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ABSTRACT
People have a remarkable capacity to process and recognize faces. Yet, they fail to recognize the faces of individuals from other racial groups - the Other-Race Effect (ORE). We investigated the role of repetition - a powerful determinant of learning and memory - in reducing the ORE. We predicted that repetition would improve face learning, particularly for other-race faces, as these are poorly learned based on a single presentation. Because own-race faces are easily learned based on a unique presentation, they should benefit less from repetition. We tested this hypothesis across five experiments. Results showed that repetition not only did not reduce the ORE, but instead, it increased it. We discuss the theoretical implications of these findings for the ORE.

Humans are particularly good at processing and remembering faces. More than for any other stimulus, we have the remarkable ability to integrate the multiple features and components of a face into a coherent perceptual representation (i.e., holistic processing; for a review, see Maurer et al., 2002). A quick glimpse at a face is enough to extract a wealth of information about the target person, such as race, gender, age, identity, personality, emotional state, or intention (for a review, Todorov et al., 2015). Moreover, neuroscience research suggests that humans have specialized brain areas dedicated to processing faces (for a recent review, see Grill-Spector et al., 2017).

Despite this apparent facility with faces, we often fail to recognize the faces of people from other groups (Anastasi & Rhodes, 2005; Bernstein et al., 2007; Malpass & Kravitz, 1969; Rule et al., 2007; Wright & Sladden, 2003). For example, we have a surprisingly poor memory for faces of other races, the so-called other-race effect (ORE; also known by cross-race effect; Malpass & Kravitz, 1969). Decades of research on the ORE have shown that this is a highly reliable phenomenon (Meissner & Brigham, 2001), which generalizes to different participant populations (e.g., MacLin, MacLin & Malpass, 2001; Ng & Lindsay, 1994; Sporer, 2001), and has important societal implications (e.g., eyewitness misidentifications; Scheck et al., 2000).

Identifying faces from other races that we have previously met is crucial if we are to develop intimate relationships with them. Without accurate identification of these faces, the bits and pieces we learn about each person are never integrated into the corresponding episodic representation, and consequently, the cumulative process of getting to know someone can never progress from its initial stages.

What then can we do to improve the learning of other-race faces? In the current research, we tried to explore this question by investigating the role of repetition—a powerful determinant of learning and memory (Ebbinghaus, 1885/1964)—in facilitating the learning of other-race faces and, consequently, in minimizing the ORE.

In the next paragraphs, we elaborate on these ideas. Namely, we start by briefly reviewing the main theoretical explanations for the ORE. Then, we reflect on the strategies that have been proposed to improve the learning of other-race faces. We then address the role of repetition of exemplars in enhancing learning, followed by a description of research showing the effects of repetition on face stimuli. Finally, we explain the goal and hypothesis of this research.

Theoretical explanations for the other-race effect

Theoretical accounts of the ORE can be broadly divided into two classes—perceptual expertise accounts and social-cognitive accounts. Expertise-based accounts share the premise that perceivers lack the

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ability to effectively learn other-race faces because of the reduced interracial contact (e.g., Chiroro & Valentine, 1995; De Heering et al., 2010; Hancock & Rhodes, 2008; Kelly et al., 2007; Sangrigoli & De Schonen, 2004; Walker & Hewstone, 2006). Differential learning opportunities with own—and other-race faces is thus at the heart of the ORE. However, the specific mechanism by which experience gives rise to the ORE is still a matter of considerable debate. According to one account, the holistic processing typically applied to human faces is reduced for other-race faces, which results in worst recognition accuracy for these faces relative to own-race faces (e.g., Michel et al., 2006; Rhodes et al., 1989; Rossion & Michel, 2011; Tanaka et al., 2004; however, see Harrison et al., 2014; Horry et al., 2015).

Another expertise-based account (Valentine, 1991; Valentine & Endo, 1992) suggests that faces are represented in a multidimensional Euclidean space, wherein each dimension represents a particular physiognomic facial feature (e.g., eye color, nose width, lip thickness). Importantly, as a result of greater daily-life contact with own-race faces, these dimensions reflect the physiognomic features that are more diagnostic for learning own-race faces. Such dimensions, however, may not be as diagnostic for other-race faces (Hills & Lewis, 2011), as own-race and other-race faces seem to vary in different physiognomic features (e.g., Ellis, 1975; Shepherd & Deregowski, 1981). Thus, while own-race faces are represented more dispersedly in the face-space, reflecting the accumulated experience with these faces, other-race faces are clustered tightly together, indicating the lack of knowledge about which physiognomic features are more useful for differentiating between these faces.

Alternatively, for social-cognitive accounts, the ORE is simply another manifestation of one's ubiquitous tendency to rely on the social category information of outgroup members (e.g., race, age, sex) rather than on its particular characteristics (e.g., Macrae & Bodenhausen, 2000; Fiske & Neuberg, 1990; Ostrom, Carpenter, Sedikides, & Li, 1993; Taylor et al., 1978). According to the categorization-individuation theory, perceivers have low motivation to attend to the individual characteristics of other-race faces as the identities of outgroup members are usually not personally relevant to them. Thus, perceivers will not individuate other-race faces (i.e., rely on their unique attributes and characteristics) unless they have reasons to do so. The result is a poor recognition memory accuracy for these faces (e.g., Adams et al., 2010; Hugenberg et al., 2007; Shriver & Hugenberg, 2010; Wilson et al., 2014).

A different social-cognitive account, the feature-selection model (Levin,1996, 2000; Levin & Angelone, 2002), proposes that other-race faces contain race-specifying features (e.g., dark skin tones, broader noses, or fuller lips in the case of Black people) that are not present in own-race faces. Importantly, the presence or absence of such race-specifying features determines the way these faces are processed. Namely, when some race-specifying feature is detected that face is readily categorized as an outgroup member and further processed based on race-specifying information rather than on individuating information. In doing this, perceivers fail to process the individuating features that would allow them to recognize that face successfully. In contrast, when no race-specifying feature is detected, that face is processed based on individuating information, resulting in better recognition.

Although the theoretical accounts described above diverge in many important respects, they all suggest that perceivers learn other-race faces less efficiently than own-race faces, thus leading to the ORE. Hence, variables known to improve learning could have an impact on eliminating the ORE. In the next section, we focus on previous learning-based attempts to reduce the ORE.

Strategies to reduce the ORE

Few studies tried to reduce the ORE by using training programs, and the results obtained were mixed. For instance, Malpass et al. (1973) trained White participants for recognition of Black or White faces by feedback trials, using a study list of 4 face stimuli and a four-alternative forced-choice test procedure. The initial ORE disappeared in the last 20 (of 100) training trials, but because it peaked at the previous set of 20 trials, this result is hard to interpret. More recently, Tanaka and Pierce (2009) trained Caucasian participants to differentiate African American (or Hispanic) faces at the individual level and to categorize Hispanic (or African American) faces in terms of race (e.g., Hispanic, African American). The individuation training led to an improvement in the Hit rate of 8% on the post-training recognition test relative to the categorization training. Both conditions had 68% of Correct Rejections in the post-training recognition test (for similar results, see Lebrecht et al., 2009). Given the small difference observed for Hits and no difference for Correct Rejections, in our view, these results should be interpreted with caution.

Other training methodologies have produced more clear-cut results. For example, Hills and Lewis (2006) demonstrated that the ORE observed before training disappeared after training for the participants that went through a training regime involving learning to distinguish faces that varied only on their chin, cheeks, nose, and mouth. Also, DeGutis and colleagues (DeGutis et al., 2011) found that developmental prosopagnosic (i.e., the inability to recognize familiar faces) patients (DPs) showed a decrease on the ORE after going through a rehabilitation training procedure developed to counter the usual holistic deficit in processing faces found in these patients. Importantly, in the training procedure, the authors used only same-race faces, suggesting that holistic training with own-race faces boosted DPs' general configural/holistic attentional resources, which they were then able to apply to other-race faces.

Thus, it seems that generic short-term training procedures have only yielded weak results at best (e.g., Malpass et al., 1973; Tanaka & Pierce, 2009), whereas feature-based training led to more promising results (e.g., Hills & Lewis, 2006). In our view, it seems highly unlikely that training programs initially designed to improve general recognition performance may lead a reduction of the ORE, as even super-recognizers, who substantially outperform normal individuals in face recognition, exhibit this bias (Bate et al., 2019). Nevertheless, the fact that short-term training produced any results at all seems difficult to explain from strict experience-based theoretical accounts (see DeGutis et al., 2011, for a similar conclusion).

The role of repetition of exemplars in improving learning

One of the most ubiquitous findings in the field of learning and memory is that repeated items are typically better remembered than non-repeated items (for reviews, see Crowder, 1976, and Greene, 2008). The empirical study of repetition dates back to Ebbinghaus (1885/1964), who conducted a series of meticulous experiments showing that learning improves as a function of the number of times an item was previously studied and that such improvement is not uniform across trials. Namely, the relationship between learning and repetition follows a negatively accelerated curve, with most learning occurring in the initial presentations and then continuously declining in subsequent presentations until it reaches a point where it is hardly measurable.

In the last decades, several studies have demonstrated the positive effects of repetition on the learning of different stimulus materials (see Greene, 2008). Moreover, research has also shown the remedial effects of repetition in learning deficits. For example, repetition of automated appointment reminding messages reduced the relative memory deficit of older adults (mean age = 71 years) for these messages relative to younger adults (mean age = 19 years; Morrow et al., 1999). Also, repetition (in particular, spaced repetition) led to reductions in relative memory deficits of traumatic brain injury patients relative to healthy controls (Goverover et al., 2009).

And this remedial approach sometimes works even for the social memory of younger and healthy participants. For example, Hamilton et al. (1980) found that when participants attempt to memorize a list of behavioral sentences that are illustrative of different traits, they remember these sentences worse than participants who formed an impression about the actor of these behaviors and later had to recall them unexpectedly. The participants instructed to memorize the sentences suffered from a relative processing deficit because they did not rely on the most appropriate structure to encode trait-implicative behaviors (i.e., the implicit personality theory semantic network; see Garcia-Marques et al., 2010) and, consequently, their performance was characterized by less recall clustering (Hamilton et al., 1980) and less false memories in trait recognition (Garcia-Marques et al., 2010). However, when the list of behaviors was repeated, differences in the recall performance and the amount of general clustering disappeared.

Repetition in face recognition

Repetition also influences perceptual stimuli such as faces (e.g., Feng et al., 2019; Parkin et al., 1995; Mammarella et al., 2004; Russo et al., 2002; Wang et al., 2017). For example, a recent study (Wang et al. (2017) demonstrated that, not only repeated faces (i.e., faces shown two times) are better recognized than non-repeated faces, but also that the benefits of repetition are higher when the target faces are spaced apart rather than massed together (i.e., the spacing effect; for a review, see Delaney et al., 2010). Additionally, Itier and Taylor (2004) showed that face inversion and contrast-reversal (i.e., the inversion of contrasts in a picture), two manipulations that typically impair face perception and memory by disrupting configurational or holistic processing (for a review, see Rossion, 2008), have no impact on recognition accuracy for repeated faces. That is, memory for inverted and contrast-reversed repeated faces was as good as it was for upright repeated faces.

To our knowledge, only a few studies looking at repetition effects on face recognition have used faces of different races (Cavazos et al., 2019; Hayward et al., 2017; Laurence et al., 2016; Matthews et al., 2018; Tüttenberg & Wiese, 2019). However, most of these studies did not test whether repeating own—and other-race faces during the study-phase impact recognition memory for those very same faces. Instead, their focus was on whether exposure to multiple varying face images of the same person promotes identity learning (i.e., recognition of a different image of the same person) more strongly for own-race than other-race face identities. One exception is a recent study by Cavazos et al. (2019; Experiment 2). In this study, the authors presented participants with repeated own- and other-race faces in a spaced or blocked fashion within the study phase. Later, they asked them to recognize the same repeated face images. Their results showed better recognition for own- relative to other-race faces irrespective of the repetition condition. Although these authors (Cavazos et al., 2019; Experiment 2) obtained an ORE for repeated faces, one should be careful in interpreting these results as evidence that the ORE is robust against face repetition because they did not manipulate repetition. Their results show an ORE for East Asians but not for Caucasians participants.

The present research

The goal of the present research was to systematically examine the role of repetition on memory for own- and other-race faces. Based on existing research on repetition effects (Ebbinghaus, 1885/1964; for a review, see Greene, 2008), particularly on face memory (e.g., Itier & Taylor, 2004), we propose that repetition should facilitate memory for own- and other-races, but not to the same degree. Our rationale is simply that the beneficial effects of adequate learning strategies (e.g., Hills & Lewis, 2006), of perceptual expertise, or motivation on memory performance for other-race faces should be higher under suboptimal learning conditions (i.e., in the absence of repetition). In contrast, in optimal learning conditions (i.e., increased repetitions), these memory enhancers should become less crucial to obtain high-performance levels. Specifically, we predict that, because other-race faces are typically poorly learned based on a unique visualization, they will show great improvement from repetition relative to own-race faces, which are much better recognized with a single presentation. Note that we are not arguing that repeating faces necessarily improves the performance for the whole race category, but rather that repetition should only benefit repeated faces. Consistent with this idea, a recent study discovered that, in an implicit learning paradigm, repetitions of lists of words that exemplified a give implicit rule resulted. Consistent with this idea, a recent study discovered that, in an implicit learning paradigm, repetitions of lists of words that exemplified a given implicit rule resulted in superior item memory, but no change in the level of learning of the implicit rule (Neil & Higham, 2020).

We tested our hypothesis across four experiments in which we manipulated repetition (one, three, and five times) of own- and other-race faces in a between- (Experiments 1 and 3) and within-participants fashion (Experiments 2A, 2B, and 4) during the study phase of a standard recognition memory paradigm.

Sample and open practices

A meta-analysis of the ORE revealed an effect size of $f = 0.41$ (Meissner & Brigham, 2001), which can be considered large, according to Cohen's (1969) guidelines. Because we predicted a complete suppression of the ORE only for repeated faces, we had to estimate the expected effect size for such ordinal interaction. Following the recommendations by Perugini et al. (2018) on how to determine an interaction effect size starting from a one-way design (see formula six on page 11), we anticipated an effect size of $f = 0.20$. Given this effect size, an a-priori power analysis using PANGEA (Westfall, 2016; for details see www.jake-westfall.org/pangea) revealed that we would need to recruit 20 participants for the experiments using within-designs and 20 participants per between-participant condition for the experiments with mixed-designs in other to have appropriate power (80% power with an alpha level of .05) to detect our predicted effect (i.e., a reduction of the ORE for the repeated faces). However, we decided to recruit at least 40 participants for the within-design experiments and 40 participants per condition in the mixed-design experiments. Whenever possible (i.e., if we still had research funds available or there were students still needing course credits), we went beyond this number and recruited as many participants as we could during the term of the experiment. In an attempt to increase the diversity of our samples, in two of the experiments, we recruited English-speaking participants using an online recruitment platform, while in the other two, we recruited Portuguese-speaking undergraduate students and conducted these experiments in the lab.

The data for each experiment were collected in one shot without prior statistical analyses. We report all data exclusions (if any), all manipulations, and all measures. Experimental materials and data are publicly available at the Open Science Framework website (https://osf.io/brzxj/). The Ethics Committee of the Faculty of Psychology of the University of Lisbon approved these experiments.

Experiment 1

In Experiment 1, we manipulated repetition between-participants such that in one condition, participants saw own-race faces (White) and other-race faces (Black) only once during the study phase, while in the other condition they saw each face three times (in a non-sequential manner). In a subsequent recognition test, participants were presented with new and previously seen own- and other-race faces. Their task was to decide whether each of these faces had been presented earlier. We predicted the elimination of the ORE in the three-repetition condition as a result of the enhanced learning of other-race faces caused by repetition.

Method

Participants

Sixty-nine participants (29 females and 39 males; 1 person preferred not to disclose his/her gender; $M_{age} = 40.04$ years, $SD_{age} = 9.75$) were recruited online via Prolific (https://www.prolific.co; see Peer et al., 2017). Participants were eligible to sign up for the experiment only if (a) they self-identified as White and (b) their first language was English. They received £1.80 (approx. $2.40 at that time) for their participation.

Materials

Materials consisted of grayscale images of 128 adult male faces (64 White and 64 Black) displaying neutral expressions and direct gaze. Each image was about 2×2.5 inches in size and displayed only the targets' faces and hair. These faces have been used in previous research on the ORE (e.g., Bernstein et al., 2014). The 128 faces were randomly divided into two lists of 64 faces each (32 White, 32 Black). These lists were counterbalanced across participants such that each participant was equally likely to see a given face as either a target face (i.e., presented in the study phase) or a distractor face (i.e., not presented in the study phase).

Procedure

Participants signed up for an online study on face perception and memory. The experiment was executed on Qualtrics (http://www.qualtrics.com). Participants were first informed that their participation was entirely voluntary and that their responses were anonymous and confidential. They were then asked about their age and gender (the options were: female, male, other, prefer not to disclose). We told participants that they would see faces of different individuals that they should pay close attention to so that they could remember them later. The faces (32 White and 32 Black) were presented sequentially at the center of the computer screen for 3000 ms each.

Each face was preceded by a warning signal (+) displayed in the middle of the screen for 1000. In the no-repetition condition ($n = 38$), each face was presented once, while in the three-repetition condition ($n = 31$),[1] each face was presented three times. Faces were presented in a random order in both conditions, with the only restriction being that repeated faces were not shown in successive trials. After the learning phase, participants completed a brief filler task (list as many European countries as they could in four minutes) intended to clear working memory. They then completed a recognition test in which they saw the target faces intermixed with an equal number of distractor faces and were asked to indicate whether they had seen each face in the previous study phase or not. Target faces were displayed exactly as they were during the learning phase. The faces remained on the screen until participants responded. Following the recognition test, participants completed the following attentional check items: i) "I performed the task and answered the questions by myself/with the help of others"; ii) "I performed the task and answered the questions without interruption/with interruption"; iii) "I performed the task and answered the questions alone/in the presence of others."

Results

As it is common practice in the field, we calculated the signal detection estimates of sensitivity (*d'*) and response criterion (*C*; see Green & Swets, 1966; Macmillan & Creelman, 1991). Sensitivity (*d'*) refers to participants' ability to differentiate between target and distractor faces. In terms of interpretation, higher

Table 1. Mean proportion of hits and false alarms as a function of face race and repetition condition.

	No-repetition		Three-repetition	
	Own-race	Other-race	Own-race	Other-race
Hits	.52 (.18)	.56 (.17)	.71 (.18)	.72 (.20)
False alarms	.22 (.17)	.34 (.21)	.23 (.18)	.36 (.19)

Note. Standard deviations are presented within brackets.

d' scores represent higher sensitivity. The response criterion reflects participants' threshold of responding. Positive values of *C* reflect a more conservative response criterion (i.e., a bias toward characterizing faces as "new"). In contrast, negative values indicate a more liberal response criterion (i.e., a bias toward characterizing faces as "old"). For completeness, we also report the average hit and false alarm rates for all conditions (see Table 1).

Four participants reported having been interrupted during the experiment; however, we decided to keep their data in the analysis as the results are the same with or without these participants' data.

Sensitivity (d')

Results showed that participants correctly recognized more own-race faces ($M = 1.21$, $SD = .79$) than other-race faces ($M = .88$, $SD = .79$), thereby replicating the ORE ($M_{\text{Diff}} = .33$, $SE = .07$, Cohen's d = .52). As expected, repeated faces were better recognized ($M = 1.29$, $SD = .69$) than non-repeated faces ($M = 0.80$, $SD = .76$; $M_{\text{Diff}} = .50$, $SE = .17$, Cohen's d = .34). Counter to our hypothesis, though, the difference between repeated own- and other-races faces ($M_{\text{Diff}} = .41$, $SE = .11$, Cohen's d = .62) was more pronounced than the difference obtained for non-repeated own- and other-races faces ($M_{\text{Diff}} = .25$, $SE = .10$, Cohen's d = .41). See Figure 1.

Response criterion (C)

Participants adopted a more conservative criterion when responding to own-race ($M = 0.29$, $SD = .46$) than other-race faces ($M = 0.02$, $SD = .46$; $M_{\text{Diff}} = .26$, $SE = .06$, Cohen's d = .54), which is consistent with previous research on the ORE. We also found that participants displayed a more conservative criterion for faces seen only one time ($M = 0.31$, $SD = .41$) than for faces viewed three times ($M = 0.001$, $SD = .34$; $M_{\text{Diff}} = .31$, $SE = .09$, Cohen's d = .40). Repetition influenced the response criterion as the mean difference between own- and other-race faces was larger for repeated faces ($M_{\text{Diff}} = .27$, $SE = .09$, Cohen's d = .59) than for non-repeated faces ($M_{\text{Diff}} = .26$, $SE = .09$, Cohen's d = .50). See Figure 2.

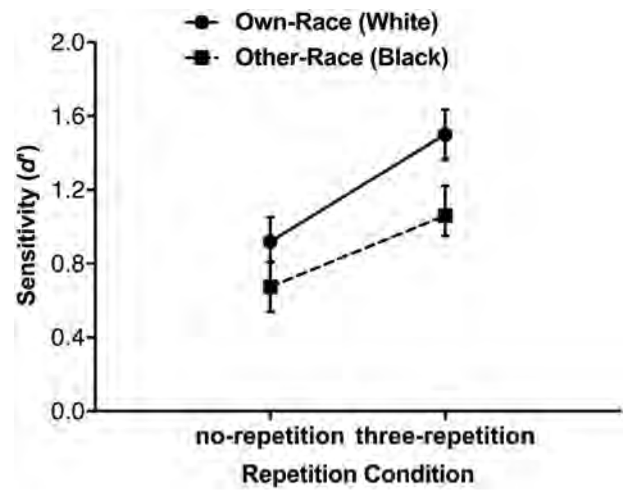

Figure 1. Mean sensitivity (*d'*) as a function of Face Race and Repetition Condition (Experiment 1). Error bars represent ± 1 standard error around the mean.

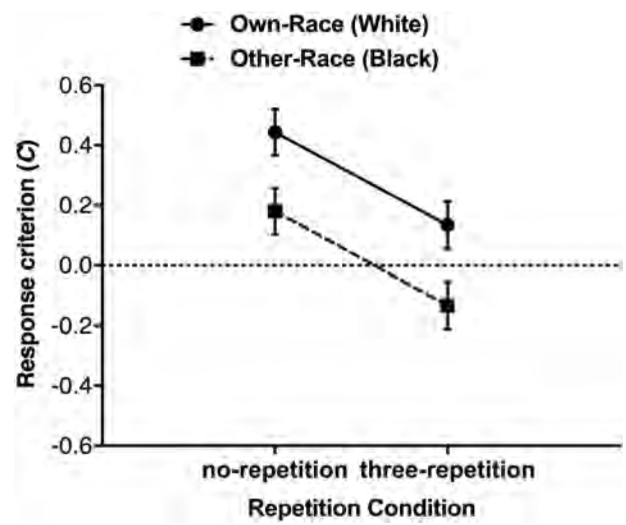

Figure 2. Mean response criterion (*C*) as a function of Face Race and Repetition Condition (Experiment 1). Error bars represent ± 1 standard error around the mean.

Discussion

In Experiment 1, we did not find evidence that repetition eliminates the ORE. Instead, repetition seem to have increased the ORE as the mean difference in sensitivity between own- and other-race faces was more than two times larger for repeated than non-repeated faces. Yet, the current experiment replicated the ORE both on sensitivity (i.e., higher recognition accuracy for own-race faces) and response criterion (i.e., a more conservative criterion for same-race than to other-race faces). There was also an effect of repetition on sensitivity, which suggests that seeing the same faces three times during the study phase indeed leads to more efficient learning of these faces relative to the faces seen only one time. Although these results do not support our hypothesis, we do not take them as decisive evidence that repetition has no impact on the ORE. Therefore, in the next two experiments (Experiments 2 A and 2B), we tested the same hypothesis using a within-participants manipulation of repetition.

Experiments 2A and 2B

In Experiments 2A and 2B, we manipulated repetition at a within-participants level during the study phase. Thus, each participant saw one-half of the faces one time, and the other half three times. Everything else was similar to Experiment 1. By manipulating repetition within-participants, we aimed at increasing the discrepancy between non-repeated and repeated faces and eventually increase the importance attributed to repeated faces (Anderson & Schooler, 1991).

Method

Participants

Sixty participants (25 females and 34 males; 1 participant preferred not to disclose his/her gender; M_{age} = 28.48 years, SD_{age} = 8.83) were recruited online via Prolific for Experiment 2 A. Monetary compensation and eligibility criteria were identical to Experiment 1. Fifty students (35 females and 25 males; M_{age} = 24.08 years, SD_{age} = 5.51) of the University of Lisbon took part in Experiment 2B. They participated in return for partial credit toward a course requirement. All participants were White.

Materials

Materials were the same 128 images of male faces (64 White and 64 Black) used in the previous experiment.

Procedure

The procedure of Experiments 2 A and 2B was mostly identical to the procedure of Experiment 1, with some differences. The main difference was that repetition was manipulated within-participants during the study phase. That is, half of the faces (16 White and 16 Black) were shown one time (no-repetition condition), while the other half (16 White and 16 Black) were shown three times (three-repetition condition). The face presentation was completely random. Repeated and non-repeated faces were counterbalanced across participants. The other differences were specific of Experiment 2B. In this experiment, participants were tested in the lab, in sessions of up to eight participants at a time. Participants sat in front of computer screens on individual workstations. All instructions and stimuli were presented on the computer. The experiment was programmed and ran in E-Prime, Version 2.0 (Psychology Software Tools, Pittsburgh, PA).

Table 2. Mean proportion of hits as a function of face race and repetition condition.

	No-repetition		Three-repetition	
	Own-race	Other-race	Own-race	Other-race
Hits	.53 (.19)	.57 (.20)	.68 (.20)	.71 (.21)

Note. The mean proportion of False Alarms for own-race faces was .25 (.16) and the one for other-race faces was .38 (.20). Standard deviations are presented within brackets.

Table 3. Mean proportion of hits as a function of face race and repetition condition.

	No-Repetition		Three-Repetition	
	Own-Race	Other-Race	Own-Race	Other-Race
Hits	.50 (.17)	.54 (.20)	.79 (.17)	.79 (.16)

Note. The mean proportion of False Alarms for own-race faces was .17 (.14) and the one for other-race faces was .29 (.19). Standard deviations are presented within brackets.

Results

Four participants from Experiment 2 A reported being interrupted during the study. We kept their data because removing it did not change the pattern of results. Because in these experiments, repetition was manipulated within-participants only during the study phase, sensitivity scores for own- and other-race faces presented one time and three times were calculated based on the same false alarm rate. Therefore, *d'* scores correspond to the hit rate but are reported as *d'* to provide a measure that takes into account also the false alarm rate on the recognition test and, consequently, control for guessing. For this reason, response criterion results are uninformative and thus not presented (for a similar analytic strategy, see, for example, Schwartz & Yovel, 2016, and Shriver et al., 2008). See Tables 2 and 3 for the average hit and false alarm rates for all conditions in Experiments 2 A and 2B, respectively.

Sensitivity (d')

In Experiment 2 A, we obtained higher recognition for own-race faces (M = 1.12, SD = .74) than other-race faces (M = .79, SD = .74; M_{Diff} = .33, SE = .08, Cohen's d = .53), as well as for repeated (M = 1.20, SD = .71) than non-repeated faces (M = .72, SD = .71; M_{Diff} = .47, SE = .06, Cohen's d = 1.04). Repetition did not diminish the ORE as the difference between own- and other-race faces seen three times

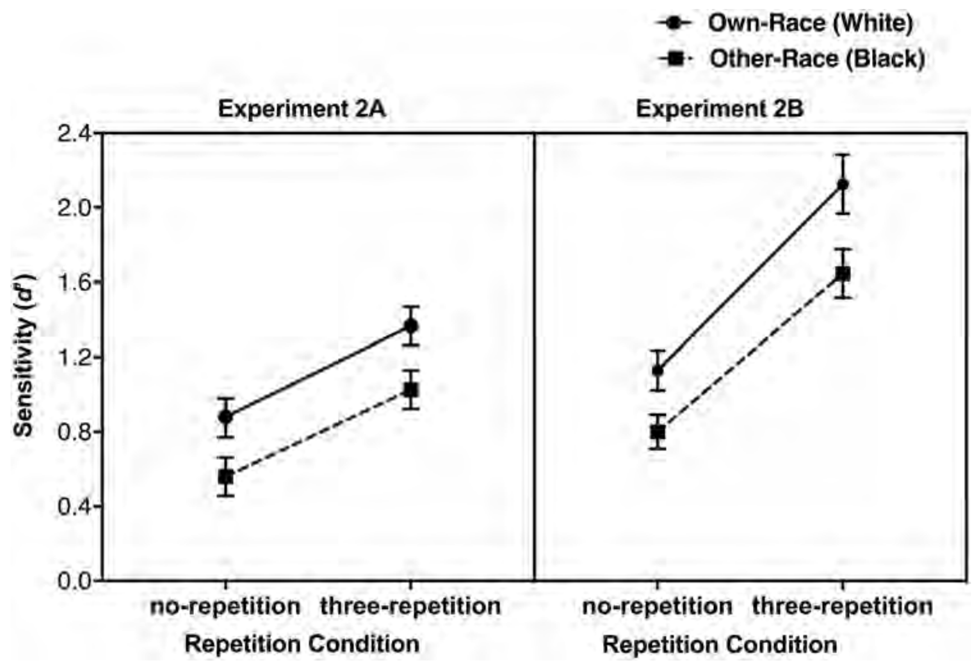

Figure 3. Mean sensitivity (*d*′) as a function of Face Race and Repetition Condition (Experiments 2 A and 2B). Error bars represent ± 1 standard error around the mean.

(M_{Diff} = .34, *SE* = .09, Cohen's d = .44) was similar to that observed for faces seen only once (M_{Diff} = .32, *SE* = .09, Cohen's d = .46). See Figure 3.

In Experiment 2B, we observed a similar pattern of results. Participants showed better recognition for own-race (*M* = 1.63, *SD* = .82) than other-race faces (*M* = 1.22, *SD* = .82; M_{Diff} = .40, *SE* = .09, Cohen's d = .64), as well as for repeated (*M* = 1.89, *SD* = .81) than non-repeated faces (*M* = .96, *SD* = .81; M_{Diff} = .92, *SE* = .08, Cohen's d = 1.66). As in Experiment 1, we found that the difference between own- and other-races was larger for repeated (M_{Diff} = .48, *SE* = .10, Cohen's d = .66) than non-repeated faces (M_{Diff} = .33, *SE* = .10, Cohen's d = .50), which is precisely the opposite of what we predicted. See Figure 3.

Discussion

Experiments 2 A and 2B examined the role repetition on the ORE using a within-participants manipulation of repetition. We predicted the elimination of the ORE for repeated faces caused by the enhanced learning of repeated other-race faces. In Experiment 2 A, we found no influence of repetition on the ORE, while in Experiment 2B, we found a small increase of the ORE for repeated faces, consistent with Experiment 1. Thus, taken together, the results of the three first experiments, suggest that, if anything, repetition increased the ORE.

Experiment 3

A potential explanation for the absence of repetition effects on the ORE in the previous experiments is that the number of repetitions (three) was not enough to promote the efficient learning of other-race faces. Thus, in Experiment 3, we added a new repetition condition in which faces were presented five times. Given the similarity between the results of Experiment 1 (between-participants manipulation of repetition) and the results of Experiments 2 A and 2B (within-participants manipulation), in the current experiment, we manipulated repetition in a between-participants fashion (i.e., no repetition, three repetitions, and five repetitions) such that we could again have information on participants response criterion.

Method

Participants

One hundred and thirty-three students (82 females and 51 males; M_{age} = 21.11 years, SD_{age} = 4.97 years; one participant did not report her age) of the University of Lisbon took part in this experiment. They received partial course credit for their participation.

Materials

We used the same set of faces of the previous experiments.

Table 4. Mean proportion of hits and false alarms as a function of face race and repetition condition.

	No-repetition		Three-repetition		Five-repetition	
	Own-race	Other-race	Own-race	Other-race	Own-race	Other-race
Hits	.63 (.17)	.61 (.17)	.72 (.17)	.72 (.17)	.72 (.19)	.69 (.21)
False Alarms	.26 (.17)	.34 (.19)	.22 (.17)	.36 (.19)	.13 (.13)	.28 (.17)

Note. Standard deviations are presented within brackets.

Procedure

The procedure was identical to that of Experiment 1, with one main difference. Namely, we added a new condition in which participants saw each one of the 64 target faces (32 White and 32 Black) five times during the study phase. All faces were presented in random order. Thus, in the no-repetition condition ($n = 44$), participants saw each face only one time; in the three-repetition condition ($n = 45$), participants saw each face three times; and in the five-repetition condition ($n = 44$), they saw each face five times. Participants were tested in the lab in sessions of up to eight participants at a time.

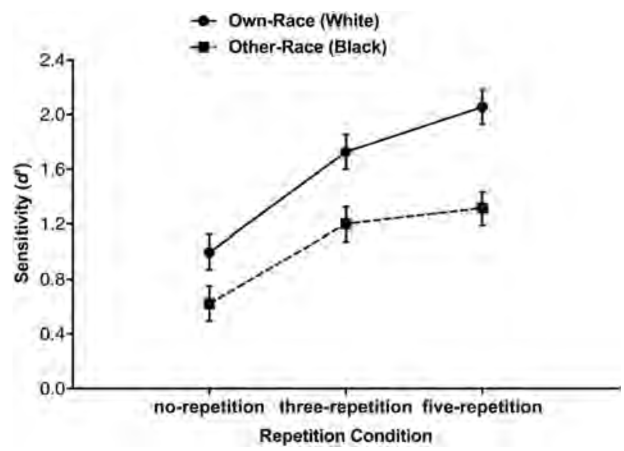

Figure 4. Mean sensitivity accuracy (*d*′) as a function of Face Race and Repetition condition (Experiment 3). Error bars represent ± 1 standard error around the mean.

Results

For the average hit and false alarm rates for all conditions, see Table 4.

Sensitivity (d′)

Results showed better recognition accuracy for own-race faces ($M = 1.59$, $SD = .84$) than other-race faces ($M = 1.05$, $SD = .84$; $M_{Diff} = .55$, $SE = .05$, Cohen's d = .86). Faces shown one time ($M = .81$, $SD = .78$) were worst recognized than faces shown three ($M = 1.46$, $SD = .78$; $M_{Diff} = -.65$, $SE = .05$, Cohen's d = −.34) and five times ($M = 1.69$, $SD = .78$; $M_{Diff} = -.88$, $SE = .17$, Cohen's d = −.46). Faces repeated five times were better recognized than those repeated three times ($M_{Diff} = .22$, $SE = .16$, Cohen's d = .12). Rather that reducing the ORE, we again found that repetition increased it. As can be observed in Figure 4, the mean difference between own- and other-race faces progressed from .35 for non-repeated faces ($SE = .10$, Cohen's d = .65) to .53 for faces repeated three times ($SE = .09$, Cohen's d = .78) to .74 for faces repeated five times ($SE = .10$, Cohen's d = 1.22).

Response criterion (C)

The response criterion was more conservative for own-race ($M = 0.20$, $SD = .43$) than for other-race faces ($M = -0.005$, $SD = .43$; $M_{Diff} = .21$, $SE = .04$, Cohen's d = .48), and more conservative for faces seen one time ($M = .13$, $SD = .78$) versus three times ($M = .02$, $SD = .78$; $M_{Diff} = .11$, $SE = .08$, Cohen's d = .13). We found a minor difference in response criterion between faces seen one time and five times ($M = 0.14$, $SD = .78$; $M_{Diff} = -.01$, $SE = .08$, Cohen's d = .01). Regarding the influence of repetition on the criterion toward own- and other-race faces, the pattern of results was not as clear as the one obtained for sensitivity scores. That is, the difference between own- and other-race faces did not increase consistently with increased repetitions as the largest difference was observed for faces repeated three times ($M_{Diff} = .31$, $SE = .09$, Cohen's d = .71), followed by faces repeated five times ($M_{Diff} = .22$, $SE = .06$, Cohen's d = .56), and finally by faces seen one time ($M_{Diff} = .11$, $SE = .06$, Cohen's d = .22).

Discussion

In Experiment 3, we tested whether repeating the faces five times would improve the learning of other-race faces and consequentially reduce the ORE. Results demonstrated that, while recognition of own-race faces continued to improve with increased repetitions, recognition of other-race faces somewhat stagnated between three and five repetitions. In fact, the effect-size (Cohen's d) of the ORE nearly doubled from the no-repetition condition to the five-repetition condition (.65 vs. 1.22). Thus, rather than reduce the

ORE, the inclusion of the new condition with five repetitions increased it.

Taken together, the results obtained so far suggest that repetition either has no influence (Experiments 2 A) or has a negative influence on the ORE (Experiments 1, 2B, and 3). These seem thus consistent with the argument that social contact with other-race faces is *only* effective in reducing the ORE when the contact requires a certain degree of individuated processing (e.g., Tanaka & Pierce, 2009; Walker & Hewstone, 2006; Walker et al., 2008). In the last experiment, we aimed to address this issue by presenting repeated and non-repeated faces paired with individuating information (i.e., names).

Experiment 4

In Experiment 4, we examined the potential reasons why repetition did not eliminate the ORE but instead increased it. Previous research exploring the role of social contact on the ORE has shown that contact with other-race faces is not efficient in promoting learning unless it comes accompanied with individuating information (e.g., McGugin et al., 2011; Walker & Hewstone, 2006; Walker et al., 2008; Young & Hugenberg, 2012). For example, training participants to categorize other-race faces at the individual level (e.g., Bob) improved recognition of different other-race faces in a post-training session, whereas training participants to categorize other-race faces at the race level (e.g., Black) did not (McGugin et al., 2011).

However, individuating information about other-race faces does not necessarily lead to better recognition for these faces. In a recent study, Stelter and Degner (2018) presented Black faces (other-race) paired with race-typical (e.g., Deshawn) and race-atypical names (e.g., Brad) in the study phase. They later asked participants to recognize the faces (without the names). Results showed that participants recognized other-race faces previously presented with race-typical names worse than other-race faces previously paired with race-atypical names. Interestingly, participants recognized other-race faces paired with race-atypical as good as own-race faces (White) paired with race-typical names.

Stelter and Degner (2018) findings suggest that the typicality of names influenced the way participants learned own- and other-race faces. One possible explanation is that presenting other-race faces with race-typical names increases their perceived prototypicality, which in turn may foster category-based processing (at the expense of individuated processing; Levin, 2000; MacLin & Malpass, 2001). Another related possibility is that race-typical names facilitate the categorization of other-race faces as out-group members, leading to a subsequent cognitive disregard of these faces (Rodin, 1987; Sporer, 2001). On the other hand, other-race faces carrying race-atypical names may be perceived as less prototypical of Blacks, or they may violate participants' expectations as they are inconsistent with the initial categorization. Consequently, they may be processed in a more individuated way or become highly salient in memory.

Based on the findings and arguments described above, in the present experiment, we repeated own- and other-race faces carrying race-typical or race-atypical names. We expected repetition to reduce the ORE when the faces were paired with race-atypical names, as atypical names potentiate individuated processing of faces (e.g., McGugin et al., 2011; Stelter & Degner, 2018). Conversely, for faces with race-typical names, we predicted that repetition would amplify the ORE as race-typical names would work as another cue leading to the attentional disregard of these faces.

Method

Participants

Eighty White students (67 females and 13 males; $M_{age} = 21.21$ years, $SD_{age} = 5.80$) of the University of Lisbon participated in exchange for partial course credit.

Materials

In addition to the 128 images of male faces (64 White and 64 Black) used in the previous experiments, we also used 64 first names of which 32 were typical of White men, and 32 were typical of Black men (see Appendix A). We selected White names from online lists of the most popular names given to Portuguese babies in the last five years (from 2013 to 2017). Regarding Black names, we first searched for the most popular names attributed to babies in four Portuguese-speaking African countries (Angola, Mozambique, Cape Verde, and São Tomé and Príncipe). We restricted our search to the same five-year period and selected only the names that were familiar to us. Based on these criteria, we selected 63 names. We then pretested these names by asking a sample of online participants ($N = 16$) to indicate the likelihood of each name belonging to a White/Black man. Participants responded using an 11-point scale (1 = *Certainly of a White man*, 5 = *Equally likely of a White or Black man*, 11 = *Certainly of a Black man*).

Table 5. Mean proportion of hits as a function of face race and repetition condition for the typical condition.

	No-repetition		Three-repetition	
	Own-race	Other-race	Own-race	Other-race
Hits	.47 (.18)	.48 (.17)	.75 (.17)	.64 (.22)

Note. The mean proportion of False Alarms for own-race faces was .19 (.16) and the one for other-race faces was .28 (.16). Standard deviations are presented within brackets.

Table 6. Mean proportion of hits as a function of face race and repetition condition for the atypical condition.

	No-repetition		Three-repetition	
	Own-race	Other-race	Own-race	Other-race
Hits	.42 (.16)	.52 (.23)	.70 (.17)	.75 (.14)

Note. The mean proportion of False Alarms for own-race faces was .21 (.17) and the one for other-race faces was .33 (.25). Standard deviations are presented within brackets.

We added eight typical White names to the list such that participants would use the entire range of the response scale. From these pretested names, we selected 32 typical Black names (the 95% confidence intervals of the mean ratings of these names did not include the scale midpoint).

Procedure

The procedure largely mirrored that of the previous experiments, with some crucial differences. In the initial instructions, we told participants they would see faces of several individuals together with their first names and that they should try to form an impression of each one of the individuals because in a later phase of the experiment we would ask some questions about each of them. We did not specify which questions were these. We informed participants that some of these faces (and respective names) would be shown more than one time while others would be shown only once (see Appendix B for the exact instructions). We included these instructions to further promote the individuated processing of faces.

In the study phase, the faces were displayed at the center of the screen with the respective name underneath for 3000 ms. For half of the participants, White faces were paired with White-typical names and Black faces with Black-typical names (typical condition). For the other half of the participants, White faces were paired with Black-typical names and Black faces with White-typical names (atypical condition). The pairing of faces and names was randomly determined before the experiment and was the same for every participant. After the study phase, participants completed a brief filler task followed by a recognition test similar to that of the previous experiments. That is, participants were tested on the faces alone, without the names.

Results

As in Experiments 2 A and 2B, repetition was manipulated within-participants in the study phase, which means that *d’* scores for own- and other-race faces presented one time and three times were calculated based on the same false alarm rate. Thus, *d’* scores correspond to the hit rate but are reported as *d’* to provide a measure that takes into account also the false alarm rate and thus control for guessing. See Tables 5 and 6 for the average hit and false alarm rates for all conditions.

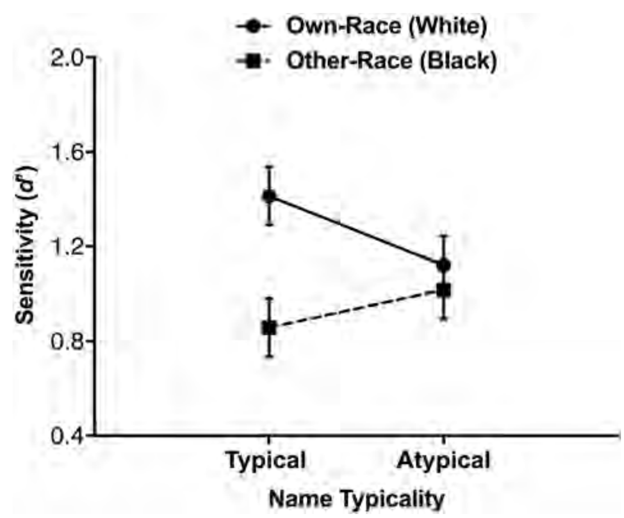

Figure 5. Mean sensitivity (*d*′) as a function of Face Race and Repetition Condition (Experiment 4). Error bars represent ± 1 standard error around the mean.

Sensitivity (d′)

Participants recognized own-race faces more accurately ($M = 1.29$, SD = .78) than other-race faces ($M = 0.94$, SD = .78; M_{Diff} = .35, SE = .06, Cohen’s d = .62), and faces seen three times more accurately ($M = 1.48$, SD = .77) than faces seen only one time ($M = 0.74$, SD = .77; M_{Diff} = .74, SE = .06, Cohen’s d = 1.43). We also found the ORE was moderated by the typicality of names in that own-race faces were much better recognized than other-race faces when presented with typical names (M_{Diff} = .56, SE = .09, Cohen’s d = .90) than when presented with atypical names (M_{Diff} = .14, SE = .09, Cohen’s d = .29). See Figure 5. Consistent with the previous experiments, we again obtained a larger difference between own- and other-race faces for repeated (M_{Diff} = .48, SE = .08, Cohen’s d = .75) than non-repeated faces (M_{Diff} = .21, SE = .08, Cohen’s d = .33). Importantly, we

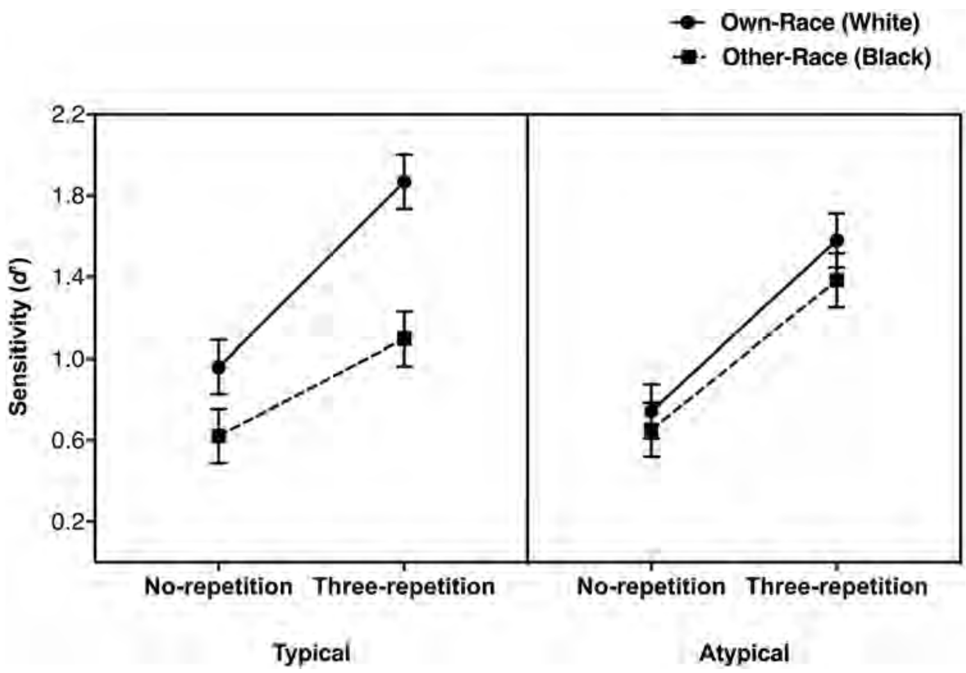

Figure 6. Mean sensitivity (*d'*) as a function of Face Race, Repetition Condition, and Name Typicality (Experiment 4). Error bars represent ± 1 standard error around the mean.

found that the effect of repetition on the ORE was more pronounced for faces with typical names. That is, for typical names, the ORE was larger for faces repeated three times (M_{Diff} = .77, *SE* = .11, Cohen's d = 1.06) than for faces seen one time (M_{Diff} = .34, *SE* = .11, Cohen's d = .43). See left side of Figure 6. For atypical names, the ORE obtained for faces repeated three times (M_{Diff} = .20, *SE* = .11, Cohen's d = .30) was slightly larger than the ORE obtained for faces not repeated (M_{Diff} = .09, *SE* = .11, Cohen's d = .17). Notably, the size of the ORE obtained for faces with atypical names was much smaller than the size of the ORE obtained for faces with typical names. See right side of Figure 6.

Discussion

In Experiment 4, we investigated the possible causes underlying the ineffectiveness of repetition in overriding the ORE. We reasoned that repeating other-race faces with race-atypical names would promote the individuated processing of these faces and consequently eliminate the ORE. Regarding the faces with race-typical names, we predicted that repetition would, if anything, increase the ORE. We obtained the following results. First, we found that name typicality moderated the ORE such that it was observed only for faces paired with race-typical names. These results seem consistent with previous work by Stelter and Degner (2018). Second, replicating Experiment 3, we again found a larger ORE for repeated faces.

Interestingly, in the present experiment, we only needed three repetitions to observe a significant increase in the ORE, while in Experiment 3, we only obtained this effect after five repetitions. Third, the impact of repetition on the ORE was moderated by name typicality. Specifically, for faces with race-typical names, repetition amplified the ORE. In contrast, for faces with race-atypical names, repetition did not eliminate the ORE as the difference between own- and other-race faces seen one time and three times was extremely small.

As we referred in the introduction to Experiment 4, we expected repetition to eliminate the ORE for faces paired with race-atypical names, as these would potentiate the individuated processing of these faces. However, the present results are not consistent with our hypothesis as, not only the ORE failed to emerge in this condition, but also the pattern of means suggests the opposite happened. We return to this issue in the next section.

General discussion

In the present work, we hypothesized that the repetition of face stimuli would produce the well-known increase in learning and subsequent memory performance (Ebbinghaus, 1885/1964). We reasoned that because other-race faces are poorly learned (either due to lack of perceptual expertise or motivational deficits) based on a single presentation, they would benefit more from repetition than own-race faces, as these are typically easily learned from a single exposure.

However, in Experiments 1, 2 A and 2B, we did not find evidence that repetition reduces the ORE, no matter whether repetition was manipulated between (Experiment 1) or within-participants (Experiments 2 A and 2B), or participants responded through an internet platform service (i.e., Prolific; Experiments 1 and 2 A) or in the lab (Experiments 2B, 3, and 4). If anything, Experiments 1 and 2B suggest that repetition increases the ORE.

In Experiment 3, we tested whether repeating the faces five times would improve the learning of other-race faces. Results, however, clearly demonstrated that the ORE increased with increased repetitions. Thus, rather than causing a reduction of the ORE, the inclusion of this new condition increased it.

In Experiment 4, we introduced a new manipulation that we hoped would finally lead to the individuation of other-race faces. Namely, in one between-participants condition, we paired own- and other-race faces with race-typical names, while in the other condition, we paired faces with race-atypical names. Replicating Experiment 3, we found that repetition increased the ORE. Importantly, we also found that the ORE did not occur for faces paired with atypical names, which seems consistent with previous research (Stelter & Degner, 2018).

Regarding the impact of repetition on own- and other-race faces presented with race-typical and atypical names, results for faces with race-typical names seemed consistent with those of Experiment 3, in that there was a larger ORE effect for repeated faces. For those faces displayed with race-atypical names, we found no substantial evidence for the ORE. Taken together, these results suggest that repetition either has no influence on the ORE (Experiments 1–2B), or it has a negative impact (Experiment 3, and Experiment 4 for race-typical names).

Possible reasons why repetition increased the ORE

The results obtained in the first three experiments collectively showed that repetition had no impact on the ORE. If such null findings can be explained by the absence of individuating information about other-race faces, as suggested by previous research (e.g., McGugin et al., 2011; Walker & Hewstone, 2006; Walker et al., 2008), the results obtained in Experiments 3 and 4 showing that repetition increased the ORE, may not. The question then is, why would repetition increase the ORE? Although our current experiments do not allow for a definitive response to this question, below, we discuss some factors that might have led repetition to increase the ORE.

One possible factor is the cognitive load imposed by the additional repetitions in Experiment 3. In the five-repetition condition, participants saw each one the 32 White and 32 Black faces five times during the study phase, thus making a total of 320 face presentations. Such a high number of trials may have become cognitively taxing, and, as a result, participants may have started relying more on other-race faces category information as a strategy to save resources for own-race faces. This would explain why the ORE was larger in the five-repetition condition than in the other two conditions.

However, although previous research has shown the memory benefits of relying on category information in cognitively demanding situations (e.g., Macrae et al., 1994), this possibility seems unlikely in light of recent findings showing that cognitive load during the study phase mostly deteriorates memory accuracy for own-race faces (Zhou et al., 2014), which suggests that the learning of own-race faces requires more attention than the learning of other-race faces (see also Van Bavel & Cunningham, 2012).

Another possibility is that the feeling of familiarity that usually comes along with repetition leads to a less attentive processing of familiar faces and increased reliance on heuristic cues, like race-identifying physical features or race-typical names. This hypothesis is based on evidence from some person perception studies showing that repetition-induced familiarity triggers more stereotype-based judgments and less sensitivity to individuating information of a familiar target individual, particularly when there is a fit between the target characteristics and the stereotype (T. Garcia-Marques & Mackie, 2007; Garcia-Marques et al., 2016; Smith et al., 2006). For example, Garcia-Marques et al., (2016) showed that participants used more stereotypical information to judge a familiar versus unfamiliar crime suspect, but only when the suspect's occupation (club bouncer) was stereotypically consistent with the crime (assault). This possibility seems consistent with results of Experiment 4 in which the ORE was amplified by repetition when other-race faces were presented with race-typical names and reduced when the same faces were paired with atypical names.

Notice, however, that if repetition would lead to more categorical and less individuate processing, that should prove detrimental for the recognition performance of both white and black target individuals, and the results showed the opposite. Repetition was beneficial for recognition performance in general, but much more in the case of white relative to black targets. Thus, future work should further investigate this possibility.

Theoretical implications for current theoretical accounts of the ORB

Despite the numerous differences between existing theoretical accounts of the ORB, they all share the assumption that other-race faces are poorly individuated and, therefore, factors that increase the individuated learning of these faces should lead to a reduction the ORB (for a review of the different accounts, see Young et al., 2012). Indeed, studies have shown that training procedures (e.g., Tanaka & Pierce, 2009) or individuation instructions (e.g., Hugenberg et al., 2007) might have some impact in reducing the ORB.

In this vein, drawing on a consistent body of evidence showing the learning and memory benefits of repetition (see Greene, 2008), in the current set of experiments, we relied on repetition to increase the individuated learning of other-race faces. Contrary to what we expected, though, we found an overall pattern of results that suggests that repetition may increase ORB. In our view, none of the ORB accounts would predict these results a priori, and thus these findings can potentially make an important contribution in constraining existing and future theories about this phenomenon. Bellow, we discuss some of the possible implications of our findings.

According to some perceptual expertise accounts (e.g., McGugin, Tanaka, Lebrecht, Tarr, & Gauthier, 201; Tanaka & Pierce, 2009), to acquire the expertise to recognize other-race faces one needs to experience these faces at the individual level. Thus, in Experiment 4, in Experiment 4, we presented did not only presented photographs of own- and other-race individuals, but also their names. We expected repetition to reduce the ORE for faces paired with race-atypical names, as these would enhance individuation, particularly for other-race faces. And, indeed, we obtained a reduction of the ORB for faces paired with atypical names; however, this reduction was mainly driven by a recognition accuracy decrease for own-race faces presented with atypical names and not by an increase for other-race faces with atypical names, as we have predicted. This pattern of results is thus inconsistent with perceptual-expertise accounts in that it does not corroborate the idea that individuated experience leads to better recognition of other-race faces.

On the other hand, the possibility that mere atypical names cause a recognition deficit for own-race faces converges with other studies demonstrating that the presence of cues signaling the group status of own-race faces influences participants memory for those faces. For example, with has been shown that participants assigned to some minimal group have superior memory for own-group compared to other-group same-race faces (e.g., Bernstein et al., 2007; Van Bavel et al., 2012). Moreover, MacLin and Malpass (2001) demonstrated that in identical but racially ambiguous faces with different racial markers (hair), the ORE emerged according to the race marker (for other related findings, see, e.g., Hourihan et al., 2013; Pauker et al., 2009). Finally, the fact that short-term training programs lead to a reduction of the ORE (Hills & Lewis, 2006; DeGutis et al., 2011) is amenable for an explanation in terms of an attentional/social-cognitive approach to the ORE rather than an approach strictly based on perceptual expertise.

Taken together, the results of the present experiments suggest that, although the lack of perceptual expertise is an important factor in understanding the ORE, it may not be necessary nor sufficient to cause it. At least, if we subscribe to the idea that the abundance of experience or learning opportunities will necessarily lead to perceptual expertise development, as suggested by previous studies (e.g., Chiroro & Valentine, 1995; Tanaka et al., 2004; Wright et al., 2001). Drawing on the model of expertise acquisition of Ericsson and collaborators (Ericsson et al., 1993), we propose that to acquire the ability to recognize other-race faces, one needs to be motivated to attend to these faces and exert deliberate effort to improve performance. Additionally, one needs immediate informative feedback and knowledge of own performance to allow for a self-reflective loop that will optimally improve performance over time. Therefore, the mere repetition of an action or the mere abundance of learning opportunities will not automatically lead to expertise acquisition. Thus, in our view, the dichotomy portrayed in literature between perceptual expertise and motivational mechanisms is a false dichotomy that hinders our full understanding of the ORE (for other proposals that also overcome this dichotomy, see Correll et al., 2017; Hugenberg et al., 2013; Meissner et al., 2005).

Our proposal would account for why motivational instructions sometimes fail to reduce the ORE (Barkowitz & Brigham, 1982; Bornstein et al., 2013; Brigham, 2008; Hugenberg et al., 2007) and why experience seems to be a weak predictor of ORE (see Meissner & Brigham, 2001). For example, attending schools with large numbers of outgroup members has been shown to have variable effects on the magnitude of ORE (for a review, see Levin, 2000), in some cases reducing the ORE (Feinman & Entwisle, 1976), in others showing no effect (Malpass & Kravitz, 1969), and in still other cases exacerbating the ORE (Lavrakas et al., 1976).

Limitations and future directions

One possible limitation of our work concerns the name manipulation employed in Experiment 4. Presenting the names together with the faces may have captured attention at the expense of face processing, particularly in the case of atypical names as these may be relatively novel, unfamiliar, or disfluent. Although this might have occurred, it seems it did not substantially affect face recognition; otherwise, participants should have had better memory for faces with typical than atypical names, which did not happen (M_{Diff} = .05, SE = .16, Cohen's d = .03). However, future research should present the names before (in a separate screen) the faces to avoid this issue.

Another limitation is that all own-race faces were White, and all other-race faces were Black. Because it is often complicated to get large enough samples of Black participants, we deliberately confounded race (White/Black) is with the own/other distinction. Although this is the common practice in the ORE literature (Meissner & Brigham, 2001), it may be a problem as we cannot rule out that the effects were not influenced by systematic differences that may exist in the stimulus set (e.g., the White set may have a higher number of highly distinctive faces). Thus, future research should try to replicate these findings with Black participants and/or different face stimuli.

Note

1. Experiments 1 and 2A were run simultaneously on Prolific, with the Qualtrics program randomly assigning participants to one of the conditions of Experiment 1 or Experiment 2A. Our goal was to collect 84 participants for Experiment 1 (42 in each condition) and 45 for Experiment 2A, however, an error in the implementation of this assignment procedure originated the observed sample sizes.

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Appendix A

List of male first names used in Experiment 4

White Names	Black Names
Ricardo	Djeniny
João	Edson
Francisco	Danilson
Rodrigo	Edmilson
Martim	Denildo
Afonso	Jailson
Tomás	Yannick
Miguel	Baldé
Duarte	Adilson
Lourenço	Odaír
Gabriel	Edmar
Gonçalo	Luaty
Pedro	Delson
Guilherme	Helton
Tiago	Omar
Dinis	Ivanildo
Rafael	Edivan
Diogo	Divon
Salvador	Adil
Gustavo	Dálcio
David	Delvanio
Vicente	Dinho
Simão	Umaro
José	Valdemar
Manuel	Danilo
António	Evandro
Daniel	Anselmo
Vasco	Stélio
André	Crimildo
Luís	Charlon
Eduardo	Mané
Filipe	Dito

Appendix B

Instructions of Experiment 4 (translated from the Portuguese)

In the first phase of this study, you will see the faces of different individuals. Each individual will be presented together with his name.

The face-name pairs will be displayed one by one in the middle of the screen. Some of these pairs will be presented only once, while others will appear more than once.

Your task at this stage is to try to form an impression of each individual you are going to see. Namely, you should try to imagine the person that is being presented, his personality, his tastes, etc. In the next phase of this study, you will be asked questions about the presented persons.

The presentation of the face-name pairs will last a few minutes. Try to stay focused throughout the entire presentation.