MinF’ and the Analysis of Psycholinguistic Data
Overview

- Statistical analysis in psycholinguistics
- The “language as a fixed effect” fallacy
- minF'
- Example of application of minF'
- When to use minF’
Analysis of behavioural data

- Commonly used: $F_1 \times F_2$ criterion
- $F_1$ : Subject analysis
- $F_2$ : Item analysis
- If both $F_1$ and $F_2$ are significant, the overall result is considered significant
“Language as fixed effect” fallacy

- Brought to the attention by Clark (1973)

- Language is not a fixed factor, it is a random factor

- Experimental words/sentences are a sample of all possible words/sentences you could have used
In separate $F_1$ and $F_2$ analyses, one random factor is alternatively denied.

Solution: calculate $F'$

$F'$ approximates $F$ distribution.
minF’

- Lower bound of F’ (i.e., The lowest value F’ could have given)

- Evaluates whether experimental manipulations are significant over subjects and items simultaneously
Calculation of minF’

- \[ \text{minF’} = \frac{F_1 \ast F_2}{F_1 + F_2} \]

- \[ \text{df} = \frac{F_1 + F_2}{(F_1^2 / n_2) + (F_2^2 / n_1)} \]

- \( n_1 \) and \( n_2 \): degrees of freedom of the error term of \( F_1 \) and \( F_2 \)
Use of minF’ in published papers

- Raaijmakers et al. (1999)
Luka & Barsalou (2005)

- Syntactic priming study
- Can judgment of grammaticality be influenced by previous exposure to identical sentences and sentences with similar structure?
- Exposure to sentence \(\rightarrow\) distractor task \(\rightarrow\) grammaticality judgment
Luka & Barsalou (2005)

- 48 sentences
- 24 related sentences
- 12 of those sentences exactly the same and 12 of those sentences structurally similar
- Main effects of grammaticality, familiarity, and repetition type
Main effect of repetition type significant for $F_1$, marginally significant for $F_2$. Not even close to significant for minF’ ($p=.195$)
When to use \( \text{min}F' \)

- Discussion in Raaijmakers et al. (1999) and Raaijmakers (2003)

- \( F_1 \) is biased due to variation between conditions being influenced by variability in item means

- Assumption that items within each condition are sampled randomly and independently
In practice, items are not always sampled randomly and independently.

Matching and counterbalancing reduces variation between groups caused by variability in item means.

Bias in $F_1$ greatly reduced by matching and counterbalancing.
Conclusion

- Counterbalancing or matching not possible, or not sure if done well: calculate minF'

- Counterbalancing or matching conducted carefully: $F_1$ suffices

- $F_1 \times F_2$ criterion unfounded in all cases
Thank you for your attention!
References