

Presidential, But Not Prime Minister, Candidates With Lower Pitched Voices Stand a Better Chance of Winning the Election in Conservative Countries

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Abstract

Previous studies have shown that voters rely on sexually dimorphic traits that signal masculinity and dominance when they choose political leaders. For example, voters exert strong preferences for candidates with lower pitched voices because these candidates are perceived as stronger and more competent. Moreover, experimental studies demonstrate that conservative voters, more than liberals, prefer political candidates with traits that signal dominance, probably because conservatives are more likely to perceive the world as a threatening place and to be more attentive to dangerous and threatening contexts. In light of these findings, this study investigates whether country-level ideology influences the relationship between candidate voice pitch and electoral outcomes of real elections. Specifically, we collected voice pitch data for presidential and prime minister candidates, aggregate national ideology for the countries in which the candidates were nominated, and measures of electoral outcomes for 69 elections held across the world. In line with previous studies, we found that candidates with lower pitched voices received more votes and had greater likelihood of winning the elections. Furthermore, regression analysis revealed an interaction between candidate voice pitch, national ideology, and election type (presidential or parliamentary). That is, having a lower pitched voice was a particularly valuable asset for presidential candidates in conservative and right-leaning countries (in comparison to presidential candidates in liberal and left-leaning countries and parliamentary elections). We discuss the practical implications of these findings, and how they relate to existing research on candidates' voices, voting preferences, and democratic elections in general.

Keywords

evolutionary political psychology, voice pitch, voting, ideology, presidential elections, parliamentary elections

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Introduction

Group living constitutes a central characteristic for human ancestors and is believed to have improved individual fitness significantly (Price & Van Vugt, 2015). Yet new problems related to coordination and cooperation among fellow group members also arose as a consequence of living in a group. One central solution to such coordination problems, it is argued, was the emergence of leadership and followership. Specifically, following a specific individual (the leader) solves a range of collective action problems, help group members achieve common goals and distribute resources among themselves (Fowler & Schreiber, 2008; Petersen, 2015; Van Vugt, 2006; Van Vugt, Hogan, & Kaiser, 2008a). Hence, leadership was key in successfully organizing, guiding, and directing multiple group

activities. In the human ancestral environment, important activities that required effective coordination were foraging (Marlowe, 2005), group hunt (K. Hill, 1982), resolving

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intragroup conflicts (Boehm, 2001), or conflicts and warfare with other groups (Van Vugt, Cremer, & Janssen, 2007). Due to the nature of these group problems, individuals with greater physical capabilities were more often successful in those activities and it is argued, that this, among other things, has led to the overrepresentation of male and more formidable group leaders (e.g., Blaker et al., 2013; Stulp, Buunk, Verhulst, & Pollet, 2013; Van Vugt et al., 2008a). In other words, natural selection might have selected for certain features related to physical formidability to be associated with competent leadership.

Different forms of hierarchical structures and leader–follower relations from families, tribes, chiefdoms, up to national-level political systems (Boehm, 2001; Van Vugt & Ahuja, 2010) have existed over human evolutionary history. Yet, for the vast majority of its history, the genus *Homo* has lived in small hunter–gatherer groups (25–200 individuals) with flat hierarchy (Boyd & Silk, 2003) and, consequently, small-scale “politics” has dominated human evolutionary history leading to a range of psychological adaptations for successful navigation of such environments (Petersen, 2015). Hence, it is suggested that one set of psychological adaptations evolved to regulate followership decisions (von Rueden & Van Vugt, 2015; Van Vugt & Ahuja, 2010; Van Vugt et al., 2008a). Because following certain—sometimes more formidable and dominant—individuals was potentially ecologically rational for human ancestors, it has been argued that modern voters might also still favor the same traits in contemporary leaders (Laustsen & Petersen, 2015; Little, Burris, Jones, & Roberts, 2007; Tigue, Borak, O’Connor, Schandl, & Feinberg, 2012; Van Vugt & Ahuja, 2010). From this perspective, contemporary voters might be sensitive to sexually dimorphic traits that signal masculinity, dominance, and physical strength in potential leaders running in modern mass elections. One well-known physical characteristic linked to perceptions of formidability and physical dominance is the sexually dimorphic trait of the human voice (Sell et al., 2010).

Biological and Evolutionary Aspects of the Human Voice

The human voice is a valuable source of information about various characteristics of the speaker. It allows us to predict a speaker’s sex, body shape, and size (Pisanski, Jones, Fink et al., 2016), age (Feinberg, Jones, Little, Burt, & Perrett, 2005), emotional state (Banse & Scherer, 1996), dominance and masculinity (Feinberg et al., 2005; Puts, Gaulin, & Verdolini, 2006; Puts, Hodges, Cardenas, & Gaulin, 2007; Wolff & Puts, 2010), attractiveness (Collins, 2000; Feinberg et al., 2006; Hodges-Simeon, Gaulin, & Puts, 2010), strength and fighting ability (Sell et al., 2010), reproductive success (Apicella, Feinberg, & Marlowe, 2007; see also Smith, Olkhov, Puts, & Apicella, 2017), foraging reputation in small scale society (Smith et al., 2017), and even genetic quality (Hill et al., 2017). Most researchers focus on fundamental frequency (F_0), which is perceived as pitch, to determine which acoustic characteristic conveys biological and psychological information about the speaker. Voice pitch depends on the rate of vocal fold

vibrations, and the rate is directly related to the size, thickness, and length of the vocal folds (Titze & Martin, 1998). Bigger, thicker, and longer vocal cords, which are found in men, vibrate at lower frequencies. Therefore, men have deeper voices than women do. It is assumed that the physiological mechanisms that cause sex differences in pitch include testosterone effects on vocal cords via androgen receptors identified in human vocal fold tissue (Newman, Butler, Hammond, & Gray, 2000). The main assumption is that higher testosterone levels cause growth of vocal cords and consequently lower voice pitch. Indeed, previous studies have found a negative relationship between circulating levels of testosterone and voice pitch among men (Dabbs & Mallinger, 1999; Evans, Neave, Wakelin, & Hamilton, 2008; Puts, Apicella, & Cardenas, 2012).

Regarding the evolutionary origins of lower pitched voices in males, the main assumption is that they were shaped by sexual selection, that is, by both mate choice and intrasexual competition (see Apicella et al., 2007; Collins, 2000; Feinberg et al., 2005, 2006; Puts, 2005; Re, O’Connor, Bennett, & Feinberg, 2012). However, there is evidence that male–male competition plays a bigger role. For example, men with lower pitched voices are perceived as more dominant (Feinberg et al., 2005; Puts et al., 2006), better hunters (Smith et al., 2017), older, and larger (Collins, 2000), which could intimidate potential rivals. Furthermore, Puts, Gaulin, and Verdolini (2006) found that men modulate their voice depending on how they perceive their competitor in terms of dominance. If they perceive the competitor as less dominant, they tend to lower their voices when addressing him. If they perceive the competitor as more dominant, they raised their pitch (Puts et al., 2006; see also Leongómez, Mileva, Little, & Roberts, 2017).

Candidates’ Voice Characteristics and Voting

Prior research on the evolutionary foundation of leader–follower relations theorizes that human followership psychology evolved to link masculine characteristics, like a deep voice, with high-quality leadership given that important leadership tasks—for example, coordination during hunt or warfare—often entailed significant degrees of physical capabilities (Laustsen & Petersen, 2017; Van Vugt, Johnson, Kaiser, & O’Gorman, 2008b). Recent experimental studies find that even contemporary humans rely on similar masculine cues to leadership ability expressing enhanced preferences and vote intentions for candidates with lower pitched voices (Anderson & Klofstad, 2012; Klofstad, Anderson, & Peters, 2012; Tigue et al., 2012). Moreover, a follow-up study finds this result to be driven by perceptions of low-pitched voices as stronger and more competent (Klofstad, Anderson, & Nowicki, 2015).

Furthermore, instead of using manipulated voices in an experiment, a few studies investigate the relationship between voices of real candidates and their actual electoral success in real-world elections. For example, candidates’ lower pitched voices were significant predictors of voting patterns in U.S. presidential elections from 1960 to 2000 (Gregory & Gallagher, 2002), and 2012 U.S. House of Representatives election

winners had lower pitched voices than the electoral losers (Klofstad, 2016). Similarly, Pavela Banai, Banai, and Bovan (2017) analyzed voices of opposing candidates in 51 presidential elections held across the world and also found that election winners had lower pitched voices compared to the losers. Finally, a recent study uses a stricter methodology for assessment of political candidates' voices, that is, analyzes voice recordings obtained in the same studio during political debates and finds that candidates with deeper voices stand a better chance of winning elections (Banai, Pavela Banai, & Bovan, 2017).

Political Ideology, Voice, and Voting

Research clearly demonstrates the link between candidate voice pitch and voters' electoral preferences. However, there are reasons to assume that the relationship between voice pitch and election outcome might vary in response to the context in which the voting occurs. Specifically, in predicting voters' decisions based on another physical cue to candidates' physical formidability and dominance, namely, their faces, it was shown that subjects preferred more masculine-looking leaders when primed with warfare compared to peace scenarios (e.g., Little et al., 2007; Spisak, Dekker, Krüger, & van Vugt, 2012; for overview, see Laustsen & Petersen, 2017). In parallel to situational aspects, individual voter characteristics, such as political ideology, also drive voters' preferences for formidable, strong, and dominant candidates. Using standard trait perceptions in the American National Election Studies as well as cross-national experimental data from the United States and Denmark, Laustsen (2017) finds that conservative voters weigh "strong leadership" and dominance in political candidates more than liberal voters (who value warmth-related traits more). Likewise, conservative subjects are found to hold stronger preferences—compared to liberals—for masculine and dominant facial and vocal features in political candidates (Laustsen & Petersen, 2015, 2016, 2017; Laustsen, Petersen, & Klofstad, 2015). Most importantly (given our focus on vocal features in this article), Laustsen, Petersen, and Klofstad (2015) across three separate studies found that conservatives, more than liberals, preferred political candidates with lower pitched voices, that is, seemingly more formidable and dominant leaders. As a whole, these findings suggest that regardless of whether impressions of political candidates are formed on the basis of physiological features (i.e., faces or voices) or on general trait impressions, conservatives hold a stronger preference for dominance-related traits in political than liberals.

The Present Study

In light of individual-level findings from experimental studies reviewed above, we examine whether similar patterns replicate outside the laboratory when we combine vocal data for real-world electoral contenders with macro-level electoral data. Specifically, we test two separate predictions. First, we test if—in line with prior studies (Banai, et al., 2017; Klofstad, 2016; Pavela Banai, Banai, & Bovan, 2017—candidates with

lower pitched voices generally stand a better chance of winning democratic elections. Second, we test whether—in accordance with micro-level studies (Laustsen & Petersen, 2015)—ideology at the country level moderates the relationship between candidate voice pitch and electoral outcome across multiple and different elections and countries. Looking at the aggregate level, this means that conservative communities should be more inclined than liberal communities to choose political leaders with lower pitched voices.

Method

To test these predictions, we collected voice pitch data for a range of presidential and prime minister candidates, aggregate national ideology for the countries in which the candidates were nominated, and measures of electoral outcome for the candidates. Below, we present how the data for the different independent and dependent variables are collected and how it is coded in the subsequent analyses.

National-Level Ideology

Data on national-level ideology were collected from the World Values Survey (WVS), an international survey based on 5-year research waves that examines different values and beliefs in large national samples throughout the world. For the purpose of this study, we rely on subjects' self-reported political ideology from "left" to "right" from the fifth (years 2005-2009) and the sixth (years 2010-2014) wave of the WVS. Specifically, we aggregate subjects' individual answers within each country to get each country's macro-level ideology as represented by subjects' mean value ranging from a theoretical minimum of 1 to a maximum of 10, with higher scores representing more conservative countries. Fifty-three countries were included in the fifth WVS wave, and fifty-five in the sixth.

For each country, we searched for elections that were held as close as possible to the WVS wave for which we collected country-level ideology ensuring maximum accuracy between country-level ideology and election data. Furthermore, we restricted our search to elections for positions with executive power. Prior research has focused exclusively on presidential elections (Banai et al., 2017; Pavela Banai et al., 2017). However, some countries do not have presidents (e.g., Spain is a parliamentary monarchy). Therefore, in the present study, we sampled both presidential and parliamentary elections with executive power in order to test the scope conditions and possible generalizability of the result obtained in prior research. Due to the institutional differences across countries in relation to division of power, our final sample includes three types of countries: countries in which prime ministers hold the executive power, countries in which presidents constitute the executive power, and countries in which the executive power is divided between prime minister and president. In the latter case, we included candidates from both the presidential and the parliamentary elections in our sample. In total, we obtained national-level ideology data across 69 different

elections (27 presidential and 42 parliamentary elections; 33 from the fifth, and 36 from the sixth WVS wave) with observed values ranging from a minimum of 4.40 to a maximum of 7.44 on the original 1-10 scale ($M = 5.66$, $SD = 0.57$). In total, the collected data amount to 1,445,347,411 voters casting their votes across the 69 elections. A full list of political candidates with corresponding YouTube URLs can be found in the Online Supplementary Material S.9.

Candidates' Voice Pitch

After the sample was defined, we searched YouTube for videos of candidates competing for positions with executive power. In the case of presidential elections, we searched for videos of the two candidates who won the largest vote shares and for parliamentary elections, we compiled videos for the leaders of the two parties that won the largest vote shares (presumably leading competing party coalitions). Because of the anatomical differences between male and female vocal cords (cf. the Introduction section) and because there were few women among the candidates with the largest vote shares, we restricted our sample to male political candidates. This led to the exclusion of two elections for which both main contenders were female and 11 elections for which a female and a male constituted the main candidates. Finally, to ensure a decent recording quality, we only sampled recordings without background sounds, music, or noise. We downloaded the selected recordings using a free version of YTD Video downloader, edited them, so that each recording contained only the speech and voice of one single candidate (e.g., journalists conducting the interviews were cut out in this process). Finally, we saved the recordings as MP3 files at 44,100 sample rate and 128 kbps bit rate using the Vondershare Filmora video editing software version: 8.4.0 (<https://filmora.wondershare.com/>).

To ensure the validity of the applied voice pitch measure, we randomly extracted three separate 5-s long voice samples from each of the candidate recordings from YouTube.¹ Next, these three clips per candidate were analyzed acoustically following the procedures described in Pavela Banai et al. (2017). Specifically, each clip was aurally and visually inspected to secure that the 5-s voice samples were uninterrupted and to double-check for background sounds. Once the voice clips were prepared, F_0 was extracted from each individual voice clip using Praat Version 6.0.28. We followed the recommendations from the program authors (Boersma & Weenick, 2016) and employed a pitch floor of 75 Hz and a pitch ceiling of 300 Hz to analyze adult male voices.

Next, we compared the three voice pitch measures obtained for each candidate to validate the measures and to investigate the within candidate variability in extracted pitch across the three samples. Repeated measures analysis of variance with three pitch measures as a within-subject factor revealed that there is no significant difference between the three measures, $F(2, 136) = 0.495$, $p = .610$. Likewise, the three separate pitch measures were highly correlated (from .78 to .86, $p < .001$). In addition, to further validate the voice recordings, we examined

whether candidates were speaking with the same loudness across the three extracted voice clips by comparing the within candidate voice intensity. As for the extracted pitch measures, repeated measures analysis of variance showed no difference in intensity between the three samples, $F(2, 136) = 0.510$, $p = .602$. On this basis, we averaged across the three separate measures of candidate voice pitch and intensity, respectively.

Next, in order to estimate meaningful and comprehensible effects of voice pitch on electoral outcome measures in our analyses, we standardized these average voice pitch and voice intensity variables to means of 0 and a standard deviation of 1. Consequently, throughout the Results section, estimated relationships can be interpreted as changes in the outcome variables caused by a change in voice pitch of 1 standard deviation.

Election-Specific Information

For the analyses, we also gathered different election- and candidate-level variables of relevance including names of candidates, incumbency, and type of election (presidential [coded 0] and parliamentary [1]). These data were all obtained from www.electionguide.org

Dependent Measures

In the analyses, we employ two dependent measures. First, we employ a measure of electoral outcome—a dichotomous measure of whether a candidate won (coded 1) or lost (coded 0) the election. Second, we employ a candidate's percentage of received votes as a continuous alternative dependent measure ($M = 37.58$, $SD = 16.17$). Data for both variables were obtained from www.electionguide.org

Results

In our analyses, the individual candidates constituted the units of analysis. Because we had two candidates for each election—the electoral winner as well as the loser—we employed standard errors clustered at the election level in our statistical models. A comparison of election winners and losers showed a slight difference in voice intensity with losers scoring higher in intensity than winners (using the standardized mean intensity variable: $t = 2.101$, $p = .038$). Consequently, we controlled for candidate voice intensity throughout our analyses. When we tested our predictions on electoral outcome (if the candidate won [1] or lost [0] the election), we estimated the effect of voice pitch using logistic regression, while we used ordinary least squares regression to predict percentage of received votes from candidate voice pitch. Below, we report the key test statistics in the main text and full regression models in tables. Finally, to clarify interactive relationships between national-level ideology and candidate voice pitch on the outcome measures, we illustrate predicted relationships between voice pitch and outcome measures for relevant levels of national ideology. All tests are reported for two-sided tests of significance.²

Table 1. Full Regression Models for Main Effects of Candidate Voice Pitch on Electoral Outcome (Model 1) and Percentage of Received Votes (Model 2).

Predictors	Model 1 Electoral Outcome (Logit)	Model 2 Percentage of Votes (OLS)	Model 3 Electoral Outcome (Logit)	Model 4 Percentage of Votes (OLS)
Voice pitch	−0.627*** (0.188)	−2.866* (1.170)	−0.737* (0.339)	−3.040 (3.348)
Election type: Parliamentary election	—	—	0.054 (0.150)	−13.774*** (1.981)
Voice Pitch × Election Type: Voice Pitch × Parliament Election	—	—	0.148 (0.404)	1.155 (3.506)
Voice intensity	−0.326* (0.159)	−1.825 (1.387)	−0.320* (0.162)	−2.535 [†] (1.339)
Constant	−0.014 (0.069)	37.577*** (1.240)	−0.052 (0.111)	45.909*** (1.347)
R ² /pseudo-R ²	0.079	0.049	0.079	0.223
N	138	138	138	138

Note. Models 3 and 4 report potential interactions between voice pitch and type of election. Unstandardized regression coefficients with standard errors clustered at the election level in parentheses. Reference category for election type is “presidential elections.” OLS = ordinary least squares.

[†] $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Are Candidates With Lower Pitched Voices More Successful in Democratic Elections?

We started our analyses by testing if candidates with lower pitched voices win more democratic elections. Across all 69 elections, we found a significant relationship between candidate voice pitch and electoral victory ($b = -0.627, p = .001$). In substantial terms, this corresponds to a predicted probability of an electoral victory of 34.5% for a candidate with a voice pitch 1 standard deviation above (a high-pitched voice) the sample mean (holding intensity its mean). In contrast, a candidate with a voice pitch 1 standard deviation below the sample mean (a low-pitched voice, again with mean-level intensity) had a 64.9% predicted probability of winning the election (see Model 1 in Table 1 for full model).

Next, we tested whether this pattern replicated when we predicted the percentage of votes received by the candidates (rather than whether they won or not). In support of the previous finding, we found a negative and significant relationship between voice pitch and the percentage of received votes ($b = -2.866, p = .017$). Substantially, this corresponded to a difference of 5.73% points in received votes between candidates with voice pitches 1 standard deviation above and below the sample mean, respectively (and both having mean-level intensity; Model 2 in Table 1 reports full regression model). That is, in parallel to the results presented for electoral outcome, we found a relationship between candidates’ voice pitches and their electoral success such that candidates with lower pitched voices generally received more votes. Importantly, this result replicated key findings in previous studies (Banai et al., 2017; Gregory & Gallagher, 2002; Klofstad, 2016; Klofstad et al., 2012; Pavela Banai et al., 2017; Tigue et al., 2012).

Finally, to investigate the robustness of these findings, we conducted different alternative models. First, we tested whether the relationship between voice pitch and the dependent measures differed for presidential and parliamentary elections. However, the interaction between voice pitch and type of election (presidential vs. parliamentary) was insignificant when

predicting electoral outcome ($b = 0.148, p = .714$) as well as percentage received votes ($b = 1.155, p = .743$). Table 1 (Models 3 and 4) reports the full models for these analyses.

That is, the general preference for lower pitched candidate voices holds for both presidential and parliamentary elections. Second, we reestimated the relationship between candidate voice pitch and the two outcome measures using each of the three separate candidate voice pitch measures, which yielded substantially similar patterns as reported above (see Online Supplementary Material S.1 for full models). Moreover, voice pitch and type of election (presidential vs. parliamentary) do not significantly interact for any of the three separate voice pitch variables (see Online Supplementary Material S.2 for full models). Finally, one might consider whether candidate incumbency constitutes an important control variable. On the one hand, incumbency holds a prominent position in electoral research (Ashworth & Bueno de Mesquita, 2008). On the other hand, counter arguments to controlling for incumbency also exists. That is, if candidate voice pitch relates to electoral outcome then incumbent candidates would already have benefited from having a deeper voice in the (prior) election in which they were initially victorious. Based on this rationale, controlling for incumbency comes with a flavor of postestimation bias. However, controlling for incumbency, we still found negative and significant relationships between candidate voice pitch and the outcome variables (see Online Supplementary Material S.3 for full models).

Does the Electoral Bonus of a Low-Pitched Voice Increase With National-Level Conservatism?

We first tested this prediction across all 69 sampled elections. Specifically, we regressed each outcome variable (electoral outcome and percentage of votes) on candidate voice pitch, national-level ideology, and the interaction between the two variables. Contrary to our prediction, the interaction between voice pitch and national ideology remained insignificant in terms of predicting both electoral outcome ($b = -0.035$,

Table 2. Full Regression Models for Two-Way Interactions Between Candidate Voice Pitch and National Ideology on Electoral Outcome (Model 1) and Percentage of Votes (Model 2).

Predictors	Model 1 Electoral Outcome (Logit)	Model 2 Percentage of Votes (OLS)	Model 3 Electoral Outcome (Logit)	Model 4 Percentage of Votes (OLS)
Voice pitch	-0.434 (1.527)	-2.507 (11.414)	6.361 (3.870)	40.906 [†] (23.644)
Ideology	-0.022 (0.123)	-1.868 (2.047)	-0.060 (0.219)	-4.775 [†] (2.408)
Voice Pitch × Ideology	-0.035 (0.276)	-0.072 (2.151)	-1.236 [†] (0.671)	-7.375 [†] (4.127)
Election type: Parliamentary election	—	—	-0.214 (1.785)	-27.101 (18.438)
Voice Pitch × Election Type: Voice Pitch × Parliament Election	—	—	-8.714 [†] (4.492)	-50.762 [†] (26.940)
Ideology × Election Type: Ideology × Parliament Election	—	—	0.043 (0.316)	2.168 (3.316)
Voice Pitch × Ideology × Election Type: Voice × Ideology × Parliament Election	—	—	1.553* (0.781)	8.798 [†] (4.816)
Voice intensity	-0.324* (0.158)	-1.786 (1.393)	-0.332 (0.163)	-2.599 [†] (1.365)
Constant	0.109 (0.691)	48.152*** (11.451)	0.326 (1.200)	73.921*** (13.478)
R ² /pseudo-R ²	0.079	0.054	0.096	0.256
N	138	138	138	138

Note. Models 3 and 4 further report results for three-way interactions between voice pitch, national ideology, and type of election on electoral outcome (Model 3) and percentage of votes (Model 4). Unstandardized regression coefficients with standard errors clustered at the election level in parentheses. Reference category for election type is presidential elections. OLS = ordinary least squares.

[†] $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

$p = .900$) and percentage of votes ($b = -0.072$, $p = .974$). In other words, we found no evidence that the bonus of having a lower pitched voice increased as a function of country-level conservatism across all elections regardless of type full models for these analyses are displayed in Table 2 (Models 1 and 2).³

However, to explore the predicted interactive nature of the relationship between candidate voice pitch and national ideology further, we also included election type (presidential vs. parliamentary election) in our models. Specifically, because the interaction between candidate voice pitch and national-level ideology could be present only for presidential or parliamentary elections, we tested the potential three-way interaction between candidate voice pitch, national ideology, and election type. Interestingly, this three-way interaction turned out to be significant when predicting both electoral outcome ($b = 1.553$, $p = .047$) and received percentage of votes ($b = 8.798$, $p = .072$). Given that our formal prediction related to the two-way interaction between candidate voice pitch and national-level ideology across all countries—and not *only* for presidential or parliamentary systems—our interpretation of this three-way interaction necessarily remains post hoc and speculative. Yet robustness results reported below show that the three-way interaction remains fairly robust within the limits of the analyzed data set. The full models for these three-way interactions are displayed in Table 2 (Models 3 and 4, respectively).

To ease the interpretation of these complicated three-way interactions, we visually illustrate the relationship between candidates' voice pitch and the dependent variables across countries varying on national ideology as well as type of election. Below, we first illustrate the relationship between candidate voice pitch and electoral outcome in Figure 1, and subsequently, we turn to the relationship between candidate voice pitch and percentage of received votes in Figure 2.

To understand how the effect of candidate voice pitch varies as a function of both national ideology and type of election, we calculated the predicted probability of winning the election for a candidate with a voice pitch one standard deviation above (+1SD pitch) and below (-1SD pitch) the sample mean, respectively. Furthermore, we calculated predicted probabilities of electoral victory for all possible combinations of country ideology and election type. With respect to national ideology, the predicted probabilities were based on the sample distribution of ideology such liberal countries were represented by the 10th percentile in the distribution (corresponding to a value of 4.80 on the scale from 1 to 10). Likewise, conservative countries were represented by the 90th percentile in the sample ideology distribution (6.53 on the 1-10 scale). In this way, we avoided the risk of extrapolating predicted probabilities from the regression model (Model 3 in Table 2) outside the observed values in our sample. Figure 1 displays the predicted probabilities of winning with a lower pitched (-1SD pitch) and a higher pitched (+1SD pitch) voice across liberal (left-hand panels) and conservative (right-hand panels) countries and for presidential elections (upper panels) and parliamentary elections (lower panels), respectively.

Comparing first the upper to the lower panels in Figure 1, we see a much more pronounced difference between liberal and conservative countries among the presidential elections (upper panels) than between liberal and conservative countries with parliamentary electoral systems (lower panels). Starting in the upper left-hand corner of Figure 1—liberal countries with presidential elections—the high-pitched voice (1SD pitch) stood a better—yet insignificant (as indicated by the overlapping confidence intervals [CIs])—chance of winning the election than the lower pitched voice (-1SD pitch). In the upper right-hand panel among the conservative countries with

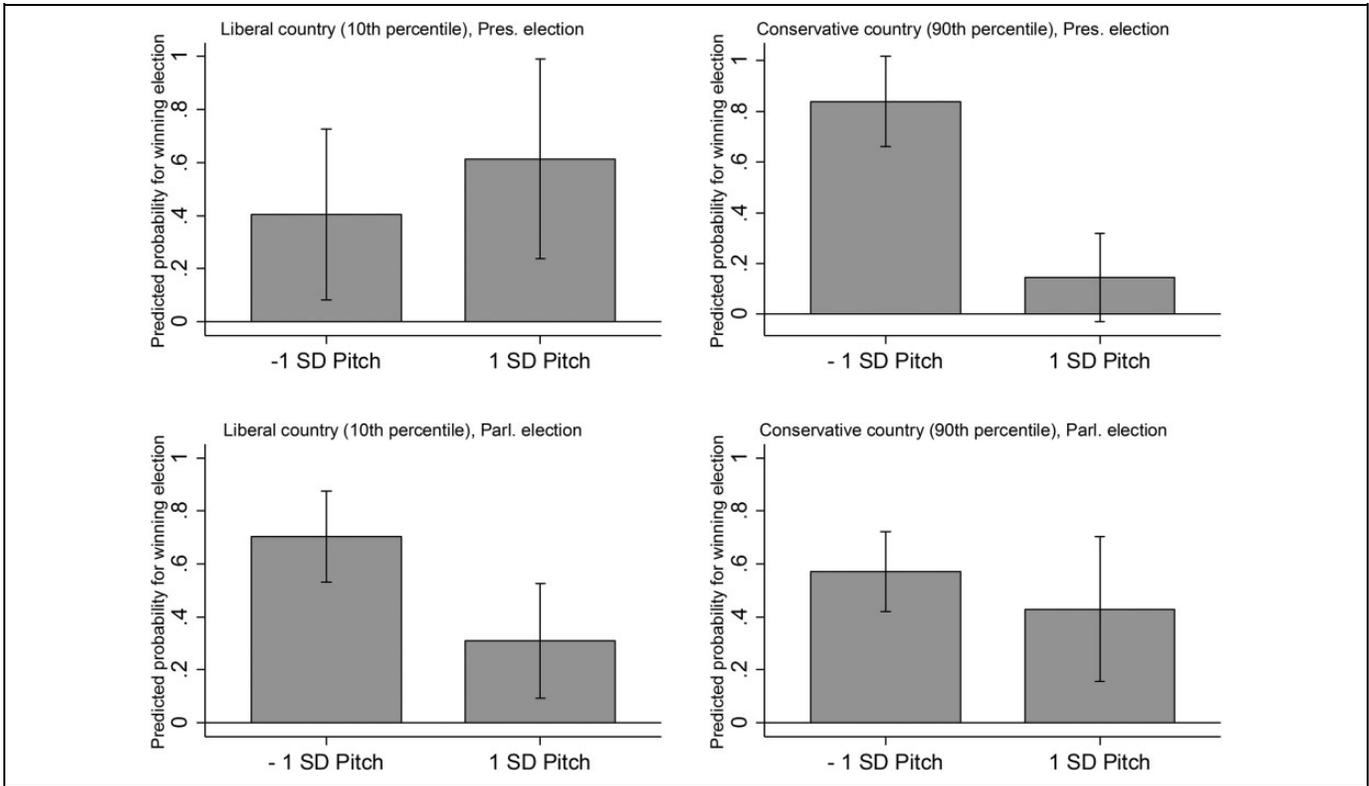


Figure 1. Predicted probabilities for winning the election for candidate voice pitches 1 standard deviation below and above the sample mean pitch (voice intensity kept at its mean across all panels). Upper and lower panels show predicted probabilities for presidential and parliamentary elections, respectively. Left- and right-hand panels show predicted probabilities for liberal and conservative countries, respectively. Bars are predicted probabilities of electoral victory and black lines are 95% confidence intervals.

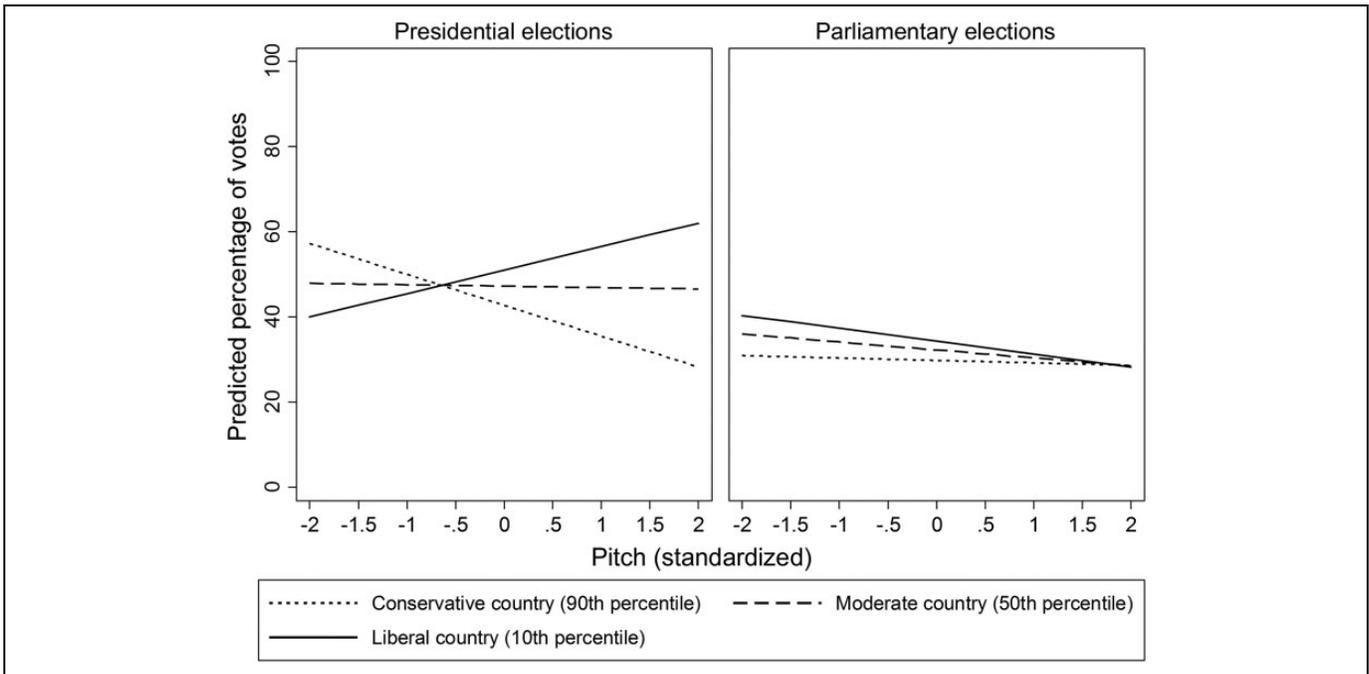


Figure 2. Predicted relationships between candidate voice pitch and percentage received votes for conservative (dotted line), median (dashed line), and liberal countries (solid black line; voice intensity kept at its mean across all panels). Presidential and parliamentary elections represented in left- and right-hand panels, respectively.

presidential elections, the opposite pattern emerged: The lower pitched voice ($-1SD$ pitch) was much more successful in winning elections than the higher pitched voice ($1SD$ pitch). Importantly, the 95% CIs in the figure—indicated by the solid black lines—do not overlap for the lower and the higher pitched voice, further stressing the preference for the lower pitched candidate voice in conservative countries with presidential electoral systems. In the lower panels—among countries with parliamentary elections—we do not see a clear difference between liberal and conservative countries. Rather, we see that regardless of national-level ideology, there is a tendency for the lower pitched voice ($-1SD$ pitch) to stand a better chance of victory than the higher pitched voice. Yet, as indicated by the difference between the predicted probabilities for the lower and higher pitched voices, respectively, and their overlapping CIs, this tendency is smaller than for presidential elections among conservative countries (the upper right-hand panel). Figure 1 thus reveals that the significant three-way interaction between candidate voice pitch, national ideology, and election type was driven by a particularly strong preference for lower pitched candidate voices in conservative countries with presidential elections. We investigate whether the same pattern emerged when predicting candidates' percentages of votes.

To investigate the interactive relationship between candidate voice pitch, national ideology, and election type when predicting percentage of votes, we illustrate the relationship between candidate voice pitch and percentage of votes for three different levels of country ideology: liberal countries (10th percentile on national ideology), moderate countries (median on national ideology), and conservative countries (90th percentile on national ideology). Figure 2 illustrates these relationships for presidential and parliamentary elections in the left- and right-hand panels, respectively.

Focusing on the presidential elections in the left-hand panel of Figure 2, we see that the most negative relationship between candidate pitch and percentage of votes is obtained for the conservative countries (the dotted line). In other words, based on these data, candidates received more votes the lower the pitch of their voices if they competed for the presidency in a conservative country. Also, among the presidential elections (still the left-hand panel), a positive trend between candidate voice pitch and percentage of votes is revealed among liberal countries (the full black line), while no trend obtained for presidential elections in ideologically moderate countries (the dashed line). Finally, for parliamentary elections, depicted in the right-hand panel, we only see weak and negative patterns—regardless of national-level ideology—between candidate voice pitch and percentage of votes (the dotted, the dashed, and the solid lines have negative slopes in the right-hand panel). This shows—in parallel to the pattern presented in Figure 1—that the relationship between candidate voice pitch and percentage of votes was only moderated by national-level ideology for presidential and not for parliamentary elections. In the Discussion section, we speculate about the potential explanations for this difference between electoral systems.

We also conducted a series of robustness analyses for the interactive relationship between candidate voice pitch, national-level ideology, and electoral system. First, we tested the three-way interaction using each of the separate voice pitch measures as predictor variable rather than the average measure. Across such analyses, the results remain substantially similar to the patterns displayed in Figures 1 and 2 with clearer ideological differences for presidential than parliamentary elections (see Online Supplementary Materials S.5 for further details). Second, we included candidate incumbency as a control variable with the same arguments for and against doing so as highlighted for the aggregate relationship above. Despite the caveats involved in controlling for incumbency, the substantial pattern displayed in Figures 1 and 2 replicated when incumbency was controlled for although it should be noted that p value for the three-way interactions rise slightly above conventional levels of statistical significance (see Online Supplementary Materials S.6 for full models and figures). Third, one might consider if any voice variable—and not only pitch—interacts significantly with national-level ideology and election type. Hence, we estimated a model including three-way interactions between both voice pitch and intensity, respectively, with the national-level ideology and election type. Importantly, only the three-way interactions for voice pitch—and *not intensity*—were significant and replicated the substantial patterns displayed in Figures 1 and 2 (see Online Supplementary Materials S.7 for full models and illustrations). Finally, we tested the robustness of the three-way by using a more crude ideology measure than the continuous variable employed above. Specifically, we created a dichotomous variable by splitting countries into a liberal (below median on continuous variable) and a conservative (above median) category. Again, the substantial patterns replicates with candidate voice pitch being most strongly related to the outcome measures for presidential elections in conservative countries (although somewhat more clearly so when predicting electoral outcome than percentage of votes; see Online Supplementary Materials S.8 for full models and illustrations).

In sum, across main results reported in Figures 1 and 2 and robustness analyses, the predicted interaction between candidate voice pitch and national ideology was supported for only the presidential elections. Candidates who sought the presidency in countries that on the national level were oriented toward the conservative end of the ideological continuum stood a better chance of winning the election the deeper their voices were. This conclusion holds regardless of whether electoral outcome or percentage of votes is used as the dependent variable. Importantly, the same pattern did *not* emerge for presidential candidates in liberal countries (if anything, the results indicate that higher pitched voices are an asset to candidates in such countries; see Figures 1 and 2) nor for parliamentary elections regardless of national ideology. Below, we speculate about the unexpected differences between presidential and parliamentary elections and discuss the practical and theoretical implications of the findings.

Discussion

In the present study, we sought to replicate previous findings of a general tendency for candidates with lower compared to higher pitched voices to be more successful in democratic elections, and subsequently, to test whether national-level ideology would moderate this relationship. That is, we aimed to extend previous findings by investigating whether they would emerge using an original and novel data set consisting of candidate voice pitches, electoral outcome measures, and national-level ideology obtained across 69 elections held across the world.

First, consistent with the initial prediction and previous research, candidates with lower pitched voices generally had a greater likelihood of winning the election and they received larger shares of the votes. This finding is in line with previous experimental studies (Anderson & Klofstad, 2012; Klofstad et al., 2012, 2015; Tigue et al., 2012) and studies in which lower pitch predicted greater success in real-world elections (Banai et al., 2017; Klofstad, 2016; Pavela Banai et al., 2017). Taken as a whole, the present and prior results suggest that lower pitch constitutes a seemingly valuable trait for candidates—potentially, because a low pitch constitutes a signal of competence but also masculinity, formidability, and dominance in a candidate (see also Klofstad et al., 2015).

Second, our prediction regarding the moderating role of national-level ideology was not confirmed in the aggregate across all 69 elections. Yet it was supported among the presidential elections included in our data set. Similar to a previous experimental study (Laustsen et al., 2015), we found that preferences for deep masculine voices exist primarily in conservative countries, but that more nuanced pattern only obtained for presidential elections. Furthermore, the ideological moderation of the preference for lower pitched candidate voices in presidential elections also extends previous results from (primarily experimental) studies in which conservative and socially dominant individuals hold stronger preferences for physical cues to dominance and formidability in political leaders (for an overview, see Laustsen & Petersen, 2017).

The results of this study indicate that the experimental findings are generalizable to national-level elections and that *presidential* candidates with deeper voices stand a better chance of winning elections in countries with more conservative voters. Importantly, ideology only seems to play a role in presidential elections since ideology did not moderate the relationship between pitch and the outcome variables for parliamentary elections. This result was unexpected and needs to be further addressed. In this study, we included only elections for political positions with executive power, that is, president or prime minister. Our research design was built on previous experimental work in which the distinction between presidential and parliamentary elections was not made. For example, Tigue, Borak, O'Connor, Schandl, and Feinberg (2012, p. 214) asked their participants to “Choose the voice that you are most likely to vote for in a national election” after presenting subjects to two politically irrelevant sentences differing only in voice pitch. In another example, Klofstad, Anderson, and Peters (2012,

p. 2700; procedures reused in Laustsen, Petersen, and Klofstad, 2015, p. 4) exposed subjects to the sentence “I urge you to vote for me this November” spoken by high- and low-pitched versions of the same voice from which participants subsequently chose their preferred voice. However, none of the previous studies instructed participants specifically whether they participated in mock elections for the position as president or prime minister.

There might be several reasons why the moderating role of ideology only obtains for presidential elections. First, there is a substantial difference between presidential and parliamentary elections. In presidential elections, voters cast their vote for a specific candidate; in parliamentary elections, they vote for a group of people (although voters in some systems can choose to vote for a specific candidate, it seems fair to state that parties and coalitions play much more prominent roles in parliamentary than in presidential elections). In relative terms, presidents also hold more power than prime ministers who are directly dependent on consistent support from fellow partisans and coalition parties. It could be that the theorized evolved followership psychology—that guides and regulates candidate preferences—is more clearly reflected the more directly voters choose the top leader and the more power this leader holds. Second, the president is typically the head of a country's armed forces and in charge of declaring war. Previous research has shown that under threat of intergroup conflict, people are more prone to select a leader with more dominant facial and vocal features (Little et al., 2007; Tigue et al., 2012; for an overview, see Laustsen & Petersen, 2017). Since the president holds power over military forces, and conservative voters tend to perceive the world as more dangerous than liberals (e.g., Duckitt & Sibley, 2010; Jost, Federico, & Napier, 2009), one might argue that it makes sense that ideology in data set analyzed here only moderates the relationship between candidates' voice pitch and election outcome for presidential elections. Moreover, in a recent study, Olivola, Eubanks, and Lovelace (2014) found that participants could identify leaders from their faces across several leadership domains (business, military, and sports). In that sense, people seem to associate some facial features with success in certain fields. There is a possibility that voters might process candidates' vocal features similarly. Deeper voices are preferred in all elections (presidential and parliamentary) and that can be linked with deeper male voice being perceived as more appealing for a range of reasons, as deeper voices signal competence, physical prowess, integrity, and age (Klofstad et al., 2015). Hence, the aggregate preference for the lower pitched leader voice among followers could be driven by multiple reasons and mechanisms; some of which relate to followers' ideological leanings and which might be more directly activated under presidential than parliamentary elections.

Yet while we think these explanations for the observed differences between presidential and parliamentary elections in the above analyses are sound and sensible, they obviously remain speculative and theoretical at this stage. We therefore urge future work on candidates' vocal and facial features to theorize and investigate how voters might hold different preferences for dominance features in candidates depending on

institutional differences (such as the type of election) and leadership domain (cf. Olivola, Eubanks, & Lovelace, 2014).

A few limitations to the present study should be addressed. First, a relatively small sample of political candidates' voices was used, which is primarily a consequence of our intention to analyze highly realistic and ecologically valid voice pitch samples from existing political candidates competing for executive power positions in different countries. One way to enhance the sample size is to include data from earlier WVS waves (years 2004 and older). However, there are few high-quality recordings of political candidate voices from earlier periods, which limited the sampled voices to what could be matched with national ideology in the fifth (2005-2009) and sixth (2010-2014) waves of the WVS. Consequently, one limitation of the present study is that we were dependent on the quality of available recordings. However, the sample size was large enough to perform parametric statistical procedures, and observed relationships were still substantially interesting and significant despite the modest sample size of 69 pairs of candidates. Second, an obvious and unavoidable problem with using audio recordings of real political candidates from different countries is that recordings were not obtained under standardized conditions, meaning that the speakers' voices may be affected by other external factors. However, to minimize this potential confound as much as possible, we extracted the vocal characteristics and the voice pitch variable based on random sampling of 5-s intervals from the harvested audio clips (as was done in previous studies, e.g., Klothstad, 2016; Pavea Banai et al., 2017). Moreover, to minimize potential measurement noise, we extracted three separate voice pitch measures per candidate (all 5-s clips, see Method section) from which we calculated the average voice pitch variable employed in the analyses. Although we think this constitutes a valid approach to measuring and comparing candidate voice pitches cross-nationally, we urge future research in this field to think of even more standardized approaches.

Conclusion

This study used highly ecologically valid data on real-world candidates' voice pitches, electoral success, and country-level ideology to replicate and extend previous findings regarding the relationship between candidate voice pitch and electoral outcomes. Our analyses support prior research, which has shown an aggregate voter preference for candidates with lower pitched voices. In addition, we found that this preference for lower pitched candidate voices was particularly pronounced for presidential elections in conservative—but not in liberal—countries. Importantly, country-level ideology only moderates the main preference for lower pitched candidate voices in presidential and not in parliamentary elections.

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Supplemental Material

The supplemental material is available in the online version of the article.

Notes

1. All voice samples available at Figshare.com: doi: 10.6084/m9.figshare.5798262.
2. Replication data and code file are available at Dataverse Network (thedata.org): doi:10.7910/DVN/1XNFN5.
3. Similar models based on each of the three separate voice pitch measures also yield insignificant two-way interactions between candidate voice pitch and national-level ideology (see Online Supplementary Material S.4 for full models).

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