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Invisible own- and other-race faces presented under continuous flash suppression produce affective response biases

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ABSTRACT

One triumph of the human mind is the ability to place the multitudinous array of people we encounter into in- and out-group members based on racial characteristics. One fundamental question that remains to be answered is whether invisible own- and other-race faces can nevertheless influence subsequent affective judgments. Here, we employed continuous flash suppression (CFS) to render own- and other-race faces unperceivable in an affective priming task. Both on-line and off-line awareness checks were employed to provide more stringent control of partial awareness. Results revealed that relative to own-race faces, imperceptible other-race faces significantly facilitated participants' identification of negative words, suggesting an other-race derogation bias. When faces were presented consciously, we found that not only other-race faces facilitated detection of negative words, but also own-race faces facilitated detection of positive words. These findings together provide novel and strong evidence suggesting that invisible racial faces can bias affective responses.

1. Introduction

People have a natural tendency to categorize others into social groups, even when such groups are formed based on minimal and ostensibly arbitrary information (Tajfel, 1970). Indeed, one triumph of the human mind is an ability to manage multitudinous social information via social categorization (Allport, 1979; Fiske & Neuberg, 1990; Macrae & Bodenhausen, 2000). Categorizing the social world into "us" and "them" provides a basis upon which people form and honor cooperative coalitions with some people while remaining vigilant for potential threats from others (Allport, 1979). In this way, social categorization not only divides the social world into us and them but also attaches presumptions of alliance versus (potential) enmity on these groupings, triggering associated affective responses. These affective responses may serve a basis for intergroup biases such as prejudice, stereotyping, and even discriminatory behavior toward out-group members (Allport, 1979; Banaji & Hardin, 1996; Bodenhausen, Kang, & Peery, 2012; Fiske & Neuberg, 1990; Hilton & Von Hippel, 1996; Macrae &

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Bodenhausen, 2000; Tajfel, 1970). One salient factor that supports social categorization is known as race. Indeed, three-month old infants begin to preferentially look at their own-race faces over other-race faces (Bar-Haim, Ziv, Lamy, & Hodes, 2006; Kelly et al., 2005, 2007). Beyond this race-based perceptual bias, 4- and 5-year old children start to show an evaluative bias to other-race members (Qian et al., 2016), and particularly to low-status other-race members (e.g., Dunham, Chen, & Banaji, 2013; for a review, see Dunham, Baron, & Banaji, 2008).

This evidence from developmental psychology strongly supports the idea that even at a very early developmental stage, infants and pre-school children showed race-based perceptual and evaluative biases. Moreover, this evidence indicates that high-level cognitive processes such as reasoning and language that are supported by developed prefrontal cortices may not be necessary for perceptual/evaluative biases to occur. However, it remains unclear whether awareness of own- and other-race faces is necessary to generate affective response bias. This is also the primary goal of the current study: can invisible own- and other-race faces bias evaluative judgments in an affective priming task.

Voluminous studies have demonstrated that inter-group prejudice and stereotyping can be manifested efficiently and spontaneously. Specifically, a briefly presented social prime such as an other-race face will facilitate judgments of subsequent prejudice- and stereotype-congruent words in a sequential priming task (e.g., Banaji & Hardin, 1996; Couto, Pinheiro, & Wentura, 2012; Dovidio, Evans, & Tyler, 1986; Dovidio, Kawakami, Johnson, Johnson, & Howard, 1997; Fazio, Jackson, Dunton, & Williams, 1995; Gaertner & McLaughlin, 1983; Kawakami, Dovidio, & Dijksterhuis, 2003; Lowery, Hardin, & Sinclair, 2001; Wittenbrink, Judd, & Park, 1997; for reviews, see Greenwald & Banaji, 1995; Greenwald et al., 2002). Although evidence from implicit or indirect tasks clearly suggests the unintentional and efficient nature of such biases, it remains ambiguous whether awareness of the primes is necessary for such biases to occur (Bargh, 1994; Gawronski, Hofmann, & Wilbur, 2006; Moors & De Houwer, 2006; Moors, 2016).

A direct test of whether interracial affective bias depends on consciousness would be to manipulate participants' awareness of the primes. Traditionally, researchers have relied on a masking approach to render stimuli invisible to study unconscious processing. Specifically, briefly presented primes (typically <30 ms) are masked by forward/backward noise patterns so as to manipulate awareness of primes (e.g., 80 ms forward mask +27 ms prime +13 ms backward mask in Couto et al., 2012; 75 ms prime +250 ms backward mask in Dovidio et al., 1997; 17 ms prime +225 ms backward masking in Study 3 of Kawakami et al., 2003; 100 ms forward mask +17 ms prime +200 ms backward mask in Study 4 of Lowery et al., 2001; 15 ms prime +2000 ms backward masking in Wittenbrink et al., 1997). As a manipulation check, participants were probed awareness of the primes following the primary priming tasks using either subjective self-reports or objective two-alterative forced-choice tasks (e.g., Couto et al., 2012). Although this masking approach has been widely used to demonstrate a range of unconscious processing effects, recent empirical data suggest that many previous findings that support the automatic or unconscious emotional processing can actually be attributed to non-automatic processing features such as attentional demand and awareness (Pessoa, 2005; Pessoa, McKenna, Gutierrez, & Ungerleider, 2002; Pessoa, Padmala, & Morland, 2005; Pessoa, Japee, Sturman, & Ungerleider, 2006). Specifically, regarding unconscious processing, Pessoa (2005) argued that previous evidence that seems to support unconscious visual processes mostly relies on imprecise awareness checks (e.g., subjective report or off-line awareness assessments). Moreover, Kouider and Dupoux (2004) showed that even partial awareness of the primes in a subliminal priming task could drive the priming effects. Lastly, it should be noted that in Weisbuch and Ambady (2008) Study 2, when 12 ms backward masked white and black neutral faces were used as primes, these faces did not produce the basic affective priming effects as in Fazio et al. (1995). Therefore, employing a paradigm other than masking to manipulate awareness and adopting both on-line and off-line, performance-based awareness checks will provide novel and stronger evidence regarding whether interracial affective bias can occur without awareness.

Here we employ continuous flash suppression (CFS; Fang & He, 2005; Tsuchiya & Koch, 2005), a relatively new variant of binocular rivalry and flash suppression, to prevent presentations of own- and other-race faces from entering into awareness and to investigate whether these invisible faces can produce affective bias. Unlike the masking approach that relies on short presentation time of primes and forward/backward masking to render primes invisible, CFS relies on dichoptic presentation and can effectively induce a prolonged state of unconscious stimulus presentation (Fang & He, 2005; Tsuchiya & Koch, 2005; Tsuchiya, Koch, Gilroy, & Blake, 2006). Specifically, during CFS, participants are presented with dynamic noise images (e.g., Mondrian) to their dominant eyes whereas primes are presented to their non-dominant eyes. Participants' conscious perceptual experience will be captured by the dynamic noise image, due to its high contrast, rich contours, and dynamic change. One notable difference between masking and CFS is the duration of unconscious presentation they can sustain: masking can render primes invisible for tens of milliseconds, whereas CFS can suppress primes from being perceived for seconds and even up to minutes (Tsuchiya & Koch, 2005; Tsuchiya et al., 2006).

Moreover, there is evidence suggesting that CFS and masking may tap into different neural mechanisms in unconscious processing. Specifically, it has been shown that invisible, masked stimuli still engage the ventral occipital-temporal cortex pathway (Dehaene et al., 2001; Liddell et al., 2005). Note activity along this pathway is tightly linked with fine-grained perceptual analyses, face/object recognition and thus rich awareness (Grill-Spector, 2003). On the other hand, it has been shown that the primes under CFS largely abolish this ventral pathway activity (Fang & He, 2005; Pasley, Mayes, & Schultz, 2004; Troiani & Schultz, 2013; Williams, Morris, McGlone, Abbott, & Mattingley, 2004, for a review, see Sterzer, Stein, Ludwig, Rothkirch, & Hesselmann, 2014). Given these behavioral and neural mechanisms differences associated with masking and CFS, previous studies also reported different priming patterns when masking and CFS were directly compared to study unconscious processing (Almeida, Mahon, Nakayama, & Caramazza, 2008; Almeida, Pajtas, Mahon, Nakayama, & Caramazza, 2013).