2020 HAWAII UNIVERSITY INTERNATIONAL CONFERENCES
ARTS, HUMANITIES, SOCIAL SCIENCES, & EDUCATION JANUARY 6 - 8, 2020
HAWAII PRINCE HOTEL WAIKIKI, HONOLULU, HAWAII

YOU LIKE DAY-TUH AND I LIKE DAA-TUH; LET'S CALL THE WHOLE THING OFF!

WESTFALL, PETER H.
DEPARTMENT OF ISQS
TEXAS TECH UNIVERSITY
LUBBOCK, TEXAS
ARIAS, ANDREA L.
DEPARTMENT OF INDUSTRIAL ENGINEERING
TEXAS TECH UNIVERSITY
LUBBOCK, TEXAS
BRAVER, AARON
DEPARTMENT OF ENGLISH
TEXAS TECH UNIVERSITY
LUBBOCK, TEXAS
FREDMAN, JOSHUA
LUBBOCK, TEXAS

Dr. Peter H. Westfall
Department of ISQS
Texas Tech University
Lubbock, Texas
Dr. Andrea L. Arias
Department of Industrial Engineering
Texas Tech University
Lubbock, Texas
Dr. Aaron Braver
Department of English
Texas Tech University
Lubbock, Texas
Mr. Joshua Fredman
Lubbock, Texas

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Synopsis:

Pronunciation of “data” in the US (approximately 2/3 “day-tuh” and 1/3 “daa-tuh”) is little affected by region and demographics, but is strongly affected by peers’ pronunciation;
further, the tendency to “fit in” with peers is more pronounced in some regions and demographics than others.

Title: You Like Day-tuh and I Like Daa-tuh; Let's Call the Whole Thing Off!

One Sentence Summary: Pronunciation of "data" in the US (approximately 2/3 "day-tuh" and 1/3 "daa-tuh") is little affected by region and demographics, but is strongly affected by peers' pronunciation; further, the tendency to "fit in" with peers is more pronounced in some regions and demographics than others.

Abstract: the most common pronunciations of the word data in the U.S. are "day-tuh" and "daa-tuh," according to historical pronunciation surveys. We review these studies, as well as theories that explain differences in pronunciation. We also report results of a new survey that we designed to estimate current frequencies and pronunciation correlates. Our results show that about 64% of people currently pronounce it as "day-tuh," and 36% "daa-tuh." Further, we find that these percentages strongly depend on how one's colleagues pronounce data, a finding consistent with the linguistic theory of phonetic convergence. Main effects analysis shows that these percentages depend relatively little on demographic variables, but we find via interaction analysis that region, age, and education affect phonetic convergence as regards pronunciation of data.

Main Text:

1. INTRODUCTION

You know what's coming when he wanders in to your office, cheerfully smiles, and says "Have you had a chance to look at the *daa-tuh* yet?" *Daa-tuh*! The pronunciation rankles. You force a smile and reply, "Yes I have, and the results from the *day-tuh* analysis are encouraging."

Of course, both pronunciations, "day-tuh" and "daa-tuh," are correct. The pronunciation "day-tuh" (first syllable rhymes with "date") is written phonetically as "dā tə" in the American Heritage Dictionary (www.ahdictionary.com/, accessed September 2015), and as [deɪ.tə] in the International Phonetic Alphabet (e.g., the Cambridge English Dictionary dictionary.cambridge.org/us/dictionary/american-english/data); the corresponding phonetic versions of "daa-tuh" (first syllable rhymes with "bat") are "dăt ə" and [dæt.ə]. Both the Cambridge and Merriam-Webster (www.merriam-webster.com/dictionary/data) online dictionaries of American English offer a single audio pronunciation, "day-tuh." As noted on the Merriam-Webster website, "[…] where there are multiple variant pronunciations only the first, most common variant is offered in audio format."

Wells (2008), and Shitara (1993) report the results of surveys of both British and U.S. speakers; their percentages are shown in Table 1, along with percentages from our current survey.

Table 1. Historical surveys on pronunciations of *data*, as reported in Wells (2008) (where the results of a survey done in 1988 are reported), Shitara (1993), and our (2015) survey. The third column contains a pronunciation variant where the first syllable rhymes with "hot."

Poll	day-tuh	daa-tuh	dah-tuh
British (1988, *n* = 275)	92%	2%	6%
U.S. (1993, *n* = 400)	64%	35%	1%
U.S. (2015, *n* = 1020)	64%	36%	–

Data is the lifeblood of scientists, so its pronunciation clearly matters to us. The purpose of this article is to shed current light on this issue by reviewing general theories of pronunciation, and by identifying current frequencies, trends, and correlates for the pronunciation of the word *data* via our new survey.

2. WHY DO PEOPLE PRONOUNCE WORDS ONE WAY OR ANOTHER?

Mimicry is a strong predictor of how one carries oneself in terms of mannerisms, behaviors, postures, and speech. In the phonetic literature, the phenomenon is called *phonetic accommodation* (e.g., Babel et al., 2014). In the sociological context it is called the *chameleon effect*, where one (consciously or unconsciously) mimics one's interaction partners. Chartrand and Bargh (1999) report that such mimicry smooths interactions between people working on a task. The chameleon effect, when applied specifically to mimicry of speech, has been called *linguistic style matching* (Niederhoffer and Pennebaker, 2002), *acoustic-prosodic entrainment* (Levitan et al., 2012), and *phonetic convergence* by Pardo (2006) and Garnier et al. (2013), who report that phonetic convergence is "hypothesized to improve communication […] ." In this article, we use the term *phonetic convergence* to describe how well one chooses to "fit in" with one's conversation partners.

Geographical region determines pronunciation to some extent: Southerners speak differently from New Englanders. The effects of region, at least as regards the U.S. versus Great Britain, are shown clearly in Table 1. In addition, ethnicity can affect pronunciation (Mather, 2012). However, in our survey we find that region and ethnicity, as main effects, have little relation to people's pronunciation of *data*. On the other hand, we find that region *is* related to phonetic convergence (or how much one fits in with one's colleagues as regards pronunciation of *data*) via interaction analysis.

Mass media such as television can also influence pronunciation styles: Stuart-Smith et al. (2013) report a positive correlation between the British Cockney dialect and "strong psychological engagement with the London-based TV soap drama *EastEnders*." It seems similarly likely that the popular television show *Star Trek*: *The Next Generation* (original release 1987 – 1994) had an impact on the American public: The show featured the character Lieutenant Commander Data, whose name was pronounced "day-tuh." Sackett (2002, p. 130 – 131) reports that Commander Data's name was originally pronounced "daa-tuh" prior to production, but was changed to "day-tuh" for the actual televised series. Plausibly, the current 2:1 odds favoring "day-tuh" as supported by our survey would be different had the producers stuck with their

original choice. Responses to one of the questions in our survey mildly corroborate this suggestion: More respondents noticed a shift towards “day-tuh” in their lifetimes (202/1020) than towards “daa-tuh” (150/1020).

3. A CURRENT PRONUNCIATION SURVEY

To shed light on how and why one pronounces *data*, we developed a survey and acquired completions from $n = 1020$ U.S. respondents in June, 2015. Use of written surveys to assess verbal pronunciation styles is considered acceptable, as reported by Wells (1999). We chose the items in our survey to identify correlates with the pronunciation of *data*, including region, profession or field of interest, country of birth, ethnicity, education and other variables. We planned to conduct a “discovery” study with no firm *a priori* expectations as to which effects would ultimately be the most important. As such, our data analysis plan was to look at many effects and select the most salient, with correction for multiplicity.

Recruited by Qualtrics, a large research company based in Provo, Utah, the survey respondents were a sample of the U.S. general population, age 18 to 65, with representative regional quotas (as per the U.S. census) of 23% from the West, 37% from the South, 22% from the Midwest, and 18% from the Northeast (and all quota targets were met within rounding error). Anticipating an effect of education on pronunciation, we stipulated that between 50% and 75% of the respondents must have some college education (and ultimately 74.7% of actual respondents had completed at least some college education). We did not stipulate quotas for age or sex; thus the survey had a higher percentage of females (63%), and slightly higher percentages of older respondents, compared to U.S. Census data. Survey items are shown in Table 2.

Table 2. Data pronunciation survey

Question Item	**Response Set**
1. In what region of the United States do you currently live?	West; South; Midwest; Northeast
2. What level of education have you completed?	Less than high school; High school; Some college; 2 year degree; 4 year degree; Higher degree
3. How do you pronounce the word *data*? If one pronunciation comes particularly close but isn't exactly correct, choose it anyway.	DAY-tuh (first syllable rhymes with “date”); DAA-tuh (first syllable rhymes with “bat”)
4. Did you used to pronounce *data* different than you do now?	Yes; No
5. Where did you learn to pronounce the word *data*? (Select one choice only from the 7 given)	Parents or family; Personal friends; Teachers; Classmates; Colleagues or coworkers; Popular culture; Formal pronunciation resource
6. To the best of your knowledge, what is the most common pronunciation of the word *data* among your colleagues?	DAY-tuh; DAA-tuh
7. Have you noticed a shift in the prevailing pronunciation over the course of your life?	No; Toward DAY-tuh; Toward DAA-tuh
8. Do you try to persuade others to pronounce *data* the way you pronounce it?	Yes; No

9. What best describes your interests or career? (Select up to four choices from the 17 given.)	Agriculture/Food & Natural Resources; Architecture & Construction; Arts/AV Technology/Communications; Business Management & Administration; Education & Training; Entertainment Industry; Finance; Government & Public Administration; Health Science; Hospitality & Tourism; Human Services; Information Technology; Law/Public Safety/Corrections & Security; Manufacturing; Marketing; Science/Technology/Engineering & Mathematics; Transportation/Distribution & Logistics
10. In what state do you currently live?	50 state choices & Washington, D.C.
11. Which group most closely describes your ethnicity?	American Indian /Alaska Native; Asian; Black/African-American; Hispanic/Latino; Middle Eastern; Native Hawaiian/Pacific Islander; White/Caucasian
12. Where were you born? (Pick the nearest country/region.)	USA; Canada; British Isles; Western Europe; Eastern Europe; Soviet Union; Middle East; China; Australia; Southeast Asia; Africa; India; Japan; Korea; Mexico; Central America; Brazil; South America (not Brazil); Caribbean Islands; Indonesia
13. Age?	Age (in years)
14. Gender?	Female; Male

4. RESULTS OF THE SURVEY

All data and R codes are available from the first author. Educators and researchers may use these codes and data freely, with proper acknowledgment.

The raw percentages in our 2015 survey, with 64% reporting “day-tuh” and 36% “daa-tuh,” are (surprisingly, given evidence mentioned above of a shift towards “day-tuh”) nearly identical to those found by Shitara in her 1993 survey. Nevertheless, the similarity of results of our studies lends a modicum of external validity to both. Note that her sample size was relatively small (n = 400 versus our n = 1020); we suggest that the extreme *similarity* of our results is explainable by random sampling variability, given that temporal changes are expected over long time horizons.

4.1 Main Effects

To identify main effects associated with pronunciation, we converted all variables shown in Table 2 to binary. For example, Item 1 was unpacked to four binary categorizations, (West/not West), (South/not South), (Midwest/not Midwest), and (Northeast/not Northeast). All other variables were unpacked similarly, with a median split for the “Age” variable, and we constructed 2x2 tables for each binary variable with the binary “day-tuh/daa-tuh” response of Item 3. (Such binary coding is commonly used in over-representation analysis of genomic pathways, e.g., Drăghici et al., 2003.) For each 2x2 table, we computed a Fisher’s exact test,

along with an odds ratio estimate favoring “day-tuh.” Odds ratio (OR) estimates were adjusted for possible 0 counts by adding 0.5 to all cells (Gart and Zweifel, 1967). This analysis yielded 118 associations having non-zero counts in at least three of the four cells of the 2x2 table; we then plotted their statistics using a *volcano plot*, a tool commonly used in genetics (e.g., Cui and Churchill, 2003). See Figure 1.

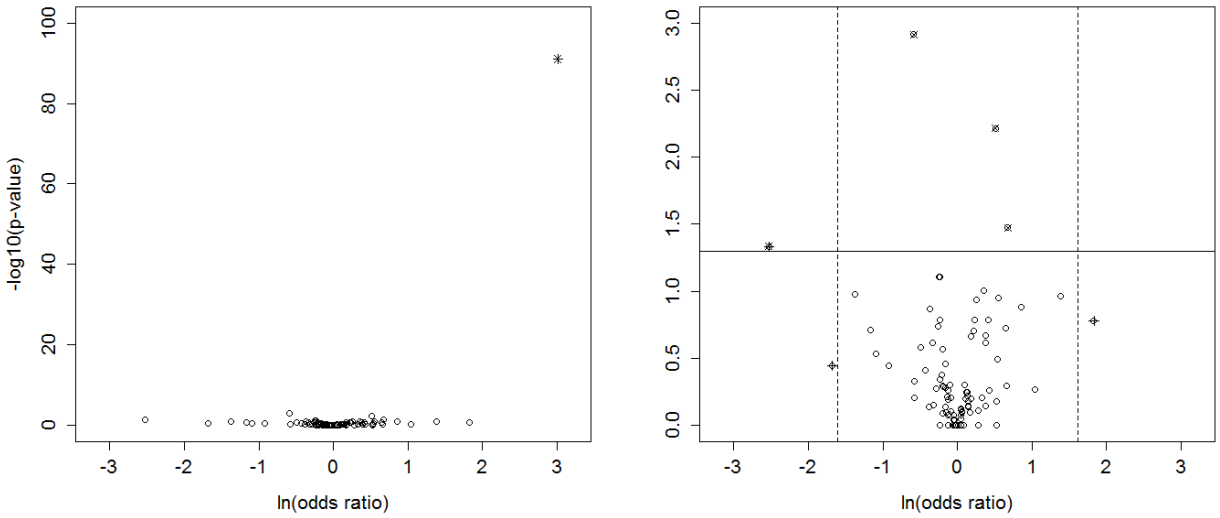

Figure 1. Volcano plots of (log odds ratio favoring “day-tuh,” -log10(*p*-value)) for 118 association tests. In the left panel all 118 tests are shown, with the extreme effect of colleagues’ pronunciation (Item 6 in our survey) shown as “*” in the upper right. The right panel zooms in to show the 117 less extreme results, with the (unadjusted) 0.05 *p*-value threshold shown horizontally (exceedances marked with “x”); and with ln(OR) = ±ln(5) thresholds (Chen et al., 2010) shown vertically (exceedances marked with “+”).

The results were surprising. In the left panel of Figure 1, there is one association, shown in the upper right, that is highly significant (Fisher exact *p*-value = 8.2×10^{-92}), while all other associations have dramatically less significance. The log odds ratio for this association is estimated to be 3.01, the most extreme among the 118 tests. This extreme association refers to Item 6 of our survey, namely, the respondents’ perception of “To the best of your knowledge, what is the most common pronunciation of the word *data* among your colleagues?” All other associations are comparatively very weak. Figure 2 shows the extreme association, along with the non-significant regional association for comparison.

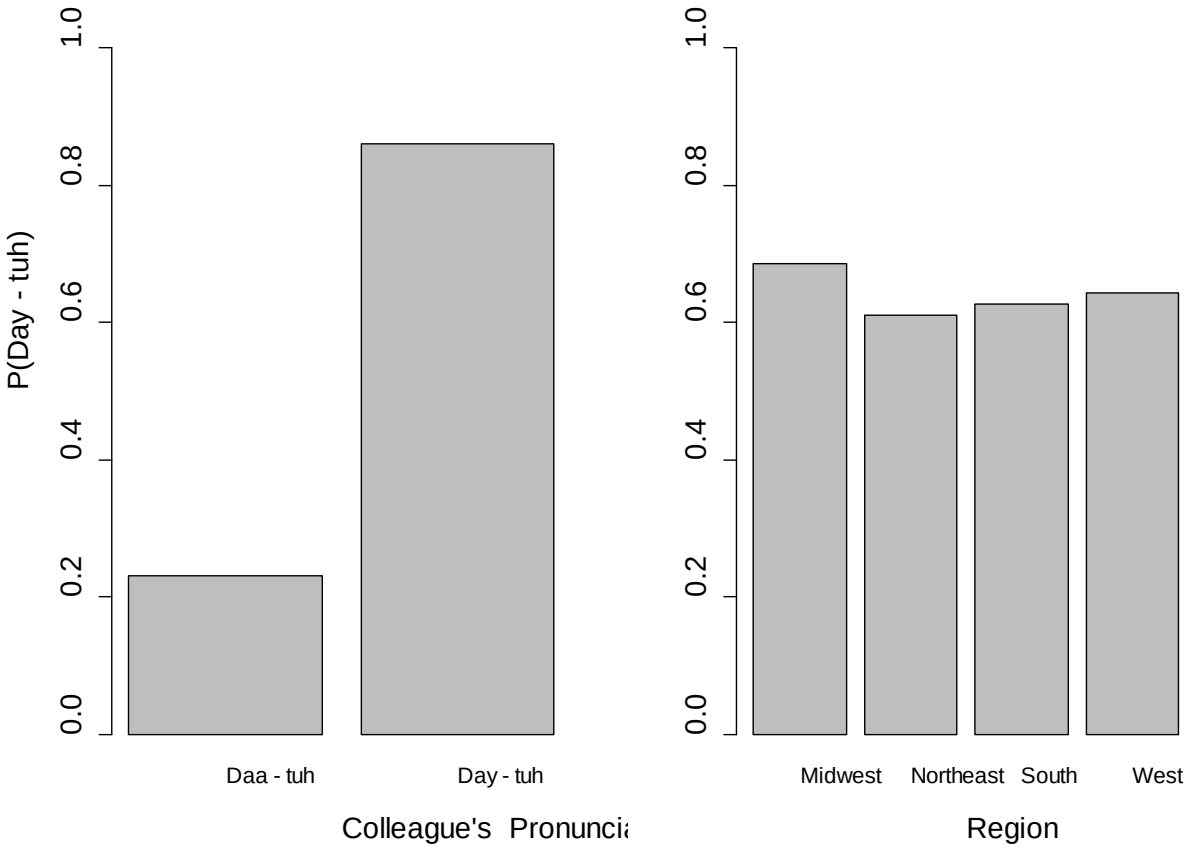

Figure 2. Proportion of respondents who pronounce *data* as "day-tuh." The left panel compares the proportion of "day-tuh" pronunciations among respondents whose colleagues pronounce the word as "daa-tuh" with respondents whose colleagues pronounce it as "day-tuh." The right panel compares the same proportion across the major U.S. geographical regions.

The extreme "colleague" effect remains highly significant after multiplicity adjustment (even the conservative Bonferroni adjusted p-value is highly significant, $118 \times 8.2 \times 10^{-92} = 9.7 \times 10^{-90}$), but none of the remaining 117 effects are significant at the multiplicity-adjusted 0.05 level even when using the less conservative Benjamini-Hochberg false discovery rate (FDR) controlling method (Benjamini and Hochberg, 1995). Nevertheless, it is worth identifying the items flagged in the right panel of Figure 1, with acknowledgment that they could easily be false positive associations. The significant ($p < .05$, unadjusted for multiplicity) associations are as follows:

- With those who have noticed a shift towards "daa-tuh" (Item 7): 52.0% of the 150 respondents who noticed such a shift still pronounce it as "day-tuh," smaller than the overall 64.0% rate ($p = 0.0012$, OR = 0.556).
- With those who try to convince others to follow their pronunciation (Item 8): 73.3% of the 165 respondents who try to convince others to pronounce it their way pronounce it as "day-tuh" ($p = 0.0061$, OR = 1.66).
- With those who expressed an interest in "Transportation/Distribution & Logistics" (Item 9): 77.6% of these 58 respondents pronounce it as "day-tuh" ($p = 0.034$, OR = 1.96).

- With those who live in Rhode Island (item 10): 0.0% of these 3 respondents pronounce it as “day-tuh” (p = 0.046, OR = 0.080).

As shown in Figure 1, there are additional insignificant associations having large effect sizes; these involve comparisons with extremely small sample sizes and are not discussed further. Gender was nearly significant at the (unadjusted) 0.05 level, and an alternative analysis using age as a quadratic predictor as well as gender showed both to be significant in a logistic regression model, with deviance chi-squares χ^2=4.62 (df=1) for gender and χ^2=12.22 (df=2) for age. As shown in Figure 3, surveyed males more often pronounce it as “day-tuh,” and the “day-tuh” pronunciation frequency declines with age in both genders.

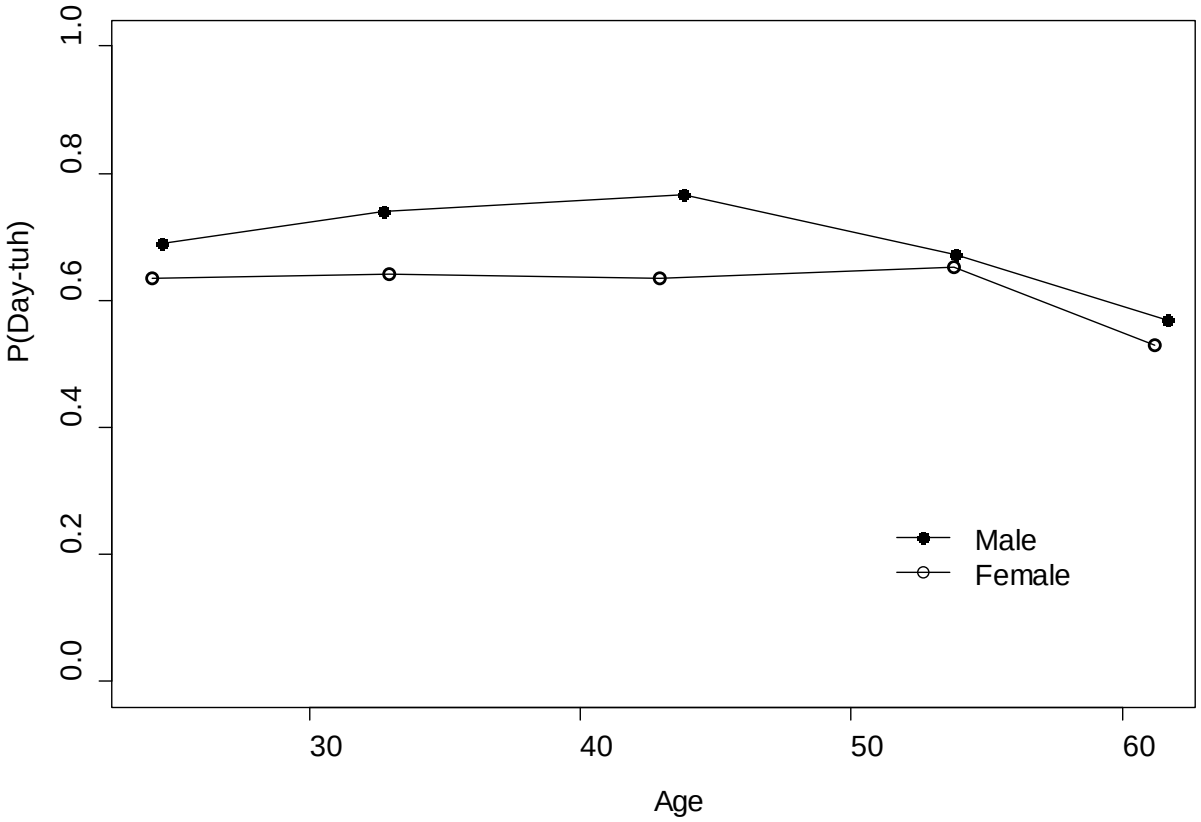

Figure 3. Proportion of “Day-tuh” pronunciation within quintile age categories. Males are indicated by solid points (•) and females indicated by hollow points (o).

How did the subjects report learning to say “data”? Figure 4 shows that most people (36.6% + 25.7% = 62.3%) report learning how to pronounce “data” from either family or teachers; interestingly, not colleagues or coworkers, despite the high association between respondents’ pronunciation and their colleagues’ pronunciation. Thus, while survey respondents perceive that their colleagues mostly pronounce *data* the same way that they do, they do not feel that they *learned* their pronunciation from their colleagues or coworkers.

Possible explanations are that (i) people in a respondent's colleague/coworker class learned their pronunciation from common sources; (ii) survey respondents are not willing to give colleagues/coworkers credit for their pronunciation; (iii) people are simply bad at remembering where they learned things; (iv) many survey respondents might not have colleagues/coworkers *per se* if they are stay-at-home workers, and as such "colleagues/coworkers" might be loosely interpreted as "family." Indeed, there is a significant association between where a respondent learned to pronounce *data* (Item 5) with their education level (Item 2), with more highly educated respondents choosing "Teacher" more often for Item 5.

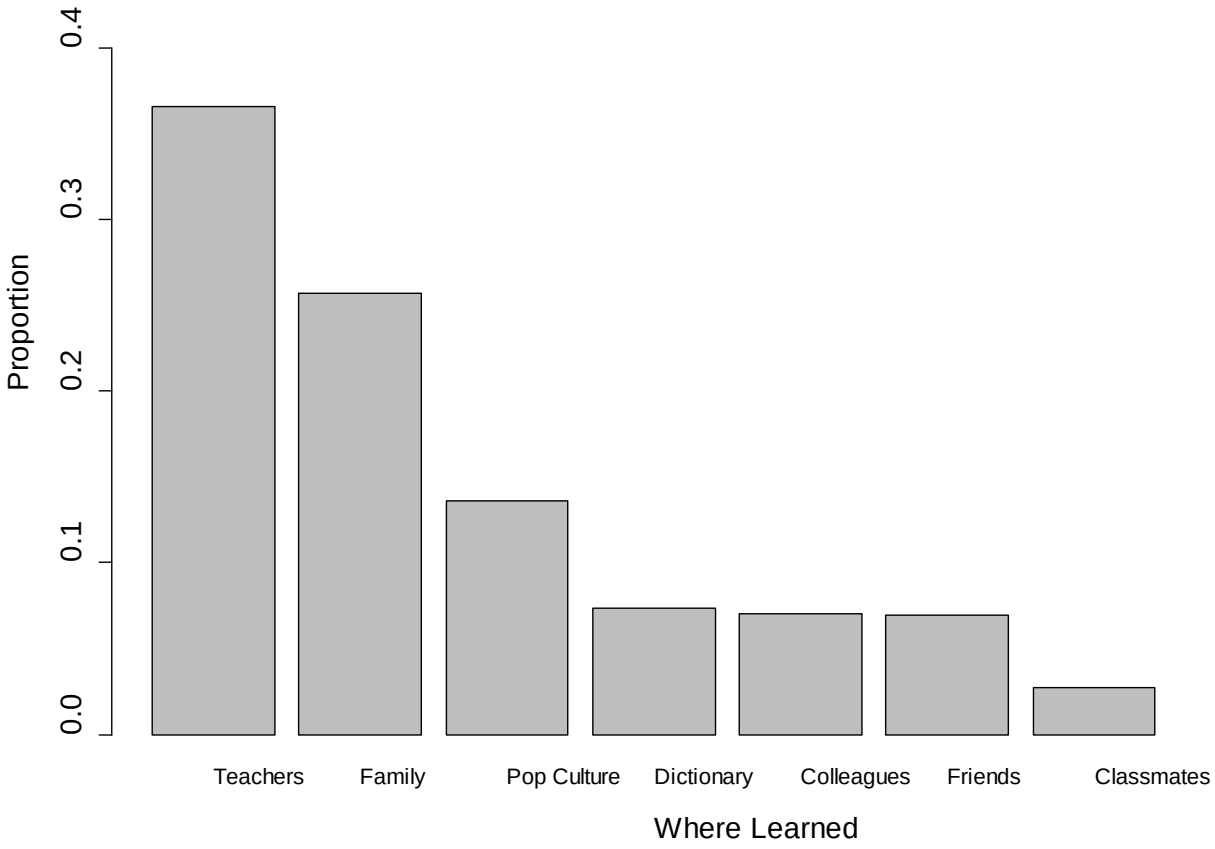

Figure 4: Proportions of responses to the question "Where did you learn how to pronounce *data*?" (Item 5 in Table 2)

4.2 Interactions: What Affects Phonetic Convergence as Regards the Pronunciation of *Data*?
The strong relationship between "pronunciation" and "colleague's pronunciation" suggests a strong phonetic convergence effect. To understand this phenomenon better, we define the following measure of phonetic convergence:

$$PC = \Pr(\text{Day-tuh} \mid \text{Colleague says Day-tuh}) - \Pr(\text{Day-tuh} \mid \text{Colleague says Daa-tuh})$$

The larger the value of *PC*, the more phonetic convergence: *PC* = 1.0 indicates perfect phonetic convergence, where everyone pronounces *data* as their colleagues do; *PC* = 0 means that one's pronunciation is independent of one's colleagues' pronunciation; and *PC* = -1 indicates perfect phonetic *divergence*, where everyone pronounces *data* the opposite of their colleagues. Thus, larger values of *PC* correspond to a culture where people "fit in" better with their colleagues as regards pronunciation of *data*.

To determine significant predictors of *PC*, we fit 117 logistic regression models to predict the "day-tuh" pronunciation, each including the "colleague" variable, one of the remaining 117 binary predictors as noted in the previous section, and an interaction term. This analysis produced 117 chi-square deviance statistics (*df* = 1 for binary predictors with sufficient data; binary predictors with sparse data have *df* = 0 and are automatically excluded) for interaction terms, which are really tests for differences in a logit variant of the *PC* measure. Two of these interactions were significant using the Benjamini-Hochberg (FDR = 0.05) adjustment: The Northeast region variable (in Item 1), and the variable "No shift noted in my lifetime" (in Item 7). Interaction plots using raw proportions given in Figure 5 show these significant effects on the PC measure. Note that higher *divergence* in the predicted probabilities, as shown in the graphs, corresponds to higher phonetic *convergence*, as regards pronunciation.

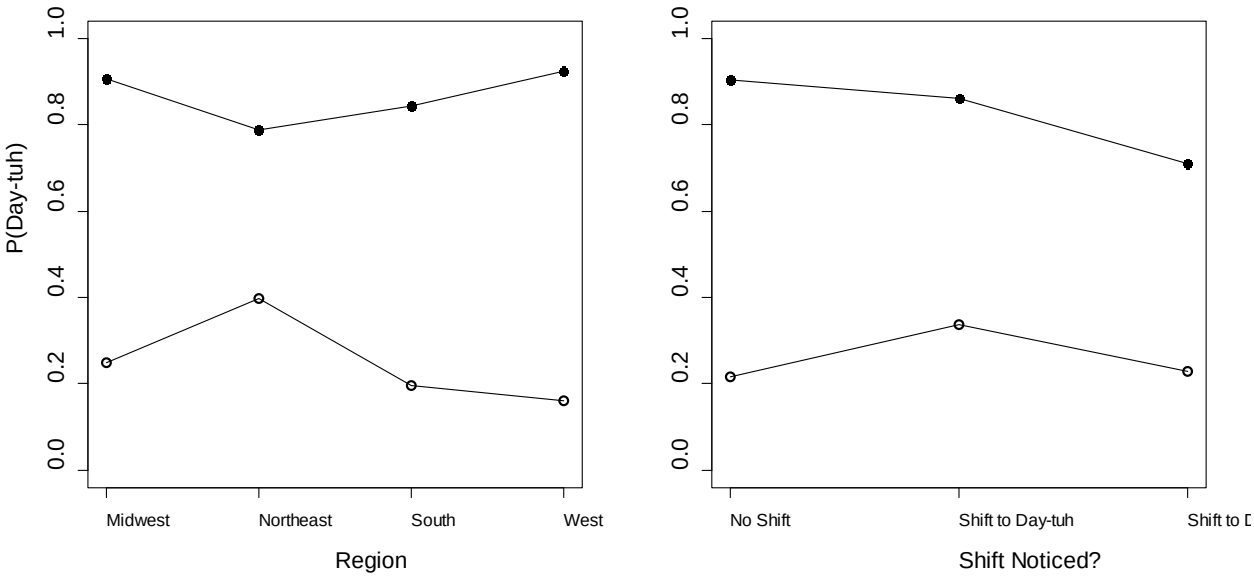

Figure 5. Variables that significantly affect phonetic convergence (*PC*). In both panels, the solid circles (•) indicate those whose colleagues say "day-tuh," and the hollow circles (o) indicate people whose colleagues say "daa-tuh." *PC* values are vertical differences. The left panel shows effect of Region on *PC* (deviance χ^2 = 22.87, *df* = 3), and the right panel shows effect of whether a shift was noticed on *PC* (deviance χ^2 = 14.82, *df* = 2).

Northeasterners are the least convergent with respect to the *data* pronunciation (i.e., least apt to try to "fit in"), with *PC* = 0.39, compared to those in the Midwest, South and West (*PC* = 0.66, 0.65, 0.76, respectively). Notable large states with low *PC* are Pennsylvannia and New York,

with estimates 0.28 and 0.43; Ohio, Texas and California are large sates with high *PC* estimates of 0.87, 0.82, and 0.73.

People who have not noticed a shift in the pronunciation of *data* in their lifetimes are more convergent with their colleagues (*PC* = 0.69) than those who have noticed a shift (*PC* = 0.53 for shift to "day-tuh," 0.48 for shift to "daa-tuh"). A plausible explanation is that many people who have noticed a shift to their non-preferred pronunciation still prefer to say it the way they always did, thus "dig in their heels" and are less convergent with those who have shifted.

We had anticipated an effect of education on pronunciation and designed the study to ensure adequate variation in the education variable. Therefore, we also considered the effect of education as an ordinal variable on phonetic convergence, rather than as a collection of binary variables as in the analyses above. While ordinal education was insignificant in a simple main-effects logistic regression model (deviance $\chi^2 = 0.77$, $df = 1$), it was significant as a predictor of *PC*, as measured by using the interaction model (deviance $\chi^2 = 5.61$, $df = 1$). Figure 6 shows the predicted probabilities from the logistic regression model, with raw proportions superimposed.

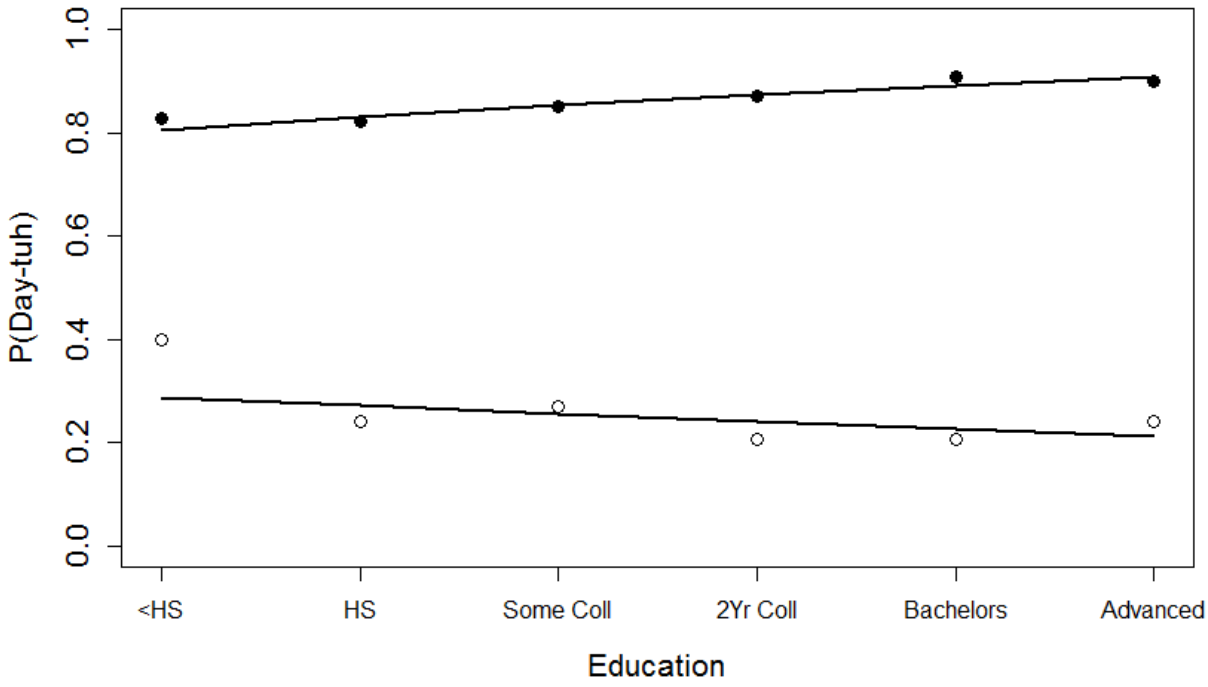

Figure 6. Effect of education on phonetic convergence (*PC*). Solid circles (•) indicate raw proportions of "day-tuh" pronunciation those among people whose colleagues say "day-tuh," and hollow circles (o) indicate raw proportions of "day-tuh" pronunciation among people whose colleagues say "daa-tuh." *PC* values are vertical differences. Solid lines are predicted probabilities from a logistic regression model including colleague's pronunciation, ordinal education (1, 2, 3, 4, 5, 6), and an interaction term.

While employment status was not measured in the survey, a possible explanation for the trend in Figure 6 is that people with more education are more employed, and that employed people feel a need to "fit in" more than the unemployed. The raw proportions suggest a dip in convergence for people with advanced degrees, possibly suggesting less of a need to "fit in" for that group. Finally, a similar analysis using age as an ordinal variable showed that older respondents tend to be significantly more convergent than the younger ones.

5. CONCLUSION

The title of this article is taken from the song *Let's Call the Whole Thing Off*, written by George and Ira Gershwin, in which different pronunciations of words like *tomato* and *pajamas* reflect regional and class differences (and the dispensability of those differences in the pursuit of love). Unlike the song, our study suggests that phonetic convergence — the linguistic mimicry of those around you — mainly explains how a person pronounces the word *data*. Other variables we studied, including education, age, ethnicity, gender, and region, have comparatively much smaller main effects on pronunciation. On the other hand, region, education, age and other variables affect degree of phonetic convergence, indicating that the tendency to "fit in" as regards pronunciation of *data* is mildly predictable.

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