Appendix: Bootstrapping procedure

The bootstrapping algorithm used to obtain the final model is based on Baayen (2008:307). It consists of taking a subset of the data by randomly sampling ca. 75% of the speakers (*n* = 580) and refitting the best fixed effects-only model on the data for these speakers. This process is repeated 1000 times, producing confidence intervals for every fixed effect in this model. The code used to run the bootstrapping procedure is as follows:

## code adapted from Baayen (2008:307)

# specify dataframe used in the glm

mydf <- anyway

# specify column that contains individuals

myIndividuals <- anyway$shortformname

# specify model formula used in non-mixed glm

modelFormula <- depvar ~ year\_of\_birth.c + gender + education + occupation +

year\_of\_birth.c:gender + year\_of\_birth.c:education +

gender:occupation + gender:education

# other parameters

speakers <- levels(myIndividuals) # speakers

nruns <- 1000 # number of bootstrap runs

for (run in 1:nruns){

 # sample with replacement from speakers (75% of speakers selected):

 mySampleOfSpeakers = sample(speakers, length(speakers)\*0.75, replace = TRUE)

 # select data for the sampled speakers:

 mysample = mydf [is.element(myIndividuals, mySampleOfSpeakers),]

 # fit best glm() model:

 mysample.glm <- glm(modelFormula, family = binomial, data = mysample)

 # extract fixed effects from model:

 fixedEffects = mysample.glm$coefficients

 # save fixed effects for later inspection:

 if(run == 1) res = fixedEffects

 else res = rbind(res, fixedEffects)

 # this takes time, so output dots to indicate progress

 cat(".")

}

cat("\n") # add new line to console

# assign sensible rownames

rownames(res) = 1:nruns

# convert into data frame

res = data.frame(res)

# inspect 95% confidence intervals for all variables simultaneously

t(apply(res, 2, quantile, c(0.025, 0.5, 0.975)))

Table A1 shows the confidence intervals after 1000 runs. The rows marked in bold have confidence intervals that do not include 0, an indicator of significant effects.

Table A1. *Confidence intervals obtained with the bootstrapping procedure*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **2.50%** | **50%** | **97.50%** |
| **(Intercept)** | **-1.546** | **-0.761** | **-0.232** |
| **year\_of\_birth (centered)** | **0.023** | **0.044** | **0.069** |
| gender: men | -1.740 | -0.660 | 0.502 |
| **education level: with post-secondary education** | **-2.542** | **-1.788** | **-0.955** |
| occupation level: blue.collar | -1.882 | -0.918 | 0.044 |
| occupation level: student | -1.566 | -0.323 | 0.723 |
| year\_of\_birth (centered) \* gender: male | -0.041 | -0.015 | 0.012 |
| **year\_of\_birth (centered) \* education: with post-secondary**  | **0.008** | **0.030** | **0.051** |
| **gender: male \* occupation: blue.collar** | **0.295** | **1.692** | **3.149** |
| gender: male \* occupation: student | -1.041 | 0.489 | 2.249 |
| gender: male \* education: with post-secondary | -0.196 | 0.960 | 1.967 |

As a next step, a new fixed effects-only model was fitted, using only the predictors whose confidence intervals do not contain 0, which indicates that they have an effect over and above by-speaker variation. For one of the interaction effects, gender by occupation level, we cannot confirm the significance of the effect as a whole, as the confidence intervals for some regressors contain 0. Nonetheless, we retain this effect in the model, because the contrast between the intercept (white-collar workers) and the blue-collar workers exhibits a consistent effect after bootstrapping.