Directed Forgetting of Emotionally-Valenced Faces of In-Group and Out-Group Members

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Abstract

The item-method paradigm of directed forgetting was employed when presenting photographs of happy, neutral and sad faces of in-group (White) and out-group (Asian) faces to discover whether facial emotion and group membership impacted directed forgetting. According to the affect-as-cognitive-feedback hypothesis, positive emotions facilitate cognitive tasks, while negative emotions have the opposite effect. Meanwhile, in-group faces tend to be devoted more processing resources and expertise. Taking these findings into account, it was hypothesized that the strongest directed forgetting effects would be found for happy, in-group faces, and the weakest directed forgetting effects would be present for sad, out-group faces. At study, participants viewed 36 faces, half of which were remember-cued and half were forget-cued. At test, participants were shown a mixture of old and new faces. They were asked to identify whether the face was "new" or "old", and if the face was identified as “old”, they then had to report whether it was remember-cued or forget-cued at study. No main effects of emotion or group membership were found on. Instructional cue had a marginal effect, with better memory shown for remember- than forget-cued faces. An analysis of false alarms revealed an effect of instructional cue and an interaction between emotion and group membership, offering indirect evidence for directed forgetting. Ultimately, due to very small effect sizes, no conclusive evidence was found for our hypotheses. However, we can speculate that effect of emotion on directed forgetting and facial recall accuracy is impacted by the group membership of the face, and race may be more salient than emotion when processing faces. These speculations demand further research. Findings regarding the effects of emotion and group membership on directed forgetting are discussed.

Our information processing system is constantly integrating information as we are introduced to new content and experiences, making memory updating a necessary process to ensure efficient information processing. Forgetting is one of the ways to update memory to ensure optimal cognitive functioning. Forgetting is important in enabling that irrelevant or unwanted information does not dominate the limited capacity of short-term memory, drawing attention away from relevant stimuli and inhibiting appropriate responses (Fawcett & Hulbert, 2020). Directed forgetting has emerged as one method to study forgetting and the resulting release of irrelevant information from memory to free processing resources for relevant information. The item-method and the list-method are two directed forgetting paradigms that are utilized to assess memory. In the list-method, some participants are instructed to remember or forget previously presented items, then learn a second list, whereas other participants are told to remember items from both sets. The item-method, a “remember” or “forget” cue randomly follows presented items, and participants are instructed that they should attempt to learn remember-cued items but not forget-cued items. Without any forewarning, participants are then told to try to remember all items. List and item methods typically yield a directed forgetting effect in which remember-cued items are remembered with more ease than forget-cued items (Bjork, Laberge, and Legrand, 1968). In the present study, the item-method directed forgetting is utilized to assess memory for photographs of happy, sad, and neutral Asian and Caucasian faces. In the following sections, research on directed forgetting and memory for emotionally-valenced in-group and out-group members will be reviewed. In the sections below, memory for emotionally-valenced faces will be examined, followed by a discussion of the processing of own-group versus other-group faces. Hypotheses guiding the present study are then presented.

Impact of emotionally charged items on directed forgetting

There are a number of methods researchers have used to examine our ability to control the contents of memory. In the directed forgetting paradigm (Bjork & Bjork, 1996; Anderson & Bjork, 2000), a directed forgetting effect is defined as the differences between items participants are asked to remember and those they are asked to forget. Two somewhat overlapping explanations have been given to account for the directed forgetting effect: the inhibition explanation (Bjork, 1996; 2000) and the active processing explanation (Fawcett & Taylor, 2010). Bjork (1996; 2000) proposed the inhibition explanation to explain item-method directed forgetting effects. The inhibition explanation states that until a “remember” or “forget” cue is presented after the item, maintenance rehearsal is used to keep the item in your memory. If the participant receives a remember-cued item, elaborate rehearsal of the item will begin, resulting in more extensive encoding in the long-term memory. However, if the item is followed by a “forget” cue, item processing ceases and the memory of the item decays. Rather than focusing on the mere stoppage of processing forget-cued items, the processing explanation (Fawcett & Taylor, 2010) argues that not only are more resources devoted to “remember” items, but resources are shifted from the “forget” items to the “remember” items. Thus, resulting in a stronger memory trace for remember-cued items and weakening the memory trace for forget-cued items. One consequence of such processing is that remember-cued items become more accessible at retrieval.

A number of factors have been found to influence item-method directed forgetting abilities, such as emotionally-valenced words, images, and faces (Berger, Crossman & Brandt, 2016; Brandt, Nielsen & Holmes, 2013; Hauswald, Schulz, Iordanov & Kissleral, 2010; Nowicka, Marchewka, Jednoróg, Tacikowski, & Brechmann, 2011; Corenblum, Goernert & Watier, 2020).

Studies assessing the extent of directed forgetting on emotionally-valenced words suggest that negative words or phrases are more easily recalled in comparison to neutral words or phrases. In the present study the impact of emotionally valenced faces on item-method directed forgetting will be examined. Facial emotion has been found to affect recognition and memory, with happy faces being more easily recognized than sad faces in some cases (D'Argembeau, der Linden, Comblain, & Etienne, 2003; Leppanen & Hietanen, 2004). Researchers explain this effect by speculating that processing resources are drawn to visually salient features such as smiles (Schyns, Bonnar, & Gosselin, 2002). However, some studies have reported the reverse effect, with negatively valenced faces being more easily recognized and more resistant to directed forgetting (Cooper & Langton, 2006; Fox et al., 2000). This effect is hypothesized to occur because negatively valenced faces demand more encoding resources because they signal an unsafe environment (Leppanen & Hietanen, 2004; Payne & Corrigan, 2007), or that negatively valenced features are more perceptually salient (Cooper & Langton, 2006). Recently, Corenblum et al., (2020) presented happy, sad, and neutral faces to participants, which were followed by a remember or forget cue. Results showed a directed forgetting effect for happy and neutral faces, but not for sad faces. Various studies have attempted to assess the effect of emotionally valenced images on directed forgetting, with mixed results. Some studies have indicated no differences in directed forgetting between neutral and emotionally-valenced images (Quinlan & Taylor, 2014; Taylor, Quinlan & Vullings, 2018). However, Hauswald et al., (2010), as well as Nowicka et al., (2011) found a significant effect of emotionally-valenced images in comparison to neutral stimuli on directed forgetting. Despite a few inconsistencies, the majority of studies suggest that emotionally laden stimuli may be more resistant to directed forgetting in comparison to neutral stimuli.

Complementing the diversity of findings on the directed forgetting of emotionally-valenced items is the range of explanations given to explain those findings. One explanation for the effect of emotionally-laden stimuli on memory emphasizes the role of level of arousal invoked by emotionally valenced stimuli. Researchers suggest that higher levels of arousal may limit cognitive abilities underlying directed forgetting (Gallant & Dyson, 2016; Bailey & Chapman, 2012). However, the present study utilizes Huntsinger, Isbell and Clore's (2014) affect-as-cognitive-feedback hypothesis to explain the effect of emotionally charged stimuli and emotional state on directed forgetting. According to Huntsinger et al. (2014), emotionally laden stimuli are more difficult to forget because such stimuli convey information about the status of current cognitions. Emotional state or emotionally valenced items can serve to reinforce or inhibit cognitive processes by assigning value or information onto cognitions. Positive emotions signal that current cognitions should be used to encode, process, and interpret the task at hand, while negative emotions act to inhibit current cognitions. One implication of the affect-as-cognitive-feedback hypothesis is that negatively valenced stimuli constrain directed forgetting because the negative item inhibits cognitive processes that underlie the ability to remember or forget the item at hand (Corenblum et al., 2020). According to Huntsinger et al. (2014), negative emotions or negatively emotionally-valenced items act as a "stop" signal that halts or reverses current cognitions, while positive emotions or positive emotionally-valenced items act as a "go" signal for the cognitive task at hand. One implication of these ideas is that positive remember- and forget-cued items should show more directed forgetting effects than negative remember- and forget-cued items. Corenblum et al. (2020) found this pattern of results in their study on the directed forgetting of happy, neutral and sad White faces

In-group racial bias

Race has been found to be one of the most salient social categories, with racial differences being prioritized in processing ahead of other external cues such as gender, age, and expression (Montepare & Opeyo, 2002). In-group facial bias is one consequence of giving priority to race-related cues, resulting in people recognizing and discriminating between people of their own race more easily in comparison to people that belong to a different race (Meissner & Brigham, 2001). One consequence of racial categorization is that such categories lead to the withdrawal of cognitive resources that process and encode facial features. This can lead to faulty generalizations and biases due reliance on categorical cues rather than individuating cues when processing the faces of out-group members. Moreover, these biases tend to cause people to favour their in-group, viewing their group as heterogeneous and distinctive while the out-group is perceived to “all look the same”. While this in-group bias leads to increased individuation and recognition of in-group faces, it is at the expense of accurate recognition of out-group faces. Consequently, fewer encoding resources designated to out-group faces may translate to poorer memory for out-group faces, causing more difficulty when determining whether an out-group face is remember-cued or forget-cued.

Models of in-group racial bias in face perception

Various models have been proposed to explain biases in face recognition. According to perceptual expertise models (Tüttenberg & Weise, 2019), people gain expertise with the faces that they are most frequently exposed to, allowing for enhanced facial recognition and processing efficiency. Holistic processing models (Tanaka, Kiefer & Bukach, 2004) provide another explanation for enhanced in-group facial recognition. Processing faces in a holistic fashion involves encoding faces as a whole, in comparison to a less holistic approach that focuses on categorizing people into the out-group based on a few select facial features. This model suggests that in-group facial biases in recognition are an outcome of the holistic facial processing given to in-group members versus the feature-based processing given to out-group members. Research on holistic processing has demonstrated that less contact with other-race faces results in poorer perceptual or holistic processing (Hayward, Crookes, & Rhodes, 2013; Michel, Rossion, Han, Chung, & Caldara, 2006; Tanaka et al., 2004). Valentine (1991) proposes that frequent contact with in-group members creates a multidimensional face space that contains multiple dimensions in which in-group faces can be located. Frequent contact with in-group faces results in a richly detailed multidimensional representation amenable to locating in-group faces. Hence, this allows us to more easily distinguish own-race faces from other-race faces that we see less often.

In the present study, we are focusing on a more recent explanation of in-group facial bias: the Categorization-Individuation Model (CIM; Hugenberg, Young, Bernstein & Sacco, 2010), According to the CIM, when out-group membership is made salient, outgroup members are categorized on the basis of outgroup features or individuated. Categorization occurs when one is focused on shared characteristics between a group of people rather than unique characteristics that distinguish one person from another, which is referred to as individuation. Categorization can be reduced when perceivers are motivated by goals and desired outcomes to individuate out-group faces, but this is unlikely because interactions with in-group members occur more frequently and are consequently more often involved in achieving task goals. Attention to categorical features reduces discriminability between other-race faces reducing recognition accuracy compared to in-group recognition accuracy (Hugenberg et al., 2010; see also Tanaka et al., 2004; Valentine, 1991 for similar concerns from different theoretical perspectives). The findings of Tuttenberg and Weise (2019) are consistent with the CIM and illustrate the effect of frequent interactions and motivation on perceptual expertise. While Caucasian participants only experienced directed forgetting effects for own-race faces, East Asian participants demonstrated directed forgetting effects for both own- and other-race faces. This effect is hypothesized to occur because East Asians have gained expertise with Caucasian faces due to the high interaction rate between both populations whereas Caucasians had more interactions with in-group members. While this finding does not demonstrate in-group racial bias for memory, it does align with perceptual expertise models that suggest enhanced facial recognition accuracy comes from increased exposure to certain faces rather than a universal inherent bias in memory toward own-race faces (Tüttenberg & Weise, 2019).

Hypotheses

In the present study, White students are asked to remember or forget White or Asian faces; at test they are then asked to recognize those faces later presented with new White or Asian faces. According to Huntsinger et al. (2014), positive items or moods facilitate task-relevant cognitive processes underlying directed forgetting whereas negative moods or items reduce or reverse those processes. This hypothesis is consistent with the many studies that found greater directed forgetting for positively-valenced drawings and scenes than for negatively valenced stimuli (Otani, Libkuman, Goernert, Kato, Migita, Freehafer, & Landow, 2012; Hauswald et al., 2011; Payne & Corrigan, 2007). These findings suggest that negatively valenced images are more difficult to forget than positive or neutral images (Corenblum et al., 2020). One implication of these findings is that that item-method directed forgetting should be greater for the positively valenced faces than the negatively valenced faces, this effect being greater for in-group than out-group faces. This is the case because more extensive cognitive processes are used to encode and individuate features of in-group than outgroup faces (Hugenberg et al., 2010). Sad in-group and out-group faces, on the other hand, should lead to little directed forgetting. This effect is anticipated because negatively valenced faces stop, inhibit, or reverse on-going cognitive processes. A different hypothesis for happy out-group faces is also possible: directed forgetting effects may be equivalent for happy in-group faces and out-group faces. In this case, an in-group bias would be eliminated for faces of positive affect. Such a finding would imply that affect is prioritized over the in-group or out-group bias in facial recognition. These hypotheses are tested by assessing memory for previously presented faces of both Group Membership conditions and all Facial Emotion conditions.

Method

Participants

Participants consisted of volunteer psychology students (N = 53, 13 male) from first, second, and third year classes. An a-priori power analysis using G*power (Faul, Erdfelder, Buchner & Lang, 2009) indicated that a sample size of 120 would be needed to attain a power of 0.8. Parameters of the power analysis included an alpha of 0.05, small effect size ($f = 0.1$; Cohen, 1988), three levels of a within-subject factor Emotion (Happy, Sad, Neutral), two levels of within-subject factor Group Membership (Caucasian, Asian). In total, 53 participants were able to be recruited.

Design

This study employed a 3 Facial Emotion (Happy, Sad, Neutral) x 2 Instructional Cue (Remember, Forget) x 2 Group Membership (In-group, Out-group) mixed design, with repeated measures on the first two factors. To assess the costs and benefits of item-method directed forgetting (Lee, 2013), two control groups were used, one with remember-all Caucasian faces and one with remember-all Asian faces. Since item method costs and benefits are not part of the present study, results from these groups will not be discussed further. 13 participants were randomly assigned to the remember-forget Asian (out-group) condition, 12 to the White remember-forget White (in-group) condition, 16 to the remember- all White condition, and 12 to the remember-all Asian condition

Materials

Photograph selection and presentation

Photographs of happy, sad and neutral Caucasian faces developed by Corenblum et al. (2020) were used in the present study. The results of Corenblum et al. (2020) indicated that the three expressions were sufficiently distinct to produce significantly different directed forgetting effects. Photographs of happy, neutral and sad Asian faces were selected from several open source Internet databases. Photographs in these databases varied widely in their size, colouring, lighting characteristics, graininess, background features, and pose. From these data-bases an initial pool of 45 photographs of happy, neutral and sad males and 45 photographs of happy, neutral, and sad female photographs was selected. To reduce the likelihood that pictorial cues might influence encoding and recognition accuracy (Bruce, 1982; Bruce & Young, 1986) these photographs must have met the selection criteria of no facial hair or heavy beards, no facial piercings, glasses, missing or crooked teeth, moles or birthmarks, jewelry, facial tattoos, asymmetrical faces, and hair styles that occlude the forehead.

To further eliminate pictorial cues, each photograph was edited using a commercially available photo-editing program. All external facial features were removed, leaving only the central internal facial features (see Fig. 1). All photographs were resized to 282 mm × 727 mm, converted to grey scale, equalized for mean luminance and contrast and centered on a 600 mm × 754 mm uniform 128 grey background. The photographs were presented and the responses collected using Matlab 7.10 (Mathworks Inc., Natick, MA; http:// www.mathworks.com) and the Psychophysics Toolbox extensions (Pelli, 1997). The presentation software positioned each face in the middle of the computer monitor and surrounded each face with a grey background. To prevent own-gender bias in face recognition (Herlitz & Lovén, 2013), participants only viewed photographs that match their self-identified sex.

Procedure

Directed forgetting task: study

Upon volunteering for this study, participants were told that this study was intended to study memory and recognition accuracy. They then completed an online consent form using a link given to psychology professors. After entering the experimental setting, participants were led to a computer that contained the presentation software. Participants were instructed to focus on each face presented on the screen, but that the upcoming memory test would only assess their memory for remember-cued items. The sequence of face presentation was as follows: a 1000 ms fixation cross was presented, then each photograph was shown for 4000 ms, which was followed by a slide with the cue “remember” or “forget”, which remained on the screen for 2000 ms. Half of the 36 faces that each participant viewed were randomly assigned a remember cue and the other half were randomly assigned a forget cue. Following the presentation of all 36 faces, participants were given a two-minute word search task in which they search for locations in Canada hidden in a 9 x 9 letter matrix. This task is intended to prevent rehearsal of faces and recency effects.

Directed forgetting task: test

Without forewarning, participants were instructed that their memory would be tested for all the faces that they had previously seen, not just remember-cued items. In this phase, 72 faces were shown to each participant, which consisted of 36 new faces (12 from each facial emotion condition) in addition to the 36 faces that they had previously seen. Upon the presentation of each face, participants were be asked to press the *'n' key* to specify whether the face was new or never seen before or press the *'r' key* if the face was old or one that they had seen before. If participants indicated that the face was old, they were also be asked to press the *'r' key* if it had been followed by a remember cue at study, or the *'f' key* if it had been followed by a forget cue at study. Source attributions (the extent to which a photograph was correctly connected to its instructional cue— remember or forget) were collected after recognition to avoid confounding source attributions with recognition. The order of collecting source attributions was included because participants may falsely assume that a face they had seen before must have been remember-cued and faces they cannot remember were forget-cued (Johnson, Hashtroudi & Lindsay, 1993). The new and old pictures were be randomly interspersed and in no particular order. The test phase was also self-paced; participants could view the face for as long as they wanted.

Following the test phase, a debriefing occurred where the researcher explained the true purpose of the study and why this information was withheld before the test. Researchers explain edto participants that they were not told of the study's true intention to assess in-group facial recognition bias in order to prevent them from being motivated to focus on other-race faces due to social desirability concerns. Participants were then thanked for their time and participation in the study.

Results

Defining false alarms, hits, corrected hits

A false alarm was defined as when a participant identified a newly presented face as one that they had seen before. A hit was defined as correctly identifying a previously seen face as old or new. Corrected hits were calculated by subtracting the false alarm rate for each emotion-instruction condition from the number of hits in that emotion-instruction condition. In the present study, corrected hits were used to measure facial recognition accuracy because the measure takes assess qualifies accuracy by taking into account recognition errors and guessing.

Accuracy (Corrected hits)

A 3 Emotion (Happy, Neutral, Sad) x 2 instructional Cue (Remember and Forget) x 2 Group Membership (Photographs of Asian or Caucasian faces) mixed analysis of variance on corrected hits revealed a marginal main effect of instructional cue (*F*(1, 51) = 3.155, *p* = 0.082, MSE = 0.033). More accurate recognition was found for remember-cued (M = 0.201, SE = 0.0320) than forget-cued photographs (M = 0.165, SE = 0.028) (see Table 2). There was no significant effect for Emotional Valence (*F*(2, 102) = 0.714, *p* = 0.492, MSE = 0.011), Group Membership (Asian M = 0.182, SD = 0.042; White faces (M = 0.184 SD = 0.039, *F*(1, 51) = 0.001, *p* = 0.976, MSE = 0.260) or any interaction (all Fs $<$ 1) on recognition accuracy.

False Alarms

A 3 Emotion (Happy, Neutral, Sad) x 2 instructional Cue (Remember and Forget) x 2 Group Membership (Photographs of Asian or Caucasian faces) mixed analysis of variance on the proportion of false alarms revealed an effect of Instructional cue. When participants falsely identified a new face as old, they were then more likely to identify the face as forget-cued than (M = 0.098, SE = 0.017) than remember-cued (M = 0.71, SE = 0.13; *F* (1,51) = 7.097, *p* = 0.010, MSE = 0.008) (see Table 2). A marginal Emotion x Group Membership (*F* (2, 50) = 2.699, *p* = 0.072), with more false alarms for happy Asian faces (M = 0.102, SD = 0.022), and the least false alarms to happy White (M = 0.074, SD = 0.021) and neutral Asian faces (M = 0.071, SD = 0.020) (see Table 1).

Discussion

The major goal of this experiment was to determine whether emotional valence could impact directed forgetting for in-group and out-group faces. Secondarily, emotion, group membership, and instructional cue were all examined to determine their individual impacts on facial recall and any interactions between variables that may arise. In accordance with Fawcett's & Taylor's (2010) processing explanation, a small directed forgetting effect was found both in terms of corrected hits (accuracy) and false alarms. Results displayed stronger memory for remember-cued items than forget-cued items, with a greater amount of corrected hits for remember-cued faces than forget-cued faces. Therefore, maintenance rehearsal kept the faces present in short term memory until the remember or forget cue was presented. The remember-cued items were provided the cognitive resources that were withdrawn from processing forget-cued items, then underwent elaborate rehearsal to strengthen their memory trace. This allowed participants to more easily identify remember-cued faces. The use of false alarms as a measure may be considered another method of assessing item strength and representation of stimuli in memory (Goernert, Otani & Corenblum, 2011). More false alarms were made for new faces incorrectly thought to be old forget-cued faces rather than remember-cued faces. The higher proportion of false alarms for forget-cued faces was likely due to difficulty when trying to recall the newly presented face. When participants viewed a new face and classified it as "old", it was likely that they identified it as forget-cued since they struggled to retrieve it from memory.

Conversely, since participants had no memory for the item, they were unlikely to assume that they were told to remember the stimuli. Otani, Libkuman, Goernert, Kato, Migita, Freehafer, & Pandow (2011) explain this phenomenon by emphasizing that participants report strongly encoded items as remember-cued whereas faces that were difficult to retrieve were given forget-cues due to the participant’s assumption that their intention to learn the face and selective rehearsal would make the item stronger had it been remember-cued.

Using the categorization-individuation model (Hugenberg et al., 2010), it was initially hypothesized that directed forgetting would be strongest for in-group faces due to increased processing resources and expertise for these faces. Findings were limited to prove that this theory was applicable in this study. Inconsistent with this theory, there was no significant effect of group membership when examining corrected hits or false alarms. When considering both the cognitive as affective-feedback hypothesis (Hunstinger et al., 2014) and the categorization individuation model (Hugenberg et al., 2010), the weakest directed forgetting effects should have been found for sad out-group faces. Sad out-group faces would hypothetically face more inhibition during encoding due to the “stop signal”, and the decrease in processing for out-group faces. While an analysis of corrected hits revealed little to no main effect or interaction between emotion and group membership, an analysis of false alarms provided slightly more suggestive results. When emotion was added to the analysis of group membership, false alarms were lower for sad and happy in-group faces (particularly happy White faces), in comparison to happy and sad out-group faces, offering indirect support that directed forgetting was strongest for in-group faces. One implication of this finding is that there may have been increased individuation for in-group faces, allowing these faces to be more thoroughly encoded into memory and recognized at test. Since more false alarms were reported for sad and happy Asian faces, it may imply that the processing of out-group faces employs little differentiation, causing faces to appear more similar at test. This would then lead to more difficulty when attempting to properly identify whether they had seen the face before. However, neutral Asian faces unexpectedly showed fewer false alarms relative to all other conditions. This finding is in contrast to the expectation that in-group faces should experience stronger directed forgetting. This unexpected finding may be related to a small sample size. With more participants, more significant group membership effects may have been found.

Despite the affect-as-cognitive-feedback hypothesis (Huntsinger et al., 2014) not explicitly addressing false alarms, this theoretical standpoint can be considered when explaining the significant interaction of emotion and group membership on directed forgetting (Corenblum et al., 2021). This study anticipated the result that emotion would impact the degree of directed forgetting, with negative stimuli inhibiting task-relevant cognitions, which were to remember or forget the faces. Studies have shown that negative stimuli are more difficult to forget (Hauswald et al., 2011; Payne & Corrigan, 2007; Tay & Yang, 2017). A consequence of this is that negatively valenced faces would produce strong memory regardless of the instructional cue, so less disparity in memory would be found for remember-cued faces versus forget-cued faces. Thus, less of a directed forgetting effect would emerge for negatively valenced faces. This study found no significant effect of emotion on directed forgetting, in contrast to the finding that directed forgetting is impacted by emotion, which has been replicated by many studies (Otani et al., 2011, Clark-Foos & March, 2008; Hulse, Memon & Read, 2007; Kensinger & Corkin, 2004, Kern, Libkuman, Otani & Holmes, 2005). Though analysis for corrected hits revealed no effect of emotion, fewer false alarms for happy White faces were shown in the analysis, offering indirect evidence for the affect-as-cognitive-feedback hypothesis. Indeed, happy or positive faces (when White) acted as a “go signal”, enhancing the participants’ ability to engage in directed forgetting processes. Thus, it was easier to remember whether they had seen the face before and whether it was remember-cued or forget-cued, so they made fewer errors. Contrarily, there were more false alarms for sad White faces than happy White faces. The affect-as-cognitive-feedback hypothesis (Huntsinger et al., 2014) can be extended to further explain this effect: sad faces signal that task goals should be inhibited when stimuli are being encoded and later retrieved. One implication of this is that all sad faces then may be attempted to be encoded or retrieved, leading to weak directed forgetting effects and potentially overburdening participants’ cognitive capacity. Such overload may cause difficulty when accessing memory and attempting to retrieve their associated cues, leading to more errors or false alarms (Corenblum et al., 2020).

Although a slight difference in false alarms was determined for happy White faces versus sad White faces, ultimately, another marginally significant finding emerged when examining the interaction between emotion and group membership: the greatest amount of false alarms were made for happy Asian faces. While differences between emotional conditions for Asian faces were small and the effects minimally significant, the mean false alarms were higher for happy Asian faces than sad. This finding aligns with the categorization-individuation (Hugenberg et al., 2010) model that predicts an in-group bias for facial memory. Perhaps this finding can be explained by referencing the recurrent notion that strong memory is found for negatively arousing stimuli, regardless of whether the stimuli is remember-cued or forget-cued (Otani et al., 2012). Indeed, another other implication of this notion is that happy faces may experience more false alarms due to success forgetting certain faces. Thus, when participants see a face that they do not recognize, they may be unsure of whether the face was forget-cued or one that they had not seen before, inevitably leading to more errors and false alarms. However, the finding of more false alarms for happy faces (when Asian) is in contrast to much literature discussed previously regarding emotion and directed forgetting. This result of more false alarms for happy Asian faces than neutral and sad Asian faces is also a reversal of this study's findings for White faces, in which more false alarms were made for sad faces than happy faces. Additionally, this finding conflicts with Corenblum et al.'s (2020) study, which found that a greater amount of classification errors were made for sad faces than happy faces; participants more often reporting new sad faces as old, forget-cued faces at study. Thus, more errors being made for happy Asian faces may indicate that race is more salient than emotion when processing faces and also may imply that the effect of emotion on facial recall varies depending on whether that face is either an in-group or out-group face. However, due to very small effect sizes and a small sample size, this is merely a speculation rather than a conclusive finding with larger effect sizes

Unfortunately, an analysis of the ideal measure for directed forgetting—corrected hits, showed minimal differences between accuracy in each condition. While measuring false alarms showed more of our predicted effects, these results are more suggestive than conclusive support for our hypothesis. There are a several identifiable limitations to this study, the first regarding the small sample size. The challenge of recruiting student participants to come to the experimental lab during an online semester posed difficulties in obtaining the ideal sample size of n = 120. With an increased sample size, larger effects for conditions may have been obtained. Another limitation involves the usage of students enrolled in more advanced courses. Since second- and third-year psychology students were used as participants, it is possible that awareness of in-group facial bias led to participants attempting to counteract this effect and further focus on Asian faces. A knowledge of directed forgetting paradigms is also a possibility, potentially causing select participants to anticipate that they would be tested on both remember-cued as well as forget-cued faces. With the inclusion of these participants, smaller directed forgetting effects may be found.

While this study controlled for gender by having participants view photographs of their own sex, future research could examine the effect of gender biases on directed forgetting. Past research completed by Herlitz and Lovén (2013) has identified a gender bias for facial recognition, with people more easily committing same-sex faces to memory. Further research that examines whether this finding is applicable to directed forgetting literature would be beneficial.

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Table 1

Proportion of mean false alarms (SD) for each emotion shown on White and Asian faces.

Group	Facial Emotion		
	Happy	Neutral	Sad
White	0.074 (0.021)	0.082 (0.019)	0.082 (0.020)
Asian	0.102 (0.022)	0.071 (0.020)	0.094 (0.021)

Table 2

Mean proportion of false alarms and corrected hits for remember-cued and forget-cued faces.

Instructional Cue	False Alarms		Corrected Hits	
	Mean	Standard Error	Mean	Standard Error
Remember	0.071	0.013	0.201	0.032
Forget	0.098	0.017	0.165	0.028