Implementing reproducibility in phonetic research: a computational workflow

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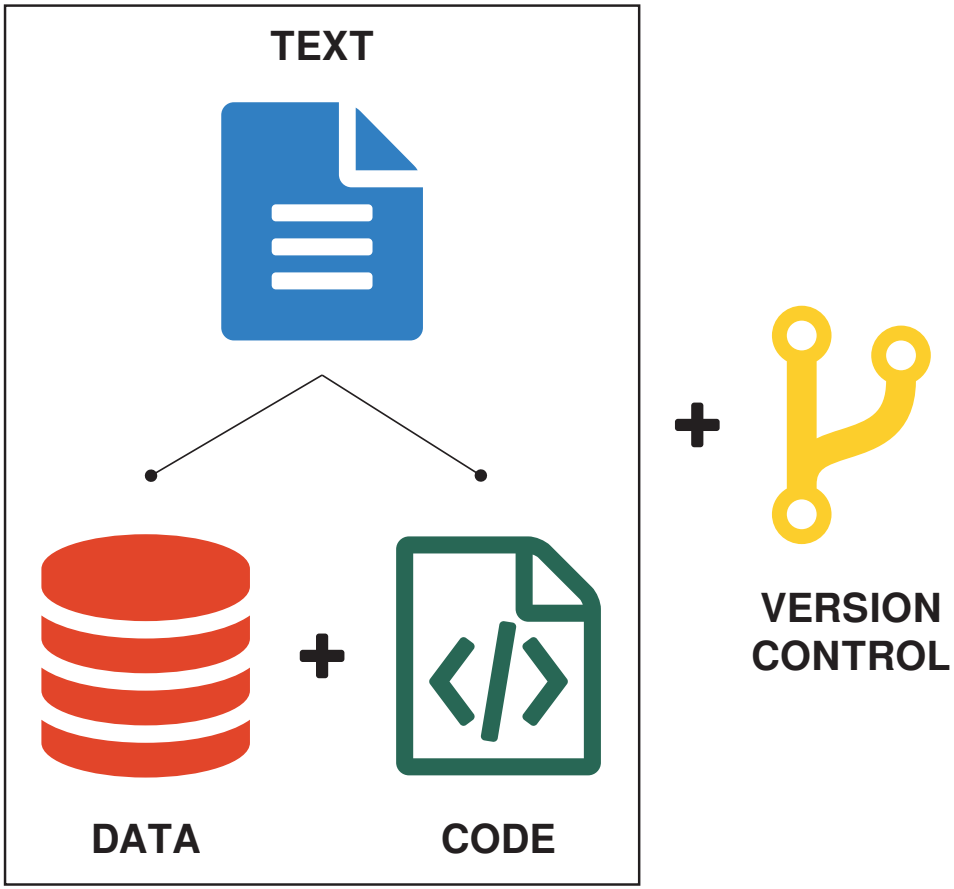
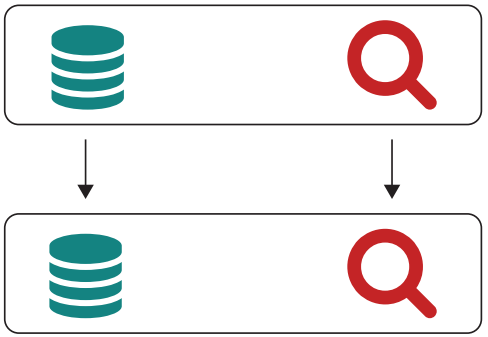
Reproducible research



Reproducible research

REPRODUCIBILITY



Researcher A

Researcher B

REPLICABILITY

Researcher A

Researcher B

Why should we care?

The problem (Sandve et al. 2013):

- difficulty of reproduction
- difficulty of replication
- retracted papers

The solution:

- Reproducible Research (RR)

A case from linguistics

The "Yokuts vowels" case (Weigel 2002):

- about **75%** of the data is contrieved (Weigel 2005:149)
- some of the generalisations are **wrong** (Blevins 2004)

Reproducible Research in linguistics

- linked data (Bird & Simons 2003, Thieberger 2004)
- computational grammar (Maxwell & Amith 2005)
- `glossbox` (McDonnell & Hall 2017)
- RR in the Speech Sciences (Abari 2012)

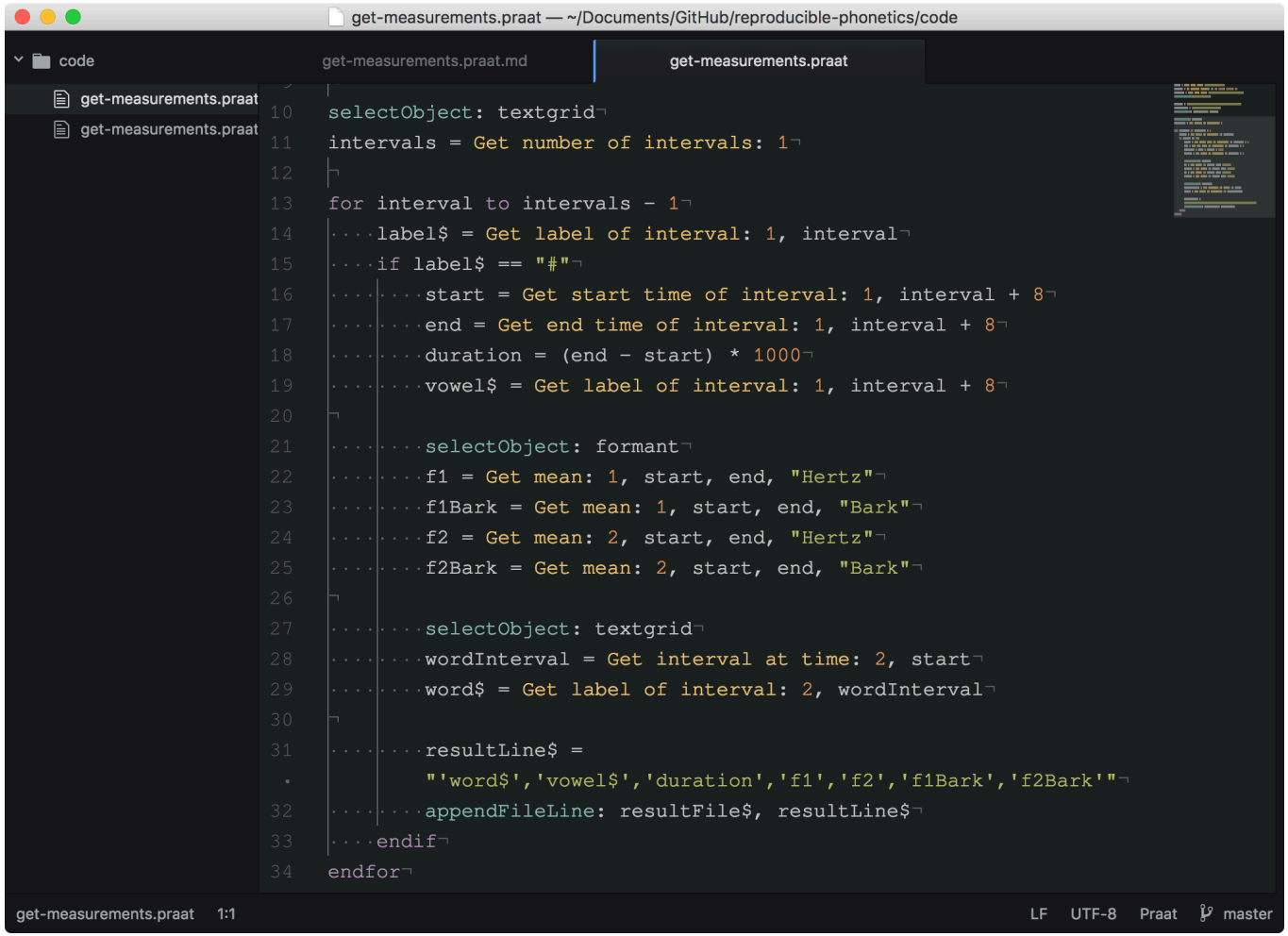
RR in phonetics: the workflow

Phase A: source code and documentation

Praat scripting:

- Atom editor (for syntax highlighting and snippets)
- Literate Markdown
  - tangle: `lmt`
  - weaving: `pandoc`

Atom


get-measurements.praat — ~/Documents/GitHub/reproducible-phonetics/code
code
get-measurements.praat
get-measurements.praat
get-measurements.praat.md
get-measurements.praat
selectObject: textgrid
intervals = Get number of intervals: 1
for interval to intervals - 1
label$ = Get label of interval: 1, interval
if label$ == "#"
start = Get start time of interval: 1, interval + 8
end = Get end time of interval: 1, interval + 8
duration = (end - start) * 1000
vowel$ = Get label of interval: 1, interval + 8
selectObject: formant
f1 = Get mean: 1, start, end, "Hertz"
f1Bark = Get mean: 1, start, end, "Bark"
f2 = Get mean: 2, start, end, "Hertz"
f2Bark = Get mean: 2, start, end, "Bark"
selectObject: textgrid
wordInterval = Get interval at time: 2, start
word$ = Get label of interval: 2, wordInterval
resultLine$ =
"'word$','vowel$','duration','f1','f2','f1Bark','f2Bark'"
appendFileLine: resultFile$, resultLine$
endif
endfor
get-measurements.praat 1:1
LF UTF-8 Praat master

lmt

[figure]

pandoc

[figure]

Phase B: the `speakr` package

`speakr` is an `R` package to aid Praat users:

- aim: tangle and run Praat scripts from within `R`
- two main functions
  - `lmt()`: tangle a Praat script
  - `praatRun()`: run a Praat script

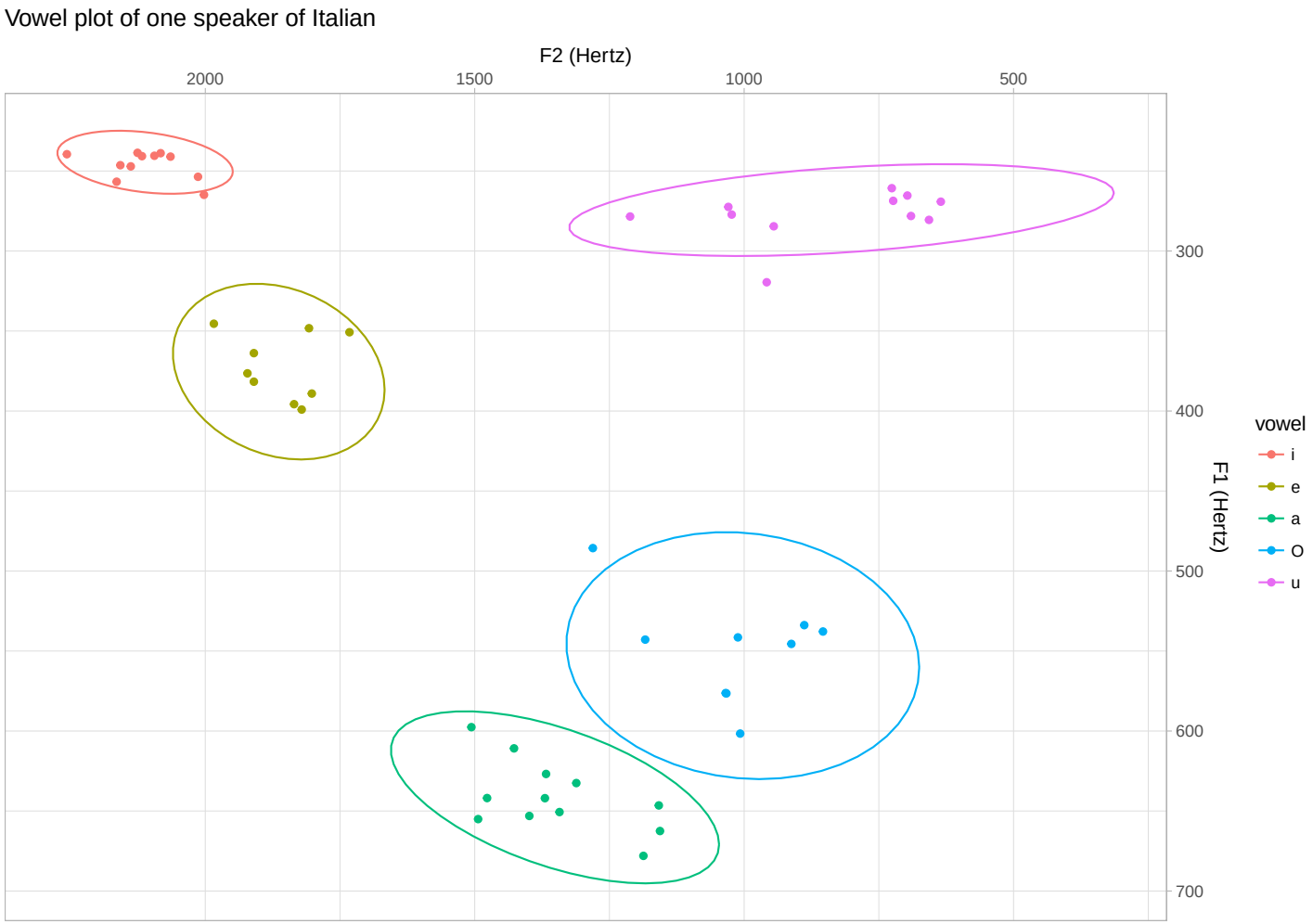
Phase B: the speakr package


```
# Tangle a Praat script
lmt("code/get-measurements.praat.md")

# Run the script
praatRun("code/get-measurements.praat")

# Read the results of the script
vowels <- read_csv("results/vowels.csv") %>%
    mutate_if(is.character, as.factor) %>%
    mutate(vowel = factor(vowel, c("i", "e", "a",
                                   "O", "u")))
```

Phase B: the speakr package



Phase C: dissemination

- GitHub
- Open Science Framework

Abari, Kálmán. 2012. Reproducible research in speech sciences. *International Journal of Computer Science Issues* 9(6). 43–52.

Bird, Steven & Gary Simons. 2003. Seven dimensions of portability for language documentation and description. *Language* 557–582.

Blevins, Juliette. 2004. A reconsideration of Yokuts vowels. *International Journal of American Linguistics* 70(1). 33–51.

Maxwell, Michael & Jonathan D. Amith. 2005. Language documentation: the Nahuatl grammar. In A. Gelbukh (ed.), *Computational Linguistics and Intelligent Text Processing*, 474–485. Berlin Heidelberg: Springer-Verlag.

McDonnell, Bradley & Patrick Hall. 2017. Developing methods for reproducible research in linguistics: a first step.

Sandve, Geir Kjetil, Anton Nekrutenko, James Taylor & Eivind Hovig. 2013. Ten simple rules for reproducible computational research. *PLoS Computational Biology* 9(10). 1–4.

Thieberger, Nicholas. 2004. Documentation in practice: Developing a linked media corpus of South Efate. In Peter K. Austin (ed.), *Language documenta and description*, vol. 2, Hans Rausing Endangered Languages Project, School of Oriental and African Studies, University of London.

Weigel, William. 2005. *Yowlumne in the Twentieth century*: University of California, Berkley dissertation.

Weigel, William F. 2002. The Yokuts canon: A case study in the interaction of theory and description. Paper presented at the annual meeting of the Linguistics Society of America, January 2002, San Francisco.