Running head: INFERRING CRIMINALITY AFTER 100 MS

Looking bad: Inferring criminality after 100 ms

Thimna Klatt[1], John J. Maltby[2], Joyce E. Humphries[3], Harriet L. Smailes[2], Hannah Ryder[2],

Matthew Phelps[1], and Heather D. Flowe[4]

[1] Criminological Research Institute of Lower Saxony, Hannover, Germany

[2] University of Leicester, Department of Neuroscience, Psychology and Behaviour, Leicester, UK

[3] Edge Hill University, Department of Psychology, Ormskirk, UK

[4] Loughborough University, School of Sport, Exercise and Health Sciences, Loughborough, UK

Correspondence concerning this article should be addressed to Thimna Klatt, Criminological Research Institute of Lower Saxony, Lützerodestr. 9, 30161 Hannover, Germany. Email: Thimna.Klatt@kfn.de

Abstract

Research finds we make spontaneous trait inferences from facial appearance, even after

brief exposures to a face (i.e., ≤ 100 ms). We examined spontaneous impressions of

criminality from facial appearance, testing whether these impressions persist after repeated

presentation (i.e., one to three exposures) and increased exposure duration (100, 500, or

1000 ms) to the face. Judgement confidence and response times were recorded. Other

participants viewed the faces for an unlimited period of time, rating trustworthiness

dominance, and criminal appearance. We found evidence that participants spontaneously

make criminal appearance attributions. These inferences persisted with repeated

presentation and increased exposure duration, were related to trustworthiness and

dominance ratings, and were made with high confidence. Implications are discussed.

Keywords: first impressions, bias, trait inferences, trustworthiness, criminality

Looking bad: Inferring criminality after 100 ms

Trait inferences are formed almost instantaneously and often without conscious awareness (Hassin & Trope, 2000; Todorov, Pakrashi, & Oosterhof, 2009; Willis & Todorov, 2006). Research suggests that a 100 ms exposure to a stranger's face is sufficient to develop a consistent judgment about their character traits, such as impressions of threat, competency, and trustworthiness (Bar, Neta, & Linz, 2006; Willis & Todorov, 2006). The impact of such judgments have been observed in important outcomes, such as elections (Todorov, Mandisodza, Goren, & Hall, 2005), military rank attainment (Mazur, Mazur, & Keating, 1984; Mueller & Mazur, 1996), and decisions in the courtroom (Blair, Judd, & Chapleau, 2004; Porter, ten Brinke, & Gustaw, 2010; Zebrowitz & McDonald, 1991).

Zebrowitz (2004) proposed that identifying emotional expressions has an adaptive function. For example, inferring whether a person is happy or angry can be a valuable cue in assessing whether this person should be approached or avoided. The *Emotion Overgeneralization Hypothesis* (Zebrowitz, 2004) posits that traits are inferred based on the face's structural resemblance to an emotional expression; this has been evidenced in numerous studies (Bar et al., 2006; Montepare & Dobish, 2003; Oosterhof & Todorov, 2008, 2009; Said, Sebe, & Todorov, 2009).

In their investigation of how people socially perceive facial cues, Oosterhof and Todorov (2008) proposed a two-dimensional model of face evaluation. They proposed that two orthogonal factors, valence and dominance, underlie face evaluations, whereby valence, which is indexed by trustworthiness, signals harmful intentions, whereas dominance conveys a more physical capability of causing harm. Changes along the valence

dimension seem to be impacted by facial features signaling emotion (in line with the

Emotion Overgeneralization Hypothesis), while dominance seems to be attributed to facial

characteristics that convey maturity and masculinity.

   Research has shown that people strongly agree in their evaluation of faces, with

studies reporting high inter-rater reliability and internal consistency for trait inferences,

including trustworthiness, aggressiveness, and emotional stability (e.g. Oosterhof &

Todorov, 2008; Willis & Todorov, 2006). Furthermore, first impressions are shown to

develop after very brief exposure times (Bar et al., 2006; Todorov et al., 2009; Willis &

Todorov, 2006). For example, Olson and Marshuetz (2005) found significant differences

between ratings of attractive and unattractive faces after as little as 13 ms exposure time.

Research has shown that people also differentiate between trustworthy and untrustworthy

faces after only 33 ms exposure time (Todorov et al., 2009), and deduce threat from faces

following only 39 ms exposure time (Bar et al., 2006). Similarly, Willis and Todorov

(2006) showed that trait judgments of attractiveness, likeability, competence,

trustworthiness, and aggressiveness are made following 100 ms exposure time. In their

study, participants were presented with photographs of emotionally neutral male and female

actors for 100 ms, 500 ms, and 1,000 ms, and subsequently asked to provide trait ratings.

The authors found that judgments of attractiveness, likeability, competence,

trustworthiness, and aggressiveness made after an exposure time of 100 ms positively

correlated with trait judgments made after unconstrained exposure time conditions. Longer

exposure durations (500 ms and 1,000 ms), however, were not found to significantly affect

trait inferences, but instead boosted participants' confidence in their trait judgements. The

present study extends this seminal work, investigating whether people spontaneously infer

criminal appearance from faces. This question has important implications for social evaluations in criminal justice settings.

Inferences about criminality based on facial appearances have captured researchers' attention since the 19th century (Lombroso, 1876) and continue to do so today (e.g. Valla, Ceci, & Williams, 2011). Nevertheless, few studies have actually investigated first impressions of criminality following minimal face exposure time. While perceived criminality was found to be strongly related to facial appearances that emanate a threat, these constructs only partially overlap (Flowe, 2012). Therefore, a deeper examination of the link between first impressions and criminality is warranted.

People seem to have well-formed ideas about what a criminal looks like: The stereotypical criminal is believed to have unkempt or long hair, scars, pockmarks, facial hair, and sharp eyes (MacLin & Herrera, 2006). Importantly, criminality inferences can bias eyewitness lineup identifications (Flowe & Humphries, 2011; Flowe, Klatt, & Colloff, 2014; McQuistion & Malpass, 2002). However, it remains unknown how rapid inferences about perceived criminality are made. This is an important question because rapid inferences of criminality are interpreted as intuition (cf. Porter & ten Brinke, 2009). This is problematic because if people have the feeling of intuitively *knowing* something about another person, it is very likely that they will act upon that intuition instead of questioning or changing it.

Although various characteristics have been associated with perceived criminality, attractiveness appears to be the most intensively studied attribute. Numerous studies yield results that corroborate the claim that attractiveness is negatively associated with criminality (e.g. Mazzella & Feingold, 1994; Stewart, 1980; Zebrowitz & McDonald,

1991). Another facial feature that has been examined in relation to criminality is maturity (Berry & McArthur, 1988; Dumas & Testé, 2006; Zebrowitz & McDonald, 1991). Babyfaced individuals, as opposed to mature-looking persons, have large, round eyes, high or thin eyebrows, a narrow chin, and thick lips (Berry & McArthur, 1985; Marsh, Adams, & Kleck, 2005). An experiment by Dumas and Testé (2006) revealed that the facial maturity of the defendant significantly influenced judgments of guilt or innocence. Specifically, baby-faced defendants received fewer guilty verdicts than their mature-looking counterparts. A masculine appearance has also been associated with a criminal appearance. Ward, Flowe, and Humphries (2012) found that guilt ratings for male and female suspect faces increased with increasing levels of perceived suspect facial masculinity.

The potential negative consequences of trait inferences of perceived criminality justify the importance of investigating how such inferences are formulated. As mentioned earlier, very fast deductions can be interpreted as an "intuition" or "gut feeling" (cf. Porter & ten Brinke, 2009), the consequences of which can influence the effectiveness of important decision-making, such as eyewitness identification, which can play a role in criminal case outcomes (see Flowe, Mehta, & Ebbesen, 2011). Therefore, our primary aim was to examine first impressions of criminality after minimal exposure, using a similar design to that employed by Willis and Todorov (2006). Note that our aim was not to establish the minimum exposure duration at which consistent inferences of criminality can be made.

We also extend previous research by investigating whether spontaneous inferences regarding criminality persist following repeated presentations of the face. This is especially

relevant in a criminal justice setting, wherein criminal justice agents (e.g., judges, jurors) have repeated contact with a defendant. As another example, in some countries such as the UK (PACE, 1984), witnesses are allowed to view lineups multiple times. Previous research suggests that simply informing people about an existing bias, or asking people to avoid making biased decisions, does not help to reduce its occurrence (Frantz, 2000; Kim, 2003). For instance, Hansen and colleagues (2014) conducted an experiment in which participants rated paintings using a biased judgment strategy. Even though the participants knowingly gave biased evaluations, they rated their judgments afterwards as being relatively objective. Thus, simply informing people about the risk of making biased decisions does not necessarily reduce bias. Therefore, it is important to investigate whether other variables, such as repeated face exposure, can reduce criminal face bias.

The effect of repeated exposures of a face on criminal face bias has not been previously investigated. On the one hand, repeated exposure to a face may increase people's ability to perceive individuating information about the face. On the other hand, repeated exposure may lead people to rely more on facial stereotypes (see Smith et al., 2006). In line with this, Willis and Todorov (2006) hypothesized that seeing a face multiple times will most likely confirm a person's initial judgment. Given this background, we hypothesize that repeated viewings of a face do not alter the first impression concerning criminality, and will increase people's confidence in their criminality judgments.

Method

Participants

A total of 40 undergraduate students (88% female, age $M = 20.43$, range: 18-24 years) evaluated the criminal appearance of faces under restricted viewing times. A further 56 participants (71% female, age $M = 33.50$, range: 22-62 years) evaluated the faces under unrestricted viewing conditions. All study faces were rated on criminal appearance, attractiveness, trustworthiness, and dominance. The participants provided written informed consent before taking part in the study and were debriefed after they finished the experiment. The research proposal was approved by the Psychology Research Ethics Committee of the University of Leicester.

Design

A 3 exposure duration (100, 500, and 1000 ms) x 3 exposure number (one, two, and three) within subjects design was employed. The dependent variables were criminal attribution (the proportion of participants who evaluated a given face as criminal-looking), mean response time (the average length of time [ms] that it took for participants to make a criminal attribution to a given face), and mean confidence (the average level of confidence in the criminal attribution made to a given face). The confidence variable was measured on a 7-point Likert type scale ranging from 1, "not at all confident", to 7, "completely confident". Criminal appearance ratings after an unrestricted viewing time were used as criterion measure.

Materials and Procedure

The photographic stimuli were 40 photographs from the Oklahoma Department of Corrections offender database (http://www.doc.state.ok.us/). Each photograph featured a head and shoulder shot of a White male, aged between 18 and 24 years, with a neutral

emotional expression. We rendered the photographs black and white to eliminate any differences across photographs with respect to clothing and background color.

Unrestricted viewing time. Participants with an unrestricted viewing time rated each of the faces with respect to how criminal, trustworthy, dominant, and attractive the face appeared; each of these traits was measured on a 7-point scale, with 1 indicating "not at all [attribute]", and 7 indicating "completely [attribute]".

Each participant in this phase rated each of the 40 faces, in a random order, using only one trait. The face remained onscreen while the participant provided their rating, and the time to make the judgment was not restricted. The trait judgments were reliable (criminal α = .95, trustworthy α = .96, dominant α = .93, attractive α = .95).

Restricted viewing time. People were asked to indicate whether a presented face was criminal-looking or not as quickly as possible. The order of the trials was randomized by the computer. Each trial began with a fixation cross at the center of the screen for 500 ms, followed by the presentation of a face, which was displayed for 100 ms, 500 ms, and 1,000 ms. Immediately following the presentation of a face participants were asked, "*Is this person criminal looking?"* Participants responded using either the 'yes' or 'no' labelled keys on the computer keyboard. Next, participants were asked to rate how confident they were in their judgment. The duration of the inter-trial interval was 1,500 ms. To analyze whether trait inferences change with exposure number, each test face was presented at each of the three exposure durations. The order of the exposure durations and stimulus images was randomly determined for each participant. For each face, the program recorded whether the participant made a criminal attribution, their response confidence, and the response time.

In the statistical analyses that follow, the stimulus face was the unit of analysis. The proportion of participants who made a criminal attribution and the average trait rating across participants was calculated for each test face. Mean confidence and response time, conditioning the data on exposure duration and on exposure number, were also calculated for each face.

Results

Criminal Attributions

First, we tested if restricted viewing time influenced criminal attributions. Toward this end, the proportion of participants who judged a face as criminal-looking and the mean criminal appearance ratings, were correlated across the faces for each exposure duration. The top panel of Table 1 presents the zero-order correlation coefficients obtained at each exposure duration. As can be seen, for each exposure duration, criminal attributions were significantly correlated with criminality ratings made under no time constraints. This suggests that people make judgments regarding perceived criminality following as little as 100 ms exposure to a face.

Table 1

Correlation of Criminal Attributions made at 100 ms versus 500 ms versus 1,000 ms with Trait Ratings that were made to Faces displayed for an Unlimited Duration. Top Panel displays Zero-Order Correlations, and Bottom Panel displays Partial Correlations for Criminal Attributions after Trustworthyness, Dominance, and Attractiveness Ratings were Partialled Out.

Zero-Order Correlations:

Trait Judgment	Exposure Duration		
	100 ms	500 ms	1,000 ms
Criminal	.805***	.782***	.736***
Trustworthy	-.809***	-.757***	-.740***
Dominant	.417**	.354**	.376**
Attractive	-0.176	-0.178	-0.191

Partial Correlations:

Trait Judgment	Exposure Duration		
	100 ms	500 ms	1,000 ms
Criminal	.428**	.444**	.326*

Note. *** $p < .001$, ** $p < .01$, * $p < .05$

Correlating the criminal appearance ratings with the other trait ratings indicated that

criminal appearance was significantly related to how trustworthy ($r = -.80$, $p < .001$),

dominant ($r = .42$, $p < .01$), and attractive ($r = -.31$, $p = .05$) a face was perceived. Next,

criminal appearance ratings were correlated with criminal attributions, as these variables

are interrelated with other traits. The partial correlation between criminal attributions and

criminal appearance ratings were computed by partialling out the association between these

variables with mean ratings of attractiveness, trustworthiness, and dominance. Table 1

presents the results. As can be seen, criminal attributions and criminal appearance ratings

made after each exposure time still significantly correlated, even after removing the

variation they shared with the other traits.

A multiple regression analysis was also conducted to assess which features of a face

predict inferences of criminality after minimal exposure. Ratings of criminality,

trustworthiness, dominance, and attractiveness made after an unconstrained exposure were

entered as predictors. Since our analyses showed that criminal attributions did not vary after

the exposure duration (see Table 1), we averaged the proportion of participants who judged

a face as criminal-looking across exposure durations (100 ms, 500 ms, and 1,000 ms). This

measure was then used as the outcome variable. The results of the analysis are presented in

Table 2.

Table 2

Multiple Regression Analysis of Perceived Criminality, Trustworthiness, Dominance, and

Attractiveness Predicting the Proportion of Participants Who Judged a Given Face as

Criminal-looking after Minimal Exposure

Trait Judgment	*B*	*SE*	β
Constant	0.556	0.363	
Criminal	0.094	0.033	.453**
Trustworthy	-0.155	0.055	-.423**
Dominant	0.031	0.048	.063
Attractive	0.022	0.040	.052

Note. $R^2 = .714$. ** $p < .01$

As can be seen from Table 2, both perceived criminality and trustworthiness

significantly predicted criminal attributions after minimal exposure (p's $< .01$). None of the

variables' variance inflation factors (VIF) was greater than 4 and all tolerance values

exceeded values of 0.3. Thus, it is assumed that collinearity did not bias the results of the

regression (Menard, 1995; Myers, 1990).

A further point of interest was whether criminal attributions varied in relation to the

number of exposures that participants had to a face. In other words, would first impressions

of criminality change if participants saw the face more often? To examine this, criminal

attributions were correlated with the criminal appearance ratings, conditioning the data on

exposure duration and exposure number (first versus second versus third). As can be seen

in Table 3, criminal attributions and criminal appearance ratings were significantly related,

regardless of exposure number and exposure duration. Thus, our first impressions of a face,

with respect to criminal attributions, do not seem to change with additional time or with

further exposures.

Table 3

Correlation of Criminal Attributions that Were Made to Faces Displayed for 100 ms versus

500 ms versus 1,000 ms with Criminal Appearance Ratings that Were Made to Faces

Displayed for an Unlimited Duration by Exposure Number.

	Exposure Duration		
Exposure Number	100 ms	500 ms	1,000 ms
First	.761**	.759**	.691**
Second	.744**	.787**	.790**
Third	.711**	.809**	.745**

Note. *** $p < .001$, ** $p < .01$, * $p < .05$

Confidence

Next, we examined whether judgment confidence increased with longer exposure durations and with repeated face exposures. The mean confidence data were entered into a repeated measures ANOVA, with exposure duration and exposure number as the independent variables. Confidence significantly varied in relation to exposure duration, $F(2, 78) = 61.03$, $p < .001$, partial eta = .61. Contrast analysis indicated that confidence significantly increased as exposure duration increased from 100 ms to 500 ms ($M = 4.00$, $SEM = .07$, versus $M = 4.45$, $SEM = .07$, respectively, $p < .001$), but did not significantly vary as exposure duration increased from 500 ms to 1,000 ms ($M = 4.45$, $SEM = .07$, to $M = 4.39$, $SEM = .07$, respectively, $p > .05$). No other significant effects emerged from the analysis.

Response Time

The final analyses examined whether the time that it took participants to make their attributions, varied in relation to exposure duration and the number of exposures they had to a face. The mean response time data were entered into a repeated measures ANOVA, with exposure duration and exposure number as the independent variables. Significant main effects were found for exposure duration, $F(2, 78) = 30.71$, $p < .001$, partial eta = .44, and exposure number, $F(2, 78) = 48.18$, $p < .001$, partial eta = .55. Contrast analysis indicated that response times significantly decreased as exposure duration increased from 100 ms to 500 ms, and from 500 ms to 1,000 ms, and as the number of exposures increased from first to second, and from second to third (p's < .05).

Discussion

People make spontaneous trait inferences from faces, and this may have important implications for social decision-making (Blair et al., 2004; Mazur et al., 1984; Mueller &

Mazur, 1996; Todorov et al., 2005). In this study, we examined whether reliable inferences of criminality are made after minimal exposure and whether these inferences persisted over multiple face presentations. It has to be noted that reliability of inferences does not necessarily mean that the judgments are accurate and indicate actual criminality. Here, reliability implies that participants strongly agree in their assessment of a face's criminal appearance.

Our results show that people make consistent attributions of criminality after as little as 100 ms exposure to a face. That is, criminal attributions made after a 100 ms presentation of a face correlated strongly and significantly with criminality ratings made in the absence of time constraints. Longer exposure durations (500 ms and 1,000 ms) did not increase the correlation of criminal attributions and criminality ratings after unconstrained exposure (i.e. criterion ratings). Only the participants' confidence in their trait judgments increased with increased exposure duration, which is in line with the results reported by Willis and Todorov (2006). Thus, judgments of perceived criminality are inferred following only minimal exposure times.

We found that ratings of criminal appearance were strongly and significantly correlated with how trustworthy and dominant the faces were perceived. This finding is consistent with the 2D model of face perception (Oosterhof & Todorov, 2008), which proposes that trait inferences are based on two dimensions; trustworthiness and dominance. However, we also found that the correlation of criminal attributions and the criterion measure still reached statistical significance when perceived trustworthiness, dominance, and attractiveness were statistically controlled for. Additionally, multiple regression analysis showed that both trustworthiness and criminal appearance ratings significantly

predicted the proportion of participants who judged a given face as criminal-looking. Dominance and attractiveness, on the other hand, were not significant predictors of criminal attributions. Taken together, our results suggest that criminality is partially inferred based on a face's perceived trustworthiness. However, there also seems to be an independent effect of criminal appearance that cannot be represented by evaluations of trustworthiness alone. Future research needs to examine what other facial features elicit inferences of criminality. A study by Flowe and Humphries (2011), for example, indicates that perception of guilt in a stranger's face could trigger inferences of criminality.

Previous research (Bar et al., 2006; Todorov et al., 2009) has shown that traits, such as threat and trustworthiness, can be inferred after less than 40 ms presentation. However, the aim of this study was not to establish the minimum exposure duration at which consistent inferences of criminality can be made. Therefore, it remains to be tested if exposure durations under 100 ms will be sufficient for people to make consistent judgments of perceived criminality. This would be an interesting avenue for further research.

A second finding of our research is that multiple presentations of a face did not result in a change in criminal attributions. Our results thus suggest that inferences of criminality after minimal exposure are stable over repeated exposures to a face. Multiple presentations of faces also did not seem to reduce the occurrence of a criminal face bias effect. However, it is also possible that our participants' evaluations of a given face indeed changed with multiple presentations, but participants responded with the same judgment on each exposure to avoid appearing inconsistent. Future research should address this limitation by controlling for potential response biases. Researchers could, for example, explicitly ask their participants about their first impression and if their evaluation of a

certain face changed after having seen it multiple times. Additionally, further studies are

warranted to examine alternate means of reducing bias in diverse situations, including

eyewitness identification from lineups.

Unexpectedly, we did not find confidence to vary significantly with exposure

number. Confidence did not vary depending on whether a given face was being shown for

the first, second, or third time. This contradicts our hypothesis that multiple presentations of

a face would increase a person's confidence in his or her initial impression. The time

needed to provide a criminality judgment, on the other hand, was found to decrease with

multiple exposures to the stimulus face. It is possible that the reduction in response time

indicates a subtle increase in confidence.

The stimuli that we used for our study are photographs of convicted criminals. We

chose to utilize police mugshots to enhance the external validity of our study, as the results

will likely be most applicable within the context of eyewitness identification procedures.

Research by Flowe (2012) has shown that the evaluation of a face's criminal appearance is

similar for both police mugshots and highly controlled photographs of non-criminals.

However, further research is warranted to examine if the results reported here can be

replicated using different stimuli, including female faces (see Ward, Flowe, & Humphries,

2012) and with different age groups (see Humphries & Flowe, 2016). A further endeavor

for future research could be to utilize short video clips of a person instead of photographic

stimuli; this could relate better with countries, such as the UK, who use video lineups for

eyewitness identification (PACE, 1984).

In summary, this study extends previous research, finding people spontaneously

make criminality inferences, and that dominance and trustworthiness appear to underlie

these inferences. The finding that criminality is deduced after as little as 100 ms

demonstrates that these inferences are spontaneous. As mentioned previously, rapid

inferences of criminality after minimal exposure could lead a person to interpret this

inference as intuition (cf. Porter & ten Brinke, 2009) and wrongly use it to make decisions.

More studies are needed to examine which features of a face elicit inferences of criminality,

for example by using eye-tracking experiments or reverse correlation techniques (see

Dotsch & Todorov, 2012). Our results have also shown that repeated exposure to a face

does not influence the initial judgment. Further research is needed to explore ways to

effectively control or reduce bias and stereotyping based on a person's physical appearance.

For example, if inferences of criminality are found to be elicited by specific features or

regions of a face, masking or blurring these regions could help to suppress snap judgments

regarding a person's criminality.

References

Bar, M., Neta, M., & Linz, H. (2006). Very first impressions. *Emotion, 6,* 269-278.

    doi:10.1037/1528-3542.6.2.269

Berry, D. S., & McArthur, L. Z. (1985). Some components and consequences of a

    babyface. *Journal of Personality and Social Psychology, 48,* 312-323.

    doi:10.1037//0022-3514.48.2.312

Berry, D. S., & McArthur, L. Z. (1988). What's in a face? Facial maturity and the

    attribution of legal responsibility. *Personality and Social Psychology Bulletin, 14,* 23-

    33. doi:10.1177/0146167288141003

Blair, I. V., Judd, C. M., & Chapleau, K. M. (2004). The influence of Afrocentric facial

    features in criminal sentencing. *Psychological Science, 15,* 674-679.

    doi:10.1111/j.0956-7976.2004.00739.x

Dotsch, R., & Todorov, A. (2012). Reverse correlating social face perception. *Social*

    Psychological and Personality Science, 3, 562-571. doi:10.1177/1948550611430272

Dumas, R., & Testé, B. (2006). The influence of criminal facial stereotypes on juridic

    judgments. *Swiss Journal of Psychology, 65,* 237-244. doi:10.1024/1421-

    0185.65.4.237

Flowe, H. D. (2012). Do characteristics of faces that convey trustworthiness and dominance

    underlie perceptions of criminality? *PLoS ONE, 7,* e37253.

    doi:10.1371/journal.pone.0037253

Flowe, H. D., & Humphries, J. E. (2011). An examination of criminal face bias in a random

    sample of police lineups. *Applied Cognitive Psychology, 25,* 265-273.

    doi:10.1002/acp.1673

Flowe, H. D., Klatt, T., & Colloff, M. F. (2014). Selecting fillers on emotional appearance improves lineup identification accuracy. *Law and Human Behavior, 38,* 509-519. doi: 10.1037/lhb0000101

Flowe, H. D., Mehta, A., & Ebbesen, E. B. (2011). The role of eyewitness identification evidence in felony case outcomes. *Psychology, Public Policy, and Law, 17,* 140-159. doi: http://dx.doi.org/10.1037/a0021311

Frantz, C. S. M. P. (2000). *Overcoming our biases: Helping observers see both sides.* Retrieved from ProQuest Digital Dissertations. (AAI9978495)

Hansen, K., Gerbasi, M., Todorov, A., Kruse, E., & Pronin, E. (2014). People claim objectivity after knowingly using biased strategies. *Personality and Social Psychology Bulletin, 40,* 691-699. doi:10.1177/0146167214523476

Hassin, R., & Trope, Y. (2000). Facing faces: Studies on the cognitive aspects of physiognomy. *Journal of Personality and Social Psychology, 78*, 837-852. doi:10.1037/0022-3514.78.5.837

Humphries, J. E., & Flowe, H. D. (2015). Receiver operating characteristic analysis of age-related changes in lineup performance. *Journal of Experimental Child Psychology, 132*, 189-204. doi: 10.1016/j.jecp.2014.12.009

Kim, D. (2003). Voluntary controllability of the implicit association test (IAT). *Social Psychology Quarterly, 66,* 83-96. doi:10.2307/3090143

Lombroso, C. (1876). *L'uomo delinquente [The criminal man].* Milan: Hoepli.

MacLin, M. K., & Herrera, V. (2006). The criminal stereotype. *North American Journal of Psychology, 8,* 197-208.

Marsh, A. A., Adams, R. B. Jr., & Kleck, R. E. (2005). Why do fear and anger look the way they do? Form and social function in facial expressions. *Personality and Social Psychology Bulletin, 31,* 73-86. doi:10.1177/0146167204271306

Mazur, A., Mazur, J., & Keating, C. (1984). Military rank attainment of a West Point class: Effects of cadets' physical features. *American Journal of Sociology, 90,* 125-150. doi:10.1086/228050

Mazzella, R., & Feingold, A. (1994). The effects of physical attractiveness, race, socioeconomic status, and gender of defendants and victims on judgments of mock jurors: A meta-analysis. *Journal of Applied Social Psychology, 24,* 1315-1338. doi:10.1111/j.1559-1816.1994.tb01552.x

McQuiston, D. E., & Malpass, R. S. (2002). Validity of the mockwitness paradigm: Testing the assumptions. *Law and Human Behavior, 26,* 439-453. doi:10.1023/A:1016383305868

Menard, S. (1995). *Applied logistic regression analysis.* Sage University paper series on quantitative applications in the social sciences, 07-106. Thousand Oaks, CA: Sage.

Montepare, J. M., & Dobish, H. (2003). The contribution of emotion perceptions and their overgeneralizations to trait impressions. *Journal of Nonverbal Behavior, 27,* 237-254. doi:10.1023/A:1027332800296

Mueller, U., & Mazur, A. (1996). Facial dominance of West Point cadets as a predictor of later military rank. *Social Forces, 74,* 823-850. doi:10.2307/2580383

Myers, R. (1990). *Classical and modern regression with applications* (2nd ed.). Boston, MA: Duxbury.

Olson, I. R., & Marshuetz, C. (2005). Facial attractiveness is appraised in a glance.

    Emotion, 5(4), 498-502. doi:10.1037/1528-3542.5.4.498

Oosterhof, N. N., & Todorov, A. (2008). The functional basis of face evaluation.

    Proceedings of the National Academy of Sciences of the United States of America,

    105, 11087-11092. doi:10.1073/pnas.0805664105

Oosterhof, N. N., & Todorov, A. (2009). Shared perceptual basis of emotional expressions

    and trustworthiness impressions from faces. *Emotion, 9,* 128-133.

    doi:10.1037/a0014520

Police and Criminal Evidence Act (PACE, 1984) Codes of Practice, Code D (2013).

    Retrieved from

    https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/25383

    1/pace-code-d-2011.pdf

Porter, S., & ten Brinke, L. (2009). Dangerous decisions: A theoretical framework for

    understanding how judges assess credibility in the courtroom. *Legal and*

    Criminological Psychology, 14, 119-134. doi:10.1348/135532508X281520

Porter, S., ten Brinke, L., & Gustaw, C. (2010). Dangerous decisions: The impact of first

    impressions of trustworthiness on the evaluation of legal evidence and defendant

    culpability. *Psychology, Crime & Law, 16,* 477-491.

    doi:10.1080/10683160902926141

Said, C. P., Sebe, N., & Todorov, A. (2009). Structural resemblance to emotional

    expressions predicts evaluation of emotionally neutral faces. *Emotion, 9,* 260-264.

    doi:10.1037/a0014681

Smith, E. R., Miller, D. A., Maitner, A. T., Crump, S. A., Garcia-Marques, T., & Mackie,

    D. M. (2006). Familiarity can increase stereotyping. *Journal of Experimental Social*

    Psychology, 42, 471-478. doi: 10.1016/j.jesp.2005.07.002

Stewart, J. E. (1980). Defendant's attractiveness as a factor in the outcome of criminal

    trials: An observational study. *Journal of Applied Social Psychology, 10,* 348-361.

    doi:10.1111/j.1559-1816.1980.tb00715.x

Todorov, A., Mandisodza, A. N., Goren, A., & Hall, C. C. (2005). Inferences of

    competence from faces predict election outcomes. *Science, 308,* 1623-1626.

    doi:10.1126/science.1110589

Todorov, A., Pakrashi, M., & Oosterhof, N. N. (2009). Evaluating faces on trustworthiness

    after minimal time exposure. *Social Cognition, 27,* 813-833.

    doi:10.1521/soco.2009.27.6.813

Valla, J. M., Ceci, S. J., & Williams, W. M. (2011). The accuracy of inferences about

    criminality based on facial appearance. *Journal of Social, Evolutionary, and Cultural*

    Psychology, 5, 66-91. doi:10.1037/h0099274

Ward, C., Flowe, H. D., & Humphries, J. (2012). The effects of masculinity and suspect

    gender on perceptions of guilt. *Applied Cognitive Psychology, 26,* 482-488.

    doi:10.1002/acp.2823

Willis, J., & Todorov, A. (2006). First impressions: Making up your mind after a 100-ms

    exposure to a face. *Psychological Science, 17,* 592-598. doi:10.1111/j.1467-

    9280.2006.01750.x

Zebrowitz, L. A. (2004). The origin of first impressions. *Journal of Cultural and*

    Evolutionary Psychology, 2, 93-108. doi:10.1556/JCEP.2.2004.1-2.6

Zebrowitz, L. A., & McDonald, S. M. (1991). The impact of litigants' baby-facedness and

attractiveness on adjudications in small claims courts. *Law and Human Behavior, 15,*

603-623. doi:10.1007/BF01065855