

# India Sociolinguistics Geographic Associations Analyses

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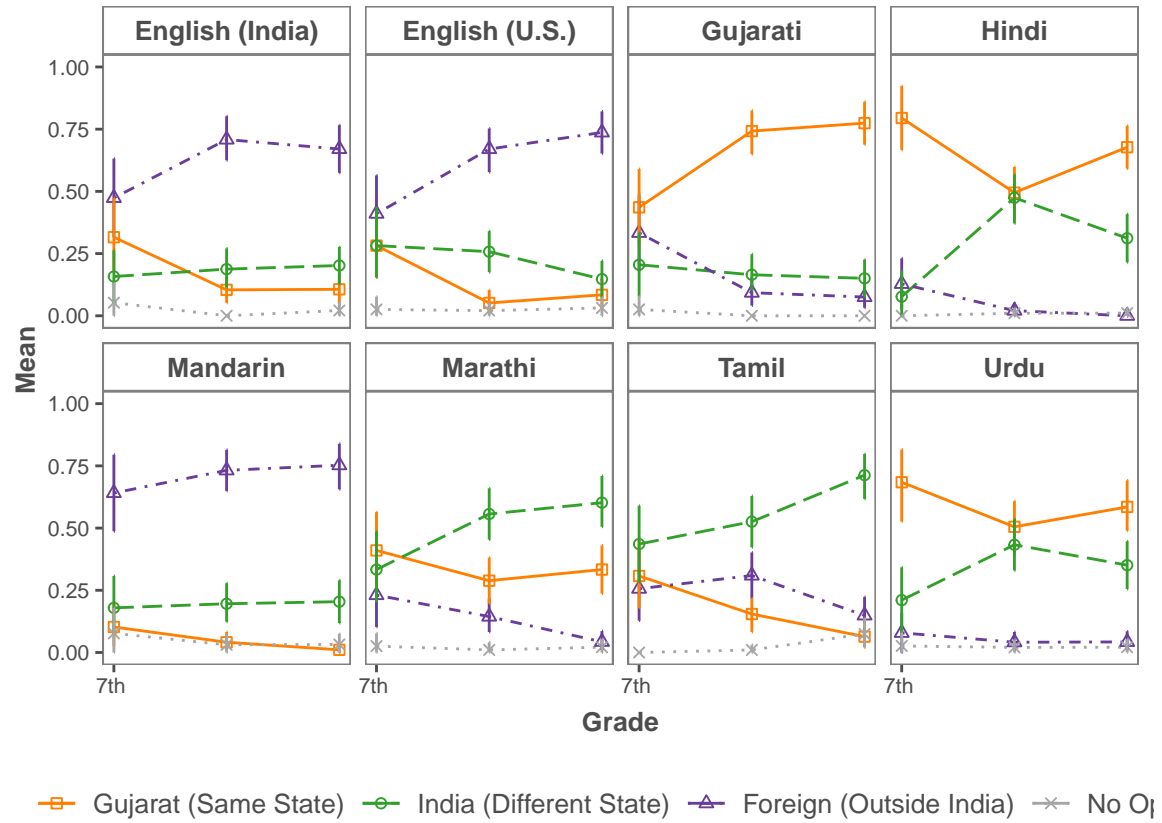
2023-08-18

no_opinion_trials	n_children
1	21
2	5
8	1

language	n
Mandarin	9
Tamil	8
English (U.S.)	6
Urdu	5
English (India)	4
Marathi	4
Hindi	2
Gujarati	1

“No opinion” selected on 39 trials by 27 children; all children selected single response.

## By Standard



## With Age

### Models

#### Odds of Origin Selection

##### Gujarat (Same place as me)

		2.5 %	97.5 %
(Intercept)	0.16	0.11	0.24
child_age_centered	0.93	0.86	1.00
languageEnglish (U.S.)	0.71	0.40	1.24
languageGujarati	14.60	9.23	23.67
languageHindi	10.05	6.42	16.13
languageMandarin	0.25	0.11	0.52
languageMarathi	2.99	1.89	4.81
languageTamil	1.03	0.61	1.74
languageUrdu	8.09	5.18	12.94

		2.5 %	97.5 %
(Intercept)	0.16	0.11	0.23
child_age_centered	0.77	0.61	0.98
languageEnglish (U.S.)	0.67	0.37	1.21
languageGujarati	14.56	9.12	23.91
languageHindi	10.14	6.43	16.42
languageMandarin	0.20	0.07	0.46
languageMarathi	3.02	1.90	4.90
languageTamil	0.99	0.57	1.71
languageUrdu	8.30	5.27	13.42
child_age_centered:languageEnglish (U.S.)	0.90	0.62	1.29
child_age_centered:languageGujarati	1.73	1.28	2.35
child_age_centered:languageHindi	1.28	0.95	1.72
child_age_centered:languageMandarin	0.77	0.45	1.28
child_age_centered:languageMarathi	1.29	0.96	1.74
child_age_centered:languageTamil	0.90	0.64	1.27
child_age_centered:languageUrdu	1.17	0.88	1.57

```
## Analysis of Deviance Table (Type II tests)
##
## Response: gujarat
##               LR Chisq Df Pr(>Chisq)
## child_age_centered      4  1    0.047 *
## language               539  7    < 2e-16 ***
## child_age_centered:language    33  7    2.6e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

#### Another part of India (A different city)

		2.5 %	97.5 %
(Intercept)	0.23	0.16	0.32
child_age_centered	1.07	1.00	1.14
languageEnglish (U.S.)	1.19	0.75	1.88
languageGujarati	0.86	0.53	1.39
languageHindi	2.23	1.46	3.45
languageMandarin	1.05	0.66	1.68
languageMarathi	5.02	3.31	7.71
languageTamil	6.14	4.05	9.47
languageUrdu	2.45	1.60	3.78

		2.5 %	97.5 %
(Intercept)	0.23	0.16	0.32
child_age_centered	1.01	0.82	1.26
languageEnglish (U.S.)	1.20	0.76	1.91
languageGujarati	0.87	0.53	1.40
languageHindi	2.18	1.42	3.39
languageMandarin	1.06	0.66	1.69
languageMarathi	4.88	3.21	7.53

		2.5 %	97.5 %
languageTamil	5.96	3.91	9.22
languageUrdu	2.39	1.55	3.70
child_age_centered:languageEnglish (U.S.)	0.84	0.63	1.12
child_age_centered:languageGujarati	0.90	0.66	1.22
child_age_centered:languageHindi	1.09	0.83	1.44
child_age_centered:languageMandarin	0.99	0.73	1.32
child_age_centered:languageMarathi	1.17	0.89	1.53
child_age_centered:languageTamil	1.23	0.94	1.61
child_age_centered:languageUrdu	1.11	0.85	1.47

```
## Analysis of Deviance Table (Type II tests)
##
## Response: india
##               LR Chisq Df Pr(>Chisq)
## child_age_centered      4.0  1    0.045 *
## language             195.3  7   <2e-16 ***
## child_age_centered:language  12.9  7    0.076 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

### Outside India (Foreign)

		2.5 %	97.5 %
(Intercept)	1.90	1.45	2.50
child_age_centered	0.98	0.90	1.05
languageEnglish (U.S.)	1.00	0.68	1.47
languageGujarati	0.08	0.05	0.12
languageHindi	0.02	0.01	0.03
languageMandarin	1.40	0.94	2.08
languageMarathi	0.07	0.04	0.11
languageTamil	0.16	0.11	0.24
languageUrdu	0.03	0.01	0.05

		2.5 %	97.5 %
(Intercept)	1.85	1.41	2.45
child_age_centered	1.15	0.96	1.36
languageEnglish (U.S.)	1.00	0.67	1.47
languageGujarati	0.07	0.04	0.12
languageHindi	0.01	0.00	0.02
languageMandarin	1.40	0.94	2.10
languageMarathi	0.07	0.04	0.11
languageTamil	0.17	0.11	0.25
languageUrdu	0.03	0.01	0.05
child_age_centered:languageEnglish (U.S.)	1.12	0.88	1.44
child_age_centered:languageGujarati	0.59	0.43	0.81
child_age_centered:languageHindi	0.33	0.14	0.61
child_age_centered:languageMandarin	1.01	0.79	1.31
child_age_centered:languageMarathi	0.59	0.43	0.81

		2.5 %	97.5 %
child_age_centered:languageTamil	0.73	0.57	0.95
child_age_centered:languageUrdu	0.74	0.48	1.13

```
## Analysis of Deviance Table (Type II tests)
##
## Response: foreign
##               LR Chisq Df Pr(>Chisq)
## child_age_centered      0  1      0.52
## language               707  7    < 2e-16 ***
## child_age_centered:language    46  7    8.8e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

### Mixed Effects Multinomial Regression

```
##
## Iteration 1 - deviance = 2926 - criterion = 0.85
## Iteration 2 - deviance = 2878 - criterion = 0.051
## Iteration 3 - deviance = 2873 - criterion = 0.018
## Iteration 4 - deviance = 2871 - criterion = 0.0053
## Iteration 5 - deviance = 2871 - criterion = 6e-04
## Iteration 6 - deviance = 2871 - criterion = 5.1e-06
## Iteration 7 - deviance = 2871 - criterion = 3e-10
## converged

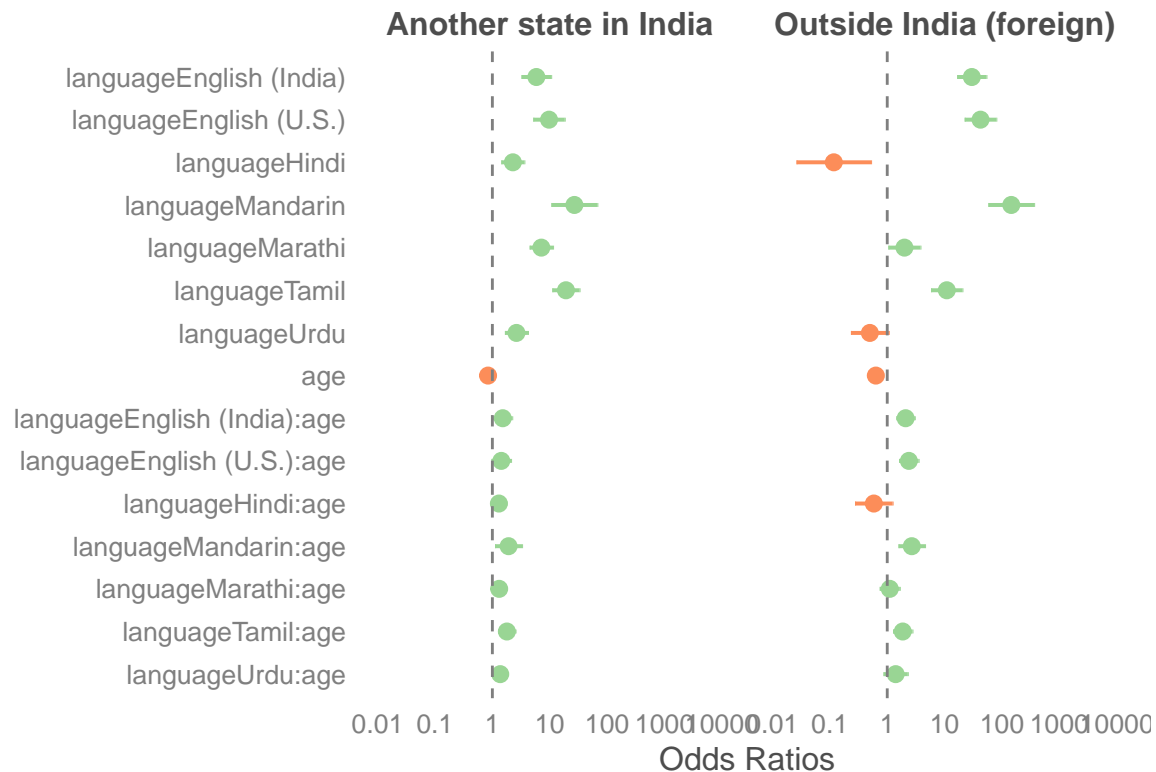
##
## Call:
## mblogit(formula = origin_labeled ~ language * age, data = g_for_plots,
##         random = ~1 | id)
##
## Equation for Outside India (foreign) vs Gujarat (Same place as me):
##
##               Estimate Std. Error z value
## Outside India (foreign)~(Intercept)      -1.823      0.227    -8.02
## Outside India (foreign)~languageEnglish (India)    3.393      0.299    11.35
## Outside India (foreign)~languageEnglish (U.S.)    3.741      0.324    11.56
## Outside India (foreign)~languageHindi      -2.143      0.762    -2.81
## Outside India (foreign)~languageMandarin    4.975      0.468    10.64
## Outside India (foreign)~languageMarathi    0.690      0.328     2.10
## Outside India (foreign)~languageTamil    2.388      0.320     7.46
## Outside India (foreign)~languageUrdu      -0.697      0.387    -1.80
## Outside India (foreign)~age      -0.457      0.144    -3.17
## Outside India (foreign)~languageEnglish (India):age  0.738      0.188     3.93
## Outside India (foreign)~languageEnglish (U.S.):age  0.868      0.200     4.35
## Outside India (foreign)~languageHindi:age  -0.537      0.384    -1.40
## Outside India (foreign)~languageMandarin:age  0.985      0.271     3.63
## Outside India (foreign)~languageMarathi:age  0.102      0.205     0.50
## Outside India (foreign)~languageTamil:age  0.622      0.199     3.12
## Outside India (foreign)~languageUrdu:age  0.338      0.248     1.36
##
##               Pr(>|z|)
## Outside India (foreign)~(Intercept)      1.1e-15 ***
## Outside India (foreign)~languageEnglish (India)    < 2e-16 ***
```

```

## Outside India (foreign)~languageEnglish (U.S.)      < 2e-16 ***
## Outside India (foreign)~languageHindi                0.00495 **
## Outside India (foreign)~languageMandarin             < 2e-16 ***
## Outside India (foreign)~languageMarathi              0.03551 *
## Outside India (foreign)~languageTamil                8.8e-14 ***
## Outside India (foreign)~languageUrdu                 0.07136 .
## Outside India (foreign)~age                          0.00152 **
## Outside India (foreign)~languageEnglish (India):age  8.4e-05 ***
## Outside India (foreign)~languageEnglish (U.S.):age   1.4e-05 ***
## Outside India (foreign)~languageHindi:age            0.16174
## Outside India (foreign)~languageMandarin:age         0.00029 ***
## Outside India (foreign)~languageMarathi:age          0.62010
## Outside India (foreign)~languageTamil:age            0.00182 **
## Outside India (foreign)~languageUrdu:age             0.17307
##
## Equation for Another state in India vs Gujarat (Same place as me):
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)      -1.484    0.194   -7.66  1.8e-14 ***
## languageEnglish (India)    1.764    0.303    5.82  5.8e-09 ***
## languageEnglish (U.S.)    2.272    0.322    7.06  1.6e-12 ***
## languageHindi           0.822    0.236    3.49  0.00048 ***
## languageMandarin        3.290    0.470    7.00  2.5e-12 ***
## languageMarathi         1.965    0.239    8.22  < 2e-16 ***
## languageTamil           2.951    0.278   10.60  < 2e-16 ***
## languageUrdu            0.965    0.236    4.10  4.2e-05 ***
## age                   -0.174    0.127   -1.37  0.17095
## languageEnglish (India):age  0.416    0.194    2.15  0.03184 *
## languageEnglish (U.S.):age  0.358    0.200    1.79  0.07303 .
## languageHindi:age        0.261    0.154    1.69  0.09057 .
## languageMandarin:age     0.650    0.276    2.36  0.01833 *
## languageMarathi:age      0.272    0.155    1.75  0.07938 .
## languageTamil:age        0.582    0.177    3.29  0.00101 **
## languageUrdu:age         0.315    0.154    2.05  0.04078 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Co-)Variances:
## Grouping level: id
##               Estimate      Std.Err.
## Outside India (foreign)~1  0.363      0.00759
## Another state in India~1  0.142 0.422    0.00830 0.01063
##
## Approximate residual deviance: 2870
## Number of Fisher scoring iterations: 7
## Number of observations
## Groups by id: 127
## Individual observations: 1795

```

## Geographic Origin: This speaker is from...



origin\_labeled: Outside India (foreign)

origin\_labeled: Another state in India

Predictors

Odds Ratios

CI

p

Odds Ratios

CI

p

(Intercept)

0.23

0.16 – 0.33

<0.001

0.16

0.10 – 0.25

<0.001

languageEnglish (India)

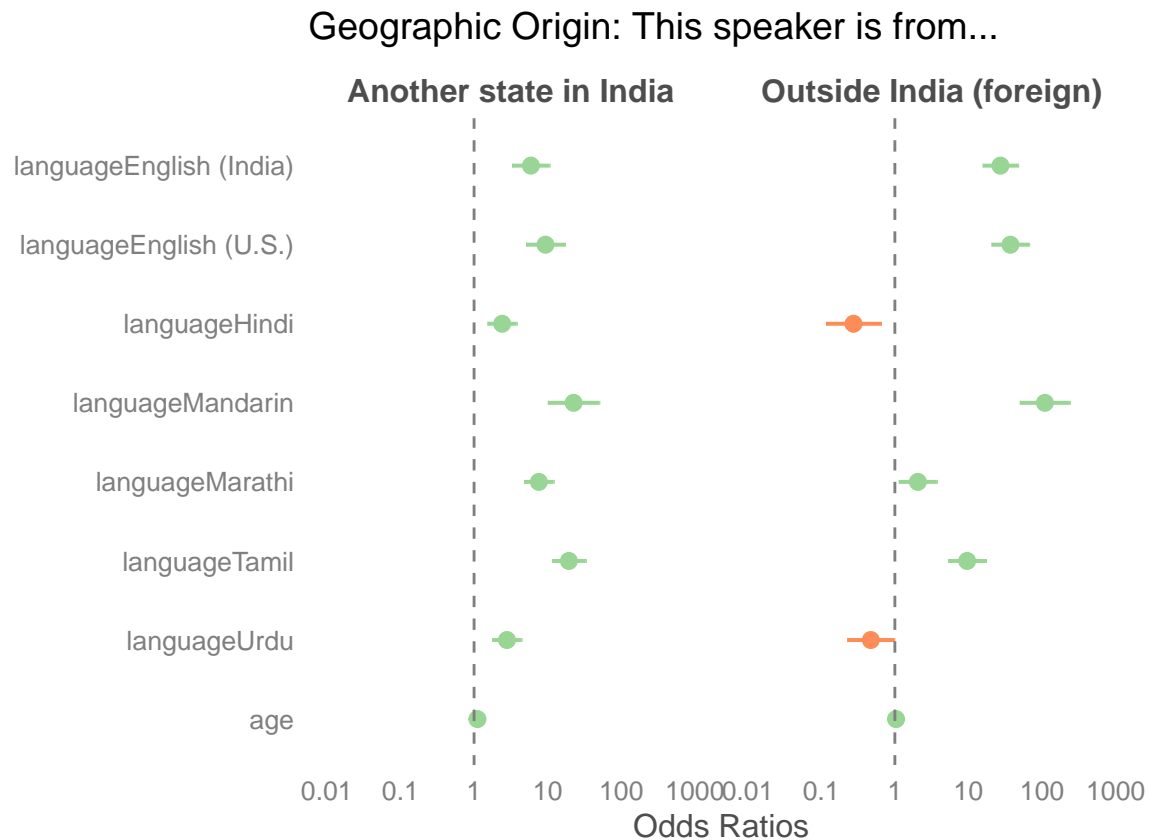
5.84  
 3.22 – 10.57  
 <0.001  
 29.75  
 16.55 – 53.47  
 <0.001  
 languageEnglish (U.S.)  
 9.70  
 5.16 – 18.23  
 <0.001  
 42.12  
 22.33 – 79.46  
 <0.001  
 languageHindi  
 2.28  
 1.43 – 3.61  
 <0.001  
 0.12  
 0.03 – 0.52  
 0.005  
 languageMandarin  
 26.84  
 10.69 – 67.40  
 <0.001  
 144.73  
 57.87 – 362.00  
 <0.001  
 languageMarathi  
 7.13  
 4.46 – 11.40  
 <0.001  
 1.99  
 1.05 – 3.79  
 0.036  
 languageTamil  
 19.13



11.08 – 33.01  
 <0.001  
 10.89  
 5.81 – 20.41  
 <0.001  
 languageUrdu  
 2.63  
 1.65 – 4.17  
 <0.001  
 0.50  
 0.23 – 1.06  
 0.071  
 age  
 0.84  
 0.66 – 1.08  
 0.171  
 0.63  
 0.48 – 0.84  
 0.002  
 languageEnglish (India):age  
 1.52  
 1.04 – 2.22  
 0.032  
 2.09  
 1.45 – 3.02  
 <0.001  
 languageEnglish (U.S.):age  
 1.43  
 0.97 – 2.12  
 0.073  
 2.38  
 1.61 – 3.52  
 <0.001  
 languageHindi:age  
 1.30  
 0.96 – 1.76

0.091  
 0.58  
 0.28 – 1.24  
 0.162  
 languageMandarin:age  
 1.92  
 1.12 – 3.29  
 0.018  
 2.68  
 1.57 – 4.56  
 <0.001  
 languageMarathi:age  
 1.31  
 0.97 – 1.78  
 0.079  
 1.11  
 0.74 – 1.66  
 0.620  
 languageTamil:age  
 1.79  
 1.26 – 2.53  
 0.001  
 1.86  
 1.26 – 2.75  
 0.002  
 languageUrdu:age  
 1.37  
 1.01 – 1.85  
 0.041  
 1.40  
 0.86 – 2.28  
 0.173  
 N id  
 127  
 Observations  
 1795

```
##
## Iteration 1 - deviance = 2977 - criterion = 0.85
## Iteration 2 - deviance = 2939 - criterion = 0.034
## Iteration 3 - deviance = 2939 - criterion = 0.0028
## Iteration 4 - deviance = 2939 - criterion = 4.8e-05
## Iteration 5 - deviance = 2939 - criterion = 1e-08
## Iteration 6 - deviance = 2939 - criterion = 9.9e-16
## converged
```



```
##
## Iteration 1 - deviance = 2737 - criterion = 0.84
## Iteration 2 - deviance = 2692 - criterion = 0.046
## Iteration 3 - deviance = 2690 - criterion = 0.011
## Iteration 4 - deviance = 2690 - criterion = 0.0011
## Iteration 5 - deviance = 2690 - criterion = 9e-06
## Iteration 6 - deviance = 2689 - criterion = 7.5e-10
## converged
```

```
##
## Call:
## mblogit(formula = origin_labeled ~ language * id_correct + age,
## data = gi, random = ~1 | id)
##
## Equation for Outside India (foreign) vs Gujarat (Same place as me):
## Estimate Std. Error
```

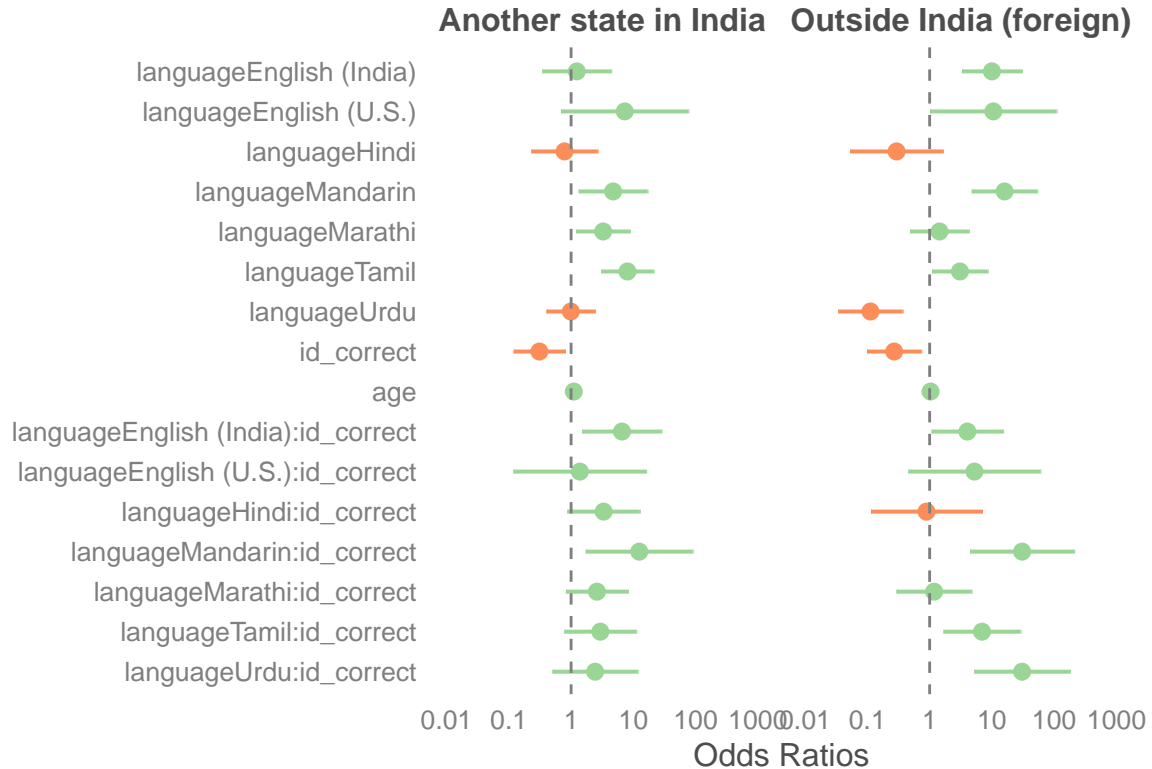
```

## Outside India (foreign)~(Intercept) -0.786 0.438
## Outside India (foreign)~languageEnglish (India) 2.302 0.564
## Outside India (foreign)~languageEnglish (U.S.) 2.354 1.192
## Outside India (foreign)~languageHindi -1.225 0.874
## Outside India (foreign)~languageMandarin 2.768 0.618
## Outside India (foreign)~languageMarathi 0.365 0.553
## Outside India (foreign)~languageTamil 1.119 0.524
## Outside India (foreign)~languageUrdu -2.187 0.607
## Outside India (foreign)~id_correct -1.310 0.512
## Outside India (foreign)~age 0.033 0.057
## Outside India (foreign)~languageEnglish (India):id_correct 1.393 0.674
## Outside India (foreign)~languageEnglish (U.S.):id_correct 1.656 1.244
## Outside India (foreign)~languageHindi:id_correct -0.117 1.046
## Outside India (foreign)~languageMandarin:id_correct 3.417 0.982
## Outside India (foreign)~languageMarathi:id_correct 0.165 0.708
## Outside India (foreign)~languageTamil:id_correct 1.935 0.726
## Outside India (foreign)~languageUrdu:id_correct 3.417 0.901
## z value Pr(>|z|)
## Outside India (foreign)~(Intercept) -1.79 0.07280 .
## Outside India (foreign)~languageEnglish (India) 4.08 4.5e-05 ***
## Outside India (foreign)~languageEnglish (U.S.) 1.97 0.04827 *
## Outside India (foreign)~languageHindi -1.40 0.16130
## Outside India (foreign)~languageMandarin 4.48 7.6e-06 ***
## Outside India (foreign)~languageMarathi 0.66 0.50927
## Outside India (foreign)~languageTamil 2.14 0.03270 *
## Outside India (foreign)~languageUrdu -3.61 0.00031 ***
## Outside India (foreign)~id_correct -2.56 0.01051 *
## Outside India (foreign)~age 0.58 0.56211
## Outside India (foreign)~languageEnglish (India):id_correct 2.07 0.03886 *
## Outside India (foreign)~languageEnglish (U.S.):id_correct 1.33 0.18327
## Outside India (foreign)~languageHindi:id_correct -0.11 0.91076
## Outside India (foreign)~languageMandarin:id_correct 3.48 0.00050 ***
## Outside India (foreign)~languageMarathi:id_correct 0.23 0.81612
## Outside India (foreign)~languageTamil:id_correct 2.67 0.00770 **
## Outside India (foreign)~languageUrdu:id_correct 3.79 0.00015 ***
##
## Equation for Another state in India vs Gujarat (Same place as me):
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.50684 0.43288 -1.17 0.242
## languageEnglish (India) 0.21238 0.64969 0.33 0.744
## languageEnglish (U.S.) 1.98313 1.20006 1.65 0.098 .
## languageHindi -0.24191 0.62474 -0.39 0.699
## languageMandarin 1.55424 0.64847 2.40 0.017 *
## languageMarathi 1.18455 0.50444 2.35 0.019 *
## languageTamil 2.08440 0.49466 4.21 2.5e-05 ***
## languageUrdu -0.00971 0.45774 -0.02 0.983
## id_correct -1.17178 0.48313 -2.43 0.015 *
## age 0.10087 0.05652 1.78 0.074 .
## languageEnglish (India):id_correct 1.88070 0.74768 2.52 0.012 *
## languageEnglish (U.S.):id_correct 0.32276 1.25084 0.26 0.796
## languageHindi:id_correct 1.20233 0.68240 1.76 0.078 .
## languageMandarin:id_correct 2.51945 1.00747 2.50 0.012 *
## languageMarathi:id_correct 0.95585 0.58507 1.63 0.102
## languageTamil:id_correct 1.08112 0.67696 1.60 0.110

```

```
## languageUrdu:id_correct          0.88848    0.80303    1.11    0.269
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Co-)Variances:
## Grouping level: id
##
##          Estimate      Std.Err.
## Outside India (foreign)~1 0.228      0.00274
## Another state in India~1  0.128 0.421    0.00491 0.00972
##
## Approximate residual deviance: 2690
## Number of Fisher scoring iterations: 6
## Number of observations
## Groups by id: 120
## Individual observations: 1697 (118 observations deleted due to missingness)
```

## Geographic Origin: This speaker is from...



origin\_labeled: Outside India (foreign)

origin\_labeled: Another state in India

Predictors

Odds Ratios

CI

p

Odds Ratios
CI
p
(Intercept)
0.60
0.26 – 1.41
0.242
0.46
0.19 – 1.08
0.073
languageEnglish (India)
1.24
0.35 – 4.42
0.744
9.99
3.30 – 30.21
<0.001
languageEnglish (U.S.)
7.27
0.69 – 76.41
0.098
10.53
1.02 – 108.93
0.048
languageHindi
0.79
0.23 – 2.67
0.699
0.29
0.05 – 1.63
0.161
languageMandarin
4.73
1.33 – 16.87
0.017
15.93

4.74 – 53.56  
 <0.001  
 languageMarathi  
 3.27  
 1.22 – 8.79  
 0.019  
 1.44  
 0.49 – 4.26  
 0.509  
 languageTamil  
 8.04  
 3.05 – 21.21  
 <0.001  
 3.06  
 1.10 – 8.56  
 0.033  
 languageUrdu  
 0.99  
 0.40 – 2.43  
 0.983  
 0.11  
 0.03 – 0.37  
 <0.001  
 id\_correct  
 0.31  
 0.12 – 0.80  
 0.015  
 0.27  
 0.10 – 0.74  
 0.011  
 age  
 1.11  
 0.99 – 1.24  
 0.074  
 1.03  
 0.92 – 1.16

0.562  
 languageEnglish (India):id\_correct  
 6.56  
 1.51 – 28.41  
 0.012  
 4.03  
 1.07 – 15.10  
 0.039  
 languageEnglish (U.S.):id\_correct  
 1.38  
 0.12 – 16.04  
 0.796  
 5.24  
 0.46 – 60.08  
 0.183  
 languageHindi:id\_correct  
 3.33  
 0.87 – 12.68  
 0.078  
 0.89  
 0.11 – 6.92  
 0.911  
 languageMandarin:id\_correct  
 12.42  
 1.72 – 89.55  
 0.012  
 30.49  
 4.45 – 209.01  
 <0.001  
 languageMarathi:id\_correct  
 2.60  
 0.83 – 8.19  
 0.102  
 1.18  
 0.29 – 4.72  
 0.816



languageTamil:id\_correct

2.95

0.78 – 11.12

0.110

6.92

1.67 – 28.75

0.008

languageUrdu:id\_correct

2.43

0.50 – 11.74

0.269

30.46

5.20 – 178.39

<0.001

N id

120

Observations

1697