Exposure to Racial Ambiguity Influences Lay Theories of Race

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Abstract

Biological lay theories of race have proven to have pernicious consequences for interracial relations, yet few studies have examined how intergroup contact itself (particularly with those who naturalistically challenge these conceptions) affects beliefs about race. Three studies (a correlational study, an interaction study, and an experimental study) examine whether exposure to racially ambiguous individuals reduces Whites' biological lay theories of race across time. Study 1 demonstrates that increased exposure to racial ambiguity across 2 weeks reduced White individuals' biological lay theories. Study 2 shows that Whites who interacted in a laboratory setting with a racially ambiguous individual were less likely to endorse biological lay theories, an effect that sustained for 2 weeks. Study 3 finds that the reduction in biological lay theories after exposure to racial ambiguity is mediated by the tendency for Whites' lay theories of race to conform to beliefs they presume racially ambiguous individuals hold.

Keywords

lay theories, essentialism, visual ambiguity, race, and intergroup contact

Funderburg (2013) of the National Geographic recently wrote, "We've become a country where race is no longer so black and white" (p. 76). The image paired with this article featured two provocative images of the changing face of Americans—one of a racially unambiguous face representing the past and one of a racially ambiguous face representing the present. By addressing the growing racial ambiguity in the United States, this article continued the prevalent discourse about how the appearance of racial groups is changing, and along with it, people's definitions and beliefs about race.

Race is typically considered an unambiguous social category, easily recognized, and readily used in social perception (Macrae & Bodenhausen, 2000), yet there is increasing variation in racial phenotypes even within racial groups (e.g., Maddox, 2004). Phenotype variability in the United States has led to a recent upsurge of research on visual racial ambiguity (Chao, Hong, & Chiu, 2013; Chen & Hamilton, 2012; Freeman, Pauker, Apfelbaum, & Ambady, 2010; Krosch, Berntsen, & Amodio, 2013). Most of this work has focused on social perception in the context of exploring the process and determinants of racial categorization. Yet, there is a dearth of empirical social psychological research examining the impact of racial ambiguity exposure on intergroup attitudes. Both researchers in various disciplines (e.g., sociology and political science) and the popular media have postulated that increasing rates of racial ambiguity (e.g., growth in mixed race, and other populations, such as Latinos, whose appearance is often characterized by racial ambiguity) will lead to the blurring of racial boundaries and ultimately affect how we think about race

(DaCosta, 2007; Funderburg, 2013; Lee & Bean, 2010). The present studies sought to empirically test this proposition across three studies. Specifically, we test whether exposure to racially ambiguous individuals reduces biological lay theories of race (Studies 1–3), and whether Whites' conformity to the beliefs they presume racially ambiguous people hold (i.e., their meta-perception of biological lay theories) acts as a mechanism that accounts for this effect (Study 3).

Racial Ambiguity and Lay Theories of Race

What are people's lay theories about race? People generally hold biological and genetic lay theories of race—in other words, they think race is biologically based and encoded in our genes—commonly referred to as essentialist beliefs (Haslam, Rothschild, & Ernst, 2000). Accumulated research on lay theories finds that biological lay theories of race rationalize existing social inequalities (Keller, 2005; Yzerbyt, Rocher, & Schadron, 1997). People who hold biological, more essentialist theories of race are more likely to racially stereotype others (Bastian & Haslam, 2006; Haslam, Rothschild, & Ernst,

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2002) and avoid interacting with members of racial out-groups (Verkuyten, 2003; Williams & Eberhardt, 2008). Thus, identifying intergroup contact conditions that naturally challenge and reduce essentialist lay theories of race could advance theorizing on prejudice reduction strategies.

Generally, there has been much theorizing about (Lee & Bean, 2010), but little empirical research on, the impact of exposure to visual racial ambiguity on how people conceive of race. There is some evidence that racially ambiguous faces increase the use of alternative nonbinary categories, such that racially ambiguous faces are more likely than nonambiguous faces to be categorized as "multiracial," or "biracial," when such options exist (Chen & Hamilton, 2012). These findings suggest that when categorizing racially ambiguous faces, standard "Black" and "White" categories are insufficient to capture the structure of perceivers' racial categories. Racial ambiguity is inherently incompatible with biological lay theories of race. Those who hold more biological lay theories of race tend to see race as immutable and racial categories as distinct (Haslam et al., 2000; Plaks, Malahy, Sedlins, & Shoda, 2011). Thus, contact with those who appear racially ambiguous (i.e., could belong to multiple different categories) fundamentally challenges the notion that racial groups are distinct. While the growing literature on perceptions of racial ambiguity has elucidated a greater understanding for how perceivers process racial ambiguity, much of the research has examined these questions in constrained situations (i.e., perceivers view many racially ambiguous faces individually and are given forced-choice response options, such as "Black" or "White"). Using these methodologies, research has found that perceivers can quickly place racially ambiguous faces into monoracial categories especially when the task highlights categorical thinking (Peery & Bodenhausen, 2008), and those that endorse more essentialist lay theories of race are particularly attentive to disambiguating racial ambiguity (Chao et al., 2013). Thus, holding biological lay theories of race impacts how perceivers view racial ambiguity, particularly in controlled laboratory tasks, but what about the opposite—can exposure to racial ambiguity impact lay theories of race, especially in situations that highlight social interactions or judgments? Given that racially ambiguous individuals naturally challenge strict binary conceptions of race, we predicted that social encounters with such individuals should reduce biological lay theories of race (Studies 1 and 2). We also expected that the ambiguity-induced reduction in biological lay theories of race would be explained by Whites' conformity to the less biological lay theories of race that they think racially ambiguous people hold (Study 3). This account of lay concept change would be consistent with the tenets of social tuning (Lun, Sinclair, Whitchurch, & Glenn, 2007). Thus, in Study 3, we measured Whites' personal endorsement of biological lay theories as well as their beliefs about the lay theories held by a racially ambiguous person.

Study 1

Study 1 examines Whites' biological lay theories of race across a 2-week period as a function of their exposure to racial ambiguity.

Participants and Procedure

For Studies 1–3, data collection was predetermined to cease at the end of the academic semester in which it began. If, however, power analysis based sample sizes were not met, collection continued until minimums were met (see supplementary materials for further details). The final sample for Study 1 consisted of 50 White participants ($M_{age} = 18.82$, 56% female) who completed two online surveys approximately 2 weeks apart ($M = 16.65$ days). This time frame was based on prior research that has examined race-related attitude changes in short intervals (Stangor, Sechrist, & Jost, 2001). The short time frame also served the practical purpose of allowing for low attrition. The surveys included reports of their exposure to racial ambiguity and other racial groups along with their self-reported endorsement of biological lay theories of race.

Measures

Biological Lay Theories of Race

This construct was measured with a well-validated racial essentialism scale—Race Conceptions Scale (RCS; Williams & Eberhardt, 2008). For the RCS, participants rated 22 items on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*) with a higher score indicated a more biological theory of race. Assessments occurred at Time 1 ($\alpha = .82$) and Time 2 ($\alpha = .83$).

Ambiguity Exposure

Participants rated their ambiguity exposure using 4 items: "How many of your acquaintances [fellow students, friends, close friends] appear racially ambiguous?" on a scale of 1 (*None*, 0%) to 7 (*Almost All*, 100%). Exposure assessments occurred at Time 1 ($\alpha = .89$) and Time 2 ($\alpha = .89$).

Results

Means, standard deviations, and correlations of the main study variables are reported in Table 1. In order to test whether differences in exposure to ambiguity at Time 1 and Time 2 predicted changes in biological lay theories, we first constructed a change in exposure to ambiguity score such that higher scores reflect an increase in exposure to ambiguous individuals across the 2 weeks. We then modeled the difference between lay theories at Time 1 and Time 2 using mixed modeling in SPSS v. 22.

Level 1:

$$Y_{ij} = \pi_{0i} + \pi_{1i}(\text{time})_{ij} + \varepsilon_{ij}$$

Level 2:

$$\pi_{0i} = \Upsilon_{00} + \Upsilon_{01}(\text{change in ambiguity exposure})_i + \mu_{0i}$$
$$\pi_{1i} = \Upsilon_{10} + \Upsilon_{11}(\text{change in ambiguity exposure})_i + \mu_{1i}$$

Table 1. Means, Standard Deviations, and Correlations of Main Study 1 Variables.

	Time 1		Time 2		Change Score	
Variable	M	SD	M	SD	M	SD
Exposure to ambiguous individuals	2.80	1.21	2.78	1.11	−0.02	1.18
Biological lay theory	4.55	0.73	4.57	0.76	—	—
Correlations	−.38**	—	−.57***	—	—	—

Note. Correlations denote the relationship between ambiguity exposure and biological lay beliefs at each time point.
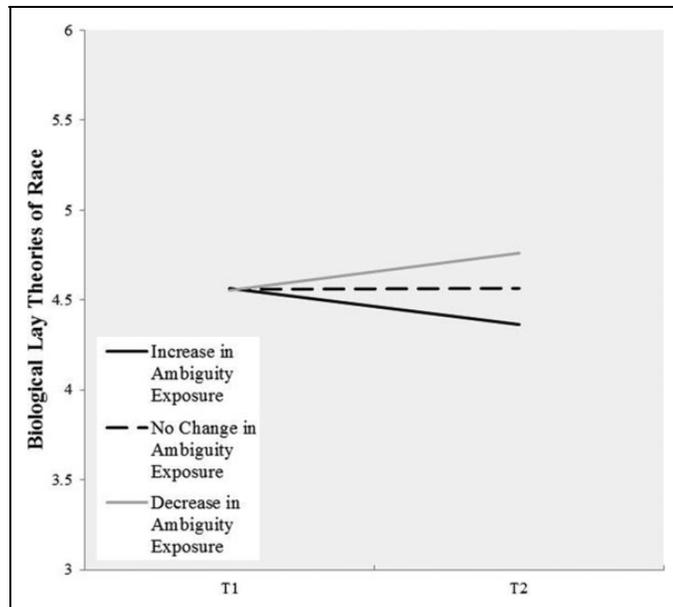**p < .01. ***p < .001.

Figure 1. Biological lay theories of race scores across T1 and T2 for individuals based on changes in exposure to racial ambiguity (increase/decrease = ±1 from no change = 0).

As predicted (see Figure 1), exposure to ambiguous individuals predicted change in biological lay theories of race over time, such that an increase in exposure to ambiguous individuals was associated with a decrease in biological beliefs over time, $\Upsilon_{11} = -.18$, $t(48) = -3.32$, $p = .002$. Though there are some limitations to using difference scores as independent variables (IVs; i.e., reducing variance explained), their use in the current study best reflects our interest in modeling how the change in ambiguous exposure influences changes in essentialist beliefs over time.

Study 2

Study 2 extends the results of Study 1 by testing whether Whites' biological lay theories of race change longitudinally after interacting in a laboratory setting with someone whom they perceive as racially ambiguous. In addition, we manipulated the conversation topic that the dyads discussed, because research has found that when interacting with a nonambiguous out-group member, engaging in a race-related topic can heighten interaction concerns for Whites (Goff, Steele, &

Davies, 2008). While making race salient often results in negative interaction outcomes for White individuals (e.g., distancing, more behavioral anxiety; see Trawalter, Richeson, & Shelton, 2009), a recent meta-analysis found that manipulating race salience can also lead to positive outcomes, such as increased egalitarian attitudes toward interracial partners (Toosi, Babbitt, Ambady, & Sommers, 2012). Thus, the effect of interacting with a racially ambiguous partner on the reduction of Whites' biological lay theories may be most evident when engaging in a discussion about race.

Participants and Procedure

After eliminating data from one dyad who knew each other prior to the study, the final set of participants included 83 White individuals (52% females, $M_{age} = 18.70$) from the subject pool. They were paired in dyads with minority interaction partners, also from the subject pool, who naturally varied in racial ambiguity. We overrecruited minority interaction partners who indicated in a prescreen questionnaire that they belonged to more than one racial group to promote variability in racial ambiguity among minority interaction partners. Sixty-three percent of dyad pairings were gender-matched. Though no a priori interactions or main effects were predicted for partner race or dyad gender-matching, post hoc analyses ruled out any differences by minority race of partner and gender-matching of dyad.

During a prescreen questionnaire, administered upon registration into the subject pool, participants reported their preexisting lay conceptions about race. Upon arrival to the lab, they were randomly assigned to engage in a 10-min discussion on a race-related (racial profiling) or nonrace-related (climate change) topic by ostensibly choosing a topic out of a box (through random assignment predetermined topic choice). After completing the interaction, participants were moved into separate rooms to complete questionnaires. They completed questions about their interaction and interaction partner (including filler items and the question about whether they knew their partner) followed by the RCS (immersed among other filler social issue topics; see supplementary materials), and a survey that assessed their personal demographics (gender, race, and age), perceived partner demographics (partner's gender, race, and age), and their certainty in their partner's race. Finally, participants completed an online survey assessing

Table 2. Means and Standard Deviations of Main Study 2 Variables.

Variable	Time 0 M	Time 0 SD	Time 1 M	Time 1 SD	Time 2 M	Time 2 SD
Racial ambiguity	—	—	2.54	1.19	—	—
Biological lay theory	4.31	0.60	4.43	0.72	4.42	0.82
Correlations	−0.14		−.30**		−.35**	

Note. Time 0 = prescreen scores, Time 1 = immediately postinteraction, Time 2 = approximately 2 weeks later; Correlations denote the relationship between racial ambiguity at Time 1 and biological lay beliefs at each time point.
**$p < .01$.

their lay theories of race approximately 2 weeks later ($M = 15.99$ days).

Measures

Biological Lay Theories of Race

The same measure from Study 1 was used. Assessments occurred at three time points: (1) during the prescreen session as participants joined the subject pool at large ($\alpha = .79$), (2) immediately postinteraction ($\alpha = .84$), and (3) in a follow-up session occurring approximately 2 weeks later ($\alpha = .87$).

Racial Ambiguity

Participants were asked several questions about their discussion partner (e.g., "What did you talk about with your partner? What was your partner's age? What is your partner's gender? What is your partner's race?"). Of key interest, participants were asked how certain they were of their partner's race on a scale from 1 (*not at all certain*) to 5 (*completely certain*). These scores were reverse-coded, such that higher numbers corresponded to higher racial ambiguity.

Results

See Table 2 for means, standard deviations, and correlations of the main study variables.

Preliminary Analyses

Ambiguity perceptions were compared to other metrics, namely, accuracy regarding their partner's race and thinking their partner was multiracial, to provide converging evidence that ambiguity measures were not socially desirable responses of minimizing race labeling or color blindness (e.g., Norton, Sommers, Apfelbaum, Pura, & Ariely, 2006), but rather indicated the participant's situational perception of their partner's racial ambiguity. Accuracy was calculated by comparing White's answer to the question, "What is your partner's race?" compared to their partner's indicated race. Greater ambiguity perceptions predicted less accuracy regarding their partner's race ($\beta = -0.36$, $SE = .91$, Wald's $\chi^2 = 3.42$, $e^\beta = 1.44$, $p = .06$). Based on whether they indicated that their partner was

multiracial (by either checking more than one race for their partner or picking the option: multiracial), we also created a variable that represented presuming one's partner was multiracial (regardless of whether he or she was actually multiracial). Greater ambiguity perceptions predicted presuming one's interaction partner was of mixed race ($\beta = -.68$, $SE = 0.23$, Wald's $\chi^2 = 8.38$, $e^\beta = .51$, $p = .004$). Also, of note, essentialism at T0, measured weeks prior to the interaction, was unrelated to the perceived racial ambiguity of their partner (see Table 2). Perceived racial ambiguity also did not vary by topic discussed, $F(1, 78) = 0.69$, $p = .41$, ns.

Based on minority interaction partners' self-reported race via a check all that apply format, interaction partners consisted of 29 (35%) Multiracial identified partners, 29 Latino/Hispanic identified partners (35%), and 25 Black/African American identified partners (30%). We did not expect changes in biological lay theories of race to be moderated by interaction partner's race, given the considerable phenotype variability in Latino, Black, and mixed-race populations. While greater interracial marriage and multiracial populations contribute to racial ambiguity, racial ambiguity is not synonymous with self-reported race. In other words, racially ambiguous people do not always self-identify as multiracial, even if others perceive them as multiracial. Similarly, nonambiguous people do not always identify with monoracial labels. In keeping with this observation, when comparing ambiguity ratings by partners' race, the analysis of variance in ambiguity was only marginally explained by partner's race, $F(2, 82) = 2.68$, $p = .08$. Post hoc analyses suggested that this marginal effect was driven by a trend toward participants who had Black/African American partners rating them as lower in racial ambiguity ($M = 2.16$, $SD = 0.90$) than those who had a multiracial partner ($M = 2.90$, $SD = 1.29$), $p = .07$, but no differences were found between Latinos ($M = 2.52$, $SD = 1.24$) and multiracial or Latinos ($ps > .6$) and Black partners. Thus, minority partners' self-identified race did not overlap considerably with ambiguity perceptions by their partner.

To ensure that partner racial self-identification did not influence our analysis, we tested additional models including partner racial self-identification as a predictor. As expected, no significant interactions or main effects were found with partner race (Black, Latino, or multiracial interaction partner) for lay theory change; and therefore, we collapsed across race of minority partner to examine the effect of primary interest: ambiguity.

Lay Theory Change

To test whether interacting with a racially ambiguous partner impacts biological lay theories of race across time, we created a multilevel model of change. Unexpectedly, no significant interactions were found for conversation topic; thus, interactions with conversation topic were dropped from the final model, and the multilevel model was tested with partner ambiguity as a predictor while controlling for conversation topic (Singer & Willett, 2003). Regression coefficients, standard
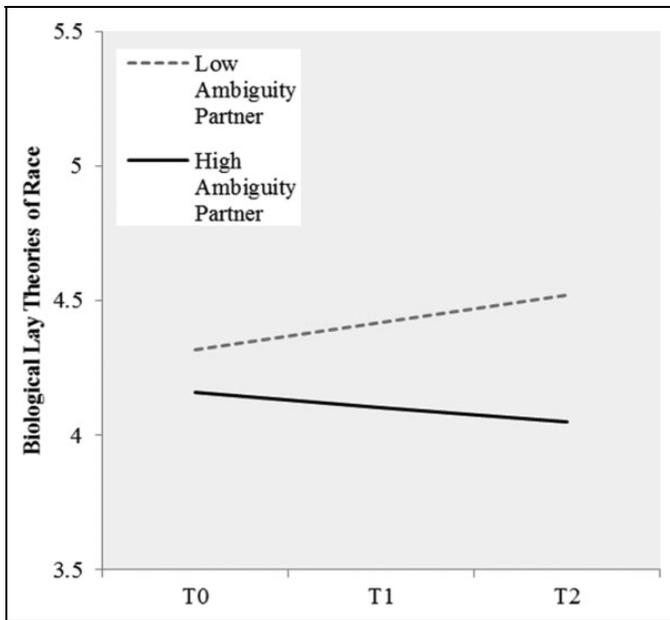
Figure 2. Prototypical trajectories for change in biological lay theories of race for individuals interacting with partners high and low in racial ambiguity (± 1 from midpoint of scale). T0 occurred before the interaction, T1 immediately after, and T2 approximately 2 weeks after the interaction.

errors, variance statistics, fit statistics, and levels of significance for all models are presented in the supplementary materials; the reported results will focus on the final model.

Level 1:
$$Y_{ij} = \pi_{0i} + \pi_{1i}(\text{time})_{ij} + \varepsilon_{ij}$$

Level 2:
$$\pi_{0i} = \Upsilon_{00} + \Upsilon_{01}(\text{ambiguity})_i + \Upsilon_{02}(\text{topic})_i + \mu_{0i}$$
$$\pi_{1i} = \Upsilon_{10} + \Upsilon_{11}(\text{ambiguity})_i + \mu_{1i}$$

Biological lay theories of race generally increased over the course of the study, $\Upsilon_{10} = .26$, $t(81.29) = 3.73$, $p < .001$, however, this effect is qualified by the influence of partner ambiguity over time, $\Upsilon_{11} = -.08$, $t(81.27) = -3.19$, $p = .002$. As predicted, interacting with an ambiguous partner led to a *decrease* in race essentialism immediately following the conversation (T1) and 2 weeks later (T2). However, participants who conversed with a nonambiguous individual had an increase in biological lay theories of race immediately after the interaction and 2 weeks later (see Figure 2). Unexpectedly, discussing a racial topic with one's partner did not determine whether racial ambiguity affected participants' lay theories of race. One possibility for the lack of influence of conversation topic is that race was made salient even during the neutral topic because of the uncertainty evoked by the visual ambiguity of their partner. There is a host of research that suggests that uncertainty about how to negotiate interracial interactions impairs interracial interactions by increasing interracial

anxiety, but also solicits egalitarian social norms among White partners (Gudykunst & Shapiro, 1997; Richeson & Trawalter, 2005; Toosi et al., 2012). Thus, uncertainty about the race of their interaction partner may have evoked racial concerns even during a neutral conversation topic.

Study 3

Study 1 and 2 demonstrate that racial ambiguity exposure is associated with decreases in essentialism. One of the limitations of the prior studies is that racial ambiguity was not experimentally manipulated (ambiguity exposure was measured via self-report in Study 1 and ambiguity varied naturalistically in Study 2). Study 3 sought to experimentally manipulate ambiguity by exposing participants to a target who was either racially ambiguous or unambiguous. In addition, though Study 1 and 2 replicated effects, they both used the same operationalization of lay theories (the RCS scale); in Study 3, we use a different measure of lay theories to increase the generalizability of the effect. Importantly, Study 3 sought to identify a mechanism that may account for the effect of exposure to ambiguity on essentialism change. We examined whether White individuals tune their attitudes to contextual social norms (i.e., social tuning) under conditions of uncertainty highlighted by racial ambiguity. In other words, do Whites adjust their lay conception of race to match the beliefs they assume racially ambiguous individuals hold regarding race?

Epistemic uncertainty has been shown to induce the tuning of intergroup attitudes to available exemplars (Lun et al., 2007). Social norms have a long history of influencing Whites' racial prejudice and stereotyping, even if these norms consist of the opinions provided by a single individual (e.g., Blanchard, Lilly, & Vaughn, 1991; Crandall, Eshleman, & O'Brien, 2002; Stangor et al., 2001; Zitek & Hebl, 2007). When Whites are subtly primed with uncertainty, they tend to mold their racial attitudes to racial attitude exemplars. For example, in Lun, Sinclair, Whitchurch, and Glenn (2007; Study 2), when primed with uncertainty words embedded in a sentence completion task and exposed to an experimenter with an "eracism" T-shirt, Whites were more likely to show lower implicit prejudice than when they received a neutral prime. Because racially ambiguous individuals evoke uncertainty, we expected Whites to conform their lay theories to that of the available exemplar. Thus, we predict that White perceivers will perceive racially ambiguous targets as having a lower endorsement of biological lay theories of race than nonambiguous targets and conform to such beliefs by reporting less endorsement of biological lay theories of race themselves.

Participants and Procedure

Participants were recruited online for monetary compensation through Amazon Mechanical Turk (56%) or for extra credit administered in a classroom setting (44%). After eliminating data from individuals who did not pass the manipulation check and one outlier whose scores were > 3 *SD* below the mean on

Table 3. Mediation Analysis for Study 3.

Mediated path	β	SE	95% Confidence Interval Lower CI	Upper CI
c (target ambiguity → personal lay theory)	−.37	.16		
a (target ambiguity → meta-theory)	−.31	.07		
b (meta-theory → personal lay theory)	1.28	.22		
c′	−.03	.15		
a × b (mediation effect)	.40	.10	0.23	0.64
κ^2 indirect effect	.29	.06	0.17	0.41

Note. CI = confidence interval, CIs that do not include zero indicate mediation.

meta-essentialism ($n = 10$), the final set of participants included 72 White individuals (58% females, M_{age}=31.93). No prescreen could be administered given the recruitment strategy; thus, we only collected one measure of biological lay theories of race. Participants were asked to evaluate a job candidate for an internship and were given a resume and photo of the candidate on which to base their evaluation. They were randomly assigned to receive a photo that was either of a target with a racially ambiguous Black/White phenotype or a nonambiguous Black phenotype. Aside from the photo, all other materials were identical across conditions. After evaluating the candidate's materials (notably, hireability was evaluated similarly by condition, $F(1, 71) = 0.80$, $p = .93$, *ns*) participants were asked to infer the lay theory of the candidate and to report their own endorsement of biological lay theories of race.

Materials and Measures

Pilot Testing Photos

The candidate photos were pretested for ambiguity and matched for attractiveness. Pictures were pretested on racial ambiguity and attractiveness using a convenience sample of 28 White individuals (15 females). To ensure that effects did not hinge on a specific picture, four photos (2 male and 2 female) that were high in racial ambiguity (rated as hard to racially categorize, $M = 2.89$) and four photos (2 male and 2 female) that were low in racial ambiguity (rated as easy to racially categorize, $M = 5.8$) were chosen. Selected photos were matched on attractiveness, $M_{diff} = .09$, $t(27) = .68$, $p = .50$.

Meta-theory

Participants were asked to complete the RCS (from Study 1 and 2) as they believed the candidate would have. This is a common strategy for measuring meta-perceptions (e.g., Rudman & Fetterolf, 2014). The scale was reliable ($\alpha = .80$).

Biological Lay Theories of Race

Based on No and colleagues (2008), participants' personal essentialist beliefs about race were measured in a short form with the following 5 items, "Race has a strong biological basis, and thus cannot be changed," "To a large extent, a person's

race biologically determines his or her abilities and traits," "A person's race is determined by their DNA," "Racial groups are primarily determined by biology," and "A person's race is fixed at birth." The scale was reliable ($\alpha = .77$).

Results

Notably, no effects of sample type (paid vs. course credit) or gender of the target were found, so these factors were not included in the analysis. As hypothesized, there was a main effect of condition on meta-theory, $t(70) = 4.51$, $p < .001$, Cohen's $d = 1.07$, such that racially ambiguous targets were presumed to be lower in biological lay theories of race ($M = 4.19$, $SD = 0.54$) compared to their nonracially ambiguous counterparts ($M = 4.80$, $SD = 0.60$). In addition, there was the expected main effect of condition on personal theory of race, $t(69) = 2.39$, $p = .02$, Cohen's $d = 0.57$, such that those who were exposed to the racially ambiguous target ($M = 3.92$, $SD = 1.40$) indicated lower biological lay theories of race than those who were exposed to the nonracially ambiguous target ($M = 4.67$, $SD = 1.23$).

To test mediation, we used the PROCESS program to compute 95% confidence intervals based on a bootstrapped inferred asymmetrical distribution of the mediated effect (Hayes, 2012; Preacher, Rucker, & Hayes, 2007). Specifically, we regressed personal lay theory (the dependent variable) on condition ($−1 = low\ ambiguous$ and $1 = high\ ambiguous$; the independent variable) in the PROCESS program, with meta-theory entered as the mediator (see Table 3). As predicted, bootstrapping suggested that ambiguity has an indirect effect on personal lay theory through the meta-theory of the target [.17, .41].

General Discussion

Across three studies, racial ambiguity served as a naturalistic challenge to biological lay theories of race. Given the growing interest in ambiguity in social perception, this finding speaks to the importance of examining the effects of ambiguity beyond categorization processes to the very definition of the categories themselves. Moreover, these findings have practical implications for the study of prejudice and stereotyping. People who hold biological lay theories of race assume that social inequalities exist because of unchangeable, biological differences

between groups, and such theories predict racial stereotyping more strongly than social dominance beliefs or authoritarianism (Dar-Nimrod & Heine, 2011). This close link between biological lay beliefs and negative out-group attitudes suggests that prejudice reduction strategies should incorporate factors that successfully mitigate biological lay theories of race. Contact with racial ambiguity and raising awareness of everyday racial ambiguity may be one effective strategy.

Reductions in biological lay theories tethered to contact with racial ambiguity may operate through the meta-perceptions of ambiguous individuals' lay theories of race. Inferences about targets' theory of race in Study 3 accounted for the effect of ambiguity on personal lay theories. People socially tune their attitudes to the beliefs of others especially under conditions of uncertainty (Lun et al., 2007). Recent studies suggest that much of the public is uncertain about how to define race (Morning, 2007, 2009, 2011), as there is conflicting evidence and ongoing debates about how to define race (see Morning, 2009). As such, lay theories of race may be malleable to change especially when physical appearance (the commonly used perceptual tool to determining race) provides a challenge to typical racial categories. This uncertainty may allow for social tuning processes to occur (Lun et al., 2007). Thus, future studies should examine how other types of ambiguity may evoke similar processes and whether such effects are driven by reduced certainty in personal lay theories of race.

As with any study, this work is not without limitations. The present study does not examine the downstream consequences to reduced biological lay theories of race, but notably, several impressive studies have collectively examined the downstream effects of biological lay theorizing and its barriers to intergroup relations (see Dar-Nimrod & Heine for review). Yet, it is important to note that social constructionism, the proposed alternative to biological lay theories, may not be the panacea either. For example, social constructionism serves to foster in-group favoritism, perceived group homogeneity, and stereotypes (Rangel & Keller, 2011). Thus, it is important to test whether ambiguity can reduce reliance on lay theories as opposed to increasing the use of alternatives that similarly impede intergroup relationships. Finally, Study 3 focused on meta-perceptions of targets' lay theories of race as one causal factor that could account for reductions in biological lay theories, but the reverse causal model is also supported by literature on social projection wherein people see others as having similar beliefs to their own (Frey & Tropp, 2006). Notably, social projection is limited to in-group members; people tend not to project their beliefs onto out-group members (Clement & Krueger, 2002; Robbins & Krueger, 2005). Because ambiguous faces are routinely considered and processed as out-group members (Pauker et al., 2009; Peery & Bodenhausen, 2008), social projection is unlikely to serve as a superior explanation of the observed results. The present study also focused on ambiguity in general, rather than exposure to specific racial groups or the self-identification of ambiguous group members, which may be important factors in understanding the boundaries of this effect.

Overall, the current work demonstrates the important impact of racial ambiguity exposure on reducing race essentialism, as well as the meta-processes that underlie changes in race essentialism. Still, it is unclear how perceivers assess meta-beliefs about race, and what other cues may evoke White perceivers' assumptions about the racial beliefs of targets. For example, there is evidence that a racially ambiguous individual's racial identification (i.e., identifying as multiracial or monoracial) can influence perceiver's race essentialism (Young, Sanchez, & Wilton, 2013), which may be readily explained by the present findings if identifications serve as perceptual cues of targets' lay beliefs, to which Whites then conform. Thus, multiple social cues may inform meta-theories of race including targets' self-identification and, as shown here, physical appearance. This research therefore paves the way to identifying the constellation of social and cognitive factors that may influence biological lay theories of race over time.

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