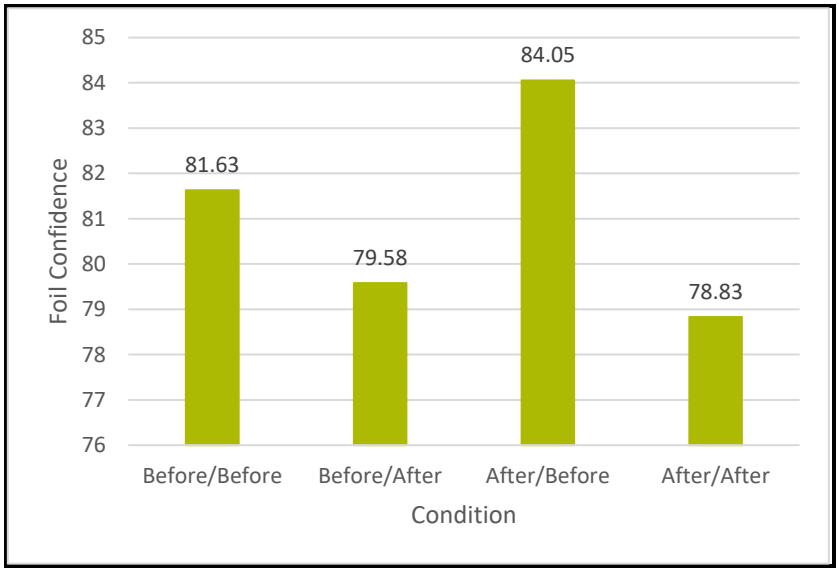


Figure 4
Mean false alarm rate by condition

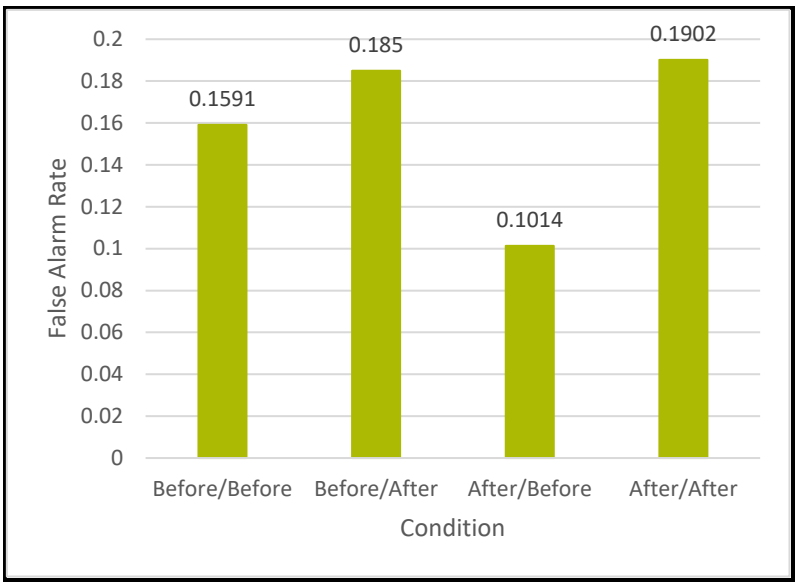


Figure 5a. Missing Person Alert before condition

Figure 5b. Missing Person Alert condition

Figure 6a. Recognition phase: Target obese

Figure 6b. Recognition phase: Target thin

Figure 7a. Examples of recognition foils for the obese condition

Figure 7b. Examples of recognition foils for the obese condition

DISCUSSION

We investigated how well adults could recognise the face of a female when they differed in appearance from photographs shown in an alert. We presented participants randomly with one of two Missing Persons Alerts (see Figure 5), where she would appear morbidly obese in one alert and thin in the other. In the recognition phase of the study, participants were again randomly assigned to one of two conditions showing the photo of the target (different from the missing persons alert) and 10 foils (females looking similar to the target). (See Figure 6 for the target and sample of foils used in the study. The four conditions used in the study are: 1) Target Photo Obese/Recognition Photo Obese, 2) Target Photo Thin/Recognition Photo Thin, 3) Target Photo Obese/Recognition Photo Thin, and 4) Alert Photo Thin/Recognition Photo Obese.

The percentage of participants correctly recognised the target in each of the four conditions corresponding to appearance in the alert (before or after the weight loss procedure) and appearance at recognition (either an obese photo or a thin photo of the target). Regarding recognition rates for each condition, all four conditions differed significantly (See Table 1 AND Figure 1). The conditions where the appearance in the alert matched appearance at recognition (before/before or after/after) were higher than the mismatched conditions (before/after or after/before). The condition before/before, meaning the photo of the target in the missing person alert, was before weight loss surgery, obese. In the recognition phase of the study, the target and foils were also obese (see Figure 1). Similarly, if the target was thin in the alert and thin in the recognition phase of the study, recognition was high but lower than the before/before condition. Between those two conditions, the before-weight loss photos in the alert and recognition had the highest recognition rate.

Our study results match Gier and Kreiner's (2009) and Gier et al. (2012) results. In both studies, participants were shown four photos of two young boys and two young girls and were told they had gone missing at a Jackson, MS zoo. One female and one male were made to look like they had been abused (dirty-looking hair, bruised and cut lips, with sad affect), and the other two were made to look like a school-type photograph (clean hair and face and showing happy affect). Foils were also made to look 'clean' or "dirty'. Gier and Kreiner's results showed higher face recognition when the children were in the 'same' condition (clean/clean) versus the 'mixed condition'(dirty/dirty). Their results suggest that individuals will be more likely to recognise a missing child if the child is similar in appearance to a photo seen in the AMBER alert. In Gier et al. (2012) study, they took photographs of children looking either clean or dirty. (ages from 4-9 years of age). A team of students made the 'targets' look either clean like a school photo or dirty by making them look bruised, with dirty hair, face, and tee-shirt. They watched a slide show of 60 photos, four being the target children (one boy and girl were made to look 'dirty' and the other two like a school photo). Therefore, they had 56 foils and four targets. Later, participants looked at photographs in a photo album and were asked to write down the number next to the photograph of the four children they had seen in the alert. The reason for creating a "dirty" condition instead of only using a school photo was due to instructions for parents on the National Center for Missing and Exploited Children's website. Parents were encouraged to have school-type photos on hand in case their child goes missing. This did not make sense to the researchers as children most likely would not look like their school photograph if they had been abducted, physically or sexually abused, having bruises and other markings indicating abuse. After Gier and Kreiner's first study, conducted and published in 2009, many changes have been made for parents and the public to know if a child is missing. The NCMEC network website now suggests that parents have multiple photos of their child/children in case the child goes missing. Similarly, in our study, people with adult children, spouses, or friends who could possibly go missing, and family and friends were still using the same photographs of the person when they went missing, recognition of the person should be lower than if they had an age-progressed photo showing the person both obese and thin For example, in our study a female was presented to participants as missing for ten years may look different, not only from aging but also due to significant weight loss or weight gain. Furthermore, there are other factors to consider, such as gender change. What if an adult female who has been missing for 10 years at 29 years old and the family is still distributing the same missing person alert? The public would be on the lookout for a 39-year-old female. However, what if the missing female is now a transgender male? Imagine you have a beautiful daughter at 29 years of age, but now, at age 39, she is a transgender male with very short hair, facial hair, and a more masculine body. Face age progression artists must consider all factors other than what the person looked like when they went missing. On a personal note, one of the authors of this study had an adult grandchild (24 years old) who is now a

transgender male. The transformation from being a female to a transgender male has spurred our interest in pursuing studies on transgender face recognition of a missing male and female.

Our study included predictor variables such as the country the participant lives in (US or Philippines) and total scores from the FAT Phobia scale (Bacon, 2001), EAT-26 score (Gardner et al. 1992), and COOL composite score (Chang et al., 2014) as well as taking into consideration the age, gender (male/female), and race/ethnicity of the participant. Table 1 shows the regression Logistic Regression Predicting Target Recognition results. Note that the only significant predictors were Alert (Before/After) <.001, Recognition (Before/After) <.001, and Alert/Recognition Interaction < .001. None of the other predictors were significant.

We predicted that our selected measurements might show a main effect or interaction. However, the measurements used in this study may differ from the questions other researchers have used and found significant findings. One study by Giannou et al. (2020) measured participants' empathy, compassion, and mindfulness regarding face recognition. The only significant predictor was mindfulness. Ostafin and Kassman (2012) defined one aim of mindfulness: '... is to limit the ability of automatically activated verbal-conceptual content derived from past experience to bias thought and behavior' (p. 1032)'. When researchers were able to decrease reliance on past memory associations, according to Ostafin and Kassman (2012), mindfulness could free people from bias from past associations. A common method for measuring these associations is the implicit association test (IAT). Research has shown that White participants who take the IAT tend to have stronger associations between White and the positive word, Good, than between Black and Good. This is indicated by quicker response times for words that represent good things when paired with White faces than with Black faces and for quicker response times for words that represent bad things when paired with Black faces (Dasgupta et al., 2000; Greenwald et al., 1998). Similarly, the own-age bias has been found using the IAT race test. The results are mixed with young people having stronger associations between young faces and the word Good than between old and Good (Dasgupta & Greenwald, 2001; Hummert et al., 2002). Several studies showed that mindfulness training in participants reduced and eliminated negative thoughts; for example, Lueke et al. (2014) used mindfulness training to reduce implicit out-group bias. The researchers used the implicit association test (IAT) to measure participants' race bias (White/Black) and to measure participants' age bias. The IAT test presents participants first with one race (e.g., White) and a positive or negative word (Good/Bad). Reaction times were faster when the race presented was White, and the word was positive, Good versus Bad. Slower reaction times were found when the faces were Black and the word positive, Good. There were quicker responses for Black faces when paired with words that represent bad things. After mindfulness training, the participants took the IAT race and age bias test again, and the results showed a reduction in race and age bias.

In the current study, most participants were young, female, and White university students. Based on past studies, we predicted race and age bias; however, there were no differences between age, gender, or race. Most of our participants were female, White students, and the target female in the study was a White female, with one photo of the target at 29 years old and the other photo of her at 39 years old. Perhaps our results did not show a race difference based on the large number of White participants and the equal male-to-female ratio. The study was conducted mainly at a university where the total number of undergraduates is approximately 22,986 students, with 17,089 undergraduates. The student population for freshmen for the 2023–2024 academic year was 3,700, with an equal percentage of the overall population being 50% male and 50% female. The university has 16,336 White students and 3,955 Black students (data on the university website). A large population of White students at the university where the study was conducted could explain why no race effect was found; furthermore, gender (male/female) being equal could explain why we did not find a gender effect. The mean age for students was approximately 20-21 (32.33% of the campus population). Past studies on reducing biases include close contact with those of different ages, gender, and races. Based on the university statistics, the composition of the university may explain why no differences in age, gender, or race/ethnicity were found. Rhodes and Anastasi (2012) found that participants closer to a missing person's age, whether from a crime scene or a missing person alert, had a higher recognition rate than when the age was significantly different. The researchers gave the example of a missing child and an older adult who may have encountered the victim, or an older adult in a missing person's alert seen by a teenager may not be as accurate compared to someone closer to the victim's age, or who have contact with people of the same age (age effect). Other face recognition studies did not show age, gender (male/female), or race/ethnicity differences. For example, Lueke et al. (2014) were interested in the effect of mindfulness training (using undergraduates as participants) to reduce face recognition biases. Using the Brief mindfulness meditation reduced implicit race and age bias. Specifically, listening to a 10-min

audiotape that focused on the individual and made them more aware of their sensations and thoughts in a nonjudgmental way caused them to show less implicit bias against Blacks and old people on the race and age IATs than individuals who listened to a 10-minute audiotape describing historical events and geographical landmarks.

When measuring alert type and recognition type as independent variables, we used a two-way between-subjects ANOVAs. Our dependent variables were target confidence rating, foil confidence rating, and false alarm rates. We found significant effects of alert type and recognition type but no significant interaction. As seen in Figure 2, target confidence was higher for before versions of the alert and for before versions of the recognition photo. When we looked at foil confidence, we did not have significant findings; however, there was a significant effect of recognition but no significant interaction. An interesting finding was that foil confidence ratings were higher for participants who saw the before weight loss version of the recognition photo. Although some of these results may not be significant, the results are still important. Our undergraduate participants scored higher in recognition for the 29-year-old missing target than the 39-year-old target as she is today. The mean age for our participants was 19.62 years, with an SD = 3.86 years. Participants ranged in age from 18 to 54 years. Adding the SD to the mean, the age is 23.48 years on the higher age, which is only a difference of 5.52 years. In other words, the target at 29 was closer in age to the target at age 29 than when the target was 39 years old.

CONCLUSION

In summary, the main purpose of our study was to determine if the age of the target in a missing person alert, as well as the age of the target in the recognition phase, would differ based on the condition the participant was assigned. The results clearly support Gier and Kreiner's studies (2009; 2012), where the researchers presented a similar scenario showing participants of children who either appeared clean or dirty in the study phase and then again, the target child in the recognition phase appearing either clean or dirty. In both the current study and Gier and Kreiner's studies, participants are better at recognizing faces when both photos of the target are similar in appearance (e.g., the current study looked at weight differences between obese versus thin). The current study on face recognition of a long-term missing person who had weight loss surgery is unique as no studies were found in an in-depth literature review.

Limitations

Our study had several limitations that need to be mentioned. First, the study was conducted online using Qualtrics, an online survey program where researchers can conduct experimental studies. The disadvantages include being unable to proctor the experiment, such as participants taking a photo of the missing person alert to enable accurate recognition of the target later in the study. Based on the results of our study, we do not believe this happened based on low accuracy scores. Secondly, perhaps the survey measurements in the study, along with the missing person alert and recognition phase of the study. The surveys in the study included three measurements on identifying eating disorders and fatphobia. These were used as an interest of the study and to allow time to pass fruitfully by responding to survey questions, which we used as a distractor task and predictor variables. Thirdly, although we had many participants in the study, 434 were eliminated for not completing at least 90% of the study, leaving our total at 732 out of 1,153 participants who signed up. We may have had more significant findings, such as the differences between age, gender, and race. On the other hand, online studies at a large institution can be completed within a month of the study being posted online. We used Sona, a research program where students sign up to participate in research studies for their introduction to psychology classes. Another limitation is the age of the participants. It is not unusual to have younger undergraduate students taking General Psychology as this is a core course for psychology and other majors. However, the large influx of participants averaging 19 years can be hard to find age differences. In the case of face recognition and the age of the participants, it would be nice to purposefully recruit different ages of interest from the university or community. For example, the target was 29 when she went missing; therefore, 30 or more participants ranging in age from 28 to 31 may have given us more interesting results. Additionally, participants around the age of the target's parents would have been interested in testing their recognition abilities. Perhaps recruiting parents with children ages 28 to 31 would add a new dimension to our study.

Future directions

Future research on long-term missing people should address some of the suggestions mentioned earlier in the paper, such as exploring more effective ways of increasing face recognition of a long-term missing person. In the age of social media and cell phones, there are no reasons for not having current photos at your fingertips. Based on this premise, studies including missing person alerts on cell phones would help us better understand how well a participant reacts if, within the study, the participant crosses paths with the "missing' person". As early as 2009, research on missing children using AMBER alerts have been published. Moore (2009) reported that several countries and cities have programs to disseminate important information from a missing person alert. One reason her results are important regarding the AMBER alert program is due to the data showing that if a stranger abducts a child, the chance of finding the child alive happens within the first three hours after he/she has been abducted. Due to the urgency to find the missing child as soon as possible, Alerts can be sent by text messages to cell phones and other wireless devices. AT&T Mobility, Sprint Nextel, Verizon Wireless, and T-Mobile are wireless service providers participating in the Amber Alert network; subscribers can sign up for free text messages. Searching Google for missing children and cell phones, 60,700,000 results were found. Although there is free access to missing people alerts such as AMBER or Silver alerts, or in Europe, Missing Kids and Missing People, no studies were found on training people who are not techno-savvy in case of seeing a person from a missing person's alert. By the time children are in middle school, the pressure from kids can be intense, and parents worry that their child will feel isolated if other kids have phones and they don't. According to Common Sense Media, 42 percent of children have a phone by age 10. By age 12, it is 71 percent. By 14, it is 91 percent. Our question is, do children with a cell phone know how to contact law enforcement if they should see someone from a missing person alert on their phone? This could be an interesting research study where half of the participants have an instructional class on responding if they see a missing person or witness an abduction. The other half will have a class on a different topic. At what age can a child follow the directions in contacting law enforcement? A mock missing person alert where participants would encounter the person from the alert (e.g., perhaps on school property so the researchers can ensure the child is always safe). A family night on Common Sense Media could also include parents for younger children. If we start training people at a young age how to report a missing person and what proper information the child would need to report the sighting of a missing person, it could possibly save lives. With the popularity of face-age progression for finding long-term missing people, one must think of multiple variables of what the person could look like other than the traditional comparison of family members and bone structure. When losing significant weight, for instance, the face will appear differently to those who knew the missing person and strangers. Weight is a variable that should be explored more in face recognition for long-term missing people. Additionally, the person's gender should be explored when a face-age progression artist creates a photo of someone missing for a decade or more. What if your daughter goes missing for 10 years, and between the last time you saw her, she is now a transgender male? No one prepares parents for this possibility, but thinking outside the box may help find your granddaughter, who may now be your grandson. According to Herman et al. (2022), the population of transgender and gender-diverse (TGD) are among the fastest-growing populations. As of June 2022, an 'estimated 1.6 million individuals in the U.S. alone identify as transgender or gender diverse, or approximately 0.5% of the adult population and 1.4% of youth aged 13–17' (Herman et al., 2022, para. 2). Additionally, the rate of violence against this population is on the rise. 'In 2019, the American Medical Association characterized anti-trans violence as an epidemic, and, of the 1.3 million adults who identify as transgender, 38.5% (515,200) are transgender women, 35.9% (480,000) are transgender men, and 25.6% (341,800) reported they are gender non-conforming (Herman et al., 2022, p.1). Transgender or gender-diverse populations are the subject of hate crimes and violence. According to The Human Rights Campaign, in 2023, 'at least 26 transgender and gender non-conforming people were tragically and inhumanely taken through violent means, including through gun and interpersonal violence in 2023'(HRC, No Author, 2023, para 1). We were surprised that research has not yet been published on before/after transgender hormone treatment. As this is one of the fastest-growing populations, research studies in this area could be valuable for face recognition studies.

With the advent of new scales and measurements from the emergence and popularity of Positive Psychology and with the number of students interested in Positive Psychology, this could be an exciting area for face recognition research. One suggestion is to have half of the participants in a face-recognition study who have taken or are currently taking Positive Psychology and the remaining half who have not taken the class. Randomly assign the participants to one of three conditions: 1) Missing person alert with the target in the recognition phase, 2) Missing person alert with the target present in the recognition phase, 3) Missing person alert with the target in the recognition phase where the target's photo is a transgender male or female.

Researchers in multiple disciplines are addressing 3D sensors, which will contribute to more accurate face recognition. The authors (Adjabi et al., 2020) used the following paragraph in their article's conclusion, which may interest those conducting face-recognition studies and technology. The title of their paper is: *Past, Present, and Future of Face Recognition: A Review*. The following was taken from the conclusion, and as we are not a 3D technologist, we are quoting what the experts concluded about 3D facial recognition.

> *The attention of researchers is increasingly attracted by 3D facial recognition. The recent development of 3D sensors reveals a new direction for facial recognition that could overcome the main limitations of 2D technologies, e.g., changes in physical appearance, aging factor, pose, changes in light intensity, and, more generally, facial expressions, missing data, cosmetics, and occlusions. The geometric information provided by 3D facial data could significantly improve the accuracy of facial recognition in the presence of adverse acquisition conditions. However, the lack of a 3D facial recognition database hinders the exploitation of methods based on deep learning. Also, interpretation of the 3D facial expression, identification of variations in age, and transfer learning are open challenges still in their beginning and require further research* (Adjabi et al., 2020, no page number).

Future studies on face recognition of missing people will, if not already, incorporate the above technology to enhance the effectiveness of recognising faces under a multitude of current issues in face recognition (such as age, gender, and race effects). We are excited to learn more about research in this area to help bring the missing home.

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