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TARGET EFFECTS

JUDGMENTS OF HEIGHT FROM FACES ARE INFORMED BY DOMINANCE AND FACIAL MATURITY

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People who occupy a larger physical space tend to occupy more social space as well. In five studies, the authors investigated how people estimate targets' physical height when provided with facial portraits. In Studies 1a and 1b, participants' estimates of height from targets' faces were significantly correlated with targets' actual height. Because dominance, facial maturity, and facial-width-to-height ratio (FWHR) are all relevant to individuals' perceived "social size," in Studies 2a and 2b participants judged dominance, facial maturity, warmth, and height. The association between actual and perceived height was partially mediated by dominance and facial maturity, but not warmth or FWHR. In Study 3, measurements of chin area—an aspect of facial maturity—also mediated the actual-perceived height association. People may therefore draw upon the most relevant aspects of "social size" to extrapolate physical size, assuming that those who are more dominant or mature are physically larger—an inference that may cause them to be ascribed higher status.

The literature on face perception suggests that individuals make myriad subjective judgments from others' facial appearance. For instance, people seem attuned to how mature versus babyish a face may be, and how socially dominant versus submissive a face appears. Facial maturity and dominance are conceptually related and highly correlated (Zebrowitz, 1997). "Facial maturity" refers to physical properties of facial features (such as large eyes and a rounded face; Zebrowitz, Montepare, & Lee, 1993) that are associated with specific perceptions and behavioral outcomes. Facial dominance, in turn, can be considered a social inference that observers make from others' facial features, such as those constituting facial maturity. Importantly, both dominance and maturity seem to relate to perceivers'

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impressions of how "large" one's social influence is. People generally expect more babyfaced or more submissive-looking individuals to be more psychologically childlike (e.g., more naïve, warm, trustworthy, dependent, less assertive, and less suited for leadership; Zebrowitz, 1997). Studies suggest that, to some extent, these expectations are well founded. For instance, nonelderly babyfaced adults feel that they have less control in relationships and work (Andreoletti, Zebrowitz, & Lachman, 2001) and are likely to be found in professional positions that are consistent with the babyface stereotype (Collins & Zebrowitz, 1995).

Given that facially mature and dominant-looking people are generally perceived as "larger" in social influence or personality, the appearance of individuals' faces might influence how physically large observers imagine them to be. Height is related to status, wherein bigger is usually regarded as more socially and cognitively competent (Eisenberg, Roth, Bryniarski, & Murray, 1984) and more dominant (Hensley, 1993). Indeed, height can also hint at some more concrete aspects of social size, as it can predict individuals' actual emergence and performance as leaders, their income, and how highly they are regarded by others (Collins & Zebrowitz, 1995; Judge & Cable, 2004).

Other studies have demonstrated this association in the complementary direction: Targets with higher perceived social status are reckoned physically larger. For instance, when nursing students were asked to draw pictures of a peer, their class president, a course instructor, and an administrator, they depicted targets' sizes proportional to their perceived authority status (Dannenmaier & Thumin, 1964). Similarly, Koulack and Tuthill (1972) found that members of racial groups who were accorded lower status by observers were judged to be shorter than members of groups who were accorded higher status. Finally, Marsh, Yu, Schecter, and Blair (2009) demonstrated that male and female actors posing high-status nonverbal cues in full-body photographs (e.g., open body posture) were perceived as taller.

An association between physical characteristics and social inferences of status is consistent with an ecological view of social perception. Borrowing from Gibson's original work on the ecological theory of nonsocial perception, Zebrowitz and colleagues have suggested that perceivers may be attuned to social percepts that provide functional affordances (McArthur & Baron, 1983; Zebrowitz & Collins, 1997). Physical size, for example, is a major determinant of many species', including humans', potential to threaten or overcome conspecifics (Fessler, Holbrook, & Snyder, 2012). People are indeed sensitive to the threat posed by others and tend to infer that more threatening people are taller (Fessler et al., 2012). Within the present context, inferences of social traits from faces, such as dominance, might therefore be used to infer a target's physical properties, such as body size. This perception could be relevant for assessing the potential threat offered by others, particularly within competitive domains (see Mazur, 2005), thereby affording the percept (i.e., facial appearance) functional value.

Overall, both tallness and facial maturity are associated with being perceived as having a larger social footprint, which to some extent seems to be true. Furthermore, people's perceptions of targets' physical size may be based on perceptions of targets' social size. Hence, we addressed two further questions: First, might perceivers' numerical estimates of others' heights based only on photographs of targets' faces converge and/or approximate targets' actual heights? Second, might perceivers base their estimates of others' physical heights on the facial cues (e.g., facial maturity) or judgments informed by facial cues (e.g., dominance) that are relevant to individuals' social size? To investigate these questions, we performed five studies: in Study 1a, Indian participants estimated the height of past American presidential candidates. In Study 1b, American participants estimated height for a diverse sample of targets, whose actual heights we had on record. In Study 2a, these targets were rated for dominance, facial maturity, and warmth, allowing us to examine which factors perceivers utilized in estimating others' height. Next, Study 2b repeated Study 2a using a partially within-subjects design to obtain trait and height estimates from the same perceivers. Finally, Study 3 investigated whether physical measurements of facial maturity would mediate the association between targets' actual and perceived height.

STUDY 1A

We first assessed whether observers could estimate targets' physical heights from photographs of their faces. Because American presidential candidates' heights are available in the public record, we asked English-speaking participants from India (who were less likely to recognize the candidates than North American participants) to estimate the height of each candidate.

METHOD

Targets were facial photos of 39 presidential candidates. Targets consisted of every Democrat and Republican candidate from 1860 to 2004, although candidates who won one term but lost another were excluded and incumbents were included only once. Six candidates were excluded because their faces are internationally famous (e.g., Al Gore), and five others were excluded because height information or a photograph could not be found. Photos were gathered online, converted to grayscale, cropped to the smallest frame that included the wider of the hair or ears and the distance from just below the chin to just above the top of the hair, and standardized to a height of 300 pixels (Figure 1).

We recruited 49 Indian participants (63% male; M_{age} = 33 years, *SD* = 10) using Amazon's Mechanical Turk.[1] Participants were asked to estimate how tall targets were, based on photographs of their faces; photos were presented one at a time in random order, and participants typed height estimates into a textbox. Finally, participants were asked to name any individuals that they recognized and were paid $0.25.

Height estimates were averaged across participants to create a mean score for each target. However, if a participant recognized a target, his or her estimate(s) for that target(s) were not included in the average perceived height for that candidate. Due to high recognition rates (50%–74%), Abraham Lincoln, Bill Clinton, and George W. Bush were excluded from analyses; all other targets were recognized by fewer than six participants.

1. The relationship between actual and perceived height did not differ between male and female participants in any of the studies reported here (all meta-analytic *z*s < .33, all *p*s > .63).

FIGURE 1. Example target photographs employed in Study 1a (left panel) and Studies 1b, 2a, 2b, and 3 (right panel).

RESULTS AND DISCUSSION

Perceivers' estimates of targets' heights (*M* = 172.62 cm, *SE* = .59) were significantly correlated with their actual heights (*M* = 179.0 cm, *SD* = 6.16): $r(34) = .34$, $p < .05$. Thus, perceivers could infer targets' relative height from their faces significantly better than chance. Given the heterogeneity among the photos in terms of emotional expression, photo quality, and changes in style over time, we continued this investigation in Study 1b using current photos taken under standardized conditions.

STUDY 1B

Study 1a showed that judgments of targets' heights from photos of their faces correlated with targets' actual heights. Given that these photos were from a heterogeneous set of famous leaders, we used target photographs acquired under standardized conditions in the laboratory in Study 1b.

METHOD

We recruited 30 American participants online via Amazon's Mechanical Turk for $0.25 compensation. The target photographs were collected in a previous study by photographing 119 individuals (42% male; M_{age} = 23 years, *SD* = 9; 46% Caucasian, 34% East Asian, 12% South Asian, 3% African, 6% other) from the University of Toronto and surrounding community while wearing translucent shower caps and posing neutral facial expressions (Figure 1). Targets reported demographic information (e.g., race, gender) and their height in inches.[2] Height data were missing

2. Since we obtained only self-reported height from these targets, we subsequently recruited a sample from the same population to test the accuracy of undergraduates' self-reports of height. We measured the height of 17 (18% male; M_{age} = 19 years, *SD* = 2) students participating in another study, in which they self-reported height in the same manner as the targets in Study 1b (via computer, before any mention of measuring their actual height). Just before debriefing, they were measured against a wall with a measuring tape with shoes removed. Self-reported (*M* = 66.00″, *SD* = 3.88) and measured (*M* = 65.50″, *SD* = 3.62) height were highly correlated [$r(15) = .95$, $p < .001$], suggesting a high concordance between participants' actual and self-reported height.

from one target, who was therefore excluded. Target photos were cropped tightly to the smallest frame that included the top and sides of the shower cap and the bottom of the chin. Thus, care was taken to assure that differences in the vertical tilt of targets' heads (e.g., Mignault & Chaudhuri, 2003) would not influence perceivers' judgments. Jewelry and clothing were not visible. The photos were converted to grayscale and standardized to a height of 300 pixels.

Stimuli were presented to participants individually in random order, and participants estimated how tall each target was using a computerized slider ranging from 4 ft 6 in. to 7 ft. (inter-rater reliabilities: Cronbach's α = .98). Twenty additional participants were separately recruited to provide judgments of facial attractiveness (inter-rater reliability: Cronbach's α = .84) for use as a covariate. All participants were asked to work quickly and to make an "intuitive judgment." Ratings were averaged across participants to create a mean score for each target on each variable.

RESULTS AND DISCUSSION

Participants' perceptions of targets' heights (M = 67.21 in., SE = .28) from facial portraits were significantly correlated with targets' actual heights (M = 66.98 in., SD = 3.98): $r(116) = .70$, $p < .001$. Attractiveness (M = 3.16, SE = .05) was not correlated with actual [$r(116) = -.11$, $p = .24$] or perceived [$r(116) = -.05$, $p = .60$] height, and controlling for attractiveness in a partial correlation did not disrupt the relationship between the two: $r(115) = .70$, $p < .001$. Similarly, actual height still predicted perceived height when targets' race and sex were controlled via dummy-coded variables; $r(111) = .26$, $p = .01$.[3]

Men's and women's relative heights therefore appear to be legible from their faces. But why? Both height (Lorentzon, Swanson, Andersson, Mellström, & Ohlsson, 2005) and aspects of facial appearance (Verdonck, Gaethofs, Carels, & de Zegher, 1999) are influenced by individual levels of testosterone during growth. Testosterone is also associated with behaviors related to one's social size, such as dominance (Tremblay, 1998). It therefore seemed reasonable that perceivers might have based their estimates of height on facial cues to social size (e.g., facial maturity; Zebrowitz, 1997) and inferences of social size (e.g., trait dominance; Mazur, 2005). We tested this in Study 2.

STUDY 2A

This study investigated how individuals can accurately perceive height from the face by examining the relationship between height perceptions and both physical

3. Target sex was also analyzed as a continuous measure of gender: 20 participants rated each face for masculinity and femininity along 7-point scales anchored at 1 (*Not at all masculine/feminine*) and 7 (*Very masculine/feminine*). Ratings were highly correlated ($r = -.98$) and therefore averaged to create a composite score (M = 4.12, SE = .15). As with dummy-coded target sex, actual and perceived height were correlated controlling for targets' masculinity and ethnicity: $r(111) = .34$, $p < .001$. Separate analyses of male [$r(44) = .31$, $p = .04$] and female [$r(62) = .24$, $p = .056$] targets, controlling for target ethnicity, showed similar effects for the relationship between actual and perceived height.

and behavioral correlates of social size: facial maturity and dominance. Additionally, recent studies have demonstrated the importance of facial width-to-height ratio (FWHR), a sexually dimorphic trait that is relatively independent of body size, in social perception. Having a higher FWHR is related to individuals being perceived as, and actually being, more physically aggressive and behaviorally deceptive (e.g., Carré & McCormick, 2008; Haselhuhn & Wong, 2011). In other words, FWHR is a feature to which perceivers are attuned, and that could factor into overall impressions of others' "social sizes" or perceived behavioral profiles. Thus, we also investigated whether FWHR may be related to estimates of others' heights.

Separate groups of perceivers were asked to rate the faces used in Study 1b for inferences of dominance (ranging from 1 *Submissive* to 7 *Dominant*; $N = 36$), physiognomic cues to dominant behavior (i.e., facial maturity, ranging from 1 *Babyish* to 7 *Mature*; $N = 27$), and a control variable not related to social size (i.e., warmth, ranging from 1 *Not at all warm* to 7 *Very warm*; $N = 28$; all inter-rater reliability: Cronbach's αs > .93). Finally, a separate group of participants completed the same height estimation judgments as in Study 1b ($N = 28$; inter-rater reliability: Cronbach's $\alpha = .97$). American participants were randomly assigned to one of the four conditions and were recruited online from Amazon's Mechanical Turk (41% male; $M_{age} = 35$ years, $SD = 13$) for $0.30 compensation. Stimuli were presented in random order, and participants were asked to work quickly and to make "intuitive judgments." Ratings were averaged across participants, yielding mean scores for each target on each variable. Subsequently, target photos were measured in the lab with ImageJ software by four research assistants who were blind to hypotheses. They measured the width (across the widest point of the cheekbones) and height (from top of the upper lip to the lateral center of the eyebrow; see Carré & McCormick, 2008) of each face. FWHR was averaged across the four measurers (inter-rater reliability: Cronbach's $\alpha = .89$).

RESULTS AND DISCUSSION

As expected, perceived height ($M = 67.19$ in., $SE = .28$) was associated with actual height [$r(116) = .71$, $p < .001$], perceptions of dominance [$M = 4.29$, $SE = .08$; $r(116) = .50$, $p < .001$], and facial maturity [$M = 3.70$, $SE = .07$; $r(116) = .69$, $p < .001$], but not warmth [$M = 2.95$, $SE = .06$; $r(116) = -.15$, $p = .12$] or FWHR [$M = 1.62$, $SE = .01$; $r(116) = .13$, $p = .17$]. In addition, targets' actual heights were correlated with perceptions of dominance [$r(116) = .39$, $p < .001$], facial maturity [$r(116) = .47$, $p < .001$], and FWHR [$r(116) = .18$, $p = .05$], but not warmth: $r(116) = -.13$, $p = .17$. Notably, actual height was more strongly correlated with maturity ($z = 2.49$, $p < .01$) and dominance ($z = 1.74$, $p = .04$) than with FWHR. Again, because both height (e.g., Lorentzen et al., 2005) and indications of social size (e.g., dominance; Tremblay, 1998) are known to be positively influenced by testosterone, it is sensible that facial appearance—including both facial maturity and FWHR—would be related to physical height. Most relevant to our hypothesis, bootstrapping analyses demonstrated that the relationship between actual and perceived height was significantly partially mediated by the targets' facial maturity and dominance but not warmth or FWHR (Table 1), suggesting that facial features related to perceptions of social size were taken into account by perceivers. Exploratory analyses also showed that, when switching the dependent variable and mediators, perceived height likewise

TABLE 1. Unstandardized Point Estimates and 95% Confidence Intervals for the Indirect Effects in Mediation Analyses Between Actual and Perceived Height in Studies 2a, 2b, and 3

		Accelerated Bootstrap 95% CI	
Mediator	**Point Estimate**	**Lower**	**Upper**
Study 2a			
Dominance	.08 (.026)**	.03	.14
Maturity	.16 (.035)***	.11	.14
Warmth	.001 (.007)	−.01	.04
FWHR	0 (.009)	−.02	.02
Study 2b			
Dominance	.14 (.032)***	.09	.22
Maturity	.08 (.025)**	.03	.14
Warmth	.002 (.004)	−.003	.02
Study 3			
Chin Area	.18 (.040)***	.10	.267
Eye Area	.001 (.013)	−.027	.031
Eyebrow Height	.026 (.016)	.001	.070
Nose Area	.003 (.007)	−.008	.046
FWHR	−.025 (.016)	−.072	.0003

Note. 1,000 bootstrap resamples; ***$p < .001$, **$p < .01$; values in parentheses are standard errors.

mediated the association between actual height and perceived maturity and dominance: both 95% CIs (.04, 12). Inferences about social size therefore seem to contribute to the relationship between actual and perceived height.

These results suggest two key findings: First, individuals incorporate perceptions of maturity and dominance, but not FWHR or warmth, into their estimates of others' height. Although all of these but warmth were related to targets' actual height, maturity and dominance were more strongly related than was FWHR. Thus, observers used the *most* height-relevant facial information, drawing on facial dominance and maturity rather than FWHR, when formulating height estimates. Second, perceived height and perceived dominance/maturity seem to be mutually influential: Perceived height mediates the association between actual height and both dominance and maturity, and vice versa. As such, it appears that observers may form an overall impression of one's social size based on all available information from the face, yet they utilize the most relevant information depending on the inference they are making (i.e., height versus dominance/maturity).

STUDY 2B

Study 2a suggested that both inferences and physiognomic cues of dominance from the face mediate the association between participants' estimates of targets' height and the targets' actual height. This corroborated the results of Study 1: Observers could reliably estimate targets' relative height from their faces. Different groups of participants, however, each rated only one of dominance, facial maturity, warmth, or estimated height. Thus, to diversify our methods, in Study 2b we utilized a within-subjects design wherein participants estimated both height and one of dominance, warmth, or facial maturity.

American participants from Amazon's Mechanical Turk viewed 116 of the 118 faces employed in Studies 1b and 2a (two faces did not appear to participants due to a software error) individually in random order for $0.40. Each participant estimated height and one of warmth, dominance, or facial maturity in randomly ordered blocks. Estimation tasks and scales were identical to those described in Studies 1b and 2a. Forty-four participants estimated height and dominance; 41 participants estimated height and warmth; and 35 participants estimated height and facial maturity (all inter-rater reliabilities: Cronbach's αs > .92).

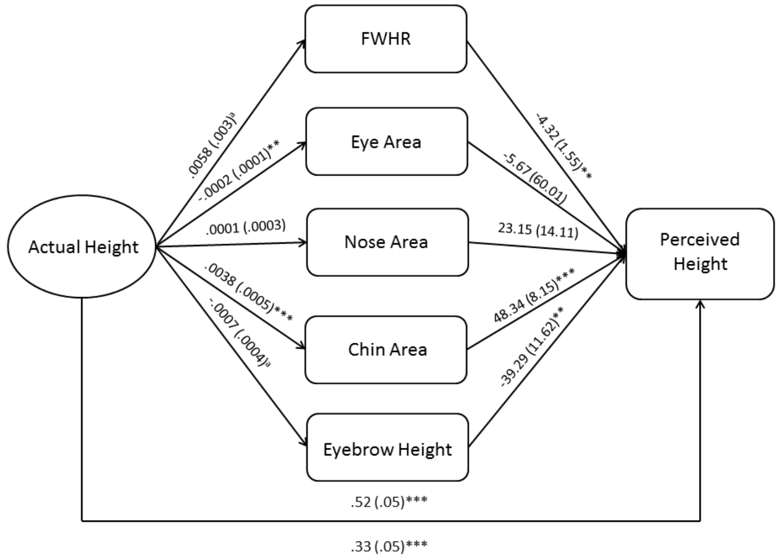
RESULTS AND DISCUSSION

Participants' height estimates were strongly related to targets' actual heights in all three samples: all rs > .70, all ps < .001. As in Study 2a, perceived dominance ratings (M = 3.92, SE = .06) were related to height estimates [M = 66.56 in., SE = .26; $r(116)$ = .66, p < .001] and targets' actual heights [$r(114)$ = .45, p < .001]. Additionally, participants' facial maturity ratings (M = 4.16, SE = .07) were related to height estimates [M = 66.98 in., SE = .27; $r(114)$ = .52, p < .001] and targets' actual heights [$r(114)$ = .37, p < .001]. However, warmth ratings of targets' faces (M = 3.01, SE = .06) were unrelated to height estimates [M = 67.08 in., SE = .26; $r(114)$ = −.10, p = .31] and actual height [$r(114)$ = −.08, p = .38]. Finally, bootstrapping analyses confirmed that the association between actual and perceived height was partially mediated by dominance and facial maturity but not warmth (Table 1). As in Study 2a, models using FWHR measurements as a mediator were not significant (all 95% CIs [−.01, .04]).

Hence, Study 2b demonstrated that the same pattern of results can be obtained regardless of whether height and facial cues of social size are each estimated by different participants (as in Study 2a) or by the same participants. Here again, actual and perceived height were strongly correlated, and this association was mediated by facial cues of dominance and facial maturity, but not warmth or FWHR. Next, we tested whether measurable physical properties of the face that are related to facial maturity (as opposed to subjective judgments of maturity or social inferences of dominance) would similarly mediate the association between targets' actual and estimated height.

STUDY 3

In this study, we used the guidelines provided by Zebrowitz et al. (1993) for measuring physical planes of the face related to facial maturity and tested whether objective measurements of facial maturity, rather than subjective judgments, would also predict height estimates. Using ImageJ software, two research assistants, who were blind to hypotheses, measured 117 of the 118 target faces from Studies 1b and 2b for face length, eye height, eye width, nose length, nose width, facial width across cheekbones, chin width, facial width through mouth, and the distances from



*** $p < .001$, ** $p < .01$, [a] $p < .07$

FIGURE 2. Multiple mediation model showing the influence of physically measured facial maturity cues and FWHR upon the relationship between targets' actual and perceived height in Study 3. Note: Path values represent unstandardized regression coefficients; values within parentheses are standard errors.

lower lip to chin tip, from pupil center to top of head, and from pupil center to eyebrow (i.e., "eyebrow height"); one face was excluded due to experimenter error. The research assistants' judgments were significantly correlated on each measure (all *r*s = .57–.99), so their measurements were averaged, standardized, and used to calculate eye area (eye height × eye width), nose area (nose length × nose width), chin area (chin width × height from lower lip to chin tip), and eyebrow height.

RESULTS AND DISCUSSION

Because the heights of these targets had been estimated in three previous studies and on identical scales by comparable samples of participants, we calculated the mean estimated height across Studies 1b and 2b (all *r*s > .96, *p*s < .001) to provide one estimated height value for each target (M = 67.03 in., SE = .27, which was highly correlated with targets' actual height [$r(115) = .72$, $p < .001$]). We similarly averaged the respective ratings from Studies 2a and 2b to compute mean facial maturity [M = 3.93, SE = .06; $r(114) = .63$, $p < .001$], warmth [M = 2.98, SE = .06; $r(114) = .92$, $p < .001$], and dominance [M = 4.12, SE = .06; $r(114) = .57$, $p < .001$].

We then ran a multiple mediation model using bootstrapping (all confidence intervals bias-corrected and accelerated) to test whether eye area, nose area, chin area, eyebrow height, and FWHR together mediated the association between actual and average perceived height. Results revealed a significant total indirect effect (ab = .19, $p < .001$; 95% CI [.11, .27]), meaning that all five facial features together partially mediated the actual-perceived height association (Figure 2). However, chin area was the only mediator with a significant point estimate (Table 1), indi-

TABLE 2. Correlations Between Mean Trait Ratings and Physical Measurements of Faces in Study 3

	1	2	3	4	5	6	7	8	9	10
1. Actual Height		.72**	.46**	.46**	−.10	−.29**	.04	.55**	−.18	.18[a]
2. Perceived Height			.67**	.66**	−.13	−.22*	.11	.63**	−.25**	.15
3. Perceived Maturity				.97**	−.32**	−.27**	.07	.60**	−.23*	.30**
4. Perceived Dominance					−.33**	−.30**	.07	.60**	−.22*	.29**
5. Perceived Warmth						.17	.29**	−.05	.09	−.10
6. Eye Area							.22*	−.32**	.09	−.32**
7. Nose Area								−.06	.05	−.15
8. Chin Area									−.05	.46**
9. Eyebrow Height										−.31**
10. FWHR										

Note. $^{**}p < .01$, $^{*}p < .05$, $^{a}p < .06$.

cating that it was the only uniquely significant mediator of the actual-perceived height association. Incidentally, chin area was strongly correlated with perceived facial maturity [$r(116) = .60$, $p < .001$], dominance [$r(116) = .60$, $p < .001$] and perceived height [$r(116) = .63$, $p < .001$], but not warmth [$r(116) = -.05$, $p = .58$]; for all correlations, see Table 2.

Thus, Study 3 suggests that observers' estimates of others' heights from only facial portraits are related to measurable differences in the sizes of their chins (relative to the rest of their faces), a physical correlate of facial maturity. These findings extend the results of Studies 2a and 2b, which demonstrated that observers' height estimates were related to inferences of social dominance and subjective interpretations of physical cues to maturity.

GENERAL DISCUSSION

These studies reveal two main points. First, observers are significantly more accurate than chance at discerning which targets are taller than others, based only on their faces.[4] In Studies 1a and 1b, we found that participants could judge the actual height of targets (American presidential candidates and Canadian undergraduates, respectively) from photos of their faces at levels significantly greater than chance. Second, people seemed to assume that social size and physical size are positively related, and this assumption mediates the association between their estimates and targets' actual heights. Study 2 demonstrated, in both a between- and a partly within-subjects design, that perceptions of dominance and facial maturity partially mediated the relationship between actual and perceived height, but neither warmth nor FWHR did. Perceivers therefore incorporated inferences of "social size" into their estimates of physical size.

Furthermore, observers seemed to draw on the most useful or appropriate information when inferring other properties of targets. Facial maturity and dominance were the most strongly related to physical height, and mediation analyses suggest that participants primarily based their height estimates on inferences of dominance/maturity, and vice versa. Finally, Study 3 confirmed that measured chin size, an important physical cue to facial maturity, similarly mediated the association between targets' actual and perceived height.

It is worth noting that simply increasing the length of people's faces (in photographs) can lead observers to perceive them as taller (Re & Perrett, 2012). In the present studies, however, pictures were standardized to a height of 300 pixels after the frame was cropped as tightly as possible to the vertical extremes of the head. Thus, our participants could not have based their height estimates on targets' absolute face length. Moreover, the lack of mediation by FWHR suggests that relative face length may not have been responsible for the effects either. Perhaps chin size, which is not included in calculations of FWHR, is an important component

4. Although we report significant correlations between perceived and actual height throughout these studies, it is also noteworthy that participants' estimates did not significantly differ from targets' actual heights (all ts < 1.67, all ps > .10) with the exception of Study 1a, which was conducted cross-culturally and with a free-response format: $t(35) = 6.40$, $p < .001$, Cohen's $d = 1.27$. The mean effect size for the difference between actual and perceived height for all of the other studies was quite small (Cohen's $d = -.01$).

of face length. Future work should explore these relationships to bridge these two programs of research.

Conceptually, these data provide support for the Gibsonian view of social perception (e.g., Zebrowitz & Collins, 1997). That is, individuals' perceptions of targets' social size, based on dominance and facial maturity, translated into greater estimates of physical size. Thus, cues from facial maturity that signal dominance may be subtle indicators of the relative physical threat that could be offered by an individual (see also Fessler et al., 2012). Perceivers may therefore be attuned to properties of faces in order to infer the physical properties of bodies, including physical height, that could be relevant to basic elements of survival (e.g., via competition for resources or reproductive success).

More contemporarily, such inferences of physical height from facial features could play a role in the political domain because most of the public's exposure to political candidates is through virtual media. Political candidates who are perceived as taller are more likely to be favored by voters (Sorokowski, 2010) and to win elections by larger margins (McCann, 2001). Given that stronger candidates are favored more heavily during times of perceived threat (McCann, 1997), candidates' facial cues to maturity, dominance, and physical height might influence voting behavior in interaction with the degree of perceived threat to a country during an electoral period. Thus, more dominant-, mature-, and relatedly tall-looking candidates could be likelier to win elections in such times (see Little, Burriss, Jones, & Roberts, 2007).

The high accuracy with which observers estimated others' relative heights suggests that assuming that physical height, facial maturity, and facial dominance are related (more so than height and warmth or FWHR) did not lead people very far astray. Indeed, dominance and facial maturity are, in fact, correlated with physical height, making them valid clues to others' physical size (see also Judge & Cable, 2004; Zebrowitz, Andreoletti, Collins, Lee, & Blumenthal, 1998). Both biological and behavioral factors might help to explain these effects. Previous work has shown that growth hormones (particularly testosterone) influence the shape and size of both bodies and faces (e.g., Verdonck et al., 1999). Because testosterone also motivates behavioral dominance (Tremblay, 1998), it is not surprising that perceptions of dominance might reliably communicate information about both actual and perceived height. The results of Study 3 are particularly consistent with this possibility: Chin size mediated the association between actual and perceived height independent of other facial features, and higher testosterone levels are associated with the development of broader chins (Mareckova et al., 2011). Thus, testosterone may present a common biological antecedent for the association between facial characteristics and facial cues of social dominance (Zebrowitz & Collins, 1997).

Furthermore, the high consensus and relative accuracy in perceivers' estimates of others' height from only their faces is consistent with the amply demonstrated ability of perceivers to glean information, such as physical strength (Sell et al., 2009) and power (Berry, 1990), from others' facial appearance (see Zebrowitz & Collins, 1997, for a review). The present results further suggest that physical height is similarly perceptible from the face. Also remarkable is that perceivers selectively incorporated the social-size-relevant information that is most predictive of physical size (as evidenced by the fact that warmth and FWHR did not mediate the relationship between actual and estimated height). Thus, excluding the latter two facial properties from physical height calculations seems relatively appropriate.

On the other hand, just over half of the variance in targets' heights was not captured by participants' estimates, suggesting that facial dominance and maturity do not provide foolproof clues to others' actual size. Indeed, one's facially implied social size can deviate from one's true social size. For example, lower-class babyfaced adolescent boys have demonstrated stereotype-disconfirming tendencies: They were more likely to perform well academically and, most counter to the babyface stereotype, were more likely to be delinquent (Zebrowitz, Andreoletti, et al., 1998). Zebrowitz, Collins, and Dutta (1998) further demonstrated that middle-class babyfaced adolescent boys were actually more assertive and hostile than more mature-looking young males. Accordingly, inferring a relationship between one's facially implied social size and actual social size, one will naturally bump up against exceptions and incur some error.

CONCLUSION

In sum, when conceptualizing another person's overall size, people tend to bundle information about one's likely "social size" and one's physical size as if they were on meaningfully comparable scales, which—to some degree—they are. This computational bundling of facially implied social and physical size leads one to both some accuracy and some error when judging physical size from facial appearance alone. Thus, these results provide an example of individuals' expectations of socially "smaller" people taking on a literal and embodied form: Babyfaced or facially submissive-looking individuals may be perceived as more childlike not only in temperament, but also in stature.

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