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LAY THEORIES ABOUT APPEARANCE AND FACIAL PROFILING

How you look is who you are: The *Appearance Reveals Character* Lay Theory Increases Support for Facial Profiling

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The study materials, data, and analysis code are available at <https://osf.io/aj86v>

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Abstract

People are excessively confident that they can judge others' characteristics from their appearance. This research identifies a novel antecedent of this phenomenon. Ten studies ($N=2,967$, four pre-registered) find that the more people believe that appearance reveals character, the more confident they are in their appearance-based judgments, and therefore, the more they support the use of facial profiling technologies in law enforcement, education, and business. Specifically, people who believe that appearance reveals character support the use of facial profiling in general (Studies 1a-1b), and even when they themselves are the target of profiling (Studies 1c-1d). Experimentally inducing people to believe that appearance reveals character increases their support for facial profiling (Study 2) because it increases their confidence in the ability to make appearance-based judgments (Study 3). An intervention that undermines people's confidence in their appearance-based judgments reduces their support for facial profiling (Study 4). The relationship between the lay theory and support for facial profiling is weaker among people with a growth mindset about personality, as facial profiling presumes a relatively unchanging character (Study 5a). This relationship is also weaker among people who believe in free will, as facial profiling presumes that individuals have limited free will (Study 5b). The *appearance reveals character* lay theory is a stronger predictor of support for profiling than analogous beliefs in other domains, such as the belief that Facebook™ likes reveal personality (Study 6). These findings identify a novel lay theory that underpins people's meta-cognitions about their confidence in appearance-related judgments and their policy positions.

Keywords: lay theories; appearance; facial profiling; overconfidence; appearance-based judgments

How you look is who you are: The *Appearance Reveals Character* Lay Theory Increases Support for Facial Profiling

The scientific question of whether people's appearance can reveal their character has experienced a resurgence in recent decades (Hassin & Trope, 2000). Researchers have argued that we often act as naïve physiognomists who make inferences about others' character based on their appearance, even when more diagnostic information is available (Todorov, 2017). People make confident guesses about others' personality traits in less than a second after first looking at them (Uleman et al., 2008). Researchers have found that people can judge others' level of openness, extraversion, neuroticism, self-esteem, religiosity, competence, and sexual orientation based on their appearance at above-chance levels (Borkenau et al., 2009; Carney et al., 2007; Freeman et al., 2010; Naumann et al., 2009; Todorov et al., 2005; Watson, 1989; Zebrowitz, 2017). However, people cannot infer other traits, such as trustworthiness (Rule et al., 2013), and the evidence is mixed for yet other characteristics such as intelligence (Zebrowitz & Rhodes, 2004) and political orientation (Samochowiec et al., 2010; Todorov et al., 2015). The key focus of past research has been on whether people's judgments are accurate at *above-chance* levels. Unlike most research on appearance-based judgments in psychology, we do not attempt to study the *veracity* of these judgments. Instead, we focus our attention on people's confidence in making accurate appearance-based judgments.

Even though people can only infer others' traits from their appearance at above-chance levels, they are excessively confident in their ability to do so (Ames et al., 2010; Hassin & Trope, 2000). When asked to guess people's occupations from their faces, participants' accuracy was 37%, but they believed that their accuracy was 68% (Hassin & Trope, 2000). Past research has identified antecedents of these confidence judgments, including the fluency of the inferred trait, the match between features of the target and the perceiver's stereotypes, an intuitive style of

thinking, and person perception self-efficacy (Ames et al., 2010). This research proposes a novel lay theory—whether people *believe* that individuals' appearance reveals their character—as a key antecedent of people's excessive confidence in their appearance-based judgments. Further, we investigate an important downstream consequence of this lay theory—people's support for widespread facial profiling.

The Appearance Reveals Character Lay Theory

The idea that a person's character can be glimpsed in their face dates back to the ancient Greeks (Little et al., 2006). Eminent philosophers, such as Aristotle, have sought to infer stable traits from people's appearance since the fourth century BC (Re & Rule, 2016; Zebrowitz, 2017). The notion that people's character is revealed in their appearance enjoyed a widespread resurgence when Johann Caspar Lavater (1775), a Swiss theologian, published his four-volume *Essays on Physiognomy*. This was subsequently dismissed by researchers (Todorov, 2017) but has experienced newfound interest in recent times (Hassin & Trope, 2000) because the idea that people's appearance can reveal their character is extremely powerful and pervasive in everyday life.

People tend to rely on their appearance-based impressions in extremely high-stakes contexts such as legal (Zebrowitz & McDonald, 1991) and business decisions (Gorn et al., 2008). For example, baby-faced defendants were less likely to lose cases where the harm was intentional but were more likely to lose cases when the harm was accidental (Zebrowitz & McDonald, 1991). In an economic game, participants were more likely to invest in partners whose (computer-generated) faces looked more trustworthy, even if these partners had acted in an untrustworthy manner in the past (Rezlescu et al., 2012). Similarly, judges and juries were more likely to sentence to death African American defendants accused of murdering a European American if the defendants' faces looked more stereotypically black (Eberhardt et al., 2006).

Even though most people may spontaneously infer others' character based on their appearance in split seconds (Willis & Todorov, 2006), we submit that there is variation in the extent to which people *believe* that individuals' appearance reveals their character. Such a variation may exist because people regularly encounter evidence that supports and evidence that opposes the view that individuals' appearance can reveal their character. On the one hand, in television series and movies, protagonists are typically portrayed by more physically attractive individuals than antagonists (Gottschall et al., 2007), thus propagating the assumption that a person's appearance reveals their character. On the other hand, idioms such as "a wolf in sheep's clothing" counter the notion that appearance is a reliable indicator of character. The degree to which people believe that appearance reveals character likely varies across individuals and can therefore be considered a lay theory (Chiu et al., 1997; Molden & Dweck, 2006; Molden et al., 2006; Plaks et al., 2001). Lay theories (also referred to as *implicit theories*, *folk theories*, or *mindsets*) are people's naïve beliefs about the world. The key distinction between lay and scientific theories is that lay theories are not necessarily explicit and are typically not rigorously formulated (Heider, 1958). That said, people usually have no difficulty reporting their lay theories (Plaks et al., 2009).

Importantly, our lay theory does not assume that there is a one-to-one relationship between individuals' appearance and character but instead asks whether people believe that there is some relationship versus no relationship. Our lay theory is related to psychological essentialism, the idea that categorical memberships (e.g., gender, ethnicity) reveal important hidden information about members (Gelman, 2004; Rhodes et al., 2018). We assess whether people believe that individuals' appearance reveals essential information about them.

Our focal construct, the lay theory about whether or not appearance reveals character, is conceptually distinct from the physiognomic beliefs scale (Suzuki et al., 2019) on multiple dimensions. First, we modeled our lay theory construct based on prior lay theories work by Dweck and colleagues (Chiu et al., 1997; Dweck, 2000; Levy et al., 1998), which conceptualizes

lay beliefs as people's naïve beliefs about the world and people around them (e.g., "People's appearance is a good indication of their character"). In contrast, the majority of items of the physiognomic beliefs scale tap into people's own, specific, perceived ability to make accurate face-based trait inferences (e.g., "I know a forgiving person when I see their face;" "I know an immoral person when I see their face"). These items thus tap into people's confidence in their appearance-based judgments, whereas our lay theory assesses beliefs about whether people's appearance reveals their character in general. Further, the physiognomic beliefs scale asks whether specific traits (e.g., warmth, intelligence, etc.) can be inferred from others' faces. In contrast, our construct focuses on whether or not character, more broadly, can be inferred from appearance without mentioning specific traits. Finally, whereas the physiognomic beliefs scale is focused only on the face, the *appearance reveals character* lay theory scale incorporates other aspects of appearance, such as body shape/size, hairstyle, and clothes. This is an important distinction as recent research suggests that the inference of specific character traits from appearance may also be influenced by factors other than the face (Gelman et al., 2018; Wang, in press). Thus, our construct taps a much more general belief than the physiognomic beliefs scale across three dimensions.

Next, we discuss a potential downstream consequence of the *appearance reveals character* lay theory—people's support for widespread facial profiling. We first describe facial profiling technology and then derive propositions regarding the relationship between the *appearance reveals character* lay theory and support for facial profiling.

Support for Facial Profiling

Driven by advances in artificial intelligence, inventors have developed new technologies that claim to infer numerous aspects of people's character just from their faces (i.e., facial profiling), including traits such as criminality (Wu & Zhang, 2016), sexual orientation (Wang & Kosinski, 2018), political orientation (Kosinski, 2021), and openness, agreeableness, and neuroticism (Suen et al., 2020). Marketing a machine-learning algorithm, Faception™, an Israeli

start-up, has claimed that it would have caught 9 out of 11 terrorists in the 2016 Paris attacks by simply scanning their faces (Adee, 2016). FaceMe™, a smartphone app, promises to help users assess their personality type, the kind of impression they would make on others, and even find people they will be most compatible with, all based on a selfie that they upload to the app (Facemetrics, 2020). A company claims to predict people's risk tolerance from their faces (Iskowitz, 2019), and another company allegedly rejects customers' insurance claims based on their facial features (Vanian, 2021). Such AI-based technologies are rapidly emerging as powerful gatekeepers even in the hiring process. Companies such as Unilever and Hilton Hotels are using these technologies to scan prospective employees' faces to predict who is more "employable" (Harwell, 2019).

Proponents of these technologies have argued that if machines can infer people's personalities from their faces, they can help businesses and governments make better decisions. For example, if a computer program can accurately generate a person's personality profile based on their looks, it can be extremely valuable for security agencies (e.g., to identify individuals with criminal intent; Junior et al., 2018), healthcare (e.g., to provide personalized therapy recommendations), educators (e.g., to provide customized learning experiences), entertainment providers (e.g., to provide customized recommendations about TV shows and movies), and businesses (e.g., to push highly targeted advertisements; Bendel, 2018).

Despite the advantages that facial profiling technologies claim to offer, there is a fierce debate about whether such technologies should actually be used. Opponents state that widespread facial profiling invades people's privacy, is similar to stereotyping people based on categorization, and can discriminate against certain groups (Acquisti et al., 2014). For example, reliance on facial profiling technologies can result in people being unlawfully labeled as criminals, arrested, and subjected to unfair prosecution (Santow, 2020). In addition, these technologies inherit biases that exist in the data on which they are trained. For example, facial software used by US law enforcement is disproportionately more likely to identify African

Americans as alleged criminals because they are over-represented in databases of mugshots (Garvie et al., 2016), and Google’s machine learning software categorized African American individuals as gorillas (Barr, 2015).

Although these concerns certainly play a role in shaping people’s support for facial profiling, we propose that the *appearance reveals character* lay theory serves as a psychological antecedent that shapes people’s views on this divisive issue. For people to support the use of such technologies, a key condition must be met—people need to believe that there exists a reliable association between individuals’ faces, and more generally, their appearance and their character. If people disagree with this assumption, then they would likely believe that it is not possible for facial profiling technologies to infer people’s character and thus oppose the widespread use of facial profiling. Hence, we propose that people’s support for facial profiling technologies is driven by their broader lay theory about whether or not individuals’ appearance can reveal their character.

We further propose that this relationship is mediated by people’s confidence in their appearance-related judgments. Even though past research has found that people are overconfident in their ability to make accurate appearance-based judgments (Hassin & Trope, 2000), relatively little research has identified factors contributing to this overconfidence. Notably, Ames et al. (2010) found that perceivers had high confidence in their appearance-based judgments when they made extreme judgments or evaluated people who looked like someone they knew. In the current research, we propose that the belief that individuals’ appearance reliably reveals their character is another antecedent of confidence in appearance-based judgments. That is, people who believe that appearance reveals character may confidently believe that they themselves, and hence other people and even human-trained machines, can reliably infer character from appearance and thus justify the use of facial profiling technologies to identify individuals’ character. On the other hand, people who do not believe that appearance reveals character may have low confidence in their own appearance-based judgments and may

therefore believe that facial profiling technologies are built on a false assumption; accordingly, they would be less likely to support such technologies.

However, people who believe that appearance reveals character may not necessarily support the use of facial profiling technologies. Classic research on attitude-behavior inconsistency has found that people's actions or positions often diverge from their beliefs or attitudes (Fazio & Zanna, 1981; Festinger, 1964; Wicker, 1969; Zanna et al., 1981). Similarly, even if people believe that there is a reliable association between individuals' appearance and their character, and hence are confident that machines *can* infer character from appearance, they may not agree that machines *should* be used to make important decisions. Strictly speaking, the connection between a descriptive belief and a policy position cannot be a tautology as logic alone does not take us from an *is* to an *ought*. In particular, policy positions may hinge on many factors other than the underlying lay theory, such as people's concern for privacy and the potential for discrimination. These other variables may influence support for facial profiling and make it difficult to identify any effect of the lay theory. Our empirical approach includes correlational studies to verify that the lay theory has predictive power and experimental studies to verify that the lay theory has a causal effect.

Careful readers may note that we theorized a relationship between the *appearance reveals character* lay theory and support for facial profiling instead of a *face reveals character* lay theory and support for facial profiling, which would pose a closer connect between the cause and the effect. We focused on the broader lay theory about appearance because of three reasons. First, research shows that extra-facial cues (e.g., bodily cues) often provide more diagnostic information about people's subjective states than the face itself (Hassin et al., 2008). Even when people think that they are making judgments about others' subjective states based on their faces, they are in reality heavily influenced by non-facial aspects of the person's appearance (Avezier et al., 2008, 2012a). Second, focusing on appearance (instead of the face) allows us to take a holistic person approach (Avezier et al., 2012b), which is important because

asking people to think about whether an individuals' face reveals their character may increase concerns about racial stereotyping and thus lead to socially desirable responding. However, asking people to think about appearance more broadly would lead them to think of other salient features of appearance that are under the individual's control (e.g., hair, clothes), and may not activate self-presentation concerns to the same extent. Third, despite the terminology, facial profiling algorithms do not just take individuals' faces as their input—they take all aspects of the person's appearance visible in the person's photograph, including the face and several extra-facial characteristics (e.g., Wang, in press).

Moderating Role of Fixed-Growth Mindsets about Personality

As our lay theory refers to individuals' character, people's other beliefs about the nature of human character are likely relevant. We considered the potential role of a fixed-growth mindset about personality. We consider the joint effects of the *appearance reveals character* lay theory and fixed-growth mindsets about personality, over and above their individual effects, acknowledging that these beliefs are likely to be somewhat correlated. The belief that people's personal characteristics are malleable and can be developed is called a *growth mindset*, whereas the belief that people's traits are stable is called a *fixed mindset* (Chiu et al., 1997; Levy et al., 1998). People with a growth mindset about personality are less likely to use trait-related information to make inferences about people's behavior (Chiu et al., 1997; Hong et al., 1999) and are less likely to stereotype others (Levy et al., 2001; Madan et al., 2019). For example, individuals with a growth mindset were not only less willing to evaluate African Americans in terms of stereotypical traits, but they were also more moderate while making judgments about other less familiar groups (Levy et al., 1998). This is because people with a growth mindset believe that individuals can fundamentally change their character.

Given that facial profiling is similar to stereotyping in that it involves pre-judging certain individuals as criminals, less competent, less intelligent, or less trustworthy, and so on, we propose that people's beliefs about whether others' character is malleable would predict their

support for facial profiling, such that those with a growth mindset are less likely to support it. Fixed-Growth mindsets are also likely to interact with beliefs about whether appearance reveals character to influence support for facial profiling. We theorize that a fixed mindset about personality would enhance the effect of the *appearance reveals character* lay theory on willingness to support facial profiling technologies. The rationale behind this hypothesis relates to people's confidence in appearance-based judgments, and thus, their willingness to support facial profiling technologies.

Individuals who believe that appearance does not reveal character are unlikely to support facial profiling irrespective of their fixed-growth mindset about personality. Among individuals who believe that appearance does reveal character, those who have a fixed mindset may be more confident in making appearance-based judgments because they believe that people's character is stable, and hence, inferring their character would provide predictive information that is valid for a long time and thus can be used to make consequential decisions. However, people with a growth mindset may believe that even if individuals' appearance can reveal their present character, their character is not stable, and thus it is not justified to make decisions with long-term consequences based on their current character. The proposed moderating role of the fixed-growth mindset is derived from the theoretical proposition that the *appearance reveals character* lay theory increases people's support for facial profiling because it increases their confidence in the accuracy of appearance-based judgments. Importantly, a growth mindset reduces people's confidence in making appearance-based judgments (Levy et al., 2001). Thus, a growth mindset blocks the underlying mechanism linking the appearance reveals character lay theory with support for facial profiling.

Moderating Role of Free will Beliefs

We next considered a factor that could directly target people's support for facial profiling even if they feel confident in their ability to accurately predict character from appearance—their belief in free will. Free will refers to the idea that “one determines one's own outcomes” (Vohs &

Schooler, 2008, p. 49). Although there is an ongoing debate in the philosophy and psychology literatures on the definition of free will, recent research investigating lay people's understanding of free will has found that people view free will as having the ability to make choices without being constrained by extraneous factors (Feldman et al., 2014; Monroe & Malle, 2010). A belief in lack of free will, the idea that one's actions are pre-determined, allows people to attribute immoral behavior to causes other than their free will, and thus increases aggression, reduces prosocial behavior (Baumeister et al., 2009), and increases conformity (Alquist et al., 2013).

A key hidden assumption of facial profiling technologies is that people's future actions can be predicted in advance. For example, inventors of facial profiling algorithms claim that they can predict whether someone is likely to commit a crime, default on a loan, or exhibit low job performance in the future (e.g., Adee, 2016). Thus, predictions made by facial profiling technologies may be construed as contradicting the idea that individuals have free will. Those holding free will beliefs are therefore less likely to support these technologies. We also hypothesize that belief in free will is likely to moderate the relationship between *appearance reveals character* lay theory and support for facial profiling technologies and elaborate on this proposition below.

Once again, individuals who believe that appearance does not reveal character are unlikely to support facial profiling irrespective of their free will belief. Individuals who believe that appearance does reveal character and hold a strong belief in free will are likely to oppose using facial profiling technologies to make consequential decisions because their belief in free will states that individuals' actions are not predictable in advance. This is not a concern for those who believe that individuals' appearance reveals their character but do not hold a strong belief in free will—if appearance reveals character, and if character shapes actions, then it makes sense to use individuals' appearance to make consequential decisions about them. Thus, examining the potential moderating role of the belief in free will can help identify another

boundary condition that may weaken the relationship between the *appearance reveals character* lay theory and support for facial profiling.

Overview of Studies

We tested our hypotheses in a series of studies (total $N = 2,967$). In a nationally representative sample, Study 1a tested whether people who believe that appearance reveals character support the use of facial profiling by the police, educational institutions, and businesses to make consequential decisions. Study 1b sought to provide a more realistic test of this hypothesis by asking participants to vote for the use of facial profiling by framing it as a ballot proposition. The next two studies tested whether those who believe that appearance reveals character support facial profiling even when they are the target of such profiling (Studies 1c-1d). Study 2 tested whether manipulating the *appearance reveals character* lay theory using news articles would alter people's support for the use of facial profiling. Study 3 tested the underlying mechanism—people's confidence in their ability to make appearance-based judgments. Study 4 tested whether manipulating the mediator by bolstering or undermining people's confidence in their own appearance-based judgments would influence their support for facial profiling technologies. We then tested the moderating role of people's fixed-growth mindsets about personality (Study 5a) and their free will beliefs (Study 5b). Finally, Study 6 tested whether the *appearance reveals character* lay theory predicts people's support for facial profiling more than similar beliefs in other domains (e.g., whether the *Facebook likes reveal personality* belief predicts support for social media profiling).

Across all studies, we report all participants run, all conditions, and all independent and dependent measures. Supplementary Materials include verbatim stimuli and additional analyses. All studies were run in a single wave, and data were analyzed only after the required sample size target was met. The study materials, data, and analysis code are available at https://osf.io/aj86v/?view_only=5741cfcd8e894b0eb6bfd05f6b6f5edc. Participants provided informed consent across all studies, and the study protocols were approved by the authors'

universities' Institutional Review Boards. Four additional studies (three pre-registered) are reported in the Supplementary Materials. There is no “file drawer”—we report all studies conducted for this project.

Study 1a: Nationally representative sample

This study aimed to test whether people who believe that individuals' appearance reveals their character would be more willing to support the use of facial profiling by the government and businesses for making consequential decisions using a nationally representative sample in the US.

As our focal construct is a lay theory (a naïve belief), we did not provide participants with a definition of *character* but instead allowed them to interpret it as per their own understanding. The dictionary defines character as “the aggregate of features and traits that form the individual nature of some person or thing” (Dictionary.com, n.d.). Synonyms of character include *personality*, *nature*, and *disposition*. Similarly, we allowed participants to interpret *appearance* as per their own understanding.

Method

Participants

We conducted this study with 997 US residents (500 women, 484 men, five others, and eight unreported; $M_{\text{age}} = 49.35$ years) recruited through a market research agency, providing a nationally representative sample on age, gender, and ethnicity.

Procedure

As part of a larger study, we first asked participants to respond to eight items measuring their beliefs about whether appearance reveals character, measured on a 6-point scale ranging from *strongly disagree* to *strongly agree* (e.g., “People’s appearance is a good indication of their character;” see Table 1).

In a supposedly unrelated task, participants were told that facial profiling has recently made a lot of advances. Participants read three different vignettes about the use of facial

profiling. In the first vignette, participants were provided details that New York City police will be able to leverage facial profiling technology to infer people’s likelihood for criminal activity using just their picture. To ensure that participants were making an informed decision, we presented them with the pros and cons associated with the adoption of facial profiling. For example, participants were told that although facial profiling may increase the police department’s efficiency in apprehending criminals before a crime was committed, it may also put individuals at risk if their pictures and criminality score are compromised. For verbatim measures, please see the Supplementary Materials. We then asked the participants, “How much do you support New York Police Department’s decision to use this facial profiling app?” on a 7-point scale from (*do not support at all to support completely*). Participants also read two other vignettes about financial institutions’ potential use of facial profiling technologies to infer trustworthiness from people’s faces to set their credit limits and insurance premiums and the US army’s potential use of facial profiling to recruit people high in bravery and courage. Similar to the first vignette, participants indicated their support for the use of facial profiling by financial institutions and the army using 7-point scales (*do not support at all to support completely*).

Table 1. Items in the *appearance reveals character* lay theory scale.

1. People’s appearance is a good indication of their character.
2. You can tell how someone is on the inside by looking at their appearance on the outside.
3. People’s appearance is a mirror of their character.
4. You can tell a person’s character from their appearance.
5. A good face almost always accompanies a good character.
6. Not all that glitters may be gold – but looks can usually give a good impression of character.
7. Usually, a person’s outside appearance reflects what’s on the inside.
8. You can almost always infer a person’s character by looking at their appearance.

Results

Psychometric properties of the lay theory scale

We tested the psychometric properties of the *appearance reveals character* lay theory scale. The items were internally consistent ($\alpha = .96$). We also subjected the items to a factor

analysis with varimax rotation, allowing factors to emerge naturally rather than imposing a specific factor structure onto the data. All 8-items loaded onto a single factor (eigenvalue = 6.103) with all factor loadings > .79 explaining 76.29% of the variance in participants' *appearance reveals character* lay theory. Furthermore, the eigenvalue of all subsequent factors was less than 1. Thus, the *appearance reveals character* lay theory scale tapped a unidimensional construct capturing a significant portion of people's beliefs about whether or not individuals' appearance reveals their character.

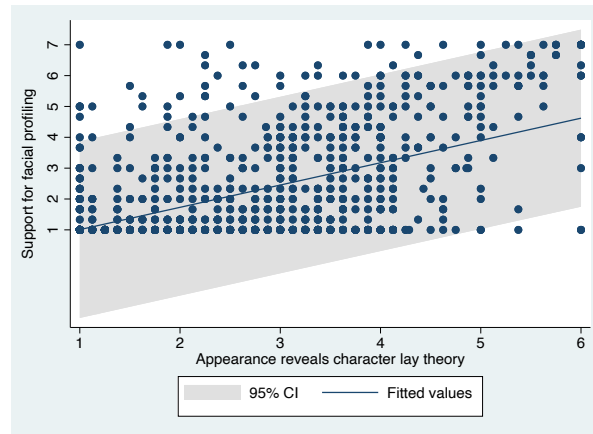
Confirmatory Factor Analysis (CFA)

We conducted a CFA to test whether the independent variable— *appearance reveals character* lay theory—was distinct from the dependent variable —support for facial profiling technologies. We found that a two-factor model fits the *appearance reveals character* lay theory and support for facial profiling variables, RMSEA = .087, CFI = .969, χ^2 (df = 43) = 362.078, better than a one-factor model, RMSEA = .211, CFI = .81, χ^2 (df = 44) = 1977.63, $\Delta\chi^2$ (df = 1) = 1615.5, $p < .0001$.

Support for facial profiling technologies

We averaged participants' support for facial profiling across the three items to create a composite score ($\alpha = .92$). We found that the more participants believed that people's appearance could reveal their character, the more they supported the use of facial profiling technologies ($r = .53$, 95% CI [.49, .58], $p < .0001$) by the police force, army, and financial institutions to make consequential decisions about whom to arrest, whom to recruit, and whom to give a loan to. See Figure 1 for the scatter plot.

Figure 1: Scatter plot of participants on the independent measure (X-axis) and the dependent measure (Y-axis) for Study 1a



Using a large nationally representative sample, this study provided preliminary evidence for the idea that people’s lay beliefs about whether or not individuals’ appearance reveals their character predicts their support for the widespread use of facial profiling.

Study 1b: Ballot voting simulation

This study sought to provide a conceptual replication of Study 1a by asking people to vote on the use of facial profiling across schools, businesses, and government departments in their state on simulated ballot propositions. We presented these policies as if they were propositions on a ballot and asked participants to respond using a binary yes/no measure of support.

Method

The hypotheses, power analysis, method, sample size, and exclusion criteria for this study were pre-registered

(https://osf.io/y67uj?view_only=b957719a3a0943ce90e5f90523342b4f).

Participants

We used the effect size from a pilot study to conduct the power analysis. We entered the following inputs in G*Power (test: correlation: point biserial model, tail(s):1, effect size (r) = 0.287, alpha = .05, power = .99), which yielded a sample size of 178. Rounding this number, we posted a survey seeking 200 US residents on Amazon Mechanical Turk. In response, 220 participants completed the study. As per the pre-registered plan, we excluded 22 participants

who did not submit the secret code on MTurk, three non-US citizens, and 15 participants who wrote gibberish in response to an open-ended question toward the end of the study (Chmielewski & Kucker, 2020; Dennis et al., 2019) leaving 180 participants (90 women and 90 men; $M_{\text{age}} = 42.88$ years) in the dataset.

Procedure

We asked participants to consider that they were voting in the Presidential elections in November 2020. Participants were told that a few state-level propositions were on the ballot. Participants saw five different ballot propositions. We modeled the ballot propositions on an actual ballot from California (Adler, 2018; see Supplementary Materials).

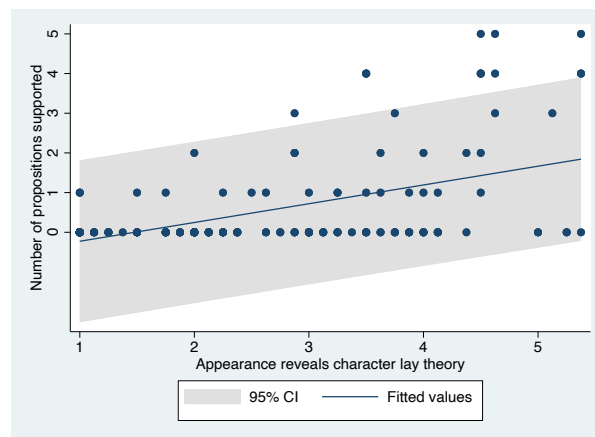
The five propositions mentioned using facial profiling for (1) inferring people's likelihood of engaging in criminal activity and proactively apprehending them, (2) inferring students' IQ to track them into different academic levels (e.g., the gifted, average, and remedial track), (3) inferring people's level of bravery while recruiting them for the army, (4) inferring job candidates' competence and screening them out in the recruitment process, and (5) inferring customers' trustworthiness to determine the credit limits and interest rates they receive. As in Study 1a, we asked participants to respond to the eight-item lay theory scale, measured on a 6-point scale ranging from *strongly disagree* to *strongly agree* ($\alpha = .97$). We randomly assigned half the participants to respond to the ballot propositions first and the other half to complete the lay theory measure first.

Results

Please see Supplementary Materials for psychometric properties of the *appearance reveals character* lay theory scale, and a CFA distinguishing it from the dependent measure. There was no order effect of counterbalancing the independent and dependent measures (please see Supplementary Materials for detailed analysis). The number of propositions on which the participant voted 'yes' formed our dependent measure. As this variable was a count variable, we ran a Poisson regression as per the pre-registered analysis plan. We found that the

more people believed that individuals' appearance reveals their character, the more propositions they supported ($b = .91$, 95% CI [.73, 1.901], incidence rate ratio = 2.48, $SE = .092$, $z = 9.94$, $p < .0001$). A negative binomial regression also indicated a significant relationship, $b = .99$, 95% CI [.701, 1.28], $SE = .15$, $z = 6.68$, $p < .0001$. The bivariate correlation was also significant, $r = .503$, 95% CI [.39, .61], $p < .0001$. See Figure 2.

Figure 2: Scatter plot of participants on the independent measure (X-axis) and the dependent measure (Y-axis) for Study 1b



Thus, Study 1b conceptually replicated the findings of Study 1a using a proposition voting simulation.

Study 1c: Profiling of the self vs. others

In the previous studies, we measured people's support for using facial profiling in general. In this study, we asked whether the *appearance reveals character* lay theory is strong enough to lead people to support facial profiling even when they themselves are being profiled and could potentially receive negative outcomes. It is possible that when presented with scenarios in which facial profiling technologies would be used on themselves, people might be more skeptical and perhaps even feel threatened; in this case, their lay theory would not predict their support for facial profiling as strongly. However, if people truly believe that appearance reveals character and think they possess a good character, they should be comfortable if facial profiling technologies were used on themselves.

Method

Participants

As we are studying the effects of a novel experimental manipulation here, we did not have a basis for determining the effect size for this study. We thus posted a survey seeking 200 US residents on Amazon Mechanical Turk. In response, 193 participants completed the study. Similar to the previous studies, we excluded 16 participants who wrote gibberish in response to an open-ended question toward the end of the study leaving 177 participants (106 women and 71 men; $M_{\text{age}} = 37.11$ years) in the dataset.

Procedure

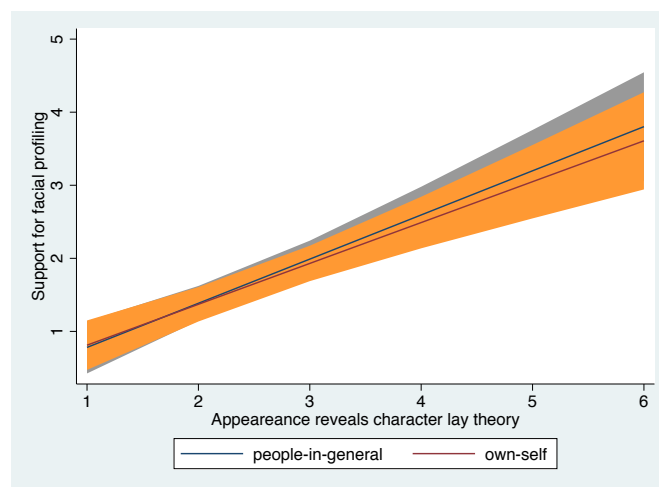
We first presented the participants with the *appearance reveals character* lay theory scale ($\alpha = .97$). Participants were then randomly assigned to either the *people-in-general* ($N = 89$) condition or *own self* ($N = 88$) condition. Participants in the *people-in-general* condition were asked to indicate their support for the use of facial profiling for people in general. Specifically, we asked participants how much would they support facial profiling technology for determining (1) people's likelihood for criminal activity, (2) children's IQ level, (3) people's competence for jobs, and (4) customers' trustworthiness to determine credit limits and interest rates, on 7-point scales, *do not support at all to support completely*. Participants in the *own self* condition were asked to indicate their support for the use of facial profiling on themselves. Specifically, we asked, "Do you support facial profiling technology for determining (1) your likelihood for criminal activity, (2) your children's IQ level, (3) your competence for jobs, and (4) your trustworthiness to determine your credit limits and interest rates," on 7-point scales, *do not support at all to support completely*.

Results

Please see Supplementary Materials for psychometric properties of the *appearance reveals character* lay theory scale, and a CFA distinguishing it from the dependent measure. We regressed participants' support for profiling on condition (*people-in-general* = $-.5$, *own-self* = $.5$),

participants' *appearance reveals character* lay theory score (mean-centered), and their interaction. We found a significant effect of the lay theory ($b = .58$, 95% CI [.501, .71], $SE = .067$, $\beta = .55$, $t(173) = 8.67$, $p < .001$), a non-significant effect of condition ($b = -.042$, 95% CI [-.36, .28], $SE = .16$, $\beta = -.017$, $t(173) = .26$, $p = .801$), and a non-significant interaction ($b = -.045$, 95% CI [-.31, .22], $SE = .13$, $\beta = -.022$, $t(173) = .74$, $p = .46$ see Figure 3).

Figure 3: Interaction plot of depicting the interaction between *appearance reveals character* lay theory and condition (*people-in-general*, *own self*) in Study 1c



This study found that people who believe that individuals' appearance reveals their character not only support the use of facial profiling technologies in general but are also comfortable if such technologies are used on themselves.

Study 1d: Profiling of the self

One may argue that participants in the previous study may have supported the use of facial profiling technologies because the scenarios were inconsequential. To address this limitation, this study was designed to conceptually replicate the finding that people's *appearance reveals character* lay theory increases their support for facial profiling in a highly self-relevant context. Specifically, we asked undergraduate students if they would be willing to undergo facial profiling for campus recruitment.

Method

Participants

We used the effect size from Study 1c to conduct the power analysis (test: correlation: point biserial model, effect size $r = 0.55$, $\alpha = .05$ (two-tailed), power = 99%), which yielded a sample size of 45. Keeping with the current norms, we posted this study for 100 undergraduate students enrolled in the behavioral lab at a large public university in the US. In response, 99 participants (76 women, 22 men, and one other; $M_{\text{age}} = 20.66$ years) completed the study.

Procedure

We first asked participants to respond to eight items measuring their beliefs about whether appearance reveals character, as in Study 1a.

In a supposedly unrelated task, participants were asked to imagine that a reputed organization was coming to the campus to recruit interns and that it gave students the option of either being screened by a facial profiling software or by a human recruiter:

“You will be asked to upload your CV along with a recent picture into their recruitment system. The system will screen applicants based on their CV and picture and select candidates for the next round.

You can also opt for your profile to be assessed by a human recruiter. A human recruiter will screen applicants based on their CV and picture and select the candidates for the next round.

However, there is a waiting period of 3 months to be assessed by a human recruiter, which means that fewer internship slots might be available.”

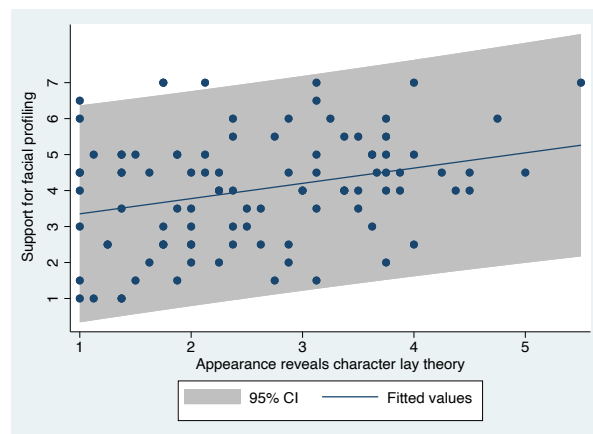
We stated that screening by a human recruiter would take more time to create a tradeoff; in the absence of this information, we would expect a big majority of students to prefer a human recruiter. Participants were asked to respond to two items measuring their willingness to be assessed by the facial profiling system: “What would you choose?” (1 = *Definitely wait for three months to be assessed by a human recruiter*, 7 = *definitely be assessed by the facial profiling system now*) and “How comfortable are you being assessed by the facial profiling system?” (1 =

Not at all to 7 = Extremely). We averaged these two measures to form the dependent variable ($r = .49$).

Results

Please see Supplementary Materials for psychometric properties of the *appearance reveals character* lay theory scale and a CFA distinguishing it from the dependent measure. We found that the more participants believed that people's appearance reveals their character ($\alpha = .94$), the more willing they were to be assessed by facial profiling software during the recruitment process ($r = .29$, 95% CI [.063, .43], $p = .003$). Please see Figure 4.

Figure 4: Scatter plot of participants on the independent measure (X-axis) and the dependent measure (Y-axis) in Study 1d



Taken together, the results from Study 1c and Study 1d indicate that the *appearance reveals character* lay theory is powerful enough to shape people's support for facial profiling technologies even if they themselves are the target of such profiling.

Study 2: Causal effect of the lay theory

This study was designed to provide causal support for the role of *appearance reveals character* lay theory in predicting support for facial profiling technologies. We experimentally manipulated people's beliefs about whether or not appearance reveals character. Although individuals may differ in the extent to which they hold this lay belief, they are probably familiar with both ends of the continuum. Most people have probably encountered cases in which a

person's appearance gave some indication of their personality and other cases when it didn't. By experimentally varying which end of the continuum is temporarily activated in people's minds, we can test whether this belief exerts a causal influence on people's support for the widespread use of facial profiling technologies. Further, in this study, apart from assessing people's support for the use of facial profiling technologies, we also asked if they supported mass facial surveillance.

Method

The hypotheses, power analysis, method, sample size, and pre-selection criteria for this study were pre-registered.

(https://osf.io/5bvkx/?view_only=ff3056f3f2e040bb9b86cb442db9b0f8).

Participants

We used a pilot study with the same measures to conduct the power analysis. The following inputs in G* Power (test: independent samples *t*-test, tail(s):1, Effect size (d) = 0.289009, alpha = .05, power = .8, allocation ratio N2/N1 = 1) yielded a sample size of 298.

Hence, we posted the study seeking 298 US residents on Amazon Mechanical Turk. In response, 603¹ participants completed the study. As per pre-registered criteria, we excluded 59 participants who completed the study from duplicate geo-locations (Dennis et al., 2019), leaving 544 participants (351 women, 187 men, three others, and three unreported; $M_{age} = 35.19$ years) in the dataset.

Procedure

¹ As per the power calculation in the pre-registration, we had posted the study for 298 participants on Amazon MTurk. For unknown reasons, 305 participants completed our survey but did not submit the secret code that we provided at the end of our study on the Amazon Mechanical Turk website precluding us from closing the survey when we had reached our sample size. Our best guess is that a technical error on the website prevented them from submitting the secret code.

To manipulate participants' lay theory about whether people's appearance reveals their character, we developed two articles purportedly reporting the results of scientific research (e.g., Chiu, Hong, & Dweck, 1997). Under the guise of a reading comprehension task, participants were randomly assigned to read an article claiming either that people's appearance reveals their character ($N = 266$) or that people's appearance has no link to their character ($N = 278$). For example, below is an excerpt from the article arguing that people's appearance reveals their character:

"Scientific research shows that how someone looks conveys reliable and important information about their inner personality traits. The real world abounds with examples of the now scientifically validated idea that outer appearances reflect inner character. When Dorothy, in *The Wizard of Oz*, asks the good witch why she's so beautiful, she replies, "Why, only bad witches are ugly." And now science has proved that just looking at a person can indeed give you valuable insights into their inner character.

In contrast, below is an excerpt from the article arguing that appearance does not reveal character:

"Scientific research shows that how someone looks does not convey any reliable or important information about their inner personality traits. It is then shocking indeed that the real world still abounds with examples of the now scientifically disproven idea that outer appearances reflect inner character. When Dorothy, in *The Wizard of Oz*, asks the good witch why she's so beautiful, she replies, "Why, only bad witches are ugly." We all have people in our lives who may not look very good but have a heart of gold."

Thereafter, participants were asked to summarize the article's main point and give one or two examples supporting the main point communicated by the article. Participants then responded to three items from the lay theory scale (e.g., "People's appearance reveals their character"; 6-point scale, *strongly disagree to strongly agree*) as the manipulation check ($\alpha = .94$). Participants were then told the reading comprehension task was over.

In the next task, participants were asked to read four vignettes about recent developments related to the use of facial profiling and surveillance in government and businesses: (1) financial institutions using facial profiling to infer trustworthiness from people's faces to set their credit limits and insurance premiums, (2) the US army using facial profiling to

recruit people high in bravery and courage, (3) the police using facial profiling to infer people's likelihood of committing a crime, and (4) the recent ban on public facial surveillance instated by the city of San Francisco (reverse coded). Participants were asked to indicate their support for each item on a 6-point scale ranging from *do not support at all* to *support strongly* ($\alpha = .80$).

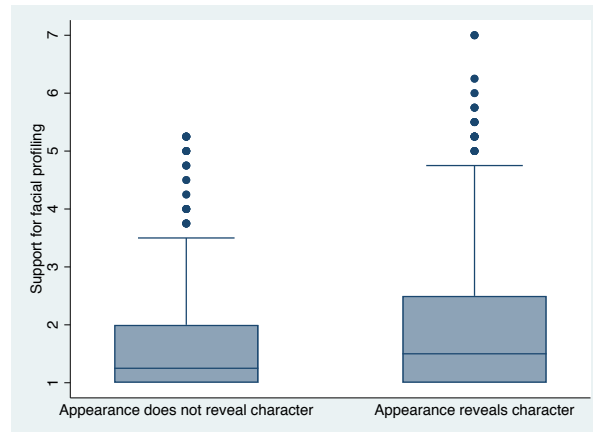
Results

Participants who read the article advocating that appearance reveals character indicated greater agreement with the three manipulation check items stating that people's appearance reveals their character ($M = 3.902$, 95% CI [3.75, 4.053], $SD = 1.25$), than those asked to read the article advocating that appearance does not reveal character ($M = 2.12$, 95% CI [1.98, 2.25], $SD = 1.15$, $t(542) = 17.301$, $p < .0001$, Cohen's $d = 1.48$, 95% CI [1.29, 1.67]), indicating that the manipulation was successful.

A t-test found that participants who read the article claiming that appearance reveals character ($M = 2.026$, 95% CI [1.87, 2.18], $SD = 1.31$), were more supportive of policies promoting pervasive use of facial profiling and surveillance by both the government and businesses than those who read the article claiming that appearance does not reveal character ($M = 1.62$, 95% CI [1.503, 1.73], $SD = .98$, $t(542) = 4.12$, $p < .0001$ (one-tailed as we pre-registered a directional hypothesis), Cohen's $d = .35$, 95% CI [.18, .52]). See Figure 5.

Figure 5: Box Plot of the dependent measure by condition²

² Given the non-normal distribution and outliers, we also conducted the analysis using the Wilcoxon rank-sum (Mann-Whitney) test which does not make any assumptions about the distribution of the dependent variable. As predicted, we found that participants in the *appearance reveals character* condition, *actual sum of ranks* = 79,011 (expected: 72,485) were more willing to support facial recognition technologies than those in the *appearance does not reveal character* condition, *actual sum of ranks* = 69,229 (expected: 75,755), $z = 3.72$, $p = .0002$.



Study 2 thus provided causal evidence for our key hypothesis: People who were experimentally led to believe that individuals' appearance can reveal their character were more supportive of the use of facial profiling and surveillance by governments and societal institutions than people who were experimentally led to believe that appearance cannot reveal character.

Study 3: Confidence in Appearance-Based Judgments as the Mediator

This study was designed to test the underlying mechanism. Specifically, we tested whether the belief that *appearance reveals character* leads people to feel confident that they themselves can accurately predict individuals' character from their appearance, which in turn increases their support for facial profiling technologies.

Method

Participants

We used the effect size from Study 1d to conduct the power analysis. We entered the following inputs in G*Power (test: correlation: point biserial model, tail(s):2, Effect size (r) = 0.29, α = .05, power = .99), which yielded a sample size of 203. Rounding this number, we posted a survey seeking 200 US residents on Amazon Mechanical Turk. In response, 212 participants (106 women, 98 men, one other, and seven unreported; M_{age} = 42.71 years) completed the study. No participant wrote a gibberish or irrelevant response to an open-ended question toward the end of the study, so all participants were retained in the analyses.

Procedure

We presented the participants with the 8-item *appearance reveals character* lay belief scale ($\alpha = .95$), with a 6-point response scale ranging from *strongly disagree* to *strongly agree*. Participants were then directed to a bonus task assessing the mediator. Specifically, we used the occupation judgment task used by Hassin & Trope (2000) to assess participants' confidence in their appearance-based judgments. We informed participants that they would view several pairs of photographs of different individuals. Each pair would be accompanied by an occupation, and they have to indicate which of the two individuals they thought practiced that occupation. We informed them that the best-performing participant would receive a bonus of \$20. Participants then saw three pairs of pictures, each accompanied by one of three occupations (i.e., psychologist, electrician, and software programmer, respectively). For each occupation, participants also indicated how confident they were in their judgment on an 11-point scale (0.5 = *mere guess* to 1 = *absolute confidence*). The stimuli and procedure were identical to that used by Hassin and Trope (2000, Study 2). Participants were then told the bonus task was over.

All participants were then asked to indicate how strongly they would support the use of facial profiling technologies for determining (1) people's likelihood for criminal activity, (2) candidates' bravery for the army, (3) customers' trustworthiness to determine credit limits and interest rates, and (4) children's IQ levels, on 7-point response scales ranging from *do not support at all* to *support completely*.

Results

Please see Supplementary Materials for psychometric properties of the *appearance reveals character* lay theory scale and CFA distinguishing it from the dependent measure. We standardized participants' confidence ratings to obtain their percentage confidence in their judgments. Participants' average confidence in their judgments was 57.02%, significantly greater than chance ($M = 57.02\%$, 95% CI [54.22%, 59.82%], $SD = 20.69\%$, $t(211) = 4.94$, $p < .0001$). In Hassin and Trope's stimuli, each trial included the photograph of one participant who worked in the target occupation and one who did not. We could thus compute each participant's

accuracy in guessing the target person's profession from their picture. In contrast to confidence, their actual accuracy was significantly *below* chance at 35.34% ($M = 35.34\%$, 95% CI [32.46%, 38.29%], $SD = 21.55\%$, $t(211) = 9.88$, $p < .0001$). This finding replicates Hassin and Trope (2000, Study 2), who found that participants' accuracy was 37%, but they believed that their accuracy was 68%. See Table 2 for correlations between the measures.

We found a non-significant trend indicating that the more people believe that appearance reveals character, the *lower* their accuracy on the occupation guessing task ($r = -.12$, 95% CI [-.25, .016], $p = .084$). As expected, we found that the more participants believed that *appearance reveals character*, the more confident they were in their ability to predict people's occupation from their faces ($r = .19$, 95% CI [.059, .32], $p < .0001$), and the more willing they were to support facial profiling technologies ($r = .43$, 95% CI [.31, .53], $p < .0001$). Importantly, the more confident they were in their ability to predict people's occupation from their faces, the more they supported facial profiling ($r = .28$, 95% CI [.15, .401], $p < .0001$). Regressing people's support for facial profiling on their lay theory, confidence, and actual accuracy revealed a significant effect of lay theory ($b = .37$, 95% CI [.25, .48], $SE = .059$, $\beta = .39$, $t(208) = 6.23$, $p < .001$) and confidence ($b = .086$, 95% CI [.034, .14], $SE = .027$, $\beta = .202$, $t(208) = 3.23$, $p = .001$). The effect of accuracy was not significant ($b = .12$, 95% CI [-.43, .67], $SE = .28$, $\beta = .$, $t(208) = .43$, $p = .67$).

Next, we tested whether there was an indirect effect of the *appearance reveals character* lay theory on support for facial profiling policies through confidence in appearance-based judgments or their actual accuracy in making appearance-based judgments. A bootstrapped analysis with 10,000 samples using Model 4 of Hayes' PROCESS macro (Hayes, 2017) with lay beliefs as the independent measure (X), support for facial profiling as the dependent measure (Y), and confidence (M1) and actual accuracy (M2) as competing mediators indicated a significant indirect effect only through confidence, $b = .036$, $SE = .017$, 95% CI = [.0076, .075].

The indirect effect through accuracy was not significant, $b = -.0029$, $SE = .0073$, 95% CI = [-.022, .0073]. See Figure 6.

Given the focus on overconfidence in past research (Hassin & Trope, 2000), we computed participants' overconfidence in appearance-based judgments by subtracting their actual accuracy from their confidence estimates. As expected, the more participants believed that *appearance reveals character*, the more overconfident they were in their ability to predict people's occupation from their faces ($r = .23$, 95% CI [.093, .35], $p < .0001$), and the more they supported facial profiling ($r = .204$, 95% CI [.071, .330], $p < .0001$). A bootstrapped analysis (PROCESS Model 4, 10,000 samples) with lay beliefs as the independent measure (X), support for facial profiling as the dependent measure (Y), and overconfidence (M1) and actual accuracy (M2) as competing mediators indicated a significant indirect effect only through overconfidence, $b = .059$, $SE = .026$, 95% CI [.016, .12]³. The indirect effect through accuracy was not significant, $b = -.026$, $SE = .019$, 95% CI [-.072, .0019].

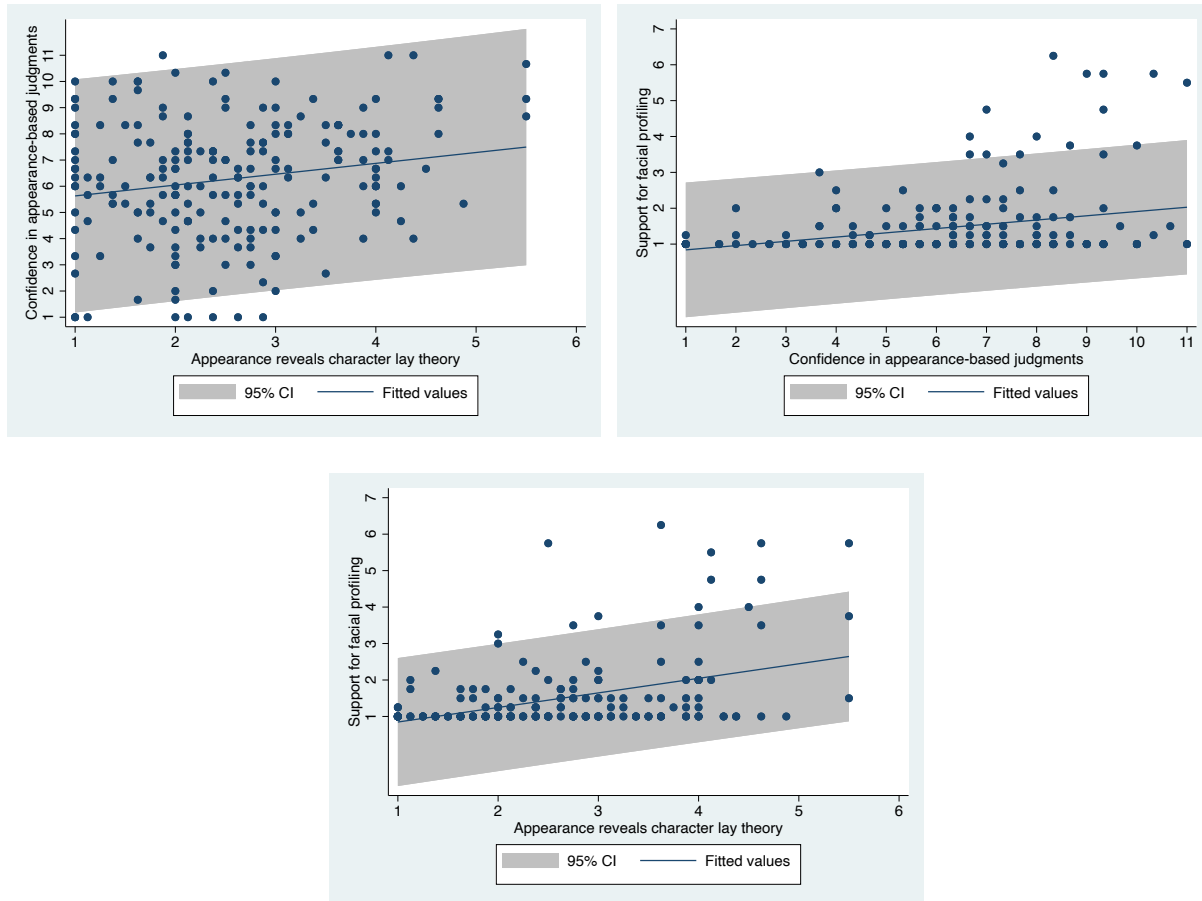
Table 2. Correlations for measures included in Study 3.

	1	2	3
1. <i>Appearance reveals character</i> lay theory	-		
2. Actual accuracy	-.12 ⁺	-	
3. Confidence in appearance-based judgements	.19 ^{***}	.0702	-
4. Support for facial profiling technologies	.43 ^{***}	-.0061	.28 ^{***}

⁺ $p < .1$, * $p < .05$; ** $p < .01$; *** $p < .001$

³ We could not add confidence as a competing mediator in this model due to collinearity with the other two mediators, but the beta for overconfidence ($B = .059$) was larger than that for confidence ($B = .036$) indicating that people's *appearance reveals character* lay theory is associated with both their confidence and their overconfidence.

Figure 6: Scatter plot of participants on 1) the independent measure (X-axis) and the mediator (Y-axis), 2) mediator (X-axis) and the dependent measure (Y-axis), and 3) independent measure (X-axis) and the dependent measure (Y-axis)



Discussion

This study found that people’s *appearance reveals character* lay belief predicts people’s confidence in accurately inferring individuals’ characteristics from their appearance, and this increases their willingness to support facial profiling technologies for consequential uses. This is interesting for two important reasons. First, the finding that people are excessively confident in their appearance-based judgments is quite robust (Ames et al., 2010; Hassin & Trope, 2000); however, little research has investigated the antecedents of this overconfidence. Second, extant research on thin-slice judgments has focused on contextual and target characteristics that may improve the accuracy of thin-slice judgments, such as time of exposure (Todorov et al., 2009)

and type of facial features (Stirrat & Perrett, 2010). The finding that people's a-priori lay beliefs can influence their overconfidence in appearance-based judgments is a novel addition to this literature. The current results suggest that people's lay theory about whether appearance reveals character serves as a filter that shapes both their judgments and their meta-cognition about their judgments.

Study 4: Manipulating the Mediator

This study investigated the causal role of the mediator on people's support for facial profiling technologies by either strengthening or undermining participants' confidence in their and others' ability to make appearance-based judgments.

Method

The hypotheses, power analysis, method, sample size, and pre-selection criteria for this study were pre-registered

(https://osf.io/8kzbx?view_only=e706b5c41e3641c1a60f70a2afc3738a).

Participants

We used the effect size from Study 2 to conduct the power analysis. The following inputs in G* Power (tail(s):1, Effect size (d) = 0.3439, alpha = .05, power = .8, allocation ratio N2/N1 = 1) yielded a sample size of 212. Hence, we posted the study seeking 212 US residents on Amazon Mechanical Turk. In response, 214 participants completed the study. As per pre-registered criteria, we excluded 6 participants who wrote gibberish in response to an open-ended question toward the end of the study leaving 208 participants (113 women, 89 men, three others, and three unreported; $M_{\text{age}} = 38.88$ years) in the dataset.

Procedure

Participants first played the personality prediction game as in the pilot study and were assigned to either the *high-confidence* condition ($N = 107$) or the *low-confidence* condition ($N = 101$). Participants had to guess people's personalities based on their faces across 11 trials. In the *high confidence* condition, no matter what personality trait participants chose, they received

congruent feedback (i.e., they were told that a majority of other people guessed the same trait and that this was the correct trait) on a majority of trials. In other words, the feedback strengthened participants' confidence in their own and majority others' ability to infer a person's character from their appearance. In the *low-confidence* condition, participants received incongruent feedback (i.e., they were told that a minority of other people guessed the same trait and that this was the incorrect trait) on a majority of trials. Please see Supplementary Materials for complete details and stimuli. A pre-test (see Pilot Study 1 in Supplementary Materials) found that the manipulation successfully altered people's confidence in their ability to make appearance-based judgments.

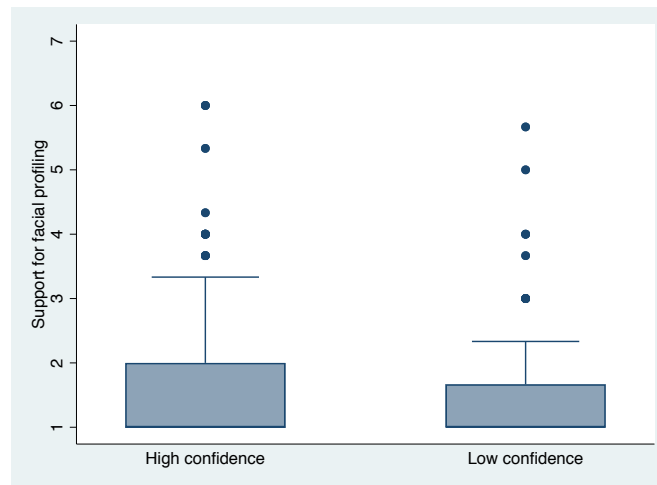
In the next task, we measured participants' support for three of the items used in Study 1a to assess the adoption of facial profiling technologies by the police to infer likely criminals, by the army to recruit brave looking candidates, and by financial institutions to decide terms of loans and credit limits ($\alpha = .83$).

Results

As hypothesized, we found that participants in the *high-confidence* condition ($M = 1.76$, 95% CI [1.54, 1.98], $SD = 1.15$) were more supportive of using facial profiling technologies by the government and businesses, such as police using such technologies to infer criminal intent, army to recruit brave individuals, and financial institutions to set credit terms, than participants in the *low-confidence* condition, $M = 1.46$, 95% CI [1.29, 1.64], $SD = .88$, $t(206) = 2.0701$, $p = .0199$ (one-tailed as we pre-registered a directional hypothesis), Cohen's $d = .29$, 95% CI [.013, .56]⁴. See Figure 7.

⁴ The pre-registration for this study mentioned a sequential analysis (Lakens, 2014). Specifically, it stated that if the hypothesized effect in analysis 1 above (the t-test reported in the manuscript) is statistically significant at $p < .0294$ (one-tailed), we will stop the study. Else, we will calculate the Cohen's d based on data collected and if Cohen's $d < .18$, we will stop the study. Else we will calculate sample size required for a t-test of two independent means using this effect size, tail(s): 2, and 80% power. We will collect the additional data required and then analyze the combined dataset. Since the pre-registered analysis was significant at $p = .0199$ (one-tailed), we stopped the study and did not collect any further data or conduct any sequential analysis.

Figure 7: Box Plot of the dependent measure by condition⁵



Discussion

This study proposed a novel manipulation to inhibit people's confidence in their own and others' ability to make accurate appearance-based judgments. We directly attacked the underlying mechanism by telling people that neither they nor most others can predict individuals' personality traits from their appearance with any degree of accuracy. This, in turn, reduced people's support for facial profiling technologies for making consequential decisions. Taken together, findings from Study 3 and 4 rule in the idea that people's confidence in their appearance-based judgments is a key predictor of their support for facial profiling technologies; confidence is, in turn, shaped by people's a priori lay theory about whether or not individuals' appearance reveals their character. Three studies in the Supplementary Materials (Studies S2-S4) extend this idea further to examine confidence in the ability of machines to infer traits from appearance.

⁵ Given the non-normal distribution and outliers, we also conducted the analysis using the Wilcoxon rank-sum (Mann-Whitney) test which does not make any assumptions about the distribution of the dependent variable. As predicted, we found that participants in the *appearance reveals character* condition, actual sum of *ranks* = 11,977.5 (expected = 11,181.5) were more willing to support facial recognition technologies than those in the *appearance does not reveal character* condition, actual sum of *ranks* = 9,758.5 (Expected = 10,554.5), $z = 2.026$, $p = .043$.

Study 5a: Role of Fixed-Growth Mindset about Personality

Study 5a tested our prediction that a growth mindset about personality would attenuate the relationship between the *appearance reveals* character lay belief and willingness to support facial profiling. We reasoned that a growth mindset about personality would weaken this relationship because growth theorists believe that character can change, so there is no enduring character waiting to be revealed by facial profiling technologies.

Method

Participants

As this was our first study testing a potential moderator, we did not have a basis for conducting a power analysis. We posted a survey seeking 200 US residents on Amazon Mechanical Turk. In response, 204 participants completed the study. As in previous studies, we excluded six participants who wrote gibberish in response to an open-ended question toward the end of the study leaving 198 participants (111 women, 83 men, and four unreported; $M_{\text{age}} = 42.49$ years) in the dataset.

Procedure

We presented the participants with the 8-item *appearance reveals character* lay belief scale ($\alpha = .96$) and the 3-item mindset about personality scale (e.g., “The kind of person someone is is something very basic about them and it can’t be changed very much” Chiu et al., 1997). Participants responded to both scales on a 6-point scale ranging from *strongly disagree* to *strongly agree*. Higher values on the mindset about personality scale reflected a fixed mindset about personality. In a different task, as in Study 1a, participants were then asked to indicate how much would they support facial profiling technology for determining (1) people’s likelihood for criminal activity, (2) candidates’ bravery for the army, (3) customers’ trustworthiness to determine credit limits and interest rates, and (4) children’s IQ levels, on 7-point response scales ranging from *do not support at all* to *support completely*. We specified the potential pros and cons associated with each policy.

Results

Please see Supplementary Materials for psychometric properties of the lay theory scale and a CFA distinguishing it from the dependent measure. Table 3 presents correlations between the measures. The more people believed that appearance reveals character, the more they held a fixed mindset about personality, $r = .29$, 95% CI [.16, .42], $p < .001$.

We regressed participants' support for profiling on *appearance reveals character* lay theory score (mean-centered), mindsets about personality score (mean-centered), and their interaction. We found a significant main effect of the *appearance reveals character* lay theory ($b = .19$, 95% CI [.084, .301], $SE = .055$, $\beta = .24$, $t(194) = 3.50$, $p = .001$) and a significant main effect of mindsets about personality ($b = .14$, 95% CI [.049, .24], $SE = .047$, $\beta = .21$, $t(194) = 3.01$, $p = .003$) indicating that the more participants subscribed to a fixed mindset, the more they supported facial profiling. Importantly, the interaction effect was also significant ($b = .101$, 95% CI [.032, .17], $SE = .035$, $\beta = .19$, $t(194) = 2.89$, $p = .004$). See Figure 8.

We then conducted simple slopes analysis at one SD above and below the mean of the mindsets about personality scale. For those who believed that people's personality is fixed (+1 SD), there was a significant effect of the *appearance reveals character* lay theory on support for facial profiling technologies ($b = .33$, 95% CI [.19, .47], $SE = .071$, $\beta = .41$, $t(194) = 4.64$, $p < .001$). However, as hypothesized, for those who believed that people's personality can change (-1 SD), the effect of the *appearance reveals character* lay theory on support for facial profiling policies was nonsignificant ($b = .057$, 95% CI [-.089, .202], $SE = .074$, $\beta = .071$, $t(194) = .77$, $p = .44$).

Table 3. Correlations for measures included in Study 5a.

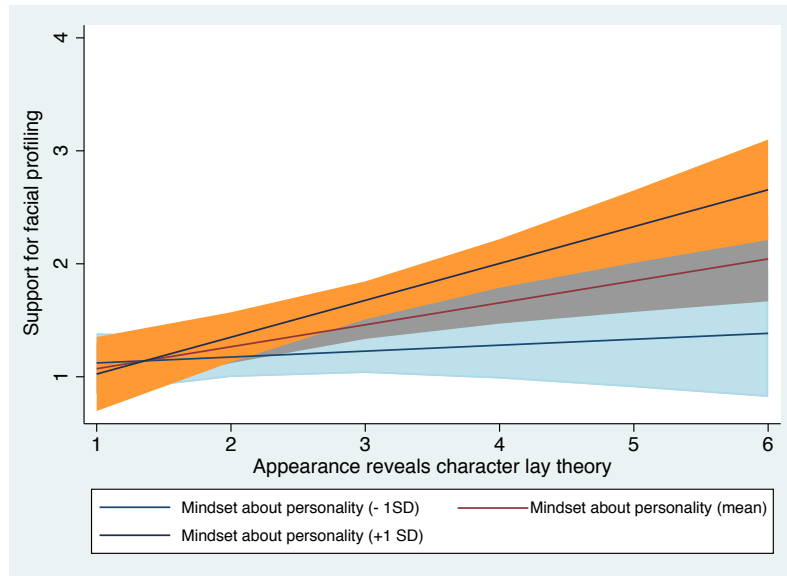
	1	2	3
1. <i>Appearance reveals character</i> lay theory	-		
2. Fixed mindset about personality	.29***	-	
3. Support for facial profiling technologies	.31***	.26***	-

* $p < .05$; ** $p < .01$; *** $p < .001$

Discussion

Extant research has found that individuals with a growth mindset about personality are less likely to make stereotypic judgments (Hong et al., 1999; 2004; Levy et al., 2001). Facial profiling is akin to stereotyping in that it involves pre-judging certain individuals as criminals, less intelligent, or less trustworthy, and so on. Hence, our finding that a growth mindset about personality attenuates the effect of *appearance reveals character* lay theory on people's willingness to support facial profiling technologies contributes to this literature by showing that even when people believe that individuals' appearance reveals their character, they are less willing to use facial profiling to categorize them if they think that people's character can change. The findings suggest that inducing a growth (fixed) mindset about personality could be a potential intervention for reducing (increasing) people's support for facial profiling.

Figure 8: Interaction plot between *appearance reveals character* lay theory and mindsets about personality



*Higher scores indicate a greater fixed mindset about personality

Study 5b: Moderating Role of Free will Belief

This study was designed to test the moderating role of the belief in free will. Specifically, we tested whether or not a stronger belief in free will would attenuate the relationship between the *appearance reveals character* lay theory and people's willingness to support facial profiling technologies. We theorized that facial profiling technologies' hidden assumption that individuals' future choices are pre-ordained and can be pre-determined would be more aversive to those who have a stronger belief in free will.

Method

Participants

As this was our first study testing belief in free will as a moderator, we did not have a basis for conducting a power analysis. We posted a survey seeking 200 US residents on CloudResearch™. In response, 200 participants completed the study. Similar to the previous studies, we excluded six participants who wrote gibberish in response to an open-ended question toward the end of the study leaving 194 participants (109 women; 83 men, one other, and one unreported; $M_{age} = 43.43$ years) in the dataset.

Procedure

Similar to Study 1a, we presented the participants with the 8-item *appearance reveals character* lay belief scale ($\alpha = .97$) on a 6-point scale from *strongly disagree* to *strongly agree*. Participants also responded to the 27-item free will and determinism scale (e.g., “What happens to people is a matter of chance”; $\alpha = .84$; Paulhus & Carey, 2011) on a 5-point response scale from *strongly disagree* to *strongly agree*. The order of the scales was counterbalanced across participants. As in Study 5a, participants were then asked to indicate their support for facial profiling technologies across four domains.

Results

Please see Supplementary Materials for psychometric properties of the lay theory scale and a CFA distinguishing it from the dependent measure. There were no scale order effects (detailed analysis is presented in the Supplementary Materials). Table 4 presents the correlations between the measures. The more people believed that appearance reveals character, the less they believed in free will, $r = -.16$, 95% CI [-.29, -.018], $p = .028$.

We coded the free will scale items such that higher values reflected a stronger belief in free will. We regressed participants' support for profiling on their *appearance reveals character* lay belief score (mean-centered), free will score (mean-centered), and their interaction. We found a significant main effect of the lay theory ($b = .42$, 95% CI [.301, .55], $SE = .064$, $\beta = .41$, $t(190) = 6.59$, $p < .001$) as well as a significant effect of free will ($b = -.43$, 95% CI [-.78, -.085], $SE = .18$, $\beta = -.16$, $t(190) = 2.46$, $p = .015$) indicating that the stronger participants' beliefs in free will, the less they supported facial profiling. Importantly, we also uncovered a significant interaction effect ($b = -.47$, 95% CI [-.71, -.22], $SE = .12$, $\beta = -.24$, $t(190) = 3.78$, $p < .001$, see Figure 9). We then conducted simple slopes analysis at one SD above and below the mean of the free will scale. For those who did not believe that individuals have free will (-1 SD), the *appearance reveals character* lay theory was strongly associated with their support for facial profiling policies ($b = .64$, 95% CI [.47, .82], $SE = .089$, $\beta = .62$, $t(190) = 7.22$, $p < .001$).

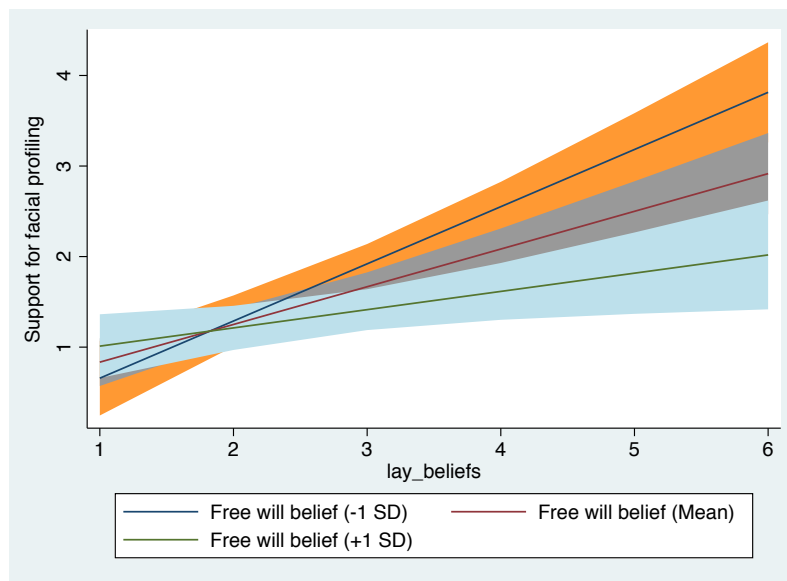
However, for those who believed that individuals have free will (+1 SD), the relationship between the *appearance reveals character* lay theory and support for facial profiling policies was attenuated ($b = .21$, 95% CI [.039, .37], $SE = .084$, $\beta = .201$, $t(190) = 2.44$, $p = .016$).

Table 4. Correlations for measures included in Study 5b.

	1	2	3
1. <i>Appearance reveals character</i> lay theory	-		
2. Free will beliefs	-.16*	-	
3. Support for facial profiling technologies	.43***	-.27*	-

* $p < .05$; ** $p < .01$; *** $p < .001$

Figure 9: Interaction plot between *appearance reveals character* lay theory and free will



Discussion

The claim that facial profiling technologies can predict people’s future choices appears counter to the idea of free will, which most people believe in (Baumeister et al., 2009). This study found that the effect of the *appearance reveals character* lay theory on support for facial

profiling was weaker among people with a stronger belief in free will. Importantly, even though the effect of *appearance reveals character* lay theory on willingness to support facial profiling technologies was still statistically significant among those who held a strong belief in free will, the effect size was one-third as large as among those who held a weak belief in free will.

Interested readers may also wonder about the correlation between fixed-growth mindsets about personality (assessed in Study 5a) and free will beliefs (assessed in Study 5b). We conducted a pilot study to assess the correlation between these beliefs with 208 US residents recruited on MTurk. We found that the more people held a fixed mindset, the lower their belief in free will ($r = -.46$, 95% CI $[-.57, -.35]$, $p < .0001$).

Study 6: Comparison to analogous beliefs

This study was designed to test whether there is something special about people's beliefs about whether appearance reveals character or whether analogous beliefs in other domains would similarly predict people's support for profiling. Comparing the relative size of the effect of the *appearance reveals character* lay theory compared to the effect of analogous beliefs in other domains could help establish the domain-specificity of our novel lay theory. For example, if people believe that others' handwriting reveals their character, then they should be more likely to support that people should be profiled based on their handwriting for employment and other purposes. Similarly, if people believe that a person's Facebook likes (i.e., the pages and posts that people "like" on Facebook) reveal their personality, then they should be more likely to support profiling people based on their Facebook likes for employment screening, for catching criminals, for identifying financially untrustworthy individuals, and so on. We conducted a pre-test assessing three other beliefs—the *voice reveals character* lay theory, *handwriting reveals character* lay theory, and *Facebook likes reveal character* lay theory—to determine a suitable analogous belief for comparison against the *appearance reveals character* lay theory.

The pre-test revealed that participants were significantly less likely to believe that people's voice reveals their character or that people's handwriting reveals their character than

the idea that people's appearance reveals their character. However, participants were more likely to believe that people's Facebook likes reveal their character than they believed that people's appearance reveals their character (see Pilot Study 2 in Supplementary Materials for details). Given the strength of people's belief that others' Facebook likes reveal their character, we pitted the *appearance reveals character* lay theory against the *Facebook likes reveal character* lay theory in the main study. The idea that people's Facebook likes reveal their character has face validity as research has found that it is possible to infer people's personalities from their Facebook likes (Kosinski et al., 2015).

Method

This study's hypotheses, method, sample size, and pre-selection criteria were pre-registered (https://osf.io/68f7p/?view_only=39d0d4aa05c44636808f6695bc18e9aa).

Participants

As we are studying the effects of a novel experimental manipulation here, we did not have a basis for determining the effect size for this study. We pre-registered a sample size of 200 and posted a study seeking 200 US residents on Amazon Mechanical Turk. In response, 193 participants completed the study. As per the pre-registered plan, we excluded 35 participants who wrote gibberish in response to an open-ended question toward the end of the study leaving 158 participants (85 women, 72 men, and one unreported; $M_{age} = 37.50$ years) in the dataset.

Procedure

Participants were randomly assigned to either the *appearance* condition ($N = 79$) or the *Facebook likes* ($N = 79$) condition. In the *appearance* condition, we presented the participants with the *appearance reveals character* lay belief scale ($\alpha = .96$). Participants were then asked to indicate their support for the use of facial profiling for four different uses (e.g., determining candidates' competence in a job search and for determining customers' interest rates and credit limits) on 7-point scales (*do not support at all to support completely*).

In the *Facebook likes* condition, we first told the participants that “Based on their interests, people can “like” several pages on Facebook from companies, causes, celebrities, brands, etc.). Keeping this in mind, please tell us what you think about the following statements.” Participants were then presented with the *Facebook likes* reveal character scale (adapted from the *appearance reveals character* lay belief scale, e.g., “People’s Facebook likes are a good indication of their character;” $\alpha = .96$). Participants were then asked to indicate their support for profiling people based on their Facebook likes for four different uses (e.g., determining candidates’ competence in a job search and for determining customers’ interest rates and credit limits) on 7-point scales (*do not support at all to support completely*).

Results

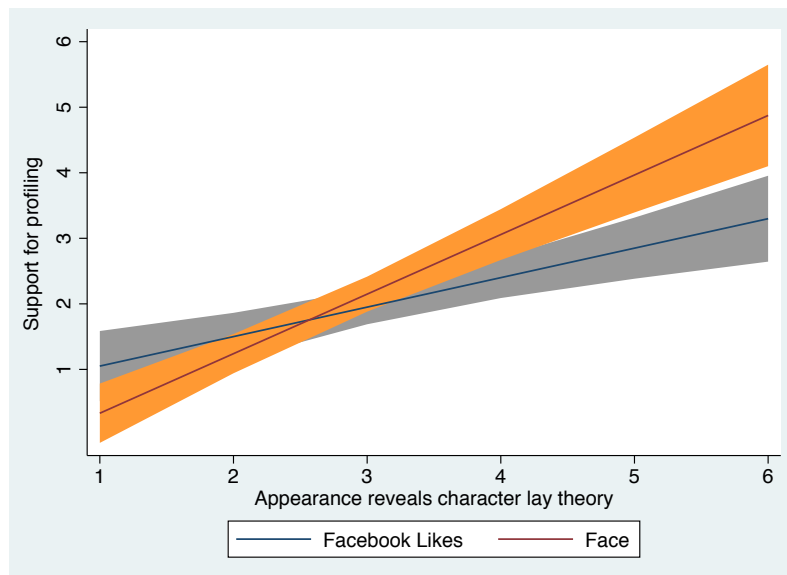
Please see Supplementary Materials for psychometric properties of the lay theory scale and CFA distinguishing it from the dependent measure. As per the pre-registered analysis plan, we regressed participants’ support for profiling (either based on *appearance* or *Facebook likes*) on condition (*Facebook likes* = -.5, *appearance* = .5), participants’ score on the respective belief, and their interaction (mean-centered). The regression analysis revealed a significant effect of participants’ belief in the predictive ability of appearance or Facebook likes ($b = .68$, 95% CI [.53, .83], $SE = .078$, $\beta = .58$, $t(154) = 8.74$, $p < .001$), a nonsignificant effect of condition ($b = .33$, 95% CI [-.62, .71], $SE = .201$, $\beta = .11$, $t(154) = 1.66$, $p = .099$), and a significant interaction ($b = .46$, 95% CI [.15, .77], $SE = .16$, $\beta = .201$, $t(154) = 2.95$, $p = .004$, see Figure 10). We then conducted pairwise correlations within each condition. In the *appearance* condition, the more people believed that appearance reveals character, the more they supported facial profiling ($r = .71$, 95% CI [.58, .804], $p < .0001$). In the *Facebook likes* condition, the more people believed that Facebook likes reveal character, the more they supported social media profiling ($r = .40$, 95% CI [.20, .57], $p = .0002$). Importantly though, the correlation

coefficient was nearly twice as strong in the *appearance* condition as in the *Facebook* condition. See Supplementary Materials for additional results.

Discussion

We found that people's *appearance reveals character* lay belief was a stronger predictor of their support for profiling than their beliefs about other analogous indicators that may also predict personality. Thus, the *appearance reveals character* belief is particularly powerful in predicting people's policy positions. We believe that this may be the case for two reasons. First, apart from clothes and hairstyle, other aspects of appearance, such as face and body size/shape, may be difficult to change. Hence, people cannot change their appearance radically to obtain favorable outcomes in the profiling process. But social media information is quite malleable in that people can alter the information that is publicly available on their Facebook profile. In addition, people's Facebook likes may change as they grow older, move across different regions, enter the workforce, and so on. Indeed, job candidates are routinely advised to purge their social media profiles of unflattering information before applying for jobs (Herman, 2020). Because Facebook likes can be easily altered and are generally more malleable, people may be less likely to support the use of Facebook likes for making consequential decisions.

Figure 10: Interaction plot between *appearance reveals character* theory and condition



General Discussion

A series of studies identified a novel antecedent of people's support for the widespread use of facial profiling and surveillance in governments and businesses. We found that the more people believed that appearance reveals character, the more they supported the use of facial profiling technologies by the police to infer individuals' likelihood of criminal activity from their faces; by the army for recruiting individuals who look brave and courageous; by schools for segregating students into different tracks according to their intelligence, as inferred from their faces; by organizations to infer individuals' employability, and by banks for determining customers' creditworthiness (Studies 1a-1b). Studies 1c-1d found that those who believed that appearance reveals character supported facial profiling even when they themselves were the target of such facial profiling. Study 2 provided causal evidence in support of our key hypothesis. Study 3 demonstrated the underlying mechanism that the more people believed that appearance reveals character, the more they supported facial profiling technologies because they felt more confident in their ability to make accurate appearance-based judgments.

To provide converging evidence for the underlying mechanism, Study 4 manipulated the mediator directly to strengthen vs. undermine people's confidence in their appearance-based judgments, thereby increasing (vs. decreasing) their support for facial profiling technologies. The next two studies found that a growth mindset about personality (Study 5a) and a stronger belief in free will (Study 5b) attenuated the effect of *appearance reveals character* lay theory on people's support for facial profiling technologies. Finally, Study 6 found that people's *appearance reveals character* lay belief particularly predicts their support for facial profiling; analogous beliefs in other domains (i.e., Facebook likes) do not predict their support for profiling to a similar extent.

Theoretical Implications

Extant research in psychology on thin-slice judgments has focused on whether people can judge others' personality traits based on faces (Naumann et al., 2009; Re & Rule, 2016;

Rule et al., 2010, 2013; Todorov et al., 2015; Zebrowitz, 2017). In contrast to this research, which has focused on the veracity of these judgments, we examined people's lay theory about whether or not individuals' appearance reveals their character. We found that independent of people's actual accuracy, their lay theory influenced their position on facial profiling. Importantly, even though absolute support for facial profiling was consistently low across studies (below the midpoint of the scale in all studies), indicating that people's general support for facial profiling is low, it is noteworthy that people's lay theories about whether or not individuals' appearance reveals their character shaped their support for facial profiling technologies. Importantly, our findings underscore the need for a scientific consensus on whether or not people's appearance reveals their character. This issue is important because earlier research has focused on whether character traits can be predicted at above-chance accuracy levels (e.g., Todorov, 2017), but more recent research has posited that machine learning methods can assess traits with much higher accuracy (Wang & Kosinski, 2018). The scientific consensus on this issue can inform people's lay theory, and consequently, shape their position on policies related to facial profiling.

Past research on people's confidence in their appearance-based judgments has focused on target-side factors, such as how similar the target is to someone the perceiver knows (Ames et al., 2010). On the perceiver side, research has also found that people with high perceived self-efficacy in person perception are also more confident in their appearance-based judgments (Ames et al., 2010). We contribute to this literature by identifying a novel antecedent—people's lay theories about appearance in general—that does not refer to the perceiver's own ability to make appearance-based judgments but still affects their confidence in their own ability to make appearance-based judgments. We found that the more people believe that appearance reveals character, the more confident they are in their appearance-based judgments. More strikingly, even though people who believed that appearance reveals character were *more confident*, they were nonsignificantly *less accurate* when making appearance-based judgments. Thus, we found

that people who believe that appearance reveals character were more prone to miscalibration in their appearance-based judgments, that is, they *feel* that they are very accurate when in reality, they are somewhat *less* accurate. Thus, the current findings suggest that people's lay theory about whether appearance reveals character serves as a filter that shapes both their judgments and their meta-cognition about their judgments.

The current research also documents support for facial profiling as a novel downstream outcome of people's confidence in appearance-based judgments. Past research has studied the consequences of confidence in appearance-based judgments in proximal judgment contexts. For example, Ballew II & Todorov (2007) found that people's judgments of competence of politicians' faces predicted the winners of gubernatorial elections in the United States. In this research, we show a downstream consequence (i.e., support for facial profiling policies) that is far removed from a proximal judgment context, yet no less significant and consequential.

Opponents of facial profiling technologies argue that facial profiling stereotypes people. The basic premise of facial profiling technologies is that they can identify people who are more or less criminal, more or less employable, and more or less intelligent. Extant research on people's beliefs about the malleability of personality has found that people with a growth mindset are less willing to attach labels to individuals or stereotype them (Chiu et al., 1997; Levy et al., 1998). Our research contributes to this stream of literature by demonstrating that people with a growth mindset about personality do not support facial profiling technologies even if they believe that individuals' appearance reveals their character. These findings suggest that those with a growth mindset see a parallel between facial profiling and stereotyping.

Facial profiling technologies assume that people's behavior at some unspecified time in the future can be determined in advance. In other words, facial profiling technologies are built on the assumption that people's future choices are constrained. For example, facial profiling technologies claim to predict whether or not a specific individual will commit criminal activity at some point in the future, fail to be a model employee, or fail to pay their loan installment. This

assumption contradicts the idea that individuals have free will, defined as the ability to make their own choices (Feldman et al., 2014). We contribute to the literature on free will by documenting that people with a stronger belief in free will are more sensitive to this assumption of facial profiling technologies. Consequently, they are more averse to the use of facial profiling technologies even if they believe that people's appearance reveals their character.

Limitations and Future Research Directions

Future research can examine people's specific beliefs about which facial features reveal which character traits for which specific groups, and whether people are more likely to support facial profiling based on specific face-trait-group combinations. One of the limitations of the present research is that our participants are exclusively US Americans. Although the idea that appearance reveals character is prevalent worldwide (De Mente, 2011; Kuei, 2000), future research needs to study whether our findings hold in other cultural contexts.

The idea of reading people's character from their appearance dates back to the ancient Greeks (Little et al., 2006) and Chinese (Kuei, 2000; Mar, 1974). However, it is still practiced extensively in East Asian countries, including South Korea, Japan, and China (De Mente, 2011; Strother, 2015). Future research can examine whether there are cross-cultural differences in people's *appearance reveals character* lay belief. Certain statistics are consistent with the idea that individuals in some countries may be more likely to believe that appearance reveals character. For example, industry statistics and empirical research find that Asian countries are some of the top spenders on beauty products per capita (Euromonitor, 2017; Madan et al., 2018) and have the highest concentration of plastic surgeons (ISAPS, 2018). Hence, cultural differences in *appearance reveals character* lay belief may help explain cultural differences in the pursuit of beauty. Future research can test this idea.

Future research can examine additional consequences of this lay belief, such as whether people who believe that appearance reveals character are more likely to reject products with minor imperfections. For example, many consumers do not buy plain-looking

products (e.g., those with simple packaging) or reject slightly blemished or asymmetrical produce. Might this be because people generalize the lay belief that appearance reveals character from animate to inanimate objects? If so, then the idea that appearance reveals character might make people more averse to plain-looking products or those with slight imperfections, thereby contributing to extra packaging and waste.

Although we examined fixed-growth mindsets about personality, people may also hold fixed-growth mindsets about appearance—Is people’s appearance largely fixed, or can it change? Although aging influences how individuals look, their core features stay the same. Others may believe that people can drastically change their appearance with effort and resources. Such fixed-growth mindsets about appearance may predict people’s willingness to change their appearance by eating healthy, going to the gym, and spending money on products and services that promise appearance makeovers.

Conclusion

The current research identifies an important psychological antecedent that influences whether people think that facial profiling is justified in society. Given the role of people’s *appearance reveals character* lay theory in shaping their support for consequential issues such as facial profiling, it is imperative to have scientific consensus on the question of whether or not appearance reveals character and communicate that consensus to the public.

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