2010

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(in press) *Social Cognition*

Abstract

Known as the cross-race effect (CRE), psychological research has consistently shown that people are less accurate at identifying faces of another, less familiar race. While the CRE has most often been demonstrated in recognition memory, its effects have also been found in temporally preceding social-cognitive stages – including racial categorization, perceptual discrimination, and higher-level cognitive processing. Using path models of own- and other-race face processing, the current study sought to estimate how temporally preceding processes might mediate the CRE established in recognition memory. Results demonstrated that racial categorization and higher-level cognitive processes primarily mediate the CRE in recognition memory, and that the degree of interracial contact moderated the incidence of repetition errors on other-race faces.

Modeling the Role of Social-Cognitive Processes in the Recognition of Own- and Other-Race Faces

Over 35 years of psychological research has investigated the commonly held notion that faces of another, less familiar race "all look alike." Meta-analyses have shown this *cross-race effect* (CRE, or *own-race bias*, or *other-race effect*) to be a robust phenomenon (cf. Meissner & Brigham, 2001), and archival studies have shown evidence of the CRE in real-world eyewitness identifications (e.g., Behrman & Davey, 2001). Numerous studies have also investigated the various social, cognitive, and perceptual factors that might govern the CRE (Brigham, Bennett, Meissner, & Mitchell, 2007; Meissner & Brigham, 2001; Sporer, 2001). Although this research has provided a greater understanding of the CRE, it has remained unclear how influential social-cognitive processes that precede the CRE may be in mediating the long-term recognition memory effect, when controlling for other factors. The current study sought to remedy this gap in the research literature. Using a temporal perspective (see Figure 1), a path-model analysis was conducted to estimate the extent to which interracial contact, racial attitudes, racial categorization, perceptual discrimination, and recollection may mediate the CRE in long-term recognition memory.

The temporal approach used in our study stems from neuropsychological research suggesting that face processing for own- and other-race faces is influenced by a chronological sequence of social-cognitive stages that precede long-term recognition memory (Cunningham et al., 2004; Ito & Urland, 2003, 2005; Wheeler & Fiske, 2005). In our model, interracial contact and racial attitudes are viewed as preexisting social psychological influences, while racial categorization and perceptual discrimination effects are associated with early cognitive processes of perception and short-term/working memory, respectively. Recollection and recognition are associated with later, higher-level cognitive processes of long-term memory. Each of these processes has been shown to play a temporally mediating role in face recognition, and in particular the CRE (Levin, 1996; Meissner & Brigham, 2001). That is, these early perceptual and cognitive processes, or pre-existing states created by perceptual experience or attitudinal bias, have been shown to influence subsequent stages of processing – in the present case, long-term recognition of own- vs. other-race faces. Our model was created to provide the first empirical test of competing accounts of the CRE by examining the strength of the mediation for each social-cognitive process on own- and other-race face recognition memory. In addition, the model was designed to explore other relationships between these variables heretofore unexamined. We briefly turn to a review of each of these processes and their association with the CRE.

Interracial Contact & Racial Attitudes

It is commonly believed that the greater the amount of contact a person has with members of other races, the better he/she will be at recognizing the facial identity of people of those races (Brigham & Malpass, 1985). A few studies have shown that living near people of other-races will reduce the deleterious effects of cross-race recognition (Carroo, 1986; Chiroro, Tredoux, Radaelli, & Meissner, in press; Chiroro & Valentine, 1995; Cross, Cross, & Daly, 1971; Wright, Boyd, & Tredoux, 2003), though other studies have failed to show this relationship (e.g., Ng & Lindsay, 1994). Self-report studies on interracial contact have also shown mixed results. In their meta-analysis of the CRE, Meissner and Brigham (2001) found that self-reported interracial contact accounted for approximately 2% of the variability across studies, thereby representing a small moderating influence on the CRE. One could speculate that individuals who report greater interracial contact with members of other races may also have more positive attitudes toward members of those races, while individuals who report less interracial contact may show more negative attitudes (Meissner & Brigham, 2001). Several studies have directly examined the impact of racial attitudes on the CRE, yet no substantial relationship has been found between face recognition accuracy and attitudes toward the racial groups identified (see Brigham & Barkowitz, 1978; Lavrakas, Buri & Mayzner, 1976; Platz & Hosch, 1988; Slone, Brigham & Meissner, 2000). Other studies, using implicit attitude measures, also failed to find a relationship between racial attitudes and the CRE (Ferguson, Rhodes, Lee, & Sriram, 2001).

Racial Categorization

Categorization has been classically defined as “treating two or more distinct entities as in some way equivalent in the service of accessing knowledge and making predictions” (Medin, 1989, p. 1469). In the context of faces, racial categorization has been conceived as involving early perceptual judgments (as quickly as 120 msec; see Ito & Urland, 2003, 2005) of a person’s race or ethnicity, especially with respect to faces of the in-group vs. out-group (Levin, 1996; Smith & Zárate, 1992). Levin (1996, 2000) has postulated that when individuals see faces of another race they quickly categorize the face based upon race (i.e., out-group), at the expense of encoding other individuating facial features (see also Rodin, 1987; Sporer, 2001). However, such racial categorization effects are not generally seen with own-race (i.e., in-group) faces. Thus, Levin argues that there is a cost to racial categorization of other-race faces in individuals’ subsequent ability to recognize or discriminate amongst similar faces (see also, MacLin & Malpass, 2001, 2003).

In what is known as the other-race classification advantage (ORCA), Levin (1996) finds that participants are faster at classifying other-race faces when compared to own-race faces. In a series of experiments, Levin (1996) used a “visual search” paradigm whereby White participants had to identify a target face that was either a Black or a White-prototype face, amongst a display of distracter faces of the opposite race. Results of the study supported Levin’s “race-feature hypothesis” such that Black faces were identified significantly faster than White faces. Levin was further able to demonstrate a link between the ORCA and the CRE such that participants who showed a significant ORCA also showed a large recognition deficit for other-race faces. In addition, Levin (1996) speculated that the degree of interracial contact a person has with other-race faces may directly affect whether or not an ORCA will be shown.

Other research supports this categorization explanation of the CRE as well. For example, MacLin and Malpass (2001, 2003) used ambiguous race faces with racially marked hairstyles and found that participants categorized faces according to their racially marked race, and that this influenced long-term recognition accuracy in accordance with the CRE. In addition, Bernstein, Young, and Hugenberg (2007) demonstrated that a mere social categorization on university affiliation can lead to the CRE (see also, Hugenberg, Miller, & Claypool, 2007; Hugenberg & Sacco, 2008). This research collectively suggests that racial categorization plays an important role in face-processing and that it mediates recognition performance on other-race faces.

Perceptual Discrimination

Recent evidence suggests that interracial contact may also directly influence the CRE during perceptual discrimination. Perceptual discrimination (or perceptual identification) is the process of differentiating complex stimuli based upon perceptual and psychological characteristics. Temporally, the encoding of facial features and configural information that is necessary for perceptual discrimination appears to follow early categorization processes and involves the use of visual short-term/working memory processes (cf. Marcon et al., in press). A recent study by Walker and Hewstone (2006; see also Lindsay, Jack, & Christian, 1991; Walker & Tanaka, 2003) demonstrated the CRE in a perceptual discrimination task and found that participants' experience with other-race faces was a significant predictor of the effect. It is currently unknown whether this CRE in perceptual discrimination might be related to the ORCA in racial categorization or long-term recognition of own- vs. other-race faces.

Representation & Long-Term Recognition Memory

Meissner, Brigham, and Butz (2005) recently examined the phenomenology of memory at the time of recognition to assess the role of certain higher-level cognitive processes operating at recognition. Specifically, they examined the CRE using a dual-process theory of recognition memory. This perspective stems from decades of cognitive, neuropsychological, and neuroimaging studies of human memory indicating that recognition memory reflects two distinct processes known as *recollection* and *familiarity* (see Yonelinas, 2002, for a review).

Using the Remember-Know-Guess procedures, Meissner et al. (2005) found that recollection-based processing was primarily responsible for the CRE observed at recognition. In a recent follow-up study, Marcon, Susa, and Meissner (2009) found that participants were also more likely to commit the "repetition error" in mistakenly recognizing repeated other-race faces (Exp. 1). This repetition error could be the result of either a misattribution of familiarity or a failure of recollection (or both). In Exp. 2, Marcon et al. estimated the contributions of recollection and familiarity by instructing participants to either exclude (say "no" to) or include (say "yes" to) repeated novel faces at test (see Jennings & Jacoby, 1997). We note here that the exclusion instructions were identical to those leading to the repetition error in Exp. 1. Using the logic of opposition, Marcon et al. found that the repetition error reported in Exp. 1 (and the resulting CRE in recognition performance) was primarily due to a failure of recollection, with no significant difference observed in estimates of familiarity. The current study assessed the extent to which prior interracial contact further moderates this repetition error for other-race faces.

Overview of the Current Study

The current study used a path analysis to statistically examine the degree to which interracial contact, racial attitudes, racial categorization, perceptual discrimination, and repetition errors may mediate the cross-race effect demonstrated in recognition memory, while controlling for other factors. As such, this temporal path-model approach provides a unique opportunity within which we can test competing accounts of the CRE in face recognition. Two identical path-models were explored involving the processes leading to recognition of own-race and other-race faces. In addition, significance tests for parameter differences across the models were calculated. Based upon prior research we hypothesized that racial categorization would significantly influence performance on other-race (but not own-race) faces in perceptual discrimination and recognition memory tasks. We also expected that repetition errors would significantly influence the recognition of own-race (but not other-race) faces, while estimates of interracial contact would moderate repetition errors on other-race (but not own-race) faces.

Method

Participants

One hundred and fifty (58 males, 92 females; mean age = 19.99 yrs) undergraduate Mexican-American students from the University of Texas at El Paso participated in this study.

Design

A path analysis was used to measure model-fit and parameter estimates of interracial contact, racial attitudes, racial categorization, perceptual discrimination, and repetition errors as temporally mediating influences of recognition for own- and other-race faces (see Figure 1).

Four separate measurements were administered to determine the strength of these relationships using a repeated measures design.

Materials

The experiment was conducted on PC computers running Medialab and DirectRT software. All instructions and images were displayed on 19" LCD monitors at 1280 x 1024 resolution.

Approximately 100 African-American faces and 100 Mexican-American faces of college-aged males were used as the experimental stimuli during the three tasks. Two photographs of each face were available for use (smiling vs. neutral facial expression) and memory was assessed across poses such that we examined invariant face recognition, not photo recognition. The faces were approximately 5" x 5" in size and featured only the face and neck of the person so that no other identifying features could be recognized.

Two questionnaires measuring interracial contact and racial attitudes were used in the current study. The interracial contact questionnaire consisted of seven items (e.g., "In El Paso, how many African-Americans do you know on first-name basis who also know you on a first-name basis?") taken from the Social Experience Questionnaire used by Slone et al. (2000). Reliability of the questionnaire (taken from the current data) was sufficient, $\alpha = .81$. The racial attitudes questionnaire involved seven items used in the Modern Racism Scale (McConahay, 1986). Here again, reliability of the questionnaire (taken from the current data) was sufficient, $\alpha = .74$.

Procedure

Participants were asked to complete four separate tasks to investigate the relative influence that the aforementioned processes might play in temporally mediating the recognition of own- and other-race faces. To minimize repetition effects of the faces used, the completion of tasks was split across two sessions completed 48 hours apart. Furthermore, the experiment was counterbalanced such that half of the participants completed the repetition-lag task and perceptual discrimination tasks one day, followed by the racial categorization task and interracial experience/racial attitudes questionnaires (or vice versa). The repetition of faces across tasks was also minimized. The three face tasks are detailed below.

Racial categorization paradigm. A racial categorization task was implemented similar to tasks used previously by Levin (1996). Specifically, participants were presented with a series of visual search trials in which they attempted to determine whether a face of a particular race (Mexican-American or African-American) was present within an array of eight faces of the opposite race. A total of 96 trials were completed by participants, half of which varied the to-be-categorized race, and half of which varied the presence vs. absence of the target race. Six blocks of 16 trials were completed by participants, with three blocks involving Mexican-American targets and the remaining three blocks involving African-American targets. Presentation of blocks was randomized across participants. Prior to each block, participants were instructed to identify the presence vs. absence of a particular race of face in the display. If a face of the specified race was present in the array, participants were instructed to press the key labeled "K" as quickly as possible. If the target race was absent from the display, participants were instructed to press the key labeled "D" as quickly as possible (keys signaling present and absent responses were counterbalanced across participants). During each trial, participants were presented with a fixation point for 1s, after which a display containing eight faces was presented on the screen. Participants were instructed to press the appropriate key, as quickly as possible, denoting the presence or absence of the target race. Upon key press, the screen was cleared and a 1500 msec inter-trial interval (ITI) preceded the subsequent trial. The racial categorization task took participants approximately 10 minutes to complete.

Perceptual discrimination paradigm. The perceptual discrimination task involved presenting participants with a target face for a brief period of time and immediately assessing their ability to perceptually discriminate the target face from a set of distracter faces. In completing this task, participants were instructed that they should “respond as quickly as possible without sacrificing accuracy.” Participants completed 128 trials, with the race of target face and distracters distributed evenly across all trials. During each trial, participants viewed a fixation point for 1 s, after which a target face was displayed for 100 msec followed by a pattern mask for 200 msec. A 100 msec ISI preceded the presentation of a test array including either 2, 4, 6, or 8 faces (with position of the target face randomized across arrays). Participants attempted to identify the target face by moving their mouse over the photo of the target as quickly as possible. The faces during test were of a different pose (neutral) than during study (smiling) so as to ensure a test of face perception and not photo perception. Once a face was selected, the display disappeared and a 2 s ITI preceded the subsequent trial. The race of the target and distracter faces was manipulated across trials in a mixed list format.

Repetition-lag paradigm. This portion of the study involved the repetition-lag paradigm used previously by Marcon et al. (2009; see also Jennings & Jacoby, 1997). The paradigm involves asking participants to encode a listing of study items for which memory is assessed subsequently using a yes/no recognition format. Unique to this paradigm, however, is that new items are sometimes repeated at test following a varying number of intervening items (referred to as *repetition lags*). Participants are asked to respond “yes” to items that they had seen at study and “no” to the new items and to any repetitions of items that occur at test (signifying that there are new items). The repetition of new items serves as the critical component of the paradigm and provides a mechanism for placing familiarity and recollection in opposition. More specifically, familiarity of a repeated item should lead participants to mistakenly respond “yes” to repetitions, while recollection of the item as originating from the study list would allow participants to correctly respond “no”.

In the current study, participants were asked to study a sequence of 30 faces (15 African-American, 15 Hispanic) that they would later be asked to recognize. Each face was presented during the study phase for 2 s, followed by a 1 s inter-stimulus interval (ISI). Presentation of faces was randomized for each participant. Immediately following the study phase participants completed a series of anagram problems for 3 min. Finally, during the test phase of the experiment participants were evaluated on their ability to distinguish studied faces from new faces and repetitions of the new faces. Participants were shown new faces and repetitions of the new faces at intervening lag intervals of three, six, and nine faces. The new faces and their repetitions were randomized across the three lags and between the two races. Studied faces were randomly intermixed between the lag intervals and initial presentation of novel faces. Participants were instructed as to the exact nature of the experiment and were warned that some of the new faces would be repeated and that they should only respond “yes” to faces viewed at study and “no” to new faces and to any repetition of a face during the study phase. A repetition error rate was calculated based upon the frequency of “yes” responses to repeated distractor faces. The repetition lag task took participants approximately 10 min to complete.

Results

Performance on Own- and Other-Race Faces

Table 1 summarizes participants' performance across own- and other-race faces within each paradigm. All effects were in the hypothesized direction and confirmed previous research. Specifically, performance on the Racial Categorization task indicated that, significant differences were found such that other-race faces were categorized more accurately than were own-race faces, $t(149) = 2.50$, $p = .01$. Furthermore, consistent with the research of Levin (1996) participants categorized other-race faces more quickly than own-race faces, in both target present, $t(149) = 10.11$, $p < .001$, and target-absent, $t(149) = 4.33$, $p < .001$ presentations. For the Perceptual Discrimination task, accuracy scores indicated that participants showed superior identification performance for own-race faces in comparison to other-race faces, $t(149) = 11.59$, $p < .001$. This is consistent with prior studies performed by Levin (1996, 2000). Performance on the Repetition Lag task also demonstrated the predicted effects. Participants were significantly more likely to falsely recognize repeated (novel) other-race faces and thereby commit the "repetition error" (see Marcon et al., 2009) when compared with performance on repeated own-race faces, $t(149) = 10.41$, $p < .001$. In addition, recognition accuracy (A_z) showed the classic cross-race effect such that own-race faces were recognized more accurately than other-race faces, $t(149) = 12.58$, $p < .001$, consistent with prior research (see Meissner & Brigham, 2001).

Temporal Path Models

Two path-models were estimated involving performance on own-race and other-race faces, respectively. In addition, differences in parameter estimates across the models were calculated. Beta weights, *z*-tests, and significance values for each path in the model are provided in Table 2. When evaluating model fit the following indicators were used: X^2/df ratio, the Comparative Fit Index (CFI), the Goodness of Fit Index (GFI), and the Root Mean Squared Error of Approximation (RMSEA). According to Kline (2005) good model fit should involve X^2/df ratio < 2.0, CFI and GFI values > .90, and a RMSEA value $\leq .05$.

Own-race model. A general test of the own-race model produced good fit to the data, with a χ^2/df ratio = 0.61, CFI = 1.00, GFI = .997, and RMSEA < .001. Overall, the own-race model accounted for 22.5% of the variance in recognition accuracy. Three paths in the model proved significant. First, as predicted, repetition errors on own-race faces were associated with face recognition such that fewer errors on the repetition-lag task were predictive of better recognition accuracy. Somewhat unexpectedly, the model also indicated that longer categorization response times for own-race faces were associated with a decreased ability to perceptually discriminate and recognize own-race faces. No indirect effects proved significant in the model.

A stronger test of the proposed hypotheses would involve an own-race model that excluded measures of interracial contact and racial attitudes, as they have not been shown to influence own-race recognition performance (see Meissner & Brigham, 2001). Dropping these parameters did not significantly reduce model fit, $\Delta\chi^2(1) = 2.59$, *ns*., with the revised model explaining 20.3% of the variance in own-race recognition accuracy. Significant parameters in this revised model were consistent with the overall model (see Figure 2). A second revised model leaving only the contribution of the repetition error variable on recognition accuracy (i.e., a simple correlation between the two variables) accounts for 16.3% of the variance. As such, it would appear that own-race recognition performance can be almost completely explained by the contribution of higher-level cognitive processes (i.e., the contributions of recollection and familiarity), consistent with the research of Meissner and colleagues (Marcon et al., 2009; Meissner et al., 2005).

Other-race model. The other-race model also produced good fit to the data, with a χ^2/df ratio = .46, CFI = 1.00, GFI = .998, and RMSEA < .001. Taken together, the other-race model explained 8.9% of the variance in recognition accuracy. Several parameter estimates showed significance in the model. First, interracial contact was found to predict the incidence of repetition errors, such that participants with greater interracial contact with other-race persons were less likely to demonstrate the repetition error with other-race faces. Second, racial categorization was found to predict both perceptual discrimination and recognition accuracy such that longer response times in categorizing other-race faces were associated with greater accuracy in both perceptual discrimination and face recognition tasks for other-race faces (consistent with Levin, 1996, 2000). Finally, perceptual discrimination scores were found to predict both repetition errors and recognition accuracy, suggesting that increased accuracy in perceptual discrimination scores for other-race faces was associated with a greater ability to correctly reject repeated novel other-race faces and improved accuracy in the recognition of other-race faces. In addition to the direct effects, a significant indirect effect of racial categorization on recognition performance was observed ($\beta = -.06$, $p < .05$).

A stronger test of the hypotheses might involve eliminating the measures of racial attitudes and repetition errors from the model. Dropping these parameters did not significantly reduce model fit, $\Delta\chi^2(1) = .69$, *ns*., with the revised model explaining 6.8% the variance in other-race recognition accuracy. Significant parameters in this revised model were consistent with the overall model (see Figure 3). It would appear that recognition performance on other-race faces can be accounted for by racial categorization and perceptual/working memory processes, consistent with the research of Levin (1996, 2000), MacLin and Malpass (2001, 2003), and Hugenberg and colleagues (Bernstein et al., 2007; Hugenberg et al., 2007, 2008).

Differences between own-race vs. other-race models. A multi-group analysis was conducted to statistically examine differences in model fit across the own-race and other-race models. This model serves as the strongest test of the proposed hypotheses regarding the role of interracial experience, racial categorization, and repetition errors in differentiating performance on own- vs. other-race faces. The overall analysis indicated marginally significant variation in the fit of the paths across the two models, $\Delta\chi^2(12, N = 150) = 20.29$, $p = .06$. Two significant parameter differences were observed across the models. First, a significant difference was observed in the relationship between repetition errors and recognition accuracy, $z = 2.95$, $p < .01$, thereby replicating and extending previous research by Marcon et al. (2009) indicating a differential effect of race on the incidence of repetition errors. Second, a significant difference was observed in the path from racial categorization to recognition accuracy, $z = 2.87$, $p < .01$. Consistent with prior research (Bernstein et al., 2007; Hugenberg et al., 2007; Hugenberg & Sacco, 2008; Levin, 1996; MacLin & Malpass, 2001, 2003), reaction times for categorization responses to other-race faces were more positively associated with recognition accuracy for other-race faces, such that quicker classification responses were associated with less accurate recognition performance (cf. Levin, 1996).

Discussion

As predicted, a significant cross-race effect (CRE) was observed for each of the face perception and discrimination tasks. These effects were in line with prior research and provide further empirical support to the already robust CRE findings in the domain of recognition memory, as well as support for the lesser-researched effects that occur during racial categorization and perceptual discrimination. More importantly, our path analyses demonstrated that a temporal framework for examining the cross-race effect in face recognition may provide a valuable perspective with regard to the various cognitive and social psychological processes mediating the phenomenon. Both the own-race and other-race models included parameter estimates that proved significant and consistent with prior research; however, it was the parameter differences between the models that we sought to test. In this regard, two key findings appear to highlight social and cognitive psychological mechanisms that are likely responsible for the CRE.

First, repetition errors were shown to predict recognition accuracy to a greater extent for own-race faces, with participants also demonstrating fewer repetition errors for own-race faces than for other-race faces. This finding suggests that higher-level cognitive processes are useful for accounting for performance on own-race (but not other-race) faces. We note here that as measured in the current study we cannot unequivocally say whether repetition errors reflect a misattribution of familiarity or a failure of recollection (i.e., we did not apply process dissociation procedures to disentangle these effects). However, this effect appears consistent with prior research by Marcon et al. (2009) demonstrating that participants are more likely to use recollection to successfully avoid repetition errors in the recognition of own-race faces, and that the use of recollection differentiates performance on own- vs. other-race faces (Meissner et al., 2005). The potential role of recollection-based processes in the CRE suggests that the effect is due, in part, to a greater reliance upon conscious-level, conceptual information that is encoded for own-race faces. In addition, our results suggested that interracial contact with other-race persons was predictive of the repetition error for other-race faces. This finding extends prior research and suggests that successful encoding processes are associated with prior experience and perceptual learning of facial characteristics that are useful for discriminating faces within a given population (cf. Chiroro, Tredoux, Radaelli, & Meissner, 2008; Chiroro & Valentine, 1995). Further research would be useful for documenting the role of experience and perceptual learning in leading to increased recollection-based processing of stimuli.

Second, our models indicated a significant role for racial categorization in explaining the CRE. Consistent with prior research (Bernstein et al., 2007; Levin, 1996; MacLin & Malpass, 2001, 2003), response times for racial categorization of other-race faces were both directly and indirectly associated with perceptual discrimination and recognition memory performance of other-race faces. The importance of racial categorization as a governing factor in the recognition of other-race faces is noteworthy and suggests that categorization processes associated with "out group" labeling can disrupt the successful encoding of individuating facial information.

The temporal path-model approach demonstrated in the current study provides the first opportunity with which to test competing accounts of the CRE in face recognition. It is clear that the data support both the role of racial categorization and the influence of higher-level, recollection-based processing in mediating the phenomenon. Further, this study provides the first indication that interracial experience may be associated with the use of recollection for other-race faces. Taken together, the CRE in face recognition is a true example of a social-cognitive phenomenon that allows us to examine social categorization, person perception, and higher-level cognitive processes that are influenced by our social experiences.

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Author Note

This research was supported by a National Science Foundation grant (SES-0611636) to the second author. In addition, this study was performed under an appointment, by the primary author, to the U.S. Department of Homeland Security Scholarship and Fellowship Program, administered by the Oak Ridge Institute for Science and Education through interagency agreement between the U.S. Department of Energy and DHS. ORISE is managed by Oak Ridge Associated Universities under DOE contract number DE-AC05-06OR23100. All opinions expressed in this paper are the authors' and do not necessarily reflect the policies and views of NSF, DHS, DOE, or ORAU/ORISE.

Table 1.

Descriptive Statistics and Effect Sizes of Own- vs. Other-Race Face Performance

	Own-Race		Other-Race		Effect Size (*d*)
Racial Categorization	*M*	952.56	*M*	797.48	.30
(Reaction Time in msec)	*SD*	294.25	*SD*	214.73	
Perceptual Discrimination	*M*	.78	*M*	.71	.46
(Proportion Accuracy)	*SD*	.11	*SD*	.11	
Repetition Errors	*M*	.18	*M*	.40	.71
(Proportion of Errors)	*SD*	.18	*SD*	.24	
Recognition Memory	*M*	.84	*M*	.67	.88
(Az)	*SD*	.13	*SD*	.15	

Table 2.

Standardized Parameter Estimates and Significance Values for Own- and Other-Race Models

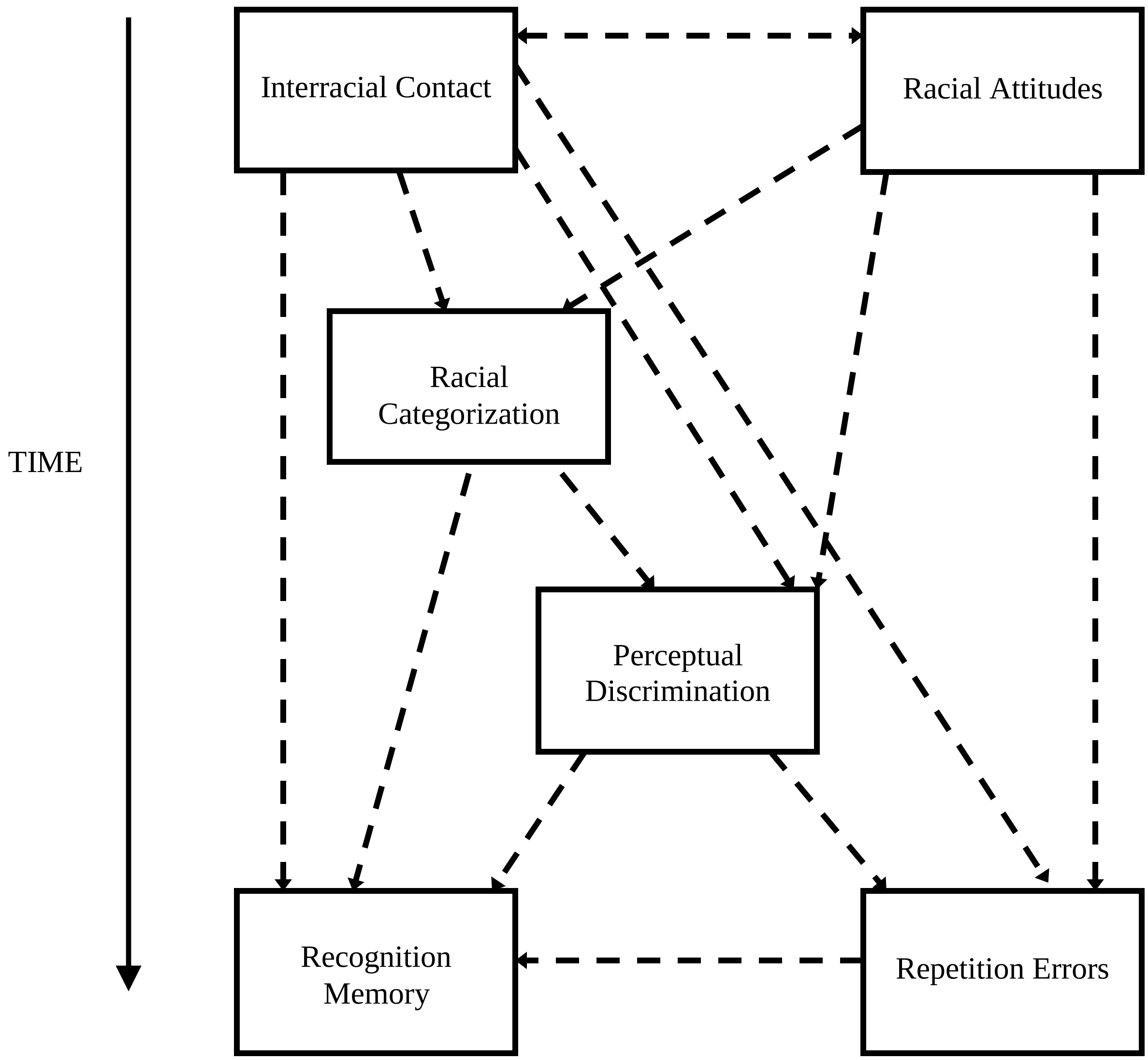
	Own-Race Model			Other-Race Model		
	β	*z*	*p*	β	*z*	*p*
Racial Cat. ← Interracial Exp.	.00	-.15	.88	.00	-.41	.68
Racial Cat. ← Racial Attitudes	.00	-.01	.99	.01	.11	.92
Perc. Discrim. ← Racial Attitudes	-.08	-.95	.34	-.06	-.75	.45
Perc. Discrim. ← Interracial Exp.	-.13	-1.69	.09	-.11	-1.36	.18
Perc. Discrim. ← Racial Cat.	**-.25**	**-3.22**	**.001**	**-.23**	**-2.90**	**.004**
Rep. Errors ← Racial Attitudes	.03	.37	.71	.00	.04	.97
Rep. Errors ← Interracial Exp.	-.04	-.50	.62	**-.18**	**-2.21**	**.03**
Rep. Errors ← Perc. Discrim.	-.03	-.31	.75	**-.16**	**-1.96**	**.05**
Recognition (A_z) ← Racial Attitudes	.01	.15	.88	-.03	-.41	.68
Recognition (A_z) ← Interracial Exp.	-.09	-1.21	.23	-.01	-.09	.93
Recognition (A_z) ← Perc. Discrim.	.11	1.48	.14	**.22**	**2.68**	**.007**
Recognition (A_z) ← Racial Cat.	**-.15**	**-2.01**	**0.04**	**.17**	**2.14**	**.03**
Recognition (A_z) ← Rep. Errors	**-.41**	**-5.74**	< **.001**	-.14	-1.75	.08

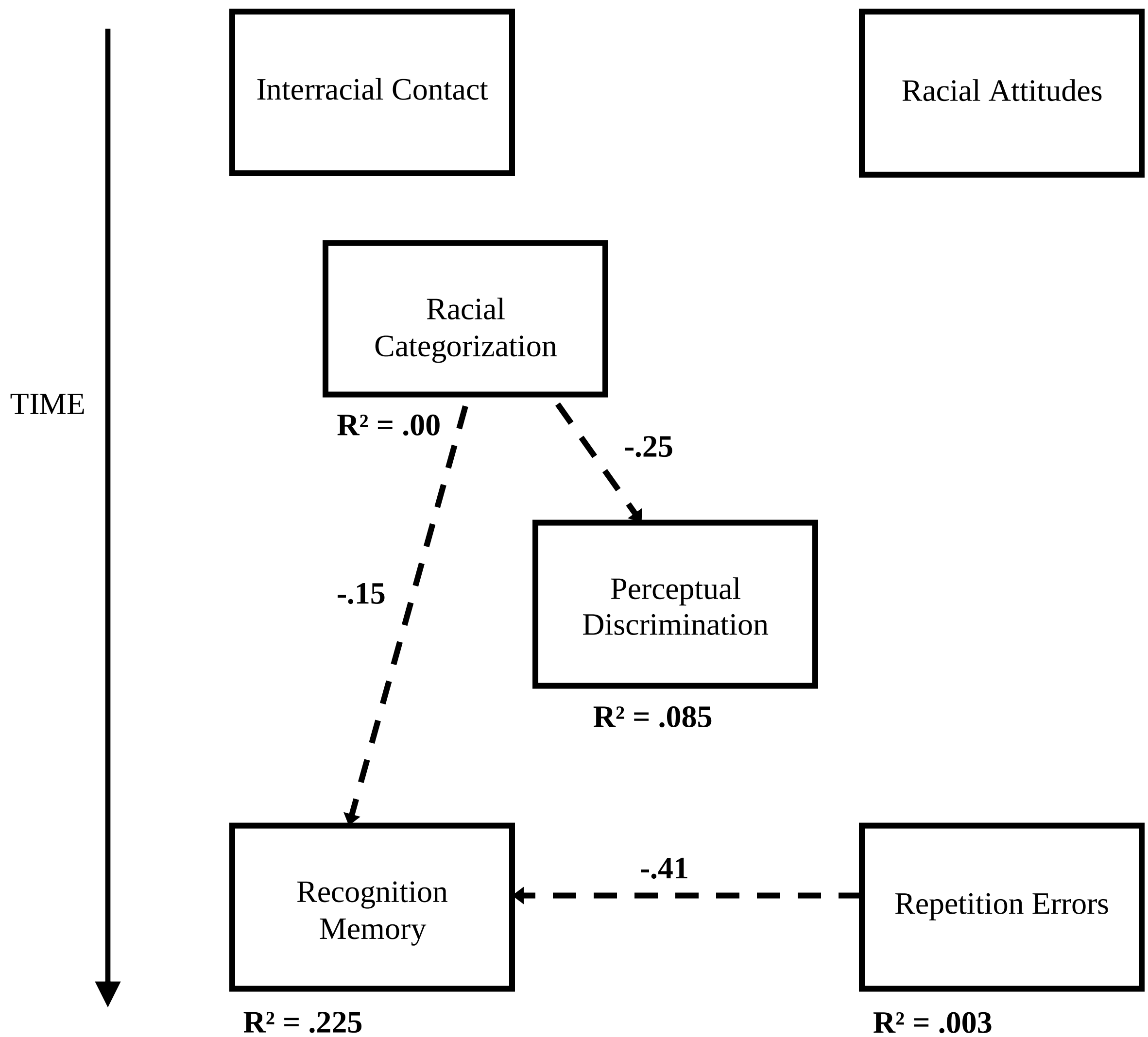
Figure Captions

Figure 1. Temporal Path Model of Own- and Other-Race Face Recognition.

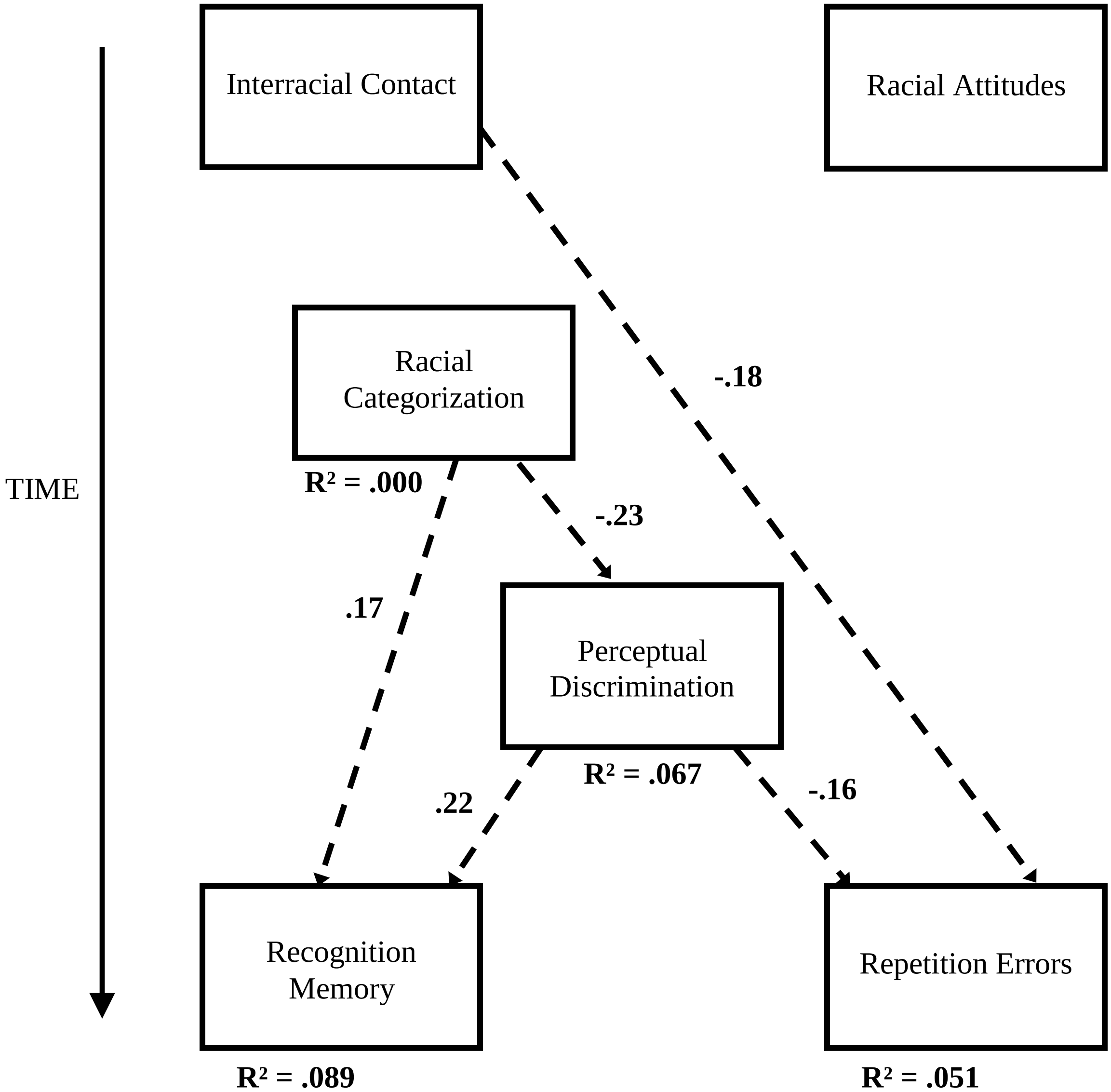
Figure 2. Standardized Regression Estimates of Significant Parameters in the Own-Race Model.

Figure 3. Standardized Regression Estimates of Significant Parameters in the Other-Race Model.


TIME
Interracial Contact
Racial Attitudes
Racial
Categorization
Perceptual
Discrimination
Recognition
Memory
Repetition Errors



Note: **Bolded** parameters were significant at $p < .05$.



Note: **Bolded** parameters were significant at $p < .05$.