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The big man has a big mouth: Mouth width correlates with perceived leadership ability and actual leadership performance

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ABSTRACT

Previous studies have found that facial appearance can predict both the selection and performance of leaders. Little is known about the specific facial features responsible for this relationship, however. One possible feature is mouth width, which correlates with the propensity for physical combat in primates and could therefore be linked to one's perceived dominance and achievement of greater social rank. Here, we found that mouth width correlated with leader selection in experimentally standardized (Study 1A) and experimentally manipulated (Study 1B) faces. Applying these findings to real leaders, we observed that mouth width correlated with judgments of CEOs' leadership ability and with a measure of their actual leadership success (i.e., the profitability of their companies; Study 2). Individuals with wider mouths were also more likely to have won U.S. senate, but not gubernatorial, races (Study 3). Mouth width may therefore be a valid cue to leadership selection and success.

One of the most cherished rights in modern society is the freedom to choose our leaders. Even outside the limits of political governance, few contemporary leaders occupy their roles based on entitlement. Rather, everyone ranging from the Chief Executive Officer (CEO) of Microsoft to the shift manager at the local McDonald's restaurant is selected by the evaluation of others. Naturally, choosing a leader is a task of no small consequence. Billions of dollars are spent annually on political campaigns across the globe, and thousands of people squeezed into St. Peter's Square for over a day to await the outcome of the Catholic Church's 2013 papal conclave (Donadio, 2013; Pinto-Duschinsky, 2002). Given this premium placed on leadership selection, it is all the more surprising that a significant predictor of a leader's selection and success is his or her facial appearance (e.g., Zebrowitz & Montepare, 2005). The present work therefore attempted to better understand how specific facial features can contribute to the perception and success of leaders.

Recent studies have found that judgments made from the faces of political candidates predict real-world election outcomes at various levels of government throughout the world. In the U.S., perceptions of facial photographs predict Senate, House, and gubernatorial election outcomes (Ballew & Todorov, 2007; Todorov, Mandisodza, Goren, & Hall, 2005), as well as the popular vote totals in presidential elections and in Democrat and Republican party primaries (Armstrong, Green, Jones, & Wright, 2010). Other studies have demonstrated that naïve observers' judgments of political candidates' facial appearance predict electoral outcomes in several other nations across Asia (Rule et al., 2010), Australia (Martin, 1978), Europe (e.g., Little, Burriss, Jones, & Roberts, 2007), and South America (Lawson, Lenz, Baker, & Myers, 2010).

People therefore seem to agree about what a good leader looks like and evidence suggests that they go on to cast their votes for that person. Perhaps more surprising, however, is that these judgments may contain a degree of validity for predicting measures of *actual* leadership performance. Although leadership ability is fairly difficult to measure among politicians due to the multifaceted nature of their position, leaders' success can be more easily quantified in the corporate world in the form of company profits, which act as a "bottom-line" for businesses (e.g., Kaiser, Hogan, & Craig, 2008). Several studies have demonstrated that social judgments made from the faces of CEOs (the highest position and thus "leader" in a business corporation) correlate with their companies' profits. For example, studies have found that inferences of leadership drawn from the faces of CEOs of Fortune 1000 companies predict their organizations' profits (e.g., Rule & Ambady, 2008) and that judgments made from the faces of Managing Partners (a leadership role in law firms) also correlate with firms' financial success (Rule & Ambady, 2011a) — even when the photos are taken decades before they attain their positions (Rule & Ambady, 2011b). The facial features associated with leadership therefore appear to be present early in adult life, and thus are likely not the product of experiencing the pressures associated with obtaining and holding leadership roles.

Several studies have uncovered facial cues that correlate with measures of perceived or actual leadership performance. Features conveying tall physical height or masculinity predict leadership selection in

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laboratory experiments (Little et al., 2007; Re, DeBruine, Jones, & Perrett, 2013; Re, Hunter, et al., 2013; Spisak, Homan, Grabo, & Van Vugt, 2011) and judgments of social traits like competence and power predict leadership selection in the real world (Rule et al., 2010; Todorov et al., 2005). One study found that male CEOs' facial width-to-height ratio (fWHR; a measure of the horizontal distance between the left and right zygion divided by the vertical distance between the brow and upper lip) positively correlated with their companies' financial performance in certain contexts (Wong, Ormiston, & Haselhuhn, 2011). Despite these findings, however, no study has investigated how internal features of the face relate to leadership ability or has described the facial features that bridge perceivers' impressions of leaders' faces to measures of their actual success. Yet previous research has shown that minimal cues from facial features can be enough for perceivers to extract a wealth of complex social information; for example, perceivers can accurately judge sex and sexual orientation from as little as men's and women's eyes (Brown & Perrett, 1993; Rule, Ambady, Adams, & Macrae, 2008; Rule, Ambady, & Hallett, 2009). Thus, particular facial features may express sufficient information for perceivers to reliably predict measures of objective leadership performance as well.

Building on studies showing that judgments of physical dominance and power from individuals' faces predict leadership selection and performance (Little et al., 2007; Rule & Ambady, 2008), researchers have also demonstrated that experimentally enhancing facial dominance by increasing perceived height or masculinity boosts a person's perceived leadership ability (Little et al., 2007; Re, DeBruine, et al., 2013). These studies did not examine whether specific features support leadership judgments, however, focusing instead on changes to face shape overall. One possible internal feature that may relate to leadership perceptions is mouth width.

Evolutionary theory suggests that modern human leader selection is biased by cues to physical formidability, as leadership hierarchies have historically been determined by force (Murray & Schmitz, 2011; Riggio & Riggio, 2010; van Vugt, Hogan, & Kaiser, 2008). Canine dimorphism and tooth size correlate with a propensity for male physical combat in anthropoid primates (Harvey, Kavanagh, & Clutton-Brock, 1978; Plavcan & van Schaik, 1992), and human mouth width is proportional to the distance between the underlying canines (Stephan & Henneberg, 2003). Mouth width may therefore be an internal facial feature that affects the perception of leadership ability in humans. Indeed, narrower mouths are associated with babyfacedness and cuteness in infants (Hildebrandt & Fitzgerald, 1979) — judgments that oppose the perceptions of dominance typically found in the faces of individuals perceived as good leaders (Little et al., 2007). Wider mouths could therefore make faces look more dominant, which could thus increase perceived leadership ability.

Here, we examined whether mouth width relates to both perceptions of leadership and actual leadership performance. We first investigated how the widths of individuals' mouths relate to perceptions of their dominance and leadership ability using a set of standardized faces for which these facial metrics could be measured with high precision (Study 1A). We then manipulated mouth width experimentally and asked participants to choose individuals with either narrow or wide mouths as leaders in a forced-choice task (Study 1B). Next, we examined whether mouth width correlates with a measure of leader performance in the real world in a sample of Fortune 500 CEOs (Study 2). Finally, we tested whether mouth width predicts leadership selection in samples of U.S. senate and gubernatorial races (Study 3). Because the theory that mouth width associates with dominance is based on male primates (Harvey et al., 1978; Plavcan & van Schaik, 1992), and because the vast majority of leadership roles in both business and politics are still occupied by men, we restricted our investigation to male faces. These are the first studies to explore the specific physical features that underlie perceivers' accuracy in inferring leadership ability from faces.

1. Study 1A

To address the question of whether individuals' perceptions of leadership vary according to the width of targets' mouths, we asked participants to rate the expected leadership ability of a sample of standardized faces for which we could measure mouth width with high precision. Considering that past research found that fWHR related to actual leaders' performance in particular contexts (Wong et al., 2011), we also measured fWHR and examined how participants' judgments of leadership ability related to both of these facial metrics. We also tested whether mouth width correlated with perceptions of dominance, as theorized, and with other personality judgments related to leadership.

1.1. Method

We used 50 male faces collected from a publicly-available database (www.3d.sk). All images were of Caucasian men (M_{age} = 24.96 years, SD = 4.66, range = 18–40) photographed under standardized lighting at the same distance from a 0° angle with neutral expressions, hair pulled back, and without facial adornments (glasses, jewelry, etc.); inter-pupillary distance was also standardized. We measured the mouth width (defined as the horizontal distance between the two canthi) and fWHR (as defined in previous studies; e.g., Wong et al., 2011) of the 50 face images in pixels by delineating the faces with 189 facial markers in Psychomorph, a custom face processing software (Rowland & Perrett, 1995) (see Fig. 1).

Forty-eight Mechanical Turk (MTurk) Workers (29 women, 19 men; M_{age} = 37.94 years, SD = 14.33) rated all of the faces for how successful a leader they thought each person would be from 1 (*Not at all successful*) to 7 (*Very successful*). Power analysis indicated that this sample would be sufficient to achieve more than 83% power in a two-tailed one-sample *t*-test based on the average effect size in social and personality psychology (r = .21; Richard, Bond, & Stokes-Zoota, 2003) assuming a false-positive rate of 5%. Because attractiveness influences how people are perceived (e.g., Dion, Berscheid, & Walster, 1972), we asked separate MTurk Workers (N = 17; 11 women, 6 men; M_{age} = 35.82 years, SD = 12.77) to judge each target's facial attractiveness (1 = *Not at all attractive*, 7 = *Very attractive*) to use as a covariate in our analyses.

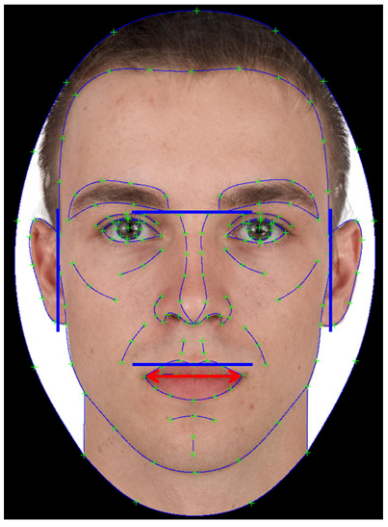

Fig. 1. An example of a standardized face showing 189 delineation points (green crosses) and an outline of face shape (thin blue lines). Mouth width constituted the horizontal distance between the two canthi (shown here with red arrow). Facial width-to-height ratio (fWHR) consisted of the horizontal width between the two zygia divided by the vertical distance between the brows and upper lip (shown here with blue bars).

To determine whether mouth width is associated with personality perceptions that may also affect leadership judgments, we asked a separate sample of 31 MTurk Workers (18 women, 13 men; M_{age} = 31.58 years, SD = 12.31) to rate the faces for how competent, dominant, and trustworthy they thought each person appeared from 1 (*Not at all* X) to 7 (*Extremely* X) in random order within three randomly-ordered blocks, as previous studies have found that judgments of these personality traits predict leadership perceptions (e.g., Little, Roberts, Jones, & DeBruine, 2012; Re, DeBruine, et al., 2013; Todorov et al., 2005). We based the sample size on those needed to achieve acceptable reliability for similar ratings in previous studies (Re, DeBruine, et al., 2013).

Because we were interested in how individual perceivers form judgments of leadership, we analyzed the data using sensitivity correlations such that the participants served as the unit of analysis (see Rule & Ambady, 2010). Thus, we tested the relationship between mouth width, fWHR, and leadership judgments while controlling for the targets' mean perceived attractiveness aggregated across perceivers (inter-rater reliability Cronbach's α = .89) and their actual ages (provided by the image database). We then converted the resulting sensitivity correlations to Fisher's z scores and tested statistical significance by conducting one-sample t-tests against the null hypothesis of no relationship (i.e., Fisher's $z = 0$). The mouth width measurements were not normally distributed; we therefore performed a 90% Winsorization of the four widest mouths to the width of the fifth-widest mouth, which produced a normal distribution: Shapiro–Wilk's W = .96, p = .12.[1]

1.2. Results

The participant-level analysis revealed that raters perceived individuals with wider mouths as significantly better leaders both when controlling for the variation in targets' ages and attractiveness ($M_{Fisher's\ z}$ = .10, SD = .14, $CI_{95\%}$ [.06, .13], $t(47)$ = 4.91, $p < .001$, d = 0.71) and when not ($M_{Fisher's\ z}$ = .11, SD = .12, $CI_{95\%}$ [.08, .15], $t(47)$ = 6.34, $p < .001$, d = 0.91). Mouth width also correlated with fWHR when analyzing the data with the target as the unit of analysis, however, $r(48)$ = .32, p = .02, essentially showing that individuals who had wider faces also had wider mouths. We therefore repeated the above participant-level analyses while including fWHR as an additional covariate. Mouth width still correlated with leadership ratings when controlling for fWHR (both with and without the other covariates: both $M_{Fisher's\ z}$ = .10, $CI_{95\%}$ [.06, .14], $ts \geq 5.45$, $ps < .001$, $ds \geq 0.67$). In contrast, fWHR only correlated with leadership ratings when not controlling for age and attractiveness ($M_{Fisher's\ z}$ = .06, SD = .12, $CI_{95\%}$ [.02, .09], $t(47)$ = 3.27, $p > .01$, d = 0.47) and did not correlate with leadership when controlling for mouth width, regardless of whether we included age and attractiveness ($|M_{Fisher's\ z}|$ = .02, $ts \leq 1.21$, $ps \geq .41$, $ds \leq 0.18$).

Participant-level analyses of the personality trait ratings revealed that mouth width correlated with perceptions of dominance both with ($M_{Fisher's\ z}$ = .06, SD = .15, $CI_{95\%}$ [.01, .12], $t(29)$ = 2.28, p = .03, d = 0.42), and without ($M_{Fisher's\ z}$ = .14, SD = .15, $CI_{95\%}$ [.08, .19], $t(29)$ = 5.11, $p < .001$, d = 0.93), controlling for age, attractiveness, and fWHR; but not with perceptions of competence or trustworthiness (all $|M_{Fisher's\ z}| \leq .05$, all CIs contained 0, all $ts \leq 1.44$, $ps \geq .16$, $ds \leq .26$).

1.3. Discussion

Although we did not have information about the actual leadership ability of the targets, the present results suggest a relationship between mouth width and *perceptions* of leadership ability. Facial width-to-height ratio did not relate to leadership perceptions when controlling for mouth width, even though people with higher fWHR tended to also have wider mouths. Despite being physically related, then, mouth width impacted perceptions of leadership ability whereas fWHR did not.

These data are intriguing in light of previous work showing that CEOs' fWHR positively predicted their companies' financial success (at least in some managerial contexts; Wong et al., 2011). Notably, that research did not examine *perceptions* of the CEOs' leadership. It is therefore interesting that here, among the faces of non-CEOs and without consideration of a particular management context, the relationship between fWHR and perceived leadership was absent when controlling for mouth width.

Mouth width also correlated with perceptions of dominance. This relationship is intuitive given the association between mouth width and success in physical combat among primates (Harvey et al., 1978; Plavcan & van Schaik, 1992). Neither competence nor trustworthiness ratings correlated with mouth width. Thus, mouth width related only to perceptions of dominance in this sample of faces.

2. Study 1B

In Study 1A, we found that mouth width correlated with leadership judgments in a natural sample of men's faces. To test this relationship in greater depth, here we experimentally manipulated the mouth width of a series of target faces and asked participants to choose which of the two versions of each face (with either the narrower or wider mouth) would make a better leader. Thus, we measured the relationship between mouth width and leadership perceptions while holding all other aspects of the face constant.

2.1. Method

We used the 50 male faces from Study 1A to create 20 face composites by digitally averaging randomly selected triads of faces using Psychomorph. Composites provide advantages over individual faces, as they reduce the frequency of unique facial characteristics or irregularities that can affect social perception.

In addition to the 20 face composites, we created an average face of the entire sample of 50 men. We then generated two versions of this averaged face—one with a narrow mouth and one with a wide mouth—by digitally moving the template points corresponding to the two canthi of the mouth either closer together or farther apart. The narrow- and wide-mouth versions of the average face served as "prototypes" to transform the shape of the 20 face composites to decrease and increase mouth width by 10% of its original size, producing narrow- and wide-mouth versions of all 20 composite faces. Because the transformation prototypes were identical except for mouth width, the narrow- and wide-mouth versions of each composite differed only in the distance between the mouth's two canthi (Fig. 2).

We presented these 40 face stimuli in a forced-choice task wherein the narrow- and wide-mouth versions of each face appeared side by side (counterbalanced for presentation on the left vs. right) for a total of 20 trials. Thirty MTurk Workers (21 women, 9 men; M_{age} = 27.9 years, SD = 8.28) then viewed the face pairs in random order and selected which version they would choose as a leader. A power analysis based on the mean size of the effect of mouth width on leadership judgments in Study 1A (average d = 0.77) indicated that this number of participants would be sufficient to achieve more than 90% power in a two-tailed one-sample t-test with a 5% false-positive rate.

2.2. Results and discussion

We coded each participant's narrow-mouth choices as 0 and wide-mouth choices as 1 and averaged these values to calculate the proportion of times that the wide-mouth version was chosen for each face. Results of a one-sample t-test with targets as the unit of analysis showed that the wide-mouth face was selected as the better leader

[1] All results remained significant without Winsorizing mouth width.

Fig. 2. Examples of narrow- and wide-mouth versions of a face composite. The versions are identical except for mouth width. The versions with wider mouths were chosen as leaders over those with narrower mouths in Study 1B.

significantly more often than would be expected by chance (.50): M = 55%, SD = 11%, $CI_{95\%}$ [.50, .60], $t(19) = 2.13$, $p = .047$, $d = 0.98$. Calculating the proportion of wide-mouth choices for each participant showed a similar (though not significant) effect: M = 55%, SD = 17%, $CI_{95\%}$ [.49, .61], $t(29) = 1.60$, $p = .12$, $d = 0.29$. Thus, faces with wider mouths were selected as leaders more often than their narrow-mouthed counterparts when controlling all other facial parameters. The results of Study 1B therefore provide experimental evidence for an association between mouth width and perceived leadership ability.

3. Study 2

In Study 1, we found evidence that people perceive men with wider mouths as better leaders among a set of standardized faces using both correlational (Study 1A) and experimental (Study 1B) designs. These results may not necessarily translate to real-world effects, however. To investigate whether mouth width predicts leadership among real leaders, we tested the relationship between mouth width and leadership performance in Study 2 by examining whether CEOs' mouth widths related to individuals' accurate perceptions of their performance as leaders.

Previous research found that people could accurately judge the success of CEOs' companies from photos of their faces (see Rule & Ambady, 2010). We likewise used faces of the CEOs of successful U.S. businesses to determine whether participants use mouth width to make these judgments. An organization's profit is often considered the standard of its success in the business world (Kaiser et al., 2008). Although CEOs are clearly not entirely responsible for their firms' financial performance, estimates suggest that the effect of executive leadership on company profit is as high as 45% (Day & Lord, 1988). Thus, CEO quality does forecast a company's financial performance to some extent, and Wong et al. (2011) showed that CEOs' facial appearance relates to their companies' financial performance specifically within their tenure. We therefore examined whether perceivers use mouth width to accurately predict CEOs' leadership success, as measured by their companies' profits.

3.1. Method

We obtained information about the CEOs of the top 25 companies in the U.S. for fiscal year 2005 from Fortune magazine's annual listing (http://money.cnn.com/magazines/fortune/fortune500/2006/full_list/). The list provided information about company performance, of which we were particularly interested in the companies' net profits, averaging these values with those for each company's performance in the prior and subsequent years to minimize anomalous values (see Rule & Ambady, 2008). We wanted to use a set of CEOs' images for which we knew that appearance predicted company profit, and so we borrowed facial portraits of CEOs collected from their companies' websites or annual reports used as part of the research reported by Rule and Ambady (2008). Whereas Rule and Ambady studied faces of the top 25 and bottom 25 CEOs of the 2006 Fortune 1000 listing, corporate financial performance follows a Pareto distribution, resulting in differences in the spread of profits within the extreme upper and lower groups of these top-ranked companies. Further research and theory has suggested that facial appearance likely has its greatest influence on leadership at the very top echelon of leadership, as it is here that all other variables between leaders are relatively well-matched (see Rule & Tskhay, 2014). Accordingly, most studies on CEO performance have used targets sampled from just the top ranks of listings (e.g., Rule & Ambady, 2010, 2011a,b; Rule & Tskhay, 2014; Wong et al., 2011). We therefore borrowed just the top 25 CEO faces from Rule and Ambady's study. All of the targets were Caucasian men (M_{age} = 55.44 years, SD = 5.60, Range = 47–75) and the images were tightly cropped around the head to remove extrafacial information and standardized in height; all held their leadership role for the entire period corresponding to the 2006 Fortune listing.

Fifty-one MTurk Workers (19 women, 32 men; M_{age} = 30.74 years, SD = 11.50) judged how successful they thought each person would be as a leader, as in Study 1A; three additional participants failed to pass an attention check question and were therefore excluded from analysis. Power analysis based on the accumulated mean effect size for the role of mouth width in leadership from Studies 1A–1B (average d = 0.53) indicated that this number of participants would be sufficient to achieve more than 96% power in a two-tailed one-sample t-test with a 5% false-positive rate. Separate participants rated the CEOs' facial attractiveness (n = 10, inter-rater reliabilty Cronbach's α = .83) or affect (n = 10, inter-rater reliabilty Cronbach's α = .93) for use as covariates along with the CEOs' ages calculated from their biographies (see Rule & Ambady, 2008).

To quantify the width of the CEOs' mouths, we asked three research assistants to measure the distance between the two canthi using ImageJ software (NIH open-source software). Three separate research assistants calculated fWHR, as in Study 1A. Both measurements showed acceptable levels of inter-rater reliability in their measurements (Cronbach's α's ≥ .76), allowing us to average them for each image.[2]

Although previous work demonstrated that CEO facial appearance predicts company profit even when controlling for past company performance (Wong et al., 2011), we also wanted to control for company performance before the current CEO took office. We therefore averaged each company's profits for the five year period preceding the CEO's tenure to use as a control variable. We could not clearly determine one company's profits for all five years, leaving 24 companies for this supplemental analysis.

3.2. Results

We first assessed how the CEOs' mouth widths related to their companies' profits. Results at the target level showed that CEOs with wider mouths led more profitable companies: $r(23) = .43$, $CI_{95\%}$ [.01, .85], p = .03. This was also true when we included the CEOs' ages, consensus (i.e., mean) judgments of attractiveness and affect, and measurements of fWHR as covariates in a partial correlation: $r(19) = .47$, $CI_{95\%}$ [.02, .92], $p = .03$. Thus, mouth width appears to be a valid cue to CEOs' leadership performance.

[2] Because we obtained the images of the CEOs in Study 2 and politicians in Study 3 from professional headshots, they were not standardized for head angle as in Study 1. Although we controlled for fWHR in both studies, all results reported in Studies 2 and 3 remained significant when we controlled for just face width (without measuring face height, which is more difficult when head angle is tilted) and when trigonometrically adjusting the measures of mouth width according to head angle.

We then examined whether CEOs' company profits related to participants' perceptions of leadership ability. Replicating past work (e.g., Rule & Ambady, 2010), sensitivity correlations (i.e., at the participant level) showed that participants' perceptions of the CEOs' leadership ability from their faces significantly correlated with their companies' profits, both when controlling for the CEOs' ages, mean perceived affect, mean perceived attractiveness, and fWHR ($M_{\text{Fisher's } z}$ = .16, SD = .19, CI_{95}% [.11, .22], $t(50)$ = 6.20, p < .001, d = 0.87) and when not controlling for these covariates ($M_{\text{Fisher's } z}$ = .14, SD = .15, $CI_{95\%}$ [.10, .18], $t(50)$ = 6.36, p < .001, d = 0.89).[3] Conversely, fWHR did not relate to leadership ratings when controlling for age, affect, and attractiveness (with or without controlling for mouth width: both $|M_{\text{Fisher's } z}| \le .03$, $ts \le 1.15$, $ps \ge .25$, $ds \le 0.16$), nor did it significantly correlate with company profit, $r(23)$ = .29, $CI_{95\%}$ [−.13, .71], p = .16. The relationship between leadership judgments and profit remained when controlling for company profit averaged over the five years before the current CEO's tenure, both with and without also controlling for age, affect, attractiveness, and fWHR (both $M_{\text{Fisher's } z} \ge .18$, $ts \ge 5.98$, $ps \le .001$, $ds \ge 0.84$). Participant-level sensitivity correlations relating raters' leadership judgments of each CEO to the width of his mouth also showed significant relationships when controlling for the companies' past performance regardless of whether we also controlled for age, affect, attractiveness, and fWHR (both $M_{\text{Fisher's } z} \ge .08$, $ts \ge 2.93$, $ps \le .01$, $ds \ge 0.41$).

3.3. Discussion

These results show that, on average, people reliably predicted CEOs' actual performance at leading their companies (based on how profitable they are) from their subjective perceptions of how successful a leader each CEO looked to be, as reported in previous work (e.g., Rule & Ambady, 2010; Rule & Tskhay, 2014). New here, the width of the CEOs' mouths correlated with the participants' perceptions of their leadership ability and also significantly predicted the profitability of their companies. These relationships between mouth width and both leadership ratings and company performance suggest that mouth width may be a valid cue to leadership performance.

Notably, we only used the faces of extremely successful real-world business CEOs in the current study. One can likely assume that CEOs of companies in the top ranks of the Fortune listings all possess the skills required to lead large corporations, as they are all elite leaders. Facial appearance may therefore distinguish the relative success of high-ranking CEOs more than it would for less exceptional leaders because the CEOs may be at ceiling levels on the other characteristics that more directly impact their performance (see Rule & Tskhay, 2014). Here, we wanted to examine whether mouth width correlated with company profit, and thus used a sample of CEOs for whom we already knew that appearance predicted company success. Thus, although these findings show a relationship between mouth width and company profit among a group of elite leaders, future research could examine how this relationship varies for more ordinary leaders and for CEOs of lower rank in the Fortune 500 listing.

Here, mouth width correlated with both perceived CEO leadership ability and actual company performance, implicating mouth width as a physical facial feature that links the perception of leadership ability to actual leadership performance. We only examined business leaders, however. To clarify whether mouth width predicts success in other leadership domains, we tested the relationship between mouth width and electoral success in two samples of U.S. politicians in Study 3.

4. Study 3

In Study 2, we established that mouth width predicts the profitability of top CEOs and significantly contributes to perceivers' ability to accurately infer CEOs' profitability from their faces. To test whether this relationship generalizes to other types of leaders, we investigated the role of mouth width in the selection of political leaders by measuring differences in mouth width between the winning and losing candidates in a host of U.S. senate and gubernatorial elections in Study 3.

4.1. Method

We obtained a database containing grayscale photos of the faces of candidates of U.S. senate and gubernatorial races used in previous studies (Ballew & Todorov, 2007; Todorov et al., 2005). The database contained headshot images of the winners and runners up from 122 senate races between 1995 and 2006 (Todorov et al., 2005) and 123 gubernatorial races between 2000 and 2006 (Ballew & Todorov, 2007). Of these, we only used the faces from races in which both candidates were Caucasian men, in which the images were of sufficiently high quality as to allow for mouth measurements, and in which both candidates faced forward towards the camera, resulting in pairs of candidates from 68 senate races (M_{age} = 54.71 years, SD = 10.70, Range = 25–79) and 68 gubernatorial races (M_{age} = 52.51 years, SD = 7.78, Range = 33–78). Because computing statistical power for multilevel models is complex, we assured that these sample sizes satisfied standard recommendations for achieving adequate levels of power in multilevel models instead of conducting formal power analyses (Maas & Hox, 2005). We cropped all of the images tightly around the face and standardized them for height.

Two separate sets of three research assistants measured the candidates' mouth widths and fWHR, using the same procedures as in Study 2 (inter-rater reliability Cronbach's α's ≥ .85). Separate MTurk Workers rated the gubernatorial candidates' affect (n = 15) and attractiveness (n = 15), and the senate candidates' affect (n = 16) and attractiveness (n = 16), which we averaged across the participants for each target (all inter-rater reliability Cronbach's α's ≥ .86) to create control variables among which we also included the candidate's age and incumbency status (coded 1 = incumbent, 0 = non-incumbent) culled from the stimulus database. We then regressed electoral success (coded 1 = winner, 0 = loser) onto mouth width with age, affect, attractiveness, fWHR, and candidate incumbency entered as covariates in separate binary logistic multilevel models for the senate and gubernatorial candidates, nesting the candidates within their respective races.

4.2. Results and discussion

Only mouth width (B = 0.10, SE = 0.04, $CI_{95\%}$ [0.01, 0.19], Wald $\chi^2(1)$ = 4.84, p = .03) and incumbency (B = 2.28, SE = 0.58, $CI_{95\%}$ [1.14, 3.42], Wald $\chi^2(1)$ = 15.31, p < .01) significantly predicted electoral success for the senators. No other covariate significantly predicted electoral outcomes (all $ps \ge .27$).

For the governors, only incumbency significantly predicted electoral success (B = 2.41, SE = 0.58, $CI_{95\%}$ [1.28, 3.54], Wald $\chi^2(1)$ = 17.55, p < .01). Mouth width did not significantly predict election outcomes (B = −0.003, SE = 0.06, $CI_{95\%}$ [−0.13, 0.12], Wald $\chi^2(1)$ = 0.003, p = .96), nor did any of the other covariates (all $ps \ge .27$).

Thus, mouth width predicted electoral success for senatorial but not gubernatorial candidates. Why this effect should differ between the two groups is unclear. One possible explanation could lay in the high level of

[3] We conducted this study contemporaneously with a series of studies investigating other facial features. There, we found that perceivers' leadership judgments also significantly correlated with company profits when we inverted the CEOs' faces or obscured them with a low-pass or high-pass filter, demonstrating that the relationship between perceived leadership and company profits is robust to changes in the orientation and visibility of the face's internal features. More critically, we additionally observed this relationship among perceivers judging just the lower half of the faces (but not the upper half of the faces), highlighting the importance of the mouth in these judgments. Along these lines, we also measured a number of other dimensions in physical proximity to mouth width, including mouth size as a proportion of the lower face area, distance from the lower lip to the chin, and height of the philtrum from the center of the upper lip to the nose; none of these other measures significantly predicted CEOs' company profits.

politics incorporated into these races. For instance, voters may be generally less aware of senate-level (representative) politics than gubernatorial-level (executive) politics. Along these lines, studies have suggested that appearance plays a larger role in leadership selection when candidates' views on particular issues and policies are less well-known (Banducci, Karp, Thrasher, & Rallings, 2008; Buckley, Collins, & Reidy, 2007) and it is noteworthy that the senate candidates had wider mouths than the gubernatorial candidates overall in the present work: $t(270) = 2.29, p = .02, d = 0.28$. Despite the differences between senate and gubernatorial candidates (both generally and among those sampled here), the explanation for the different relationships between their electoral success and mouth width remains somewhat mysterious, particularly as previous research has shown that judgments of competence from the faces of both groups relate to their electoral success (Ballew & Todorov, 2007; Todorov et al., 2005). Whereas the precise nature of this difference is tangential to the intentions of the present work, investigating its basis may remain an interesting direction for future research.

5. General discussion

Previous studies demonstrated that facial appearance influences real-world leadership selection (Todorov et al., 2005) and correlates with measures of actual leadership success (Rule & Ambady, 2008). Despite these findings, few studies have investigated the features subserving these relationships. In Studies 1A and 1B, we observed that individuals perceived people with wider mouths as better leaders, both in standardized and experimentally-manipulated stimuli. In Study 2, we showed that mouth width predicted leadership judgments and actual leader performance among business CEOs. Finally, in Study 3, we found partial support for a relationship between mouth width and electoral success, as candidates with wider mouths were more likely to have won U.S. senate but not gubernatorial elections. A congregate advantage of these studies was that mouth width correlated with perceptions of leadership ability both in the lab and in the real world. Furthermore, mouth width correlated with a putative measure of actual leadership *performance* among CEOs. These findings therefore provide converging evidence that mouth width relates to leadership judgments among experimental and naturalistic stimuli.

We approached the current research from an ecological and evolutionary perspective wherein a feature presumed to be linked with physical dominance (i.e., mouth width) would relate to leadership attainment such that humans would form a mental association between the two over the span of millennia. Indeed, leadership hierarchies are based on physical formidability in many species, and tooth and mouth size correlate with combat success in primates (Harvey et al., 1978; Plavcan & van Schaik, 1992). Mouth width in humans is predicted by the distance between the underlying canines (Stephan & Henneberg, 2003), and the results of Study 1A suggest that this feature does indeed predict perceptions of dominance, whereas previous studies have found that mouth width inversely relates to perceptions of babyfacedness (Hildebrandt & Fitzgerald, 1979). Mouth width may therefore cue perceived leadership ability based on a historical relationship between physical features and leadership attainment. The results of the current studies suggest that wider mouths make faces look more dominant and increase perceived leadership ability. Taken together, these studies are the first to uncover a physical facial feature related to both perceptual and actual measures of leadership quality, helping to illuminate how people make decisions about candidates for leadership based on their faces.

Despite the insights from ecological and evolutionary theory, however, the effects reported here could possibly also be partly due to social learning whereby people develop an association between wide mouths and leadership over the course of a lifetime. Although research suggests that facial appearance affects leadership choices in children as young as five years old (Antonakis & Dalgas, 2009), there may be a developmental aspect to these relationships such that people learn to associate facial traits with leadership over time (van Vugt & Ronay, 2014). Relatedly, it is possible that potential leaders could learn to purvey an image of leadership via physically extending their own mouth width. Indeed, just as research on the correlation between height and leadership choice has made its way to public attention (Page, 2004), individuals seeking leadership positions may put on a "leader's face" by widening their mouths. Although this hypothesis cannot be ruled out, there is evidence to the contrary. Previous research has demonstrated that the facial cues responsible for leadership judgments can predict their performance long before they attain their leadership roles (Rule & Ambady, 2011b), suggesting that facial cues to leadership may develop early and remain relatively stable throughout one's life. Given that these are the first data linking mouth width to leader choice and that the theory behind this relationship is relatively esoteric, it seems doubtful that people would consciously know to widen their mouths to look more "leader-like." It is possible, however, that personality traits associated with leadership – like dominance (van Vugt et al., 2008) – do lead individuals to widen their mouths (consciously or non-consciously) as a signal of aggression. This, in turn, could permit people with wider-looking mouths to attain leadership roles more often than their narrower-mouthed counterparts. Further research into leaders' lay beliefs may be needed to address this possibility.

We found no statistically significant relationship between fWHR and leadership perceptions in the present research. One previous study reported a relationship between fWHR and financial performance among CEOs (Wong et al., 2011). Although we also found a correlation between CEO fWHR and company profit similar in magnitude to that reported in Wong et al. (2011) in Study 2, it was statistically non-significant in our smaller sample. These results and those reported by Wong et al. only linked fWHR to actual financial performance, however, not to perceptions of leadership ability. Furthermore, Wong et al. only found a relationship between fWHR and company profit for CEOs of companies operating in a context with low management complexity—in which the CEO has more control over the company's decisions. In companies with high levels of management complexity, there was no relationship between the CEO's fWHR and financial success. The results of these studies therefore suggest that high fWHR may not increase perceptions of leadership ability. It is alternatively possible that, rather than correlate with leadership, fWHR may instead correlate with measures of aggressive behavior (as documented in past work; Carré, McCormick, & Mondloch, 2009; Stirrat & Perrett, 2010) that itself could enhance success in particular contexts within the business world (such as the low management complexity conditions examined by Wong et al.) independent of whether it is a desirable leadership trait. Thus, fWHR may be a valid cue to leadership in some situations, but not a utilized cue (see Brunswik, 1956). Further research may be beneficial for elucidating this relationship.

Despite the consistency of these effects, it would be imprudent to suggest that either mouth width (or facial appearance, in general) is the most important factor in leader selection and performance. Business and management research suggests that CEOs account for only 20–45% of their firm's financial performance (Day & Lord, 1988; Thomas, 1988); moreover, 50% of eligible voters in the U.S. vote entirely along party lines (at least in Presidential elections; Kaufmann, Petrocik, & Shaw, 2008). Thus, the effect of a leader's facial appearance on firm performance or electoral success is not all-encompassing. Indeed, previous studies have shown that CEOs' facial appearance predicts roughly 9–14% of the variance in their firm's financial performance (Harms, Han, & Chen, 2012; Rule & Ambady, 2008, 2011a). Here, mouth width accounted for a small, yet significant, portion of the variance in leadership judgments among the experimental stimuli, CEOs, and senators; thus, the effects should not be overstated. Rather, mouth width likely interacts with other aspects of facial appearance (like masculinity or perceived stature; Little et al., 2007; Re et al., 2012; Re, Hunter, et al., 2013) in forming perceptions of leadership ability, which then have

some influence on leader selection and performance. Nevertheless, this research does provide the first insight to a discrete facial feature affecting leadership judgments in laboratory studies; and one that is also associated with leader selection and performance in the real world.

Moreover, although we have discussed perceivers' accuracy in judging leaders' success, caution is warranted in interpreting these results. First, consistent with past work (e.g., Kaiser et al., 2008) we have assumed that company profits serve as a valid measure of the success of the CEOs leading those companies in Study 2. Second, we cannot be certain about the causal direction of these effects. People who look like better leaders may lead their companies to greater profits. Alternatively, more profitable companies may hire CEOs who look like better leaders. We continued to observe a significant relationship between facial appearance and company profits when we controlled for the companies' financial performance prior to the CEOs' tenures in Study 2, however, suggesting that the relationship between CEO appearance and company success was specific to the target CEO. Finally, although many studies have documented the accuracy of judgments from facial appearance (see Re & Rule, 2015, for review), accurate interpersonal perception is domain-specific and there are many areas in which individuals do not judge each other accurately (e.g., Rule, Krendl, Ivcevic, & Ambady, 2013). Thus, readers should not overgeneralize these results beyond the present context.

Although these studies have the advantage of spanning both experimental and naturalistic stimuli, they leave open the possibility for several distinct areas of further research. First, we only examined the faces of men. We hypothesized that mouth width would be important for leadership judgments based on canine dimorphism and tooth size (and thus perceived dominance), which correlate with male physical combat in primates (Harvey et al., 1978; Plavcan & van Schaik, 1992). Because the vast majority of leadership roles in both business and politics are still occupied by men (and women's leadership positions are, on average, more precarious and volatile; Bruckmüller, Ryan, Rink, & Haslam, 2014), it was theoretically and practically sensible to restrict our analysis to male faces in these initial studies. Future research could examine whether these findings extend to female faces as well, however. Previous work found that the facial traits associated with leadership performance are similar across sexes (Rule & Ambady, 2009), even though management theory suggests that women may be more effective when enacting less aggressive and more cohesive interpersonal leadership styles (Eagly & Johnson, 1990; Sczesny, Bosak, Neff, & Schyns, 2004). Thus, if mouth width affects leadership perceptions due to its association with physical dominance cues, the effects reported here may not extend, or may even reverse, for female faces.

Similarly, all of the targets in the current studies were Caucasian. There is some reason to question whether these effects would generalize to other ethnicities. For example, previous research has suggested a "teddy-bear effect" for Black men such that babyfaced features reduce perceptions of threat and therefore facilitate leadership (Livingston & Pearce, 2009). Babyfacedness decreases perceived leadership ability outside of this context (Zebrowitz & Montepare, 2005), and small, narrow mouths portend judgments of babyfacedness (Hildebrandt & Fitzgerald, 1979; Zebrowitz-McArthur & Apatow, 1984). Thus, it is unclear how mouth width would affect leadership judgments in the faces of Black individuals. Although Caucasian men still tend to hold most leadership roles in present-day Western society (Bass & Bass, 2009), future research could examine whether the reported effects generalize to other racial and ethnic groups.

6. Conclusion

Facial appearance influences real world leadership selection and correlates with measures of actual leadership performance. The current data demonstrate that a single internal facial feature, mouth width, predicts leadership perception and performance in both experimental stimuli and photos of real-world leaders in business and politics, providing crucial replication across correlational and experimental designs that is not often found in leadership research. These findings are the first to uncover a physical facial feature related to both perceived and actual measures of leadership quality.

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