

## The Perfect Match: Do Criminal Stereotypes Bias Forensic Evidence Analysis?

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This research provided the first empirical test of the hypothesis that stereotypes bias evaluations of forensic evidence. A pilot study ( $N = 107$ ) assessed the content and consensus of 20 criminal stereotypes by identifying perpetrator characteristics (e.g., sex, race, age, religion) that are stereotypically associated with specific crimes. In the main experiment ( $N = 225$ ), participants read a mock police incident report involving either a stereotyped crime (child molestation) or a nonstereotyped crime (identity theft) and judged whether a suspect's fingerprint matched a fingerprint recovered at the crime scene. Accompanying the suspect's fingerprint was personal information about the suspect of the type that is routinely available to fingerprint analysts (e.g., race, sex) and which could activate a stereotype. Participants most often perceived the fingerprints to match when the suspect fit the criminal stereotype, even though the prints did not actually match. Moreover, participants appeared to be unaware of the extent to which a criminal stereotype had biased their evaluations. These findings demonstrate that criminal stereotypes are a potential source of bias in forensic evidence analysis and suggest that suspects who fit criminal stereotypes may be disadvantaged over the course of the criminal justice process.

**Keywords:** forensic analysis, fingerprint evidence, stereotypes, forensic confirmation bias, contextual bias

In 2004, Oregon lawyer Brandon Mayfield was falsely arrested and detained by the Federal Bureau of Investigation (FBI) after his fingerprints were mistakenly matched to a fingerprint recovered on a bag of detonators near the site of the Madrid commuter train bombings. In the wake of this high profile error, many people wondered whether Mayfield's personal characteristics might have played a role in the misidentification. Mayfield had recently converted to Islam, was married to an Egyptian immigrant, and had once been an attorney for a convicted terrorist—facts that fit the FBI's theory that the bombings were a terrorist attack carried out by radical Muslims (Department of Justice, Office of the Inspector General, 2006). In an official investigation of the FBI's handling of the case, one FBI forensic examiner admitted that their lab might have been more skeptical of the initial identification had the suspect been someone like the "Maytag Repairman" (Department of Justice, Office of the Inspector General, 2006, p. 12).

This forensic examiner's candid remark reflects an important question, which we addressed in the current research: Are forensic judgments susceptible to biases derived from social stereotypes? The National Academy of Sciences (NAS, 2009) raised concerns regarding the extent to which the forensic sciences "rely on human interpretation that could be tainted by error" (p. 9). Corroborating these concerns, empirical studies have shown that contextual information—for example, that the suspect confessed (Dror & Charlton, 2006; Elaad, Ginton, & Ben-Shakhar, 1994; Kukucka & Kassin, 2014) or that eyewitnesses incriminated the suspect (Charman, Gregory, & Carlucci, 2009; Miller, 1984)—influence evaluations of forensic evidence (i.e., *forensic confirmation bias*; Kassin, Dror, & Kukucka, 2013). Although these findings are troubling, we believe that the potential for contextual information to bias forensic judgments may be more ubiquitous than these findings suggest. Whereas incriminating contextual information (e.g., that the suspect confessed) may be present in only a subset of cases, stereotypes are a pervasive feature of human social cognition (Nosek et al., 2007), and more than 100 years of research has demonstrated that stereotypes bias judgments and alter behavior (see Dovidio et al., 2010; Fiske & Tablante, 2015; Hilton & VonHippel, 1996).

The current research provides the first test of the hypothesis that criminal stereotypes bias forensic analysis using one of the most common types of forensic evidence: fingerprints (Peterson et al., 2010). The FBI's fingerprint system, which contains more than 70 million individuals, includes "not only fingerprints, but criminal histories; mug shots; scars and tattoo photos; physical characteristics like

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height, weight, hair and eye color; and aliases” (FBI, 2016). Hence, fingerprint examiners are routinely exposed to stereotype-relevant information, the effects of which have thus far been presumed innocuous but which we propose may constitute a pervasive source of bias that can taint fingerprint match-judgments.

### Research Overview

We first conducted a pilot study to determine the content and consensus of criminal stereotypes for 20 different crimes—that is, the extent to which each crime was associated with particular perpetrator characteristics (e.g., race, sex, age, social class, religion, etc.). Based on the results of the pilot study, we selected two crimes for use in the main experiment: one crime that was strongly associated with particular perpetrator characteristics (stereotyped crime) and one crime that was not strongly associated with particular perpetrator characteristics (nonstereotyped crime). In the main experiment, we tested the idea that knowledge of a suspect’s characteristics can bias evaluations of forensic evidence. Specifically, we predicted that suspect characteristics would have little effect on evaluations of forensic evidence for a crime that is not strongly associated with a criminal stereotype; however, we expected those same suspect characteristics to bias evaluations of forensic evidence when the characteristics matched the characteristics associated with a stereotyped crime.

### Pilot Study

Although a few studies have investigated whether certain types of people tend to be associated with certain crimes, the predominant focus has been on criminal stereotypes for different racial groups (e.g., Gordon et al., 1988; Sunnafrank & Fontes, 1983; Willis Esqueda, 1997). Importantly, however, race might not be the only characteristic that comprises people’s criminal stereotypes. Criminal stereotypes might also include perpetrator characteristics pertaining to sex, age, and perhaps other demographic dimensions as well. For example, people tend to view men as being more aggressive than women (Frodi, Macaulay, & Thome, 1977), which could lead to differences in criminal stereotypes regarding the sex of violent versus nonviolent crime perpetrators. In a recent exception to the predominant focus on race-based criminal stereotypes, Skorinko and Spellman (2013) examined the extent to which a number of crimes were associated with different racial groups as well as with men versus women, elders versus youth, rich versus poor, and heterosexuals versus homosexuals. Their findings confirmed many of the race-based criminal stereotypes that had been observed in past research and identified a number of additional characteristics comprising criminal stereotypes (e.g., sex, age, and socioeconomic status).

Skorinko and Spellman’s (2013) study represents an important contribution to the literature because it documented a broader range of characteristics that comprise criminal stereotypes than had been established previously. However, the criminal stereotypes identified in their study were based on general crime categories (e.g., rape, vandalism), rather than on specific criminal events (e.g., date rape, graffiti). Because the goal of the present research was to test whether criminal stereotypes bias evaluations of forensic evidence and forensic analysts must evaluate evidence in specific criminal cases (rather than for general categories of

crimes), we first conducted a pilot study to establish criminal stereotypes associated with 20 different crimes using specific crime vignettes. We included a number of crimes that were used in Skorinko and Spellman’s study (e.g., auto theft, child molestation, embezzlement, prostitution), as well as new crimes that have not been examined in past research (i.e., carrying a concealed weapon, drive-by shooting, Munchausen’s syndrome by proxy, purse snatching, and serial murder). We also sought to expand the extant literature on criminal stereotypes by examining a number of perpetrator characteristics that have not been examined in prior criminal stereotype research (i.e., citizenship, education, marital status, mental health, attractiveness, employment, intelligence, and religion) in addition to characteristics that have received some attention in the literature (i.e., race, sex, and age).

### Method

#### Participants

The sample included 107 undergraduates at a large Midwestern university (76 women, 31 men) with a mean age of 21 years. Participants were native English speakers and included 3 Asians/Pacific Islanders, 1 Black, 102 Caucasians, and 1 participant who self-described as multiethnic. To increase the likelihood that participants were familiar with criminal stereotypes in the United States, only data from participants of U.S. origin were analyzed.

#### Materials and Procedure

We used a modified version of Katz and Braly’s (1933) adjective checklist method to examine which personal and demographic characteristics were most strongly associated with 20 different crimes. Participants were given a packet containing short vignettes for the following 20 crimes: auto theft; bank robbery; carrying a concealed weapon; child molestation; custodial kidnapping; date rape; domestic assault; drive-by shooting; driving while intoxicated (DWI); drug dealing; embezzlement; graffiti; identity theft; Munchausen’s syndrome by proxy; prostitution; purse snatching; serial murder; shoplifting; stalking; and terrorism. The vignettes are shown in the Appendix. Before opening the packet, participants were informed that the purpose of the study was to identify their beliefs about the typical characteristics of crime perpetrators. They were then given the following instructions:

Each page of this survey pertains to a different suspect. Each suspect is described in a brief paragraph. Below each suspect’s description is a list of characteristics. Your job is to circle all of the characteristics that you believe probably describe the suspect. You should circle as many characteristics as you believe apply. All of your answers will be kept anonymous so please answer as honestly as you can.

Each crime vignette was followed by a list of characteristics, which were the same for every crime. These characteristics included sex (male, female); age (17 or younger, 18–29, 30–39, 40–49, 50–59, 60–69, 70 and older); citizenship (U.S. citizen, legal resident, illegal immigrant); education (high school or less, some college, college graduate, advanced degree); ethnicity/race (Asian, African American, Latina/o, Middle Eastern, Caucasian, other); marital status (single, married, divorced, widowed); social class (poor/lower class, middle class, upper class); mental illness

(sane, insane/mentally unstable); attractiveness (attractive, average, unattractive); employment (employed, unemployed); intelligence (below average, average, above average); and religion (Atheist/Agnostic, Christian, Hindu, Jewish, Muslim, other). After participants had finished indicating all of the characteristics they associated with each suspect, they were given the following instructions:

Please go back over your responses to the survey that you completed. For each suspect, mark an "X" by the three characteristics that you believe are most typical of that type of suspect. You should select these three characteristics from the pool of characteristics that you circled. If you did not originally circle at least three characteristics for a suspect, then please do so now. It is essential that you mark an "X" by exactly three characteristics—no more, no less. Again, all of your answers will be kept anonymous so please answer as honestly as you can.

## Results

We assessed the content and consensus of the 20 criminal stereotypes using procedures similar to those developed by [Katz and Braly \(1933\)](#). Specifically, we examined which characteristics were most frequently associated with each crime (i.e., criminal stereotype content), as well as the level of agreement regarding those characteristics (i.e., criminal stereotype consensus).

### Criminal Stereotype Content

To determine which characteristics were most strongly associated with each of the 20 crimes, we rank-ordered the characteristics according to the frequency with which they were endorsed as one of the three most typical characteristics. [Table 1](#) presents the content of the stereotypes as indicated by the five characteristics that received the greatest number of endorsements, with those higher on the list receiving more endorsements. The characteristics that were most frequently associated with the 20 crimes were sex (20 crimes), age (18 crimes), education level (16 crimes), ethnicity (13 crimes), and social class (13 crimes). Employment status, mental health status, and marital status were each associated with six of the crimes, and religion and citizenship status were both associated with one crime.

### Criminal Stereotype Consensus

Following the method of [Katz and Braly \(1933\)](#), we calculated a measure of stereotype consensus by determining the number of characteristics that were needed to reach 50% of the total number of endorsements. Specifically, we summed the endorsement frequencies (beginning with the most frequently endorsed characteristic) until the cumulative frequency equaled 50% of the total number of endorsements. Given that 107 participants each endorsed three characteristics, the total number of endorsements for each crime was 321, half of which yielded the consensus criterion of 160.5. Because the cumulative frequency associated with a discrete number of characteristics will seldom precisely equal the criterion value (indeed, it is impossible in the current case in which the criterion is not an integer), interpolation was used to calculate the consensus score.

To illustrate, for the crime of auto theft, the first, second, and third most frequently endorsed characteristics were male (97 en-

Table 1  
*Criminal Stereotype Content*

Crimes and characteristics	No.	Percent
Auto theft		
Male	97	91
High school	82	77
Poor/lower class	76	71
18–29 years of age	65	61
African American	40	37
Bank robbery		
Male	101	94
Unemployed	90	84
Poor/lower class	71	66
High school	63	59
African American	34	32
Carrying concealed weapon		
Male	101	94
Poor/lower class	66	62
High school	56	52
18–29 years of age	50	47
African American	38	36
Child Molestation		
Male	104	97
Caucasian	80	75
Sane	57	53
Married	35	33
40–49 years of age	32	30
Custodial kidnapping		
Sane	86	80
Divorced	71	66
Caucasian	67	63
Male	62	58
30–39 years of age	46	43
Date rape		
Male	104	97
Single	85	79
18–29	67	63
Caucasian	62	58
Some college	48	45
Domestic assault		
Male	92	86
Poor/lower class	53	50
Married	49	46
High school	48	45
18–29 years of age	33	31
Drive-by shooting		
Male	99	93
High school	84	79
Poor/lower class	74	69
18–29 years of age	69	65
African American	54	51
Drug deal		
Male	97	91
High school	86	80
Poor/lower class	76	71
18–29 years of age	60	56
African American	45	42
DWI		
Caucasian	71	66
Male	63	59
Middle class	62	58
18–29 years of age	60	56
Some college	47	44

Table 1 (continued)

Crimes and characteristics	No.	Percent
Embezzlement		
Employed	100	94
Male	85	79
Upper class	54	51
College	45	42
40–49 years of age	37	35
Graffiti		
High school	96	90
Male	95	89
17 or younger	74	69
Poor/lower class	72	67
African American	43	40
Identity theft		
Employed	58	54
Male	56	52
Average intelligence	45	42
30–39 years of age	41	38
College	36	34
Munchausen's by proxy		
Female	83	78
Insane	80	75
30–39 years of age	44	41
Married	39	36
High school	34	32
Prostitution		
Female	104	97
High school	92	86
Poor/lower class	88	82
Unemployed	78	73
18–29 years of age	68	64
Purse snatching		
Male	101	94
Unemployed	93	87
High school	80	75
Poor/lower class	77	72
18–29 years of age	61	57
Serial murder		
Male	104	97
Insane	86	80
Caucasian	68	64
Some college/college	56	52
30–39 years of age	40	37
Shoplifting		
Female	95	89
Unemployed	68	64
High school	57	53
Poor/lower class	48	45
18–29 years of age	46	43
Stalking		
Single	71	66
Caucasian	71	66
Male	69	65
Sane	52	49
18–29 years of age	45	42
Terrorism		
Male	101	94
Middle Eastern	81	76
Muslim	72	67
Illegal immigrant	60	56
Insane	50	47

dorsements), high school education (82 endorsements), and poor/lower class (76 endorsements). Because the summed endorsement frequencies of the first two characteristics surpassed the consensus criterion of 160.5 by 18.5 endorsements ( $97 + 82 = 179$ ;  $179 - 160.5 = 18.5$ ), the third characteristic was not needed to reach

consensus. In fact, only 63.5 of the 82 total endorsements of the second characteristic, high school, were needed to reach consensus; hence, the consensus score equaled  $[1 + (63.5/82)]$ , or 1.77 characteristics. The consensus score inversely indexes consensus because greater consensus requires fewer characteristics to achieve the cumulative frequency criterion. Table 2 presents the consensus scores for each of the 20 crimes, with those higher on the list having greater consensus.

As can be seen in Table 2, 13 out of the 20 crimes reached the consensus criterion using fewer than two characteristics. This finding suggests that there was relatively high agreement about which two characteristics were most strongly associated with the majority of the crimes. For example, prostitution was most frequently associated with a female with a high school education; purse snatching was most frequently associated with a male who was unemployed; and serial murder was most frequently associated with a male who was insane. Four of the crimes required more than two characteristics to reach consensus (custodial kidnapping; stalking; domestic assault; drive-by shooting), and three of the crimes required more than three characteristics to reach consensus (identity theft; driving while intoxicated; Munchausen's syndrome by proxy). Hence, there was considerable variability in the consensus regarding which characteristics were associated with each of the 20 crimes.

## Discussion

The pilot study examined social stereotypes associated with a variety of different crimes using specific crime vignettes, the results of which were quite consistent with the extant body of literature on criminal stereotypes. For example, auto theft has been shown to be associated with African Americans whereas child molestation has been shown to be associated with Caucasians—findings that were replicated in the current work (e.g., Sunnafrank & Fontes, 1983; Willis Esqueda, 1997; Skorinko & Spellman, 2013). Likewise, robbery and narcotics sales have been shown to be associated with

Table 2  
*Criminal Stereotype Consensus*

Crime	Consensus <sup>a</sup>
Prostitution	1.61
Purse snatching	1.63
Serial murder	1.65
Bank robbery	1.66
Date rape	1.66
Graffiti	1.67
Child molestation	1.70
Embezzlement	1.71
Terrorism	1.73
Drug deal	1.73
Auto theft	1.77
Carrying concealed weapon	1.89
Shoplifting	1.96
Custodial kidnapping	2.04
Stalking	2.26
Domestic assault	2.31
Drive-by shooting	2.77
Identity theft	3.02
Driving while intoxicated	3.73
Munchausen's by proxy	3.85

<sup>a</sup> Smaller values correspond to greater consensus.



African Americans in past research as well as in our study (Willis Esqueda, 1997; Skorinko & Spellman, 2013). Overall, the high degree of consistency between the criminal stereotypes observed in our study and those of prior research speaks to the validity of the criminal stereotypes established in the current work.

Fifteen of the 20 crimes that we examined in the current research were also examined in Skorinko and Spellman's (2013) study of criminal stereotypes regarding race, age, sex, and socioeconomic status. Again, the findings were quite consistent. For 13 of the 15 crimes that were examined in both studies, there were no direct characteristic contradictions. In other words, when a crime in our study was associated with a given characteristic (e.g., poor/lower class), it was rarely associated with a conceptually contradictory characteristic (e.g., rich) in Skorinko and Spellman's study. There were, however, two crimes that involved clear conceptual contradictions: date rape was associated with Caucasians in the current study whereas rape was associated with African Americans in Skorinko and Spellman's study, and identity theft was associated with the 30–39 age group in the current study whereas identify fraud was associated with youth in Skorinko and Spellman's study. These conceptual conflicts are likely attributable to the fact that the current research used specific crime vignettes whereas Skorinko and Spellman used general crime categories. For example, for the crime of rape, participants in the current study knew that the rape involved a dating partner (i.e., date rape), whereas in Skorinko and Spellman's study, participants simply read the crime category 'rape.' To the extent that participants in Skorinko and Spellman's study imagined circumstances of the rape that were different from that of a date rape (e.g., a stranger rape), a different criminal stereotype may have been activated. Though these conceptual contradictions were few, they nevertheless highlight the need for researchers to make careful decisions about research methodology—namely, whether to use specific crime events or more general crime categories—as these different methodologies have the potential to activate different criminal stereotypes.

An important contribution of the current work is that many of the criminal stereotypes that were established involved characteristics that have not been examined in past research. Sixteen crimes were associated with educational status, six with employment status, six with mental health status, six with marital status, and one with religion and citizenship status. Although these characteristics have been neglected in the criminal stereotypes literature, they could have important effects on the trajectories of criminal cases in the real world. Specifically, as stereotype-relevant characteristics about a particular criminal suspect become known to legal decision makers (e.g., investigators, lawyers, judges and jurors), the extent to which the suspect appears to confirm versus disconfirm a criminal stereotype may have an impact on subsequent decision making. Future research should examine the extent to which these understudied dimensions of criminal stereotypes influence legal outcomes.

### Main Experiment

The main experiment provided an initial test of the hypothesis that criminal stereotypes bias evaluations of forensic evidence. Two crimes were selected for use in the main experiment on the basis of our findings from the pilot study: one crime that was strongly associated with particular perpetrator characteristics (stereotyped crime) and one crime that was not strongly associated

with particular perpetrator characteristics (nonstereotyped crime). We selected child molestation as the stereotyped crime for two reasons. First, child molestation was identified as a crime that is associated with a highly consensual criminal stereotype. Second, the perpetrator characteristics comprising the criminal stereotype for the crime of child molestation were ethnicity (White) and sex (male)—two characteristics that are likely to appear in fingerprint databases (e.g., Federal Bureau of Investigation, 2016). Although there were other criminal stereotypes that were also highly consensual—for example, prostitution and purse snatching—we elected not to use them because they were associated with perpetrator characteristics that would not likely be available to forensic examiners (e.g., education level and employment status). We selected the crime of identity theft as the nonstereotyped crime because both our pilot study as well as past research indicate that it is not strongly associated with any particular perpetrator characteristics (e.g., Skorinko & Spellman, 2013).

In the main experiment, we varied the characteristics of the criminal suspect such that the suspect's characteristics were either consistent with the child molestation stereotype (White man) or inconsistent with the child molestation stereotype (Asian woman). Hence, participants were randomly assigned to a 2 (crime type: child molestation v. identity theft)  $\times$  2 (suspect characteristics: White man v. Asian woman) between-subjects factorial design. We predicted that the suspect's characteristics would bias evaluations of forensic evidence for the crime of child molestation, which is strongly associated with White male perpetrators, but not for the crime of identity theft, which is not associated with particular perpetrator characteristics.

## Method

### Participants

The sample included 225 undergraduates (158 women, 67 men) at a large Midwestern university. Participants were native English speakers and included 7 Asians/Pacific Islanders, 12 Blacks, 200 Caucasians, 4 Hispanics/Latinos, and 2 participants who self-described as multiethnic. To increase the likelihood that participants were familiar with criminal stereotypes in the United States, only data from participants of U.S. origin were analyzed.

### Materials and Procedure

**Crimes.** Participants read a mock police incident report about a crime that occurred in the Detroit area. The crime descriptions were based on the crime vignettes from our pilot study. In the child molestation condition, the vignette read: *This investigation involves a claim of child molestation that was made by a 6-year-old child on September 14, 2012. The child reported that an unidentified individual brought the child behind a shed in Greensbury Park, where the child was inappropriately fondled.*<sup>1</sup> In the identity theft condition, the vignette read: *This investigation involves a*

<sup>1</sup> We excluded incriminating details about the child molestation case that had been present in the pilot study (i.e., that the child identified the suspect and that child pornography was discovered on the suspect's computer) so that neither police incident report in the main experiment contained any incriminating information about the suspect.

string of identity theft incidents occurring in the Detroit metropolitan area. At least 20 individuals' identities have been stolen and used to obtain thousands of dollars in payday loans. After reading the police incident report, participants learned that a fingerprint was recovered from the crime scene (from the park shed in the child molestation case; from a public computer in the identity theft case) and that the fingerprint was submitted to a database that returned a number of potential matches.

**Suspect profiles.** Participants viewed a profile of one of the supposed database matches that included information routinely available to fingerprint analysts: the suspect's photo, name, address, birthdate, height, weight, hair color, and eye color. For half of the participants, the suspect was a middle-aged White man named Steve Johnson. For the other half of participants, the suspect was a middle-aged Asian woman named Mei Lee. With the exception of the names, photos, and physical descriptors, the information in the suspect profiles was held constant.

**Dependent measures.** Before viewing the fingerprints, participants were given the following instructions: "Imagine that you are the forensic examiner in this case. You will be asked to compare the print taken from the [shed/computer] to the print from the suspect. Please indicate whether you believe that the fingerprints are a match." Participants then viewed the two fingerprints (labeled "print from [shed/computer]" and "suspect print," respectively), and selected a match judgment from one of the following options: match, do not match, inconclusive. In reality, the prints did not match. In order to obtain match judgments from all participants, participants who selected the 'inconclusive' option were subsequently asked to provide a forced-choice match judgment: "If you were forced to choose whether these prints match or do not match, what would you choose?" with options "match" and "do not match." All participants then indicated their confidence in their match/do not match judgment on a scale from 1 (not at all confident) to 10 (totally confident) and indicated how fair and impartial they had been when evaluating the case on a scale from 1 (*not at all fair and impartial*) to 7 (*very fair and impartial*). Finally, as a manipulation check, participants answered the question "How much did the suspect fit your expectations about the kind of people who commit this crime?" on a scale ranging from 1 (*not at all*) to 7 (*very much*).

## Results

### Manipulation Check

A  $2 \times 2$  (crime type  $\times$  suspect characteristics) analysis of variance (ANOVA) on participants' judgments of how much the suspect fit their expectations about the kind of people who commit the crime in question indicated that the White man better fit participants' expectations than did the Asian woman for both the crime of child molestation and the crime of identity theft,  $F(1, 221) = 152.9$ ,  $p < .001$ , Cohen's  $d = 1.59$ . Critically, however, this main effect was qualified by a significant crime type  $\times$  suspect characteristics interaction,  $F(1, 221) = 19.25$ ,  $p < .001$ , partial  $\eta^2 = .08$ . Follow-up analyses indicated that the extent to which the White man better fit participants' expectations than did the Asian woman was significantly stronger for the crime of child molestation (Cohen's  $d = 2.20$ ) than for the crime of identity theft (Cohen's  $d = 1.09$ ). Hence, the strongest perceived match to a

criminal stereotype occurred in condition in which the White man was suspected of child molestation.

### Match Judgments

We first examined whether the frequency of "inconclusive" judgments varied as a function of the crime type and suspect characteristic manipulations. Across the sample, 18.2% of participants indicated that the prints were inconclusive, and the rate at which participants selected this option did not vary by condition,  $\chi^2(1, N = 41) = 1.17$ ,  $p = .279$ . Accordingly, all subsequent analyses were conducted on the entire sample of match/do not match judgments (i.e., including forced-choice match judgments). Effect size estimates for differences in proportions are reported using Cohen's  $h$ . An  $h$  of 0.2, 0.5, and 0.8 correspond to a small, medium, and large effect size, respectively (Cohen, 1988).

Overall, 34.2% of participants indicated that the fingerprints matched and 65.8% of participants indicated that the fingerprints did not match. We performed a logistic regression analysis on the match judgments to test the hypothesis that criminal stereotypes can bias forensic judgments. The independent variables were crime type, suspect characteristics, and their interaction. Neither of the main effects was significant, Wald  $\leq .10$ ,  $ps \geq .747$ , however, there was a marginally significant crime type  $\times$  suspect characteristics interaction, Wald = 3.63,  $p = .057$ , odds ratio (OR) = 3.0. As shown in Figure 1, participants were nearly twice as likely to judge the fingerprints as a match for the crime of child molestation when the suspect was a White man (51.9%) as opposed to an Asian woman (27.1%),  $\chi^2(1, N = 113) = 7.25$ ,  $p = .007$ , Cohen's  $h = .52$ . Suspect characteristics did not influence match judgments for the crime of identity theft,  $\chi^2(1, N = 112) = .007$ ,  $p = .932$ , Cohen's  $h = .02$ .

We next created a scalar variable that incorporated participants' confidence ratings into their match judgments, which we analyzed using a  $2 \times 2$  (crime type  $\times$  suspect characteristics) ANOVA. Specifically, we multiplied participants' match judgments (coded as  $-1$  for no match and  $+1$  for match) by their confidence (1–10) and applied a  $\pm .5$  correction to account for the absence of zero values. Paralleling what was observed in the dichotomous match-judgment data, neither main effect was significant,  $F_s(1, 221) \leq 1.88$ ,  $ps \geq .172$ , but there was a significant crime type  $\times$  suspect characteristics interaction,  $F(1, 221) = 5.30$ ,  $p = .022$ , partial

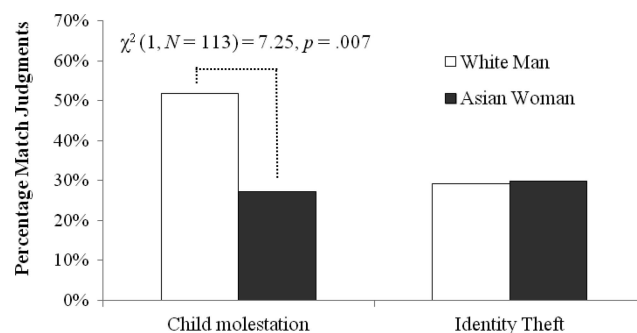


Figure 1. Interaction of crime type and suspect characteristics on rates of participants indicating that crime scene fingerprint matched suspect's fingerprint.

$\eta^2 = .023$ . Follow-up analyses indicated that participants had higher match-judgment confidence scores for the crime of child molestation when the suspect was a White man ( $M = .13$ ,  $SD = 5.67$ ) as opposed to an Asian woman ( $M = -2.47$ ,  $SD = 4.94$ ),  $F(1, 221) = 6.77$ ,  $p = .010$ , Cohen's  $d = .49$ , 95% CI [Cohen's  $d$ ] =  $[-.47, 1.46]$ . For the crime of identity theft, match-judgment confidence scores did not vary as a function of suspect characteristics,  $F(1, 221) = .43$ ,  $p = .512$ , Cohen's  $d = .13$ , 95% CI [Cohen's  $d$ ] =  $[-1.10, .846]$ .

### Participants' Self-Perceptions of Fairness and Impartiality

We also examined the extent to which participants believed they had been fair and impartial when evaluating the fingerprints using a  $2 \times 2$  (crime type  $\times$  suspect characteristics) ANOVA in which the dependent variable was participants' rating of how fair and impartial they had been. Neither of the main effects was significant,  $F_s(1, 221) \leq .48$ ,  $p_s \geq .490$ , however, there was a marginally significant crime type  $\times$  suspect characteristics interaction,  $F(1, 221) = 3.77$ ,  $p = .054$ , partial  $\eta^2 = .017$ . Follow-up analyses indicated that suspect characteristics did not significantly influence participants' perceptions of how fair and impartial they had been when evaluating the crime of identity theft ( $M = 5.76$ ,  $SD = 1.44$ ),  $F(1, 221) = .78$ ,  $p = .378$ , Cohen's  $d = .17$ , 95% confidence interval (CI) [Cohen's  $d$ ] =  $[-.43, .10]$ . For the crime of child molestation, however, participants tended to report that they had been more fair and impartial when the suspect was a White man ( $M = 5.98$ ,  $SD = 1.34$ ) as opposed to an Asian woman ( $M = 5.47$ ,  $SD = 1.55$ ), an effect that was marginally significant,  $F(1, 221) = 3.48$ ,  $p = .064$ , Cohen's  $d = .36$ , 95% CI [Cohen's  $d$ ] =  $[-.09, .62]$ . Because the data pattern associated with participants' estimates of their fairness and impartiality did not map onto the data pattern from their match judgments, these results indicate that participants were unaware of the extent to which criminal stereotypes influenced their evaluations of the fingerprint evidence.

### Discussion

This experiment demonstrated for the first time that criminal stereotypes can bias evaluations of forensic evidence. Participants were more likely to incorrectly judge two fingerprints as a match when the suspect fit a criminal stereotype than when the suspect did not fit a criminal stereotype. For the crime of identity theft, which is not strongly associated with a criminal stereotype, the suspect's characteristics did not affect participants' match judgments. Indeed, the majority of participants in the identity theft condition correctly judged the fingerprints as a nonmatch regardless of whether the suspect was a White man or an Asian woman. But for the crime of child molestation, which has strong stereotypic associations with White male perpetrators, the suspect's characteristics strongly influenced participants' judgments. Participants were nearly twice as likely to indicate that the prints matched in the child molestation case when the suspect was a White man as opposed to an Asian woman. An interesting question raised by these findings is whether differences in the perceived severity of the crimes of child molestation and identity theft may have influenced participants' match judgments. We elected to use these two crimes because of their strong and weak associations

with a criminal stereotype, respectively, however, it may have also been the case that differences in the perceived severity of the crimes influenced participants' reliance on a criminal stereotype to inform their match judgments. Such a phenomenon would raise the possibility that the effects observed in the current research may be even more pronounced in real-world cases involving severe crimes. Future research should examine whether crime severity moderates the extent to which criminal stereotypes bias evaluations of forensic evidence.

Another important finding in this work is that participants appeared to be unaware of the extent to which a criminal stereotype had influenced their evaluations of the fingerprint evidence. Whereas the match-judgment data showed a clear bias against the White man in the child molestation case, participants did not judge themselves to have been more biased against the White man in the child molestation case than against the suspects in the other cases. These asymmetric data patterns for the match-judgment data and participants' ratings of their own fairness and impartiality are consistent with the idea that people lack strong awareness of the factors that influence them (e.g., Nisbett & Wilson, 1977). Moreover, research on bias correction suggests that people often hold inaccurate beliefs about how their biases influence their behavior (e.g., Wegener & Petty, 1995, 1997). These well-established psychological principles converge with the current research findings to suggest that simply asking forensic examiners whether their judgments were influenced by a criminal stereotype is an insufficient method of assessing bias.

One potential criticism of the current research is that it was conducted on a college student sample and that the biases observed in this work might not occur with trained forensic examiners. However, prior research has clearly demonstrated that even highly trained forensic examiners are susceptible to the influence of contextual biases (e.g., Dror & Charlton, 2006; Dror, Charlton, & Péron, 2006). Indeed, a forensic examiner with nearly 30 years of experience confirmed that "analysts do face, and are influenced [. . .] by the types of biasing stimuli that are discussed [in the research]" (Butt, 2013, pp. 59–60). Part of the problem lies in the fact that forensic fingerprint evaluation is far from an objective science. In fact, the threshold for matching a latent fingerprint to a source in the United States is deliberately kept subjective so as to allow the examiner to take into account differences in the quality and quantity of details between the latent print and crime scene print (NAS, 2009). One consequence of this inherent subjectivity, however, is that fingerprint examiners' interpretations of fingerprint evidence tend to vary not only from examiner to examiner but also within a single examiner from one point in time to another (Dror et al., 2011). Moreover, because there are no standardized training or certification requirements for forensic analysts in the U.S (Haber & Haber, 2013; NAS, 2009), some fingerprint analysts may be operating in crime labs with little prior experience. And, many forensic analysis tasks in the real world are arguably even more difficult and ambiguous than was the task that confronted the participants in our study because latent fingerprints in real cases are often smudged or incomplete. Even DNA analysis—considered by many to be the gold standard of forensic evidence—has been shown to be influenced by bias when it involves a complex mixture of DNA from multiple individuals (Dror & Hampikian, 2011). Our findings, therefore, suggest that stereotypes are likely



a pervasive source of bias in real-world cases involving forensic evidence analysis.

This research lends support to recent calls for reform in the domain of forensic evidence analysis (NAS, 2009). Potential remedies have been proposed to help combat the effects of contextual biases on forensic examiners' judgments. For example, linear sequential unmasking is a method in which analysts are shielded from all task-irrelevant information and are exposed to potentially biasing task-relevant information as late in the examination process as possible and only when absolutely necessary (Dror et al., 2015; Krane et al., 2008). Another potential remedy to combat the effects of contextual biases is the filler-control method, in which the suspect's sample is presented along with other "filler" samples that are known to be unassociated with the crime (Wells, Wilford, & Smalarz, 2013). Because the forensic analyst does not know which sample is from the suspect and which samples are fillers, the filler-control method neutralizes the effects of potentially biasing contextual information. Moreover, the filler-control method has the unique advantage of providing an estimate of error rates and thus can quickly expose fraudulent analysts and invalid forensic techniques.

### Conclusion

The present research documented criminal stereotypes associated with a number of different crimes and showed for the first time that criminal stereotypes can bias forensic evidence analysis. Forensic analysis techniques have been criticized for lacking scientific basis and being subject to contextual biases. Indeed, forensic science errors were involved in nearly 50% of the wrongful convictions exposed through DNA-testing (Innocence Project, 2016). The present work heeds recent calls for research on sources of human error in forensic examinations (NAS, 2009) by showing that even when contextual information is not incriminating, it can still bias forensic evaluations by virtue of its consistency with a criminal stereotype. Our findings suggest that suspects who fit a criminal stereotype may be disadvantaged over the course of the criminal justice process and may be at increased risk of wrongful conviction.

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## Appendix

### Crime Vignettes

#### Auto Theft

The suspect is accused of auto theft after being spotted by deputies getting into a black 2003 Ford Expedition on a street corner. The Expedition had been reported stolen from a residence earlier that day.

#### Bank Robbery

The suspect is accused of attempting to rob a bank. The suspect entered the bank and presented a handgun to the teller, demanding to be given money. The suspect was apprehended by police upon attempting to flee from the scene with over \$4,000.

#### Carrying a Concealed Weapon

The suspect is accused of carrying a concealed weapon. An anonymous caller to a 9-1-1 operator identified the suspect by name and responding officers found a handgun in the suspect's coat pocket.

#### Child Molestation

The suspect is accused of molesting the child-victim. The suspect was identified by the victim who reported having been fondled by the suspect. The suspect's computer was confiscated and was found to contain child pornography.

#### Custodial Kidnapping

The suspect is accused of intentionally removing the child-victim from school in direct violation of previous-joint custody

agreements. The suspect had no authority to remove the child from school on the day in which the child was removed.

#### Date Rape

The suspect is accused of forcing the victim to engage in unwanted sexual activity. The victim reported having been raped in the suspect's car. The victim and suspect are reported to have spent several hours drinking at a bar prior to the alleged assault.

#### Domestic Assault

The suspect is accused of repeatedly kicking and punching the victim during the course of an argument. Law enforcement was notified by neighbors who overheard a violent argument.

#### Drive-by-Shooting

The suspect is accused of firing a gun at the victim from a moving vehicle, causing the victim significant physical injury. The suspect admitted to being familiar with the victim prior to the incident.

#### Drug Deal

The suspect is accused of drug dealing. Police observed the suspect participating in a suspicious transaction at a street corner. The suspect was in possession of a large amount of crack cocaine.

(Appendix continues)

### **DWI**

The suspect is accused of DWI after being pulled over for erratic driving in which the suspect did not maintain a steady speed and swerved several times. The suspect refused to take a breathalyzer test upon being pulled over by police.

### **Embezzlement**

The suspect is accused of embezzling clients' money into international investments unbeknownst to the clients. The amount of money embezzled is estimated at \$500,000 over the course of approximately 6 months.

### **Graffiti**

The suspect is accused of making graffiti on the exterior walls of several establishments. Seven buildings in the vicinity are alleged to have been tagged by the suspect. When stopped by police, the suspect was in possession aerosol spray cans.

### **Identity Theft**

The suspect is accused of identity theft for allegedly stealing the identities of at least 20 clients. The suspect reportedly had been using client identities to obtain thousands of dollars in payday loans.

### **Munchausen's Syndrome by Proxy**

The suspect is accused of intentionally engaging in behaviors to cause illness to the child-victim. These behaviors include poisoning of the child's food, administering inappropriate medication, and not administering prescribed medications.

### **Prostitution**

The suspect is accused of prostitution. The suspect approached vice officers who were in an unmarked patrol car late in the

evening, and offered to engage in sexual acts in exchange for money.

### **Purse Snatching**

The suspect is accused of theft after forcibly pulling the victim's purse from her arm and attempting to flee on foot. Officers identified and apprehended the suspect after a brief chase.

### **Shoplifting**

The suspect is accused of stealing over \$200 worth of clothing from a department store. The suspect was caught attempting to leave the store with the merchandise in a large tote bag shortly after exiting the dressing room.

### **Serial Murder**

The suspect is accused of the murder of five individuals. The suspect is accused of strangling and killing each victim on separate occasions. Authorities are examining evidence they believe link the suspect to as many as thirty deaths.

### **Stalking**

The suspect is accused of making repeated unwanted contact with a former significant other for a period of six months. This contact was made in the form of calls, emails, letters and visits to the victim's home and workplace.

### **Terrorism**

The suspect is accused of contributing to a terrorist effort after placing an explosive device in an airport. The suspect hid a suitcase in a remote section of the airport that was seen and reported by a waiting passenger. The bag contained an explosive device.

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