Political Psychology

Political Psychology, Vol. 33, No. 6, 2012
doi: 10.1111/j.1467-9221.2012.00917.x

Should Candidates Smile to Win Elections? An Application of Automated Face Recognition Technology

Yusaku Horiuchi
Dartmouth College

Tadashi Komatsu
Komatsu Research Office

Fumio Nakaya
Osaka Kyōiku University

Previous studies examining whether the faces of candidates affect election outcomes commonly measure study participants' subjective *judgment of various characteristics of candidates, which participants infer based solely on the photographic images of candidates. We, instead, develop a smile index of such images* objectively *with automated face-recognition technology. The advantage of applying this new technology is that the automated process of measuring facial traits is by design independent of voters' subjective evaluations of candidate attributes, based on the images, and thus allows us to estimate "undiluted" effects of facial appearance per se on election outcomes. The results of regression analysis using Japanese and Australian data show that the smile index has statistically significant and substantial effects on the vote share of candidates even after controlling for other covariates.*

KEY WORDS: voting behavior, automated face recognition, facial appearance, smile, Australia, Japan

Introduction

A growing number of recent studies in leading multidisciplinary, economics, and political science journals examines whether voters make their voting decisions based on candidates' looks.[1] Some studies show that candidates with a more "beautiful" face can attract significantly more votes (Berggren, Jordahl, & Poutvaara, 2010; King & Leigh, 2009). Other studies find that the rapid judgment of competence is a robust predictor of actual or hypothetical voting behavior (Atkinson, Enos, & Hill, 2009; Ballew & Todorov, 2007; Olivia & Todorov, 2010; Todorov, Mandisodza, Goren, & Hall, 2005). Do the photos of candidates really matter in shaping election outcomes? If so, how? When voters are exposed to such photos, do they infer the qualities of candidates, or do they vote unthinkingly? If the images of candidates matter, do they have substantially large effects or just negligibly small effects?

[1] An influential recent work is Todorov, Mandisodza, Goren, and Hall (2005). For a comprehensive review of the literature, see Lawson, Lenz, Baker, and Myers (2010).

Published by Wiley Periodicals, Inc., 350 Main Street, Malden, MA 02148, USA, 9600 Garsington Road, Oxford, OX4 2DQ, and PO Box 378 Carlton South, 3053 Victoria, Australia

In this research note, we revisit these questions by taking a new approach radically different to the one commonly used in previous studies. Instead of measuring study participants' *subjective* judgment of various characteristics of candidates, which participants infer based solely on the photographic images of candidates, we *objectively* measure a specific facial attribute of the candidate—the smile—with automated face-recognition technology and correlate this with vote share. This new technology is now widely used in digital cameras (e.g., Sony's Cybershot) and other software packages (e.g., Google Picasa and Apple's iPhoto), but to the best of our knowledge this is the first application in social science research.

The advantage of applying it is that the automated process of measuring facial traits is by design independent of voters' subjective evaluations of candidate attributes, based on the images. Specifically, we pay attention to the fact that voters (or study participants) assess various facial attributes of candidates *after the images of candidates are shown*. Therefore, any subjective evaluation of the images is "causally posterior" to the images themselves that are presented to voters. In our regression analysis, we exclude such variables to avoid "posttreatment bias" (Rosenbaum, 1984) and estimate "undiluted" effects of (objectively measured) facial appearance per se on election outcomes.[2]

The results of regression analysis using Japanese and Australian data show that the smile index has statistically significant and substantial effects on the vote share of candidates even after controlling for other covariates. The effect is larger for the Australian sample, and we will discuss a possible interpretation of this difference.

Smile Index

We use the photos of 672 candidates in the 2000 Lower House election in Japan and those of 286 candidates in the 2004 Lower House election in Australia. In these elections, the chance that voters were exposed to these particular photos before casting their ballots can be presumed to be high. In the Japanese case, these photos were actually used in campaign posters, which were highly visible everywhere during the campaign period. In Australia, they were used in "how-to-vote" cards, which voters received, almost without exception, from major parties.

The software suite we used for this study is called OKAO Vision, which was developed by Omron Corporation, a Japanese electronics company. One of the most revolutionary features of this software is its ability to evaluate smiles in digital images and produce a continuous measure of smiles. This index is developed based on the growing literature on mathematical approaches for describing the form of organisms, more specifically, the shape of a human face (Bookstein, 1991; Pete, 1997; Viola & Jones, 2004). Omron engineers trained the software with about five million images of human faces and confirmed that their evaluation of smiles is robust to cultural and demographic differences. It is worth noting that the expression of happiness (i.e., smile) is the facial clue that people around the world can most consistently recognize, compared to five other distinct emotions; sadness, surprise, fear, anger, and disgust (Ekman & Friesen, 2003).

Specifically, OKAO Vision works as follows. First, it rapidly extracts a face-like object by assessing varied brightness levels in different parts of a given digital image. Second, it fits a 3D face model onto landmark data of the identified object and identifies the various organs of a human face. Third, it computes the so-called Harr-like features around key patterns common in smiling faces, such as how much the mouth and eyes are open, how the outer corners of the eyes are shaped, and how developed wrinkles around eyes, nose, and mouth are. Finally, based on a Bayesian statistical method, it produces the posterior distribution of a smile score, which ranges from 0 (no smile; 0%) to 1 (full smile; 100%).

[2] The mechanism of this effect is a "black box," which enables us to examine possible alternative explanations for the effect. We will discuss this point later.

Figure 1. *The estimated smile score of sample candidates in the 2000 Lower House election in Japan (top row) and the 2004 Lower House election in Australia (bottom row).* The smile scores are measured with OKAO Vision, a software suite developed by Omron Corporation. The box in each photo shows the area OKAO Vision automatically identifies as the area with features of a human face. The smile score is calculated based on information within this box.

Some examples of the estimated smile scores for Japanese and Australian candidates are shown in Figure 1. Our careful check of smile scores of all candidates suggests the high accuracy of OKAO Vision's smile index—when all candidates are sorted by the smile index, the degree of smile does indeed appear to change monotonically.

The descriptive statistics, which are shown in Table 1, suggest that Australian candidates smile more than Japanese candidates. The average value of the smile index is 0.49 in Japan, whereas it is 0.73 in Australia. Although fully investigating the origins of this difference is beyond the scope of this article, we believe it may arise from cultural difference. In Japan, smiling without showing one's teeth has been viewed as a virtue, and it is common to see a woman covering her mouth when smiling. By contrast, in Australia, perhaps also as in other Western countries, people are not reluctant to smile broadly, showing their teeth.

Research Findings

Using this index as the causal variable, we then conduct ordinary least square (OLS) regression analysis. The outcome variable is the vote share of each candidate. Below, after briefly introducing

Table 1. Descriptive Statistics

Variable	*N*	Mean	Std. Dev.	Min	Max
		Japan			
Vote Share	672	28.973	18.437	0.691	83.602
Smile Index	672	0.489	0.389	0	1
Age	672	51.854	10.519	25	86
Male Dummy	672	0.879	0.326	0	1
Incumbent Dummy	672	0.369	0.483	0	1
(Former) Incumbent Dummy	672	0.052	0.222	0	1
Number of Candidates	672	4.195	1.061	2	7
Number of Past Wins	672	1.521	2.622	0	15
Dual Candidacy Dummy	672	0.680	0.467	0	1
		Australia			
Vote Share	288	41.880	11.179	8.687	65.530
Smile Index	286	0.725	0.312	0	1
Age	288	49.354	8.678	25	73
Male Dummy	288	0.743	0.438	0	1
Incumbent Dummy	288	0.448	0.498	0	1
Number of Candidates	288	8.813	1.642	5	14

Note: The unit of observation is each candidate.

the electoral system used in Japanese and Australian Lower House elections, we explain our measures more specifically. We then introduce other predetermined covariates that need to be controlled and show the findings.

Outcome Variables

The Japanese Lower House uses a combination of the first-past-the-post system with 300 single-member districts (SMDs) and the closed-list proportional representation (PR) system with 180 seats from 11 regional blocs. Under this system, which has been used since the 1996 election, voters cast two separate ballots—one for a candidate from an SMD and another for a party that fields candidates in a PR bloc—and candidates can run from both the SMD and PR portions of the system. Since each party's list ranking for the PR system is in part determined by their candidates' SMD vote shares, and since most PR candidates from major parties also run from SMDs, the Japanese system is regarded as an SMD-dominant hybrid system. In our research, we focus on the effects of SMD candidates' photos on their SMD vote shares. Specifically, the outcome variable in our analysis is the number of valid votes a particular SMD candidate received divided by the total number of valid votes in the district. The average vote share is 29.0%.

The electoral system used in Australian Lower House elections is the preferential voting system. Voters assign their preferential orders to all candidates/parties in a given SMD. In the 2004 elections, there were 150 seats. After the full distribution of preferences, a candidate with more than 50% of the two-candidate preferred vote share wins a seat. In most districts, the top two candidates are a candidate from the Australian Labor Party (ALP) and a candidate from the coalition of the Liberal Party of Australia and the National Party. In our analysis, we use the number of valid first-preference votes a particular candidate received divided by the total number of valid votes. The average vote share is 41.9%.[3] The higher vote share in Australia than in Japan suggests that the top two candidates,

[3] The sum of first-preference vote shares by two major candidates in a given district is less than 100% because a certain proportion of voters cast their first-preference votes for other candidates.

most of whom are an ALP candidate and a Coalition candidate, garner more than 80% of first-preference votes.[4]

Predetermined Covariates and Methodological Issues

Obviously, the number of votes a candidate can attract is influenced by many other factors, and thus we attempt to control predetermined variables, which may affect both the degree of smile by candidates and their votes garnered. For example, some demographic attributes (e.g., gender and age) may be correlated with both the degree of smile and with vote share. More importantly, candidates who have resources to mobilize voters (e.g., funding for employment of a campaign advisor and/or a photographer who can suggest the best possible facial expression for each candidate's campaign photo) and those who know how to mobilize votes effectively using all possible tools including the campaign photo may carefully "craft" their smile: They may smile more than they normally do only for the purpose of electioneering. These resourceful, tactical, and skillful candidates are, for many reasons, expected to obtain more votes than others. In our regression analysis, we add many available variables that are relevant to candidates' calculations and strategic environments when their photos are taken for the campaign, although we admit that it is difficult, if not impossible, to control *all* relevant predetermined covariates. The descriptive statistics of these variables (except party fixed effects) are presented in Table 1.

Specifically, the control variables used in the analysis of Japanese data are party fixed effects, a candidate's age, a dummy variable for a male candidate, a dummy variable for an incumbent candidate, a dummy variable for a former incumbent candidate (i.e., a challenger in the 2000 election but a winner in at least one election before the 1996 election), the number of candidates in a district, the number of times a particular candidate won in past Lower House elections, and a dummy variable for dual candidacy (i.e., whether or not a SMD candidate also ran from a PR bloc). For the analysis of Australian data, we added a similar set of control variables. They include party fixed effects, a candidate's age, a dummy variable for a male candidate, a dummy variable for an incumbent candidate, and the number of candidates in a district.

We exclude variables measuring voters' appearance-based inferences from our regression analysis. When voters are exposed to the photos of candidates, they are likely to develop certain images of candidates and decide how to vote based on such images. Any psychological process, however, is "causally posterior" to the presentation of these photos to voters and thus should be omitted from analysis to avoid the problem of posttreatment bias (Rosenbaum, 1984). This does not necessarily mean that we disagree with the many existing studies showing the significant effects on election outcomes of variables measuring such appearance-based inferences. Rather, the novelty of our approach lies in that we do not need to worry about inherent (and often difficult) measurement and specification problems of using such *subjective* measures and that we can estimate the "total" effect of *objective* characteristics of the candidates' faces on their vote share.

There are some additional methodological notes. Under an assumption that observations are correlated within each electoral district, we calculated clustered robust standard errors of regression coefficients where clusters are electoral districts. Given the possibility of nonlinear effects, we considered adding the squared term of the smile index. In both Australian and Japanese samples, however, it was found to be insignificant, and thus we decided to drop it from our final model.

[4] The vote share for a candidate is the same as the vote share for his/her party in both Australia and Japan, as there is one candidate per party in each district.

Results

The results of regression analysis are presented in Table 2. The estimated effect of the smile index on the vote share is positive and statistically significant in both Japanese and Australian samples, even after controlling for a range of other variables.[5] Why does the candidate smile affect voters' decisions to cast their ballots? Some recent neuropsychological studies suggest an intriguing mechanism that connects candidates' smiles and their votes. Using event-related functional magnetic resonance imaging (fMRI), they show that when the subjects are presented with smiling faces, a particular region of the brain (medial orbitofrontal cortex, or OFC) is activated (O'Doherty et al., 2003). This region is known to be involved in processing various kinds of rewards—food, pleasant music, monetary gain, etc. Therefore, people tend to consider smiling faces as a type of reward. Furthermore, a more recent study shows that the rewarding social signals from a smiling face can enhance the memory process; specifically, the subjects can more accurately retrieve face-name associations for smiling faces than neutral faces (Tsukiura & Cabeza, 2008). Getting name recognition is obviously an important goal for candidates during the campaign period. Taken together, these studies suggest that the estimated effect of the smile index on the vote share is by no means spurious. Rather, these studies may suggest that when voters' brains are responding to the smiling

Table 2. OLS Regression Results

Variables	Japan	Australia
Smile Index	2.311**	5.172***
	(0.926)	(1.174)
Age	–0.125***	–0.038
	(0.039)	(0.049)
Male Dummy	–2.340**	0.966
	(1.156)	(0.855)
Incumbent Dummy	9.694***	16.158***
	(1.134)	(0.927)
(Former) Incumbent Dummy	3.306**	
	(1.613)	
Number of Candidates	–4.064***	–0.293*
	(0.379)	(0.175)
Number of Past Wins	0.866***	
	(0.239)	
Dual Candidacy Dummy	–3.069*	
	(1.761)	
Number of Observations (Candidates)	672	286
R-squared	0.762	0.675
Root MSE	9.104	6.390

Note: The dependent variable is each candidate's vote share. Each OLS regression model includes party fixed effects (coefficient estimates not shown). The clustered robust standard errors are in parentheses where clusters are electoral districts. ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$ (two-sided).

[5] As a robustness check, we replaced all interval control variables, which are assumed to have linear effects, with a set of dummy variables. These variables include a candidate's age, the number of candidates in a district, and the number of times a particular candidate won in the past elections. The effects of the smile index were found to be still positive and highly significant. The magnitudes of the effects also did not change drastically ($b = 4.422$, $t = 3.15$ in the Australian sample; $b = 2.406$, $t = 2.58$ in the Japanese sample).

faces of candidates, it is a natural response independent of any evaluation of the qualities of candidates as a legislator.

The magnitude of the effect is larger in Australia than in Japan. A candidate with a full smile (smile index = 1), as compared to a candidate with no smile (smile index = 0), can increase the vote share by 2.3 percentage points in Japan, but this increase is as large as 5.2 percentage points in Australia (Figure 2). In Australia, since one in ten races is decided by a margin of less than 1.4 percentage points (King & Leigh, 2009), smiling can be pivotal in determining who gets elected and, furthermore, which party forms the government. In Japan, the magnitude of the effect is smaller but still nonnegligible. Smiling can be consequential in marginal districts. The sources of this difference between Australia and Japan need further empirical investigation, but our tentative interpretation is that this is due to a key difference in electoral rules. In Australia, as voting is compulsory, voters without sufficient knowledge about candidates, parties, and issues may instead rely on superficial

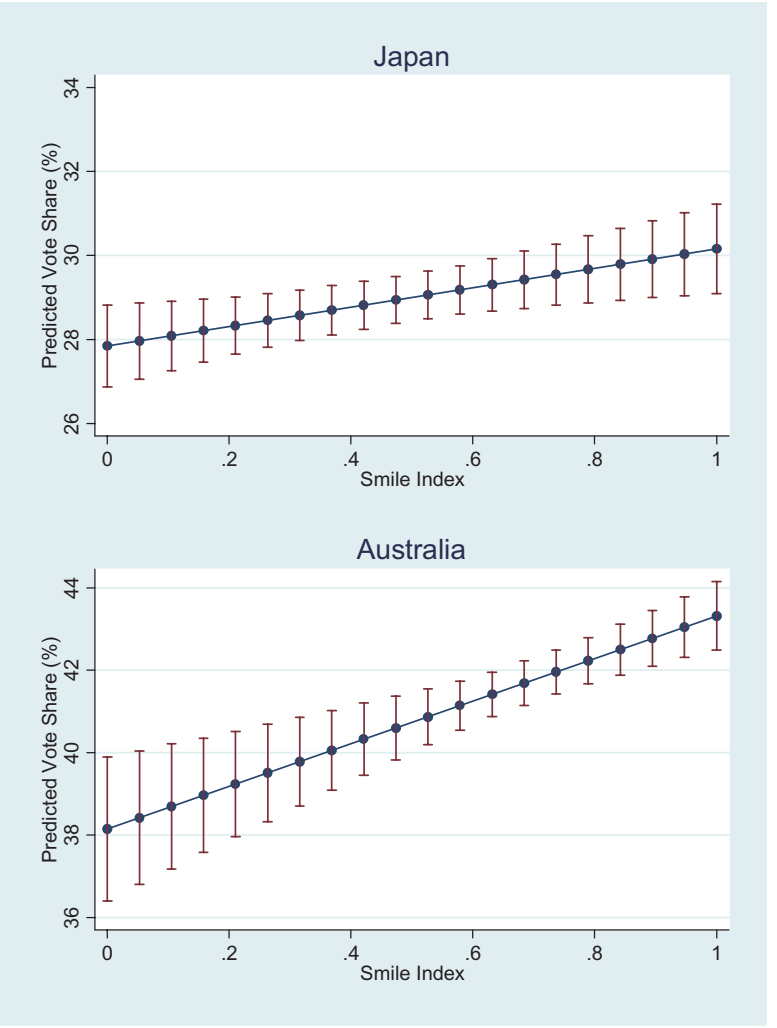

Figure 2. *The estimated marginal effect of the smile index on the vote share in Japanese and Australian Lower House elections*. The vertical lines indicate the 95% confidence interval of prediction.

cues at polling booths. In Japan, however, uninformed and uninterested voters can choose to abstain from voting.

Conclusion

So, should candidates smile to win elections? Our results clearly suggest that they should do so. Just smiling in campaign photos can significantly affect election outcomes. Representatives who look happy, however, are not necessarily those who can make their constituents happy.

There are some avenues for future research. First, as we discussed, we do not completely preclude the possibility that voters consider smiling candidates as politically competent, but this is perhaps unlikely. At a minimum, we do not (yet) have any political-psychological theory, or empirical study, suggesting that candidates with bigger smiles are seen to be legislators who are more likely to deliver desirable policy outcomes. We leave further investigation on this matter, which is relevant to understanding the functioning of today's representative democracy, for our future research.

Second, as we mentioned, this is the first application in social science research of automated face recognition technology, but we believe that it can be applied, more broadly, in studies of political psychology. While the present study used the photos of candidates, our next project uses a movie of political leaders during a policy debate and measures a range of second-by-second attributes of each speaker, which include not only the degree of smile by him/her but also the direction of his/her face, using OKAO Vision. These time-series variables are then merged with other measurable indicators, such as the tone and volume of leaders' voice, the contents of the debate, and "warm," real-time reactions by a group of selected participants watching the debate. Using OKAO Vision, we further intend to measure real-time facial attributes of study participants (e.g., voting-age adults) while they are watching a political leader's speech. If this new technology is used effectively, we may discover new theories of political psychology and opinion formation, which can never be investigated using traditional toolkits (i.e., surveys and interviews).

ACKNOWLEDGMENTS

We thank Shihong Lao and Masato Kawade from Omron for allowing us to use their software; Andrew Leigh, Amy King, and Taku Sugawara for allowing us to use their candidate photo collection and electoral data; and Ben Goldsmith and Alison Cumming Thom for useful comments and proofreading. The authors are listed in alphabetical order, as this article is in every way a collaborative project. Correspondence concerning this article should be sent to Yusaku Horiuchi, Department of Government, Dartmouth College, 211 Silsby Hall, HB 6108, Hanover, NH 03755. E-mail: yusaku.horiuchi@gmail.com

REFERENCES

Atkinson, M. D., Enos, R. D., & Hill, S. J. (2009). Candidate faces and election outcomes: Is the face-vote correlation caused by candidate selection? *Quarterly Journal of Political Science, 4*, 229–249.

Ballew II, C. C., & Todorov, A. (2007). Predicting political elections from rapid and unreflective face judgments. *Proceedings of the National Academy of Sciences, 104*, 17948–17953.

Berggren, N., Jordahl, H., & Poutvaara, P. (2010). The looks of a winner: Beauty and electoral success. *Journal of Public Economics, 94*, 8–15.

Bookstein, F. L. (1991). *Morphometric tools for landmark data: Geometry and biology*. Cambridge: Cambridge University Press.

Ekman, P., & Friesen, W. V. (2003). *Unmasking the face: A guide to recognizing emotions from facial clues*. Englewood Cliffs, NJ: Prentice Hall.

King, A., & Leigh, A. (2009). Beautiful politicians. *Kyklos, 62*, 579–593.

Lawson, C., Lenz, G. S., Baker, A., & Myers, M. (2010). Looking like a winner: Candidate appearance and electoral success in new democracies. *World Politics, 62*, 561–593.

O'Doherty, J., Winston, J., Critchley, H., Perrett, D., Burt, D. M., & Dolan, R. J. (2003). Beauty in a smile: The role of medial orbitofrontal cortex in facial attractiveness. *Neuropsychologia, 41*, 147–155.

Olivia, C. Y., & Todorov, A. (2010). Elected in 100 milliseconds: Appearance-based trait inferences and voting. *Journal of Nonverbal Behavior, 34*, 83–110.

Pete, E. L. (1997). *Fourier descriptors and their applications in biology*. Cambridge: Cambridge University Press.

Rosenbaum, P. R. (1984). The consequences of adjustment for a concomitant variable that has been affected by the treatment. *Journal of the Royal Statistics Society, Series A (General), 147*, 656–666.

Todorov, A., Mandisodza, A. N., Goren, A., & Hall, C. C. (2005). Inferences of competence from faces predict election outcomes. *Science, 308*, 1623–1626.

Tsukiura, T., & Cabeza, R. (2008). Orbitofrontal and hippocampal contributions to memory for face-name associations: The Rewarding power of a smile. *Neuropsychologia, 46*, 2310–2319.

Viola, P., & Jones, M. J. (2004). Robust real-time face detection. *International Journal of Computer Vision, 57*, 137–154.