

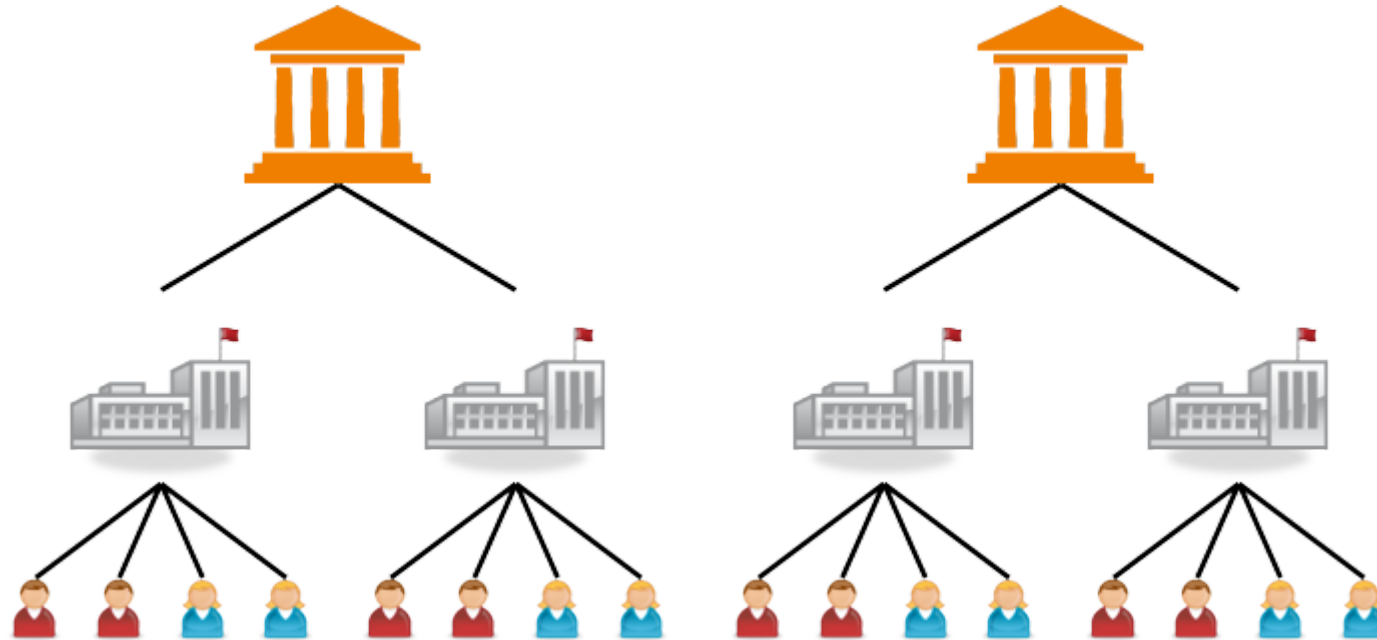
# Introduction to Multilevel Analysis

PSYC 575

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# Learning Objectives

Other names used for MLM

Types of data structure MLM handles

# Naming and History of MLM

# Alternative names for MLM:

- Hierarchical linear model: Education/Sociology/Psychology <sup>1</sup>
- Variance component model: Statistics <sup>2</sup>
- Mixed model/mixed-effect model: Statistics, biomedical
- Random coefficient model: Econometrics

[1]: Raudenbush & Bryk, 1986

[2]: Aitkin et al., 1981

# History of MLM

MLM naturally handles data coming from different "levels"

Robinson (1950)<sup>1</sup>

- State level: Correlation between % illiterate and % foreign born:
  - $r = -.53$
- Individual level: Within-state correlation between illiteracy and foreign born status:
  - $r = .12$

[1]: p. 354, <https://doi.org/10.2307/2087176>

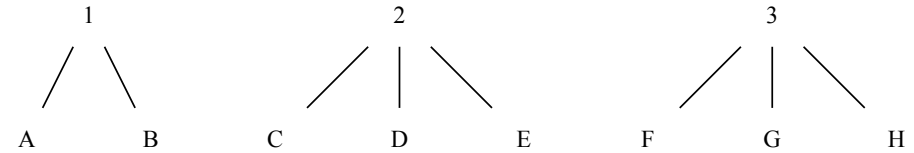
# Usage of MLM

# Hierarchical Data Structure

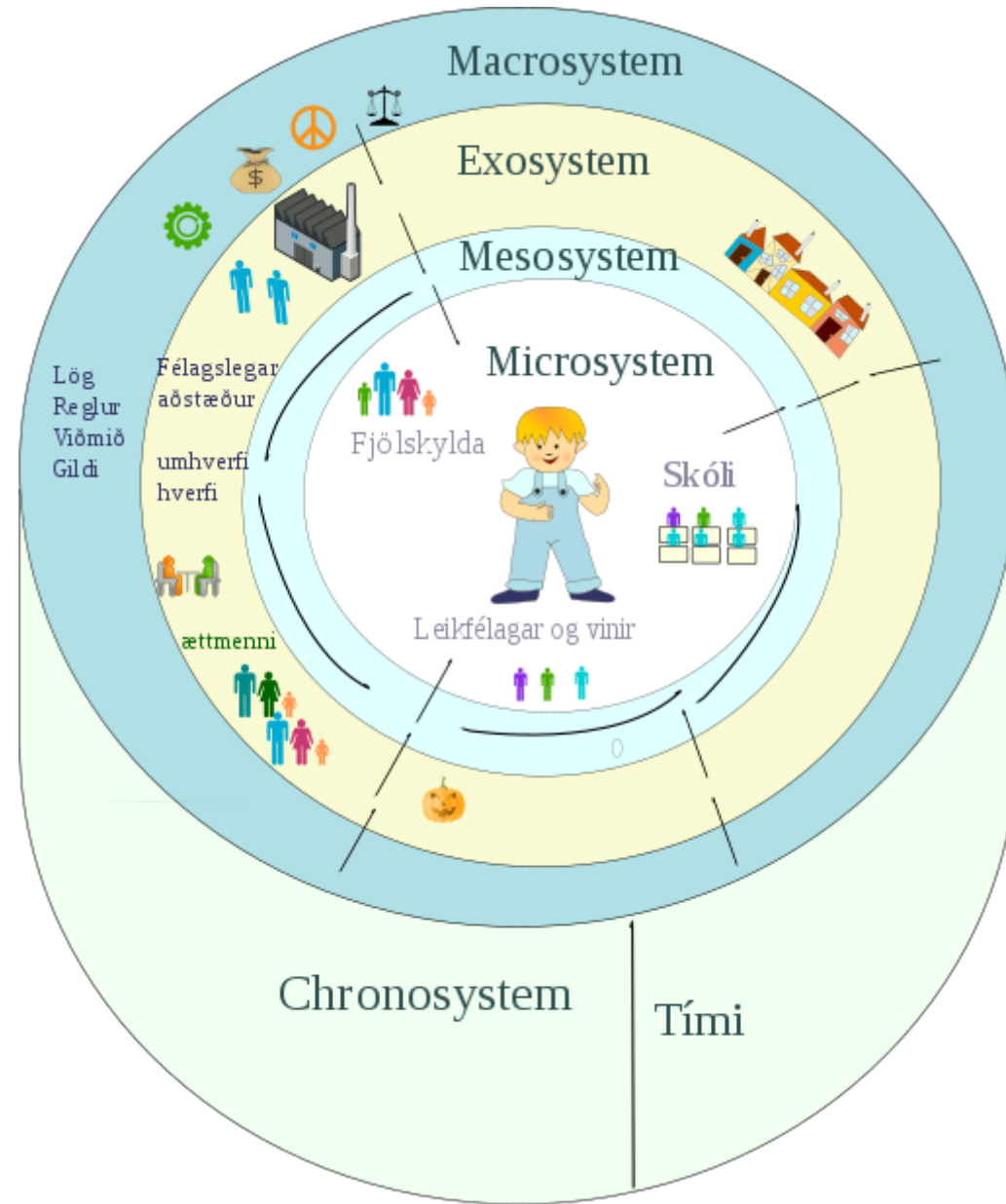
Multiple units at a lower level nested within a unit at a higher level

Level 1	Level 2
Clients	Therapist
Classrooms	School
Employees	Organization
People	Family
Citizens	Country
Measurements	Person

## Network Graph







Once you know that hierarchies exist, you see them everywhere.

Kreft & de Leeuw (1998, p. 1)

Kreft, I. G., & de Leeuw, J. (1998). *Introducing multilevel modeling*. Sage. <https://dx.doi.org/10.4135/9781849209366>

# When it comes to regression, multilevel regression deserves to be the default approach

McElreath (2020, p. 400)

McElreath, R. (2020). *Statistical rethinking: A Bayesian course with examples with R and Stan (2nd ed.)*. Chapman & Hall/CRC.  
<https://doi.org/10.1201/9780429029608>

# Sampling the Literature

PsycINFO, 2022 May-Aug, with keywords

```
"multilevel model*" OR "mixed model*" OR "mixed-effect model*" OR "hierarchical linear model"
```

266 results

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## Classification

Health & Mental Health

Treatment & Prevention (38)

Psychological & Physical

Disorders (28)

Developmental Psychology

(11)

Educational Psychology (11)

Neurological Disorders & Brain

Damage (8)

More >

## Recent literature in 2022

class: middle

- A lasso and a regression tree mixed-effect model with random effects for the level, the residual variance, and the autocorrelation
- Crossover of resources within formal ties: How job seekers acquire psychological capital from employment counselors
- On the basis of source: Impacts of individual differences on multiple-document integrated reading and writing tasks
- The tone atlas of perceptual discriminability and perceptual distance: Four tone languages and five language groups
- Translational research on caregiver reading and playing behaviors: Evidence from an in vivo community-based intervention throughout the covid-19 pandemic
- How does goal orientation fuel hotel employees' innovative behaviors? A cross-level investigation
- Effect of exposure to maternal diabetes during pregnancy on offspring's brain cortical thickness and neurocognitive functioning

# Software

## General stat software

- R (**lme4**, **brms**, nlme)
- SAS
- SPSS
- Stata

## Specialized software

- HLM
- MLwiN
- Mplus

# Resources

- Centre for Multilevel Modeling, University of Bristol  
<http://www.bristol.ac.uk/cmm/learning/multilevel-models/>
- Textbook examples (with syntax for different software), Institute for Digital Research and Education, UCLA  
<https://stats.idre.ucla.edu/other/examples/>
- GLMM FAQ by Ben Bolker  
<https://bbolker.github.io/mixedmodels-misc/glmmFAQ.html>
- Curran-Bauer Analytics, Multilevel Modeling Archives <https://curranbauer.org/category/news-and-updates/multilevel-modeling/>
- Multilevel Modeling Discussion List (Listserv) <https://www.jiscmail.ac.uk/cgi-bin/webadmin?A0=multilevel>