Social categorization and individuation in the own-age bias

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Abstract

Young adults recognise other young adult faces more accurately than older adult faces, an effect termed the own-age bias (OAB). The Categorisation-Individuation Model (CIM) proposes that recognition memory biases like the OAB occur as unfamiliar faces are initially quickly categorised. In-group faces are seen as socially relevant which motivates the processing of individuating facial features. Out-group faces are processed more superficially with attention to category specific information which hinders subsequent recognition. To examine the roles of categorisation and individuation in the context of the OAB, participants completed a face recognition task and a speeded age categorisation task including young and older adult faces. In the recognition task, half of the participants were given instructions aimed to encourage individuation of other-age faces. An OAB emerged that was not influenced by individuation instructions, but the magnitude of the OAB was correlated with performance in the categorisation task. The larger the categorisation advantage for older adult over young adult faces, the larger the OAB. These results support the premise that social categorisation processes can affect the subsequent recognition of own- and other-age faces, but do not provide evidence for the effectiveness of individuation instructions in reducing the OAB.

Keywords: Face perception; Own-Age Bias; Social categorisation; Individuation

Social Categorisation and Individuation in the Own-Age Bias

The information provided on a face allows us to recognise the people that we encounter, but can we always trust our ability to remember this information accurately? Previous research suggests not. We are reliably worse at recognising other-race than own-race faces (own-race bias; see Meissner & Brigham, 2001; Sporer, 2001 for reviews). Similarly, we are worse at recognising faces of other-age groups, compared to our own-age group, an effect termed the own-age bias (OAB). This OAB has been reported across many studies using participants and stimuli of different ages (e.g., young adult participants - Anastasi & Rhodes, 2006; Harrison & Hole, 2009; He, Ebner, & Johnson, 2011; Wallis, Lipp, & Vanman, 2012; and older adult participants - Anastasi & Rhodes, 2005; Perfect & Harris, 2003; Wiese, Komes, & Schweinberger, 2012). A meta-analysis by Rhodes and Anastasi (2012), found that both young and older adults show the OAB, although it is smaller in older adults.

Despite strong evidence for the OAB, it remains unclear what exactly drives the effect. Many studies investigating the mechanism/s underlying the OAB have focused on the role of exposure and perceptual expertise. As individuals tend to have greater contact with members of their own age group, it is proposed that this experience increases sensitivity to processing identity relevant features in own-age faces resulting in better recognition (Tanaka & Pierce, 2009). In support of this account, He et al. (2011), demonstrated that self-reported contact with own- and other-age faces predicted the magnitude of the OAB in a sample comprising both young adult and older adult participants viewing young and older adult faces. Furthermore, Harrison and Hole (2009), found the OAB for young adult relative to children's faces was absent in a sample of trainee teachers who reported high contact with children.

The Categorisation-Individuation Model

Although some evidence supports exposure and perceptual expertise as a mediator of the OAB, social-motivational factors have also been proposed to contribute to face recognition biases. These accounts suggest that out-group faces are processed differently from in-group faces, which

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contributes to out-group recognition biases (e.g., Hugenberg, Young, Bernstein, & Sacco, 2010; Levin, 1996, 2000; Proietti, Laurence, Matthews, Zhou, & Mondloch 2018; Rhodes & Anastasi, 2012). In particular, the Categorisation-Individuation Model (CIM; Hugenberg et al., 2010) proposes that both a social categorisation component and a subsequent motivated individuation component are involved in the OAB. In this model, unfamiliar faces are first rapidly categorised. Faces deemed socially relevant (such as members of in-groups) are processed with a focus on individuating information whereas out-group faces are processed superficially with greater attention to category-relevant information, resulting in poorer subsequent recognition of out-group faces.

Earlier studies showing support for the CIM looked at race rather than age related memory biases. In support of the categorisation component of the CIM, previous studies have reported a categorisation bias in the processing of own- and other-race faces. Other-race faces tend to be categorised by their race faster than own-race faces, termed the other-race categorisation advantage (Levin, 2000; Valentine & Endo, 1992; Zhao & Bentin, 2011). The other-race categorisation advantage is suggested to be evidence of stronger category activation for other-race faces and a tendency to focus more on categorical rather than individuating features of other-race faces (Hugenberg et al., 2010; Levin, 1996, 2000). This heightened attention to category diagnostic features is argued to impede processing of identity relevant information, hindering subsequent recognition. In support of this, studies suggest that the other-race categorisation advantage is related to the own-race bias (Ge et al., 2009; Levin, 1996; Susa, Meissner, & de Heer, 2010). For example, one study found a significant correlation between faster categorisation of other-race faces and poorer recognition of these other-race faces (Susa et al., 2010).

In support of the motivated individuation component of the CIM, a number of studies have found that the own-race bias is attenuated when participants are given instructions to try to individuate other-race faces. This has been found in samples of White-European participants remembering Black and White-European faces (Hugenberg, Miller, & Claypool, 2007; Rhodes, Locke, Ewing, & Evangelista, 2009; Young, Bernstein, & Hugenberg, 2010; Young & Hugenberg, 2012). There is, however, currently no consistent evidence that individuation instructions reduce the own-race bias in White-European participants remembering White-European and Chinese faces (Tullis, Benjamin, & Liu, 2014; Wan, Crookes, Reynolds, Irons, & McKone, 2015). Other studies have also failed to find an influence of social motivation on face recognition (Crookes & Rhodes, 2017; Oates, 2014). Together, these findings suggest that motivation to individuate can reduce the own-race bias, at least under some circumstances.

Categorisation and Individuation in the OAB

The CIM was developed predominantly based on evidence from the race literature but has been proposed as a possible explanation for other out-group processing biases like the OAB (Hugenberg et al., 2010). Despite this, only a handful of studies have investigated categorisation and individuation processes in the context of the OAB. Similar to the other-race categorisation advantage, previous studies have shown an other-age categorisation advantage — faster categorisation of other-age than own-age faces (Craig & Lipp, 2018a, 2018b; Johnston, Kanazawa, Kato, & Oda, 1997; Wiese, Schweinberger, & Hansen, 2008). To date, no studies have sought to assess whether the other-age categorisation advantage and the OAB are related (as has been done for the own-race bias), but one study has attempted to manipulate the degree to which observers engaged in age categorisation to examine the influence of this manipulation on the OAB. Young adults were presented either with young and older adult faces mixed together (mixed list), or only young or only older adult faces (pure list). An OAB was observed for participants who saw the mixed list of faces, but not for participants in the pure list conditions (Bryce & Dodson, 2013). It was argued that seeing both young and older adult faces intermixed encouraged age categorisation, resulting in the OAB observed in the mixed list condition but not the pure list conditions. These results suggest that social categorisation may be involved in the OAB but due to the nature of the task, social categorisation was not measured so other processes may also have played a role.

In support of the notion that individuation processes are involved in the OAB, a recent study by Proietti et al. (2018), found that manipulating individuation using a matching task reduced the

OAB. Half of the participants saw pairs of faces in a matching task and indicated whether the two photographs were the same person or two different people, the other participants saw faces presented one at a time with no matching task. It was proposed that judging whether pairs of faces were the same person required processing of individuating information. In a subsequent recognition phase, an OAB was observed for participants who saw the faces presented one at a time, but no OAB was observed for participants who first saw the faces in the matching task. Another way to increase individuation that can be applied more easily to real world interactions is to provide individuation instructions. This manipulation has been effective in reducing or eliminating the own-race bias in some contexts (Hugenberg et al., 2007; Rhodes et al., 2009; Young et al., 2010; Young & Hugenberg, 2012), but the effectiveness of individuation instructions in reducing the OAB has not yet been assessed.

Current Study

As such, the aim of the current study was to test the effectiveness of individuation instructions in reducing the OAB. We also aimed to assess the link between social categorisation and the recognition memory bias by looking at the correlation between the other-age categorisation advantage and the OAB. Samples of predominantly young adult participants were asked to remember a set of young and older adult faces. Before they saw the faces, half of the participants were instructed to individuate the older adult faces. All participants also completed a speeded age categorisation task to investigate the relationship between social categorisation and recognition performance. After Experiment 1 was conducted, we ran a direct replication (Experiment 2) to attempt to replicate the pattern of results observed. As the methods were almost identical and the results were comparable, for brevity and to take advantage of increased power in the combined data set, we present a combined method and results section. In line with the CIM and consistent with previous findings, it was predicted that the OAB would be observed in the control group but would be attenuated for participants provided with individuation instructions. It was also predicted that the magnitude of the OAB would be positively correlated with the other-age categorisation advantage, such that as the magnitude of the OAB increases so too does the magnitude of the other-age categorisation advantage.

Method

We report all measures, manipulations, and exclusions in these experiments.

Participants

As this was the first study to investigate the influence of individuation instructions on the OAB, we targeted recruitment of young adult participants (aged 31 years or younger - based on the upper age limit of the young adult face stimuli). The OAB is most reliable and robust in this age group (Rhodes & Anastasi, 2012). A power analysis conducted using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) indicated that at least 62 participants would be required to have an 80% chance of detecting an effect the same size as the within-between Individuation instructions × Face race interaction effect reported in the original study by Hugenberg and colleagues (2007; Experiment 1a; $\eta_p^2 = .12$). As such, we aimed to recruit at least 62 young adult participants but continued testing until the end of the semester in which each experiment was conducted. We did not prevent undergraduate volunteers outside of the target age range from taking part. This recruitment strategy resulted in 78 participants (22 males, *M* = 21.68, *SD* = 5.04) in Experiment 1 and 89 participants (26 males, *M* = 21.00, *SD* = 4.06) in Experiment 2. All participants were volunteers from the university community or undergraduate students who received course credit in return for participation.

Three participants in Experiment 1 and one participant in Experiment 2 were above the age of 31. These participants were retained in analysis as their exclusion did not influence the significance or direction of the results and because one of our aims was to investigate the relationship between social categorisation and memory biases, which should not be contingent on the age of the observer. If individual differences in social categorisation biases are related to face recognition biases, including participants outside of the young adult age group should still contribute to meaningful variability in the correlational analysis. The same pattern of results also emerged including and excluding non-Caucasian participants (12 in Experiment 1 and 26 in Experiment 2) so participants were retained in analyses regardless of ethnicity.

Stimuli

Consistent with methods adopted in previous studies investigating the influence of individuation instructions on recognition biases (Hugenberg et al., 2007; Young et al. 2010; Young & Hugenberg, 2012), stimuli consisted of 80 photographs. All images were of White-European male faces retrieved from the FACES database (Ebner, Riediger, & Lindenberger, 2010) and the Productive Ageing Lab database (Minear & Park, 2004). Half of the faces were young adults aged 18 to 31, and half were older adults aged 69 to 80. All faces were presented frontally with a neutral expression and direct gaze, and without significant conspicuous features, (i.e., facial hair, glasses). Photographs were digitally edited to maintain consistency across stimulus sets. Backgrounds, clothes, necks etc., were removed so that only the head appeared. All images were converted to greyscale, and placed on a white background (377 × 567 pixels in size). The 80 faces were randomly assigned to two lists comprising 40 faces each (20 Old, 20 Young).

Procedure

After providing informed consent, participants were randomly assigned to the control or individuation instruction conditions. Participants sat in an individual cubicle in front of a 23-inch LCD monitor with a screen resolution of 1650 × 1050 pixels and a refresh rate of 60Hz. Participants were verbally instructed that they would complete a few short tasks and were asked to read the instructions provided on the screen prior to each task. The task was executed in DMDX (Forster & Forster, 2003). Participants verbally provided their sex, age, and ethnicity at the end of the experiment.

Recognition task. Participants were instructed that they would see faces presented one at a time, and were to look closely at the faces to recognise them later. Participants assigned to the individuation condition were given the following additional instructions (modified from Hugenberg et al., 2007, p. 336):

Previous research has shown that people reliably show what is known as the Own-Age Bias (OAB) when learning faces. Basically, people tend to confuse faces that belong to other age groups. For example, a young adult learner will tend to mistake one older face for another. Now that you know this, we would like you to try especially hard when learning faces in this task that happen to be of a different age. Do your best to try to pay close attention to what differentiates one particular face from another face of the same age, especially when they are of a different age than you in order to try to avoid this Own-Age Bias.

Instructions were presented in writing for Experiment 1 and both written and verbally in Experiment 2. After receiving the instructions, participants completed the exposure phase. On each trial, a black fixation cross was presented centrally for 500ms, followed by one of 40 faces (20 Old, 20 Young) presented for 3000ms in a randomised order. We counterbalanced the set of faces presented in the exposure phase across participants.

After completing an unrelated 5-minute filler task, participants completed the recognition phase. Participants were instructed to indicate whether each face was one they had seen before ('seen') or a new face ('not seen') by pressing the left or right shift keys. Presentation of all 80 faces, including 40 'seen', and 40 'not seen' faces, was in a randomised order. Each face was presented once, and remained on the screen until the participant responded (or for 30 seconds), after which, the next face appeared.

Categorisation task. The categorisation task always followed the recognition task so that exposure to the faces in the categorisation task would not influence performance on the recognition task. Participants were instructed to categorise each face as old or young as quickly and accurately as possible using the left and right shift keys. These instructions were presented in writing for Experiment 1 and both written and verbally in Experiment 2. On each trial, a fixation cross appeared for 500ms, followed by a face, which was presented until a response was made or for 3000ms. Response mapping was counterbalanced across participants. Each face was presented once in a randomised order, resulting in 80 trials.

Data Processing and Analysis

Recognition task. We calculated measures of sensitivity (*d'*) and response bias (c) based on participant responses for Young and Old faces using the procedures recommended by Macmillan and Creelman (1991), and as used by Hugenberg et al. (2007). *d'* and c both take into account the proportion of hits (correctly recognising the face), and false alarms (reporting that they have seen the face when they had not; see Table 1 for summary statistics for hits and false alarms). Higher *d'* indicates higher recognition accuracy. Response bias (c) indicates whether participants have a bias towards making more 'seen' or more 'not seen' responses with negative scores indicating a more liberal response criterion (more 'seen' responses) and positive scores indicating a more conservative response criterion (more 'not seen' responses). Given that Experiments 1 and 2 were almost identical and the results patterns were comparable, we combined the data from the two experiments to maximise power, but included Experiment as a factor in analysis to identify any differences between the samples. The *d'* and *c* scores as well as hit and false alarm rates were submitted to separate 2 (Experiment: 1, 2) × 2 (Instruction: control, individuation) × 2 (Target age: young, old) mixed ANOVAs.

Categorisation task. Incorrect responses and response times faster than 100ms or more than three standard deviations from a participant's mean response time were coded as invalid and removed. We computed mean age categorisation times and accuracy rates for Young and Old faces. As above, data were submitted to a 2 (Experiment, 1, 2) × 2 (Instruction: control, individuation) × 2 (Target age: young, old) mixed ANOVA. For the categorisation task, data from five participants in Experiment 1 could not be analysed. Four provided no valid responses in at least one condition meaning that no condition mean could be computed and for one further participant, 88% of their responses were missing or incorrect suggesting that they did not complete the task properly and stable condition means could not be calculated.

Relationship between recognition and categorisation. An OAB score was calculated for each participant by subtracting the Old *d*' from Young *d*'. An other-age categorisation advantage score (Cronbach's $\alpha = .70$) was also calculated by subtracting the average categorisation time for older adult faces from the average categorisation time for young adult faces. Pearson's *r* was calculated to quantify the relationship between the OAB and the other-age categorisation advantage. The analysis was first conducted for each experiment separately and then for the two samples combined to maximise power. Initial exploration of the data indicated that the OAB scores in both samples were normally distributed, but the distribution of categorisation advantage scores was very positively skewed with extreme outliers in both samples. As we initially analysed the correlation for each experiment separately and because the magnitude of the other-age categorisation advantage differed significantly between Experiments 1 and 2, we excluded participants with other-age categorisation advantage scores more than three standard deviations away from the mean of their sample. This resulted in the exclusion of three participants in Experiment 1 (with other-age categorisation advantage scores > 418ms where the other-age categorisation advantage M = 83.14ms and SD = 107.36ms) and two participants in Experiment 2 (with other-age categorisation advantage scores > 297ms where the other-age categorisation advantage M = 45.10ms and SD = 59.56ms) from the correlational analysis. The same participants who were included in the separate analyses for each experiment were those included in the combined analysis reported[1]. Data have been made available at https://osf.io/8wah4/.

Results

Frequentist Analyses

Influence of individuation instructions on recognition.

Sensitivity. As can be seen in Figure 1, participants were significantly more accurate to recognise young adult than older adult faces, $F(1, 163) = 40.05$, $p < .001$, $\eta_p^2 = .20$, but contrary to

[1] The outcome of the combined analysis was not dependent on the method used to correct for skewness or reliant on a single extreme data point. The combined analysis was also significant when conducting the analysis applying the three standard deviation cut-off based on the mean and standard deviation of the combined sample as well as when excluding the participant with the largest other-age categorisation advantage score that was not an outlier based on the three standard deviation criterion (but which may visually appear to be an outlier on the scatterplot). The relationship was also significant when retaining participants with outlying other-age categorisation advantage scores but using a non-parametric test (spearman's rho) which does not assume of normality as well as when applying a cubed-root transform to the other-age categorisation advantage scores to reduce positive skew.

prediction, individuation instructions did not moderate this memory bias, $F(1, 163) = 0.01$, $p = .917$, $\eta_p^2 < .01$. Performance did not differ across experiments as all other effects were not significant, Fs < 1.65, ps $> .201$, η_p^2s $< .01$.

Response bias. As seen in Figure 2, consistent with previous research (Rhodes & Anastasi, 2012), our predominantly young adult sample showed a significantly more conservative response bias for young adult than older adult faces, $F(1, 163) = 41.52$, $p < .001$, $\eta_p^2 = .20$. This age bias was not moderated by instructions or by experiment, all Fs $< .769$, ps $> .382$, η_p^2s $< .01$. There was, however, an unexpected Instruction × Experiment interaction, $F(1, 163) = 4.64$, $p = .033$, $\eta_p^2 = .03$. This emerged as participants in the control group had a more conservative response bias in Experiment 2 than in Experiment 1, $t(80) = 2.05$, $p = .044$, $d = 0.46$, but the response bias for participants in the instruction group did not differ between Experiments, $t(83) = 1.01$, $p = .318$, $d = 0.22$.

Hits. As can be seen in Table 1, hit rates did not differ as a function of the age of the face, the instructions provided to participants, or between experiments. All main effects and interactions were not significant, Fs < 1.91, $p > .169$, $\eta_p^2 < .02$.

False alarms. Overall, participants made more false alarms responding to older adult than young adult faces, $F(1, 163) = 75.62$, $p < .001$, $\eta_p^2 = .32$, but this effect was not moderated by individuation instructions as no other main effects or interactions were significant, Fs < 1.18, $p > .279$, $\eta_p^2 < .01$, (see Table 1).

Categorisation. There was a significant other-age categorisation advantage, $F(1, 158) = 91.17$, $p < .001$, $\eta_p^2 = .37$, but the magnitude of this effect depended on the experiment (significant Experiment × Face age interaction, $F(1, 158) = 8.03$, $p = .005$, $\eta_p^2 = .05$). This Experiment × Face age interaction emerged as the other-age categorisation advantage was significant in both experiments, ts > 5.00, ps $< .001$, d_zs $> .53$, but significantly smaller in Experiment 2, (See Figure 3). Overall, response times were also faster in Experiment 2 when both written and verbal instructions were provided, $F(1, 158) = 36.74$, $p < .001$, $\eta_p^2 = .19$.

Relationship between categorisation and recognition biases. As can be seen in Figure 4, looking at the two samples separately, there was a significant positive relationship between the magnitude of the OAB and the other-age categorisation advantage in Experiment 1, $r(68) = .26$, $p = .032$, 95% CI [.03 - .47]. This relationship was in the same direction in Experiment 2 but did not reach significance, $r(85) = .17$, $p = .115$, 95% CI [-.04 – .37]. The correlation coefficients did not differ significantly between experiments, $z = 0.58$, $p = .562$, so to maximise power we looked at the correlation with both samples included in the analysis. As predicted, there was a significant positive relationship between the OAB and the other-age categorisation advantage, $r(155) = .20$, $p = .011$, 95% CI [.05 – .35]. As the magnitude of the OAB increased, the magnitude of the other-age categorisation advantage also increased.

Supplementary Bayesian Analyses

As a non-significant result does not provide evidence for the absence of an effect, we conducted additional Bayesian analyses. Bayesian analyses produce Bayes Factors (BFs) which indicate the relative likelihood of an effect (alternative model) over the null model (BF_{10}) or the relative likelihood of the null model over the alternative model (BF_{01}) given the observed data. BFs can also be interpreted based on conventions (e.g., Jeffreys, 1961; Kass & Raftery, 1995) with BFs between 1 and 3 representing anecdotal evidence, between 3 and 20 representing positive evidence, between 20 and 150 representing strong evidence, and greater than 150 representing very strong evidence for a given model. To look at the influence of individuation instructions on recognition accuracy for older adult and young adult faces, we conducted a 2 (Instruction: control, individuation) × 2 (Target age: young, old) JSZ Bayesian mixed ANOVA with default priors. To investigate the relationship between OAB scores and other-age categorisation advantage scores we conducted a JSZ linear regression analysis with default priors. Both analyses were conducted in JASP using the data from Experiments 1 and 2 combined (JASP Team, 2017; Morey & Rouder, 2015; Rouder, Morey, Speckman, & Province, 2012).

Influence of individuation instructions on recognition accuracy. The strongest model included only the main effect of target age ($BF_{10} = 5.37 \times 10^6$) indicating very strong evidence for the OAB. Looking at evidence for or against the Target age × Instruction interaction alone by comparing the effects across matched models ($BF_{inclusion}$) indicated positive evidence for the null model over the interaction effect, (BF_{01}) = 6.06. This analysis provides positive evidence that individuation instructions did not have an influence on the magnitude of the OAB in the current study.

Relationship between recognition and categorisation biases. This analysis indicated that the presence of a relationship between recognition and categorisation was around three times more likely than the absence of a relationship in the observed data ($BF_{10} = 3.57$), providing positive evidence for the presence of a relationship between the OAB and the other-age categorisation advantage.

Discussion

The current study had two aims. First, we aimed to determine whether providing individuation instructions would attenuate the OAB. Second, we aimed to determine whether social categorisation and memory biases are related by investigating whether relatively faster categorisation of other-age than own-age faces was related to the magnitude of the OAB. Contrary to the first prediction, providing instructions to individuate older adult faces did not influence the magnitude of the OAB, but in line with the second prediction, the magnitude of the OAB was related to the magnitude of the other-age categorisation advantage. These findings suggest that social categorisation processes may be involved in the OAB to some extent, but instructing participants to try to individuate older adult faces is not an effective strategy to reduce this bias.

Social Categorisation and the OAB

Finding that participants were faster on average to categorise other-age than own-age faces, and more accurate to recognise own-age than other-age faces is consistent with previous studies reporting the other-age categorisation advantage (Craig & Lipp, 2018a, 2018b; Johnston et al., 1997; Wiese, et al., 2008) and the OAB (Anastasi & Rhodes, 2006; Rhodes & Anastasi, 2012; Wiese et al., 2012). Finding that the OAB in the current study was due to participants having a more liberal response criterion and responding with more false alarms for older adult than young adult faces is also consistent with previous research (Rhodes & Anastasi, 2012). To our knowledge, this is the first study to report a relationship between the other-age categorisation advantage and the OAB, but the link between social categorisation and recognition has been found for own- and other-race faces (e.g., Susa et al., 2010).

The relationship between the OAB and the other-age categorisation advantage observed in the current study was small to medium in size (r = .2). Based on this correlation coefficient, only a relatively small amount of variance in the OAB can be accounted for by variance in the other-age categorisation advantage. This indicates that social categorisation processes may be involved in the OAB to some extent, but there are likely to be other factors that come into play to influence the presence and magnitude of the OAB. These could include other social/motivational processes as well as perceptual expertise.

It should also be noted that the categorisation task always occurred after the recognition task. The categorisation task was not the context in which the faces were encoded. Previous studies show that the other-age categorisation advantage is observed when the age categorisation task is completed first as well as after other tasks (Craig & Lipp, 2018a, 2018b) so the other-age categorisation advantage is not contingent on prior exposure to the faces. We cannot, however, conclude that relatively poorer memory for older adult faces was caused by faster categorisation of that face. Rather, the findings indicate that people who tend to be relatively faster to categorise the age of older adult than young adult faces in a social categorisation task also tend to be relatively worse at recognising older adult than young adult faces. These results may have emerged as social categorisation processes contribute to biases in face recognition; however, the correlational nature of this study, means that a third variable may have mediated the relationship between the social categorisation and recognition biases.

One theoretically relevant third variable to consider is perceptual expertise. Perhaps those with more extensive expertise processing own-age relative to other-age faces are both more accurate to recognise own-age faces and faster to categorise other-age faces. This is an important possibility to consider given that previous research demonstrates a relationship between the extent of contact with age out-groups and the OAB (Harrison & Hole, 2009; He et al., 2011). Looking to the broader literature on perceptual expertise does not support this explanation. In a previous study of bird and dog experts, experts were faster to categorise their animal of expertise as a 'dog' or a 'bird' than the animal they did not have expertise with (Tanaka & Taylor, 1991). Based on this finding, young adult participants (who generally have more contact with and expertise processing young adult faces; He et al., 2011) should have been faster to categorise own-age than other-age faces, the opposite of what was observed in the current study.

Taken together, past research (e.g., Bryce & Dodson, 2013) and the current results provide evidence supporting a role of initial social categorisation in the OAB. These findings are consistent with the aspect of the CIM proposing that unfamiliar faces are initially categorised along social dimensions such as age, and that this initial categorisation has consequences for subsequent face recognition. Considering these results alone, however, the process/es that occur after this initial social categorisation and lead to the OAB cannot be determined.

Individuation and the OAB

The CIM proposes that after initial categorisation, socially relevant faces such as own-age faces are processed in more detail and with more attention to individuating information than other-age faces. In line with this proposal, we instructed half of our predominantly young adult sample to try to individuate older adult faces. Contrary to prediction, no influence of individuation instructions was observed. Failing to find an influence of individuation instructions in the current task may have occurred for a number of reasons. Despite using a sample size similar to (or larger than) previous experiments reporting an influence of individuation instructions on the own-race bias (Hugenberg et al., 2007; Rhodes et al., 2009; Young et al., 2010; Young & Hugenberg, 2012), it is possible that individuation instructions have a smaller influence on the OAB meaning that we were underpowered to detect this influence. This explanation is unlikely given that the supplementary Bayesian analysis provided positive evidence for the absence of an influence of individuation instructions on the OAB.

Finding no influence of individuation instructions on the OAB is inconsistent with a number of studies which have found individuation instructions to be effective in reducing race related memory biases, particularly in White-European observers recognising White-European and Black faces (Hugenberg et al., 2007; Rhodes et al., 2009; Young et al., 2010; Young & Hugenberg, 2012). This inconsistency between past findings and the current study may have occurred as the own-race bias and the OAB, although appearing the same in direction, are not driven by the same underlying mechanism/s (for a review see Wiese, Komes, & Schweinberger, 2013). The OAB may be more dependent on perceptual expertise than the own-race bias. This could influence results as individuation instructions are most effective when the observer has sufficient perceptual expertise with the out-group faces (Young & Hugenberg, 2012). It is possible that our young adult sample had insufficient perceptual expertise processing older adult faces to overcome the OAB even when instructed to do so, but the results of Proietti et al. (2018), demonstrate that facilitating individuation of older adult faces via an identity matching task was effective in reducing the OAB. This suggests that young adult participants can have sufficient perceptual expertise for an individuation manipulation to overcome the OAB (at least in some circumstances).

Taken together, findings from past research and the current study suggest that individuation instructions may only be effective under a limited set of circumstances. Perhaps there are further boundary conditions, such as motivation to avoid appearing prejudiced, that contribute to the effectiveness of individuation instructions in past research. To be effective, individuation instructions may require both a base level of perceptual expertise that allows performance to improve, but also a context where individuation instructions are sufficiently motivating. Black/White Race relations may be a particular context where perceptual expertise is sufficient and motivation to avoid appearing prejudiced is sufficiently high that individuation instructions are effective (Young & Hugenberg, 2012). Perhaps in the current study, perceptual expertise was sufficient (Proietti et al., 2018), but the motivation or ability to actually implement the instructions with these faces was lacking. The face matching exposure phase used by Proietti et al. (2018), may have forced participants to focus on configurations of facial features that facilitated subsequent individuation so motivation to avoid appearing prejudiced was less important in that task. In the current study, participants given the instruction to ‘pay attention to what differentiates one particular face from another face of the same age’ may not have been sufficiently motivated to implement this strategy or may have focused on features which seemed to distinguish one older adult face from another (e.g., big nose, small eyes) but which turned out not to be helpful for recognising the face in the subsequent recognition phase.

Future Directions

The current results are based on a predominantly young adult sample. Using a young adult sample had the benefit of increasing the chance of detecting an OAB as this memory bias is most robust in young adults (Rhodes & Anastasi, 2012); however, using a young adult sample meant that young adult faces always represented the age ‘in-group’ and older adult faces represented the age ‘out-group’. The results observed could have arisen due to properties of the stimuli unrelated to the identity or age of the faces. In previous research, the OAB and the other-age categorisation advantage have been observed using older adult and children’s faces which differ considerably in the visual properties that indicate their age (Craig & Lipp, 2018b; Johnston et al., 1997; Rhodes & Anastasi, 2012). This makes it less likely that specific properties of the stimuli used in this experiment can explain the results; however, using a cross-over design and finding the same own-age vs. other-age biases in samples of young adults (where older adults represent the other-age group) and older adults (where young adults represent the other-age group) would be one way to provide more definitive evidence against a stimulus based account. Such a study would also establish the generalisability of these effects to participants of different ages.

Given the methodological approach taken in the current study, it could also be suggested that the results reflect image recognition rather than face recognition. Using the same image of each individual in both the learning and test phases means that recognition performance could be at least partly driven by properties specific to the image, but not related to identity or age (Vokey & Read, 1992). Presenting the same image of each individual at learning and test is a methodological detail common to all previous studies that have found individuation instructions to reduce the own-race bias (Hugenberg et al., 2007; Rhodes et al. 2009; Young et al., 2010; Young & Hugenberg, 2012). As this was the first attempt to establish whether individuation instructions reduce the OAB, we chose to maintain consistency with past research to maximise our chances of detecting an effect of individuation instructions. We also digitally edited the images to remove necks, clothes, and backgrounds in order to reduce the influence of non-face relevant image properties on performance.

It is, however, worth considering the implications of using the same image at learning and test for the interpretation of results. Prior research has demonstrated that the OAB is also observed when different images of the same individual are presented in the learning and test phases (Anastasi & Rhodes, 2006; Cronin, Craig, & Lipp, 2018; Harrison & Hole, 2009) so the presence of an OAB in the current study is unlikely to be affected by this methodological decision. The effectiveness of individuation instructions has, so far, only been demonstrated when using the same image at learning and test (Hugenberg et al., 2007; Rhodes et al. 2009; Young et al., 2010; Young & Hugenberg, 2012). Our failure to find an influence of individuation instructions on the OAB is unlikely to be due to this methodological decision. A relationship between race categorisation and face recognition has been demonstrated using the same image at learning and test (Ge et al., 2009; Levin, 1996) and also when using different images of the same individual at learning and test (Susa et al., 2010). It is unlikely that the relationship between the magnitude of the OAB and the other-age categorisation advantage depends on the use of the same photographs at learning and test, but it is possible. For this to be the case, non-identity/age relevant image specific properties would have to facilitate recognition of young adult faces over older adult faces and also facilitate categorisation of

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other-age over own-age faces across a range of different identities sourced from different face databases. Considering the current results in the context of the broader literature, it is likely that results are driven by the age/identity relevant information in the faces and the consequences of this information for social perception, though this remains to be confirmed in future research.

Conclusion

In line with social-motivational accounts of face recognition biases like the OAB, the results of the current study provide empirical evidence that individual differences in social categorisation are related to individual differences in the magnitude of the OAB. At this point, the current findings do not support the effectiveness of individuation instructions as a means of reducing the OAB. Finding suggestion of an influence of early social categorisation processes on the OAB does not preclude the potential concurrent influence of other mechanisms like perceptual expertise or motivation. Both perceptual expertise and socio-cognitive factors together have been shown to contribute to the magnitude of the own-race bias (Young & Hugenberg, 2012) so it is likely that multiple factors also influence the OAB. Future research will be required to better understand when and how both perceptual expertise and socio-cognitive factors concurrently influence recognition of own- and other-age faces.

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Tables and Figures

Table 1.

Table of hit and false alarm rates as a function of the age of the faces and the instructions provided to participants in Experiments 1 and 2. Values in parentheses represent 1 standard deviation.

	Control		Individuation	
	Older Adult	Young Adults	Older Adult	Young Adult
Experiment 1				
Hit Rate	0.63 (0.14)	0.62 (0.19)	0.63 (0.19)	0.60 (0.21)
False Alarm Rate	0.38 (0.21)	0.26 (0.20)	0.33 (0.18)	0.22 (0.15)
Experiment 2				
Hit Rate	0.61 (0.23)	0.59 (0.22)	0.65 (0.14)	0.65 (0.16)
False Alarm Rate	0.32 (0.17)	0.23 (0.18)	0.33 (0.17)	0.20 (0.14)

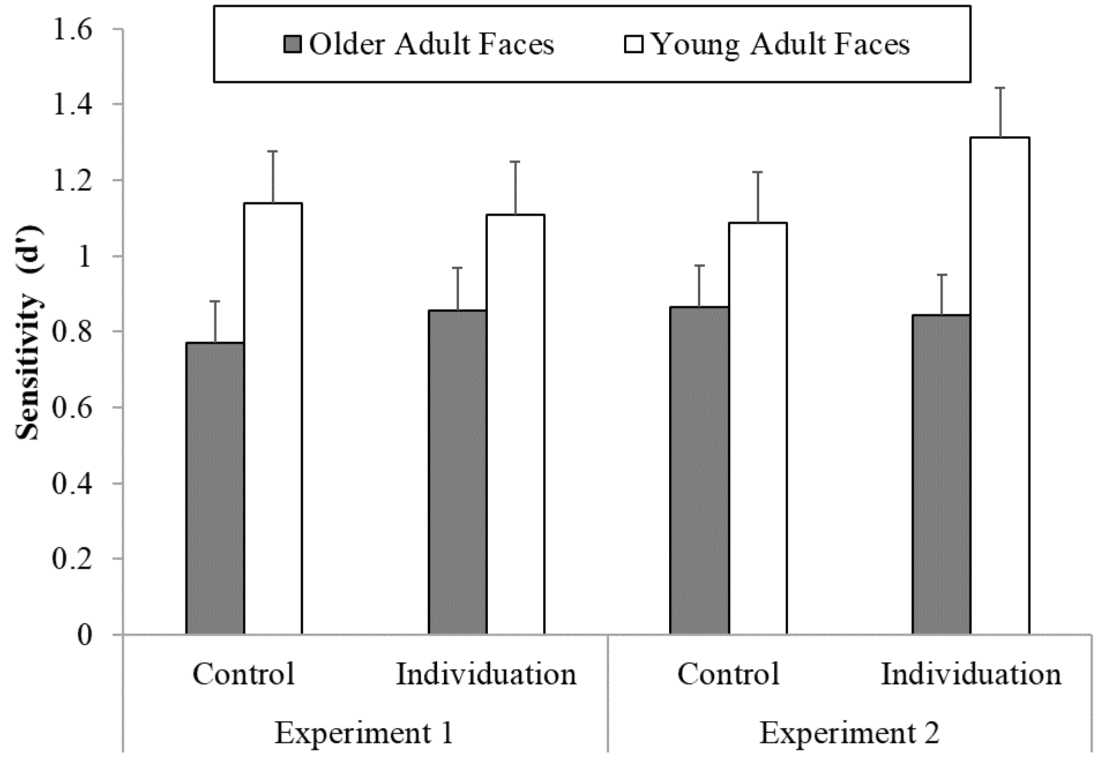

Figure 1. Recognition memory performance (*d'*) as a function of the age of the faces and the instructions provided to participants in Experiments 1 and 2. Error bars represent one SEM.

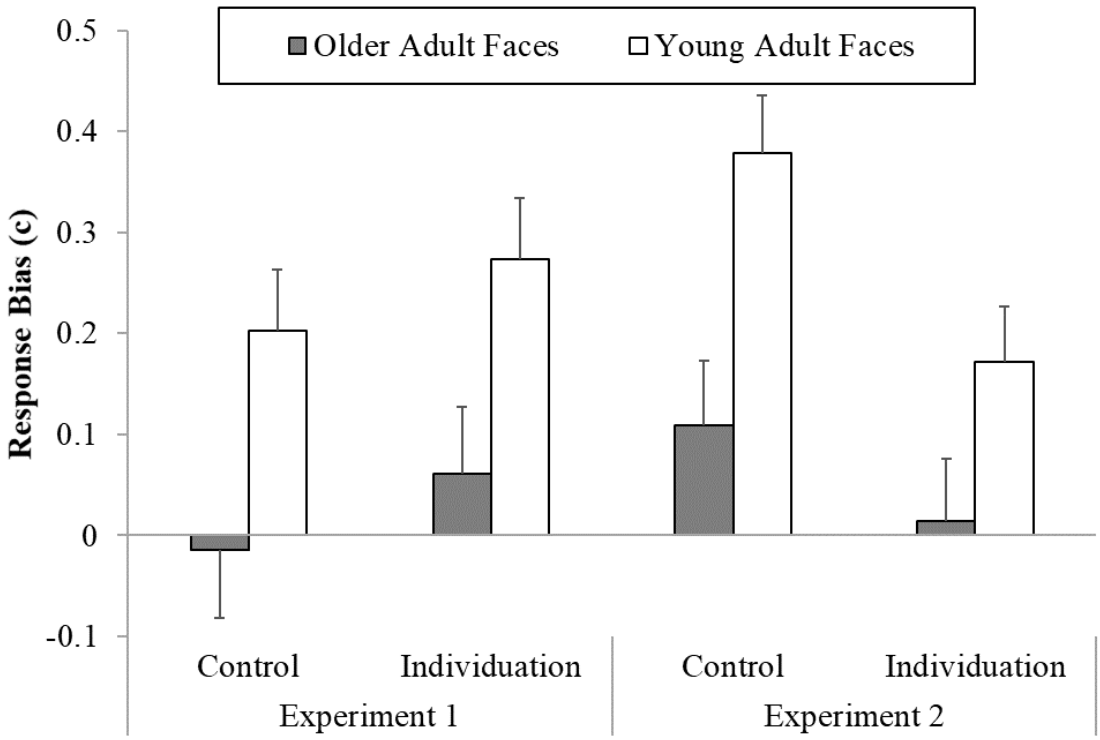

Figure 2. Response bias (*c*) as a function of the age of the faces and the instructions provided to participants in Experiments 1 and 2. Error bars represent one SEM.

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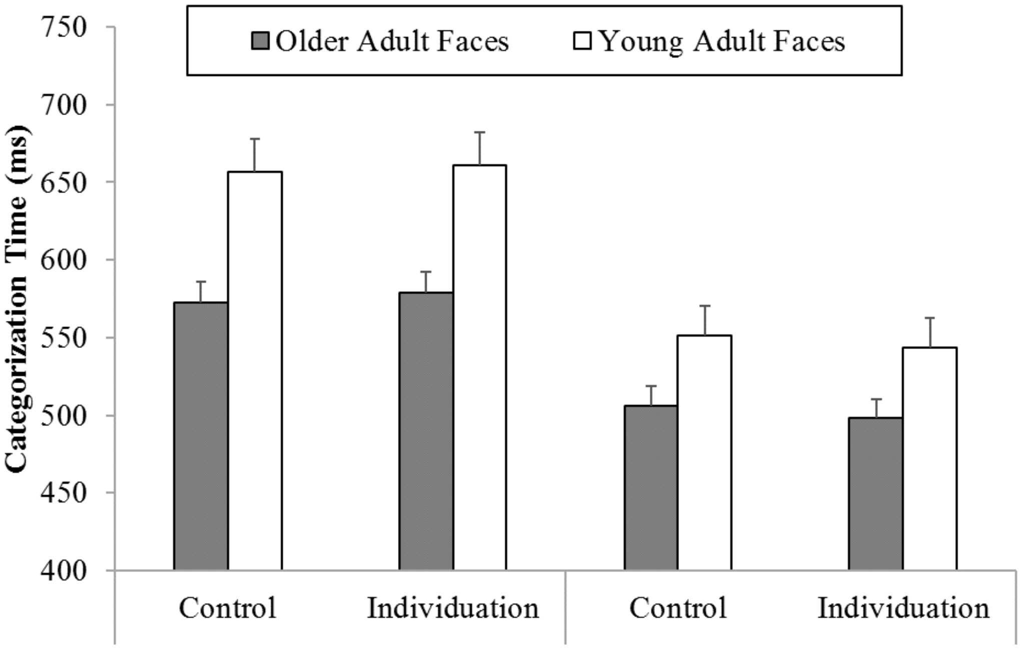

Figure 3. Age categorisation speed as a function of the age of the faces and the instructions provided to participants in Experiments 1 and 2. Error bars represent one SEM.

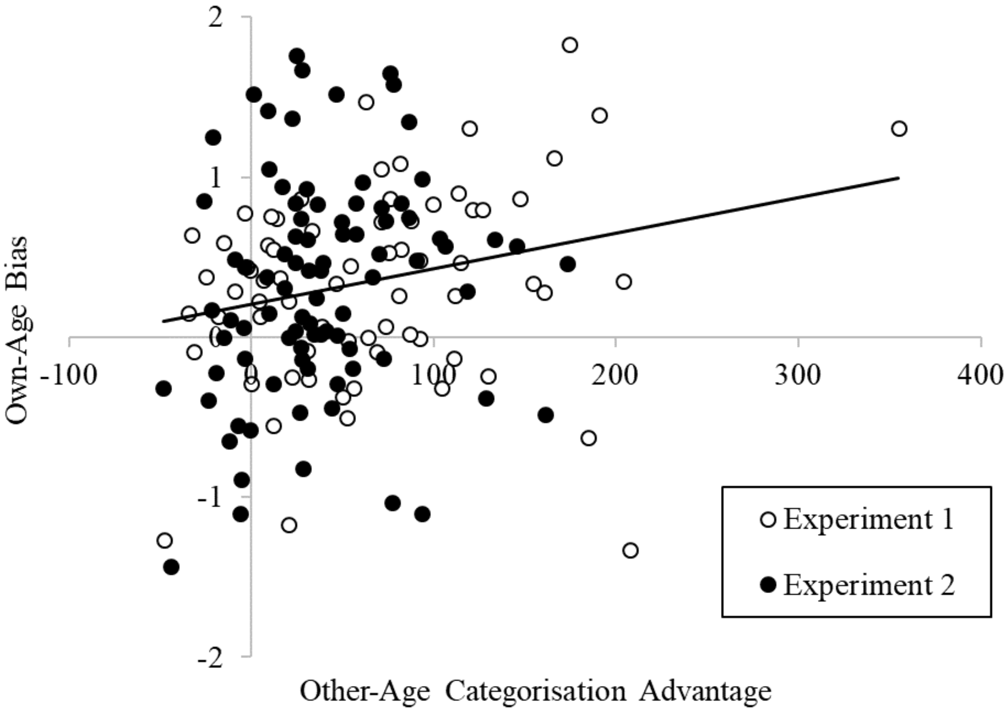

Figure 4. Scatterplot representing the relationship between the OAB and the other-age categorisation advantage for Experiment 1 (open circles) and Experiment 2 (closed circles). The trend line is the line of best fit across Experiments 1 and 2 combined.

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