

Exercise 2: Identifying Random Effects-Structure

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Your task is to identify the *maximal random-effects structure justified by the design* (Barr, Levy, Scheepers, & Tily, 2013) for one data set and implement this structure in `lme4::lmer` syntax.

Freeman, Heathcote, Chalmers, and Hockley (2010)

Lexical decision and word naming latencies for 300 words and 300 nonwords presented in Freeman, Heathcote, Chalmers, and Hockley (2010). The study had one between-subjects factors, `task` with two levels ("`naming`" or "`lexdec`"), and four within-subjects factors: `stimulus` type with two levels ("`word`" or "`nonword`"), word `density` and word `frequency` each with two levels ("`low`" and "`high`") and stimulus `length` with three levels (4, 5, and 6).

The data comes with `afex` as `fhch2010`:

```
data("fhch2010", package = "afex")
str(fhch2010)
```

```
## 'data.frame':    13222 obs. of  10 variables:
## $ id          : Factor w/ 45 levels "N1","N12","N13",...: 1 1 1 1 1 1 1 1 1 1 ...
## $ task        : Factor w/ 2 levels "naming","lexdec": 1 1 1 1 1 1 1 1 1 1 ...
## $ stimulus    : Factor w/ 2 levels "word","nonword": 1 1 1 2 2 1 2 2 1 2 ...
## $ density     : Factor w/ 2 levels "low","high": 2 1 1 2 1 2 1 1 1 1 ...
## $ frequency   : Factor w/ 2 levels "low","high": 1 2 2 2 2 2 1 2 1 2 ...
## $ length      : Factor w/ 3 levels "4","5","6": 3 3 2 2 1 1 3 2 1 3 ...
## $ item        : Factor w/ 600 levels "abide","acts",...: 363 121 202 525 580 135 42 368 227 141 ...
## $ rt          : num  1.091 0.876 0.71 1.21 0.843 ...
## $ log_rt      : num  0.0871 -0.1324 -0.3425 0.1906 -0.1708 ...
## $ correct     : logi  TRUE TRUE TRUE TRUE TRUE TRUE ...
```

What is the maximal random-effects structure justified by the design for this data set for the dependent variable `log_rt`:

```
mixed(log_rt ~ ...)
```

References

- Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language*, 68(3), 255-278. <https://doi.org/10.1016/j.jml.2012.11.001>
- Freeman, E., Heathcote, A., Chalmers, K., & Hockley, W. (2010). Item effects in recognition memory for words. *Journal of Memory and Language*, 62(1), 1-18. <http://doi.org/10.1016/j.jml.2009.09.004>