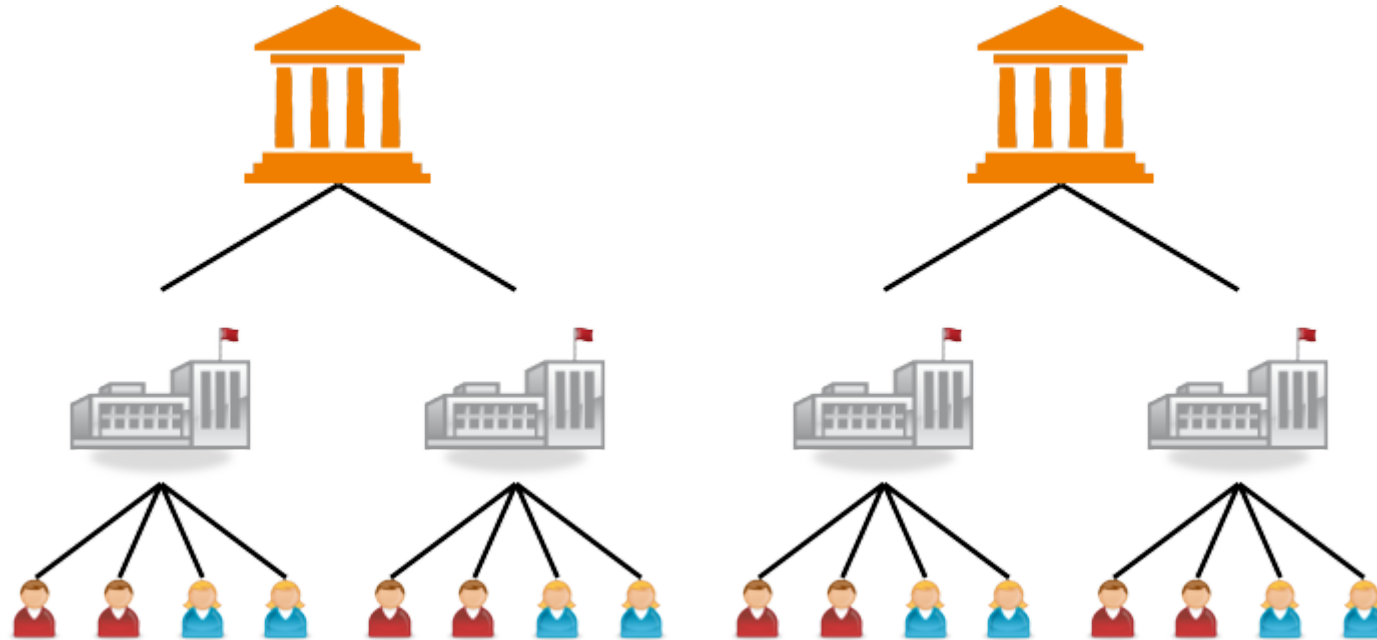# Introduction to Multilevel Analysis

PSYC 575

Hok Chio (Mark) Lai

University of Southern California

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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 [1]

- Variance component model: Statistics [2]

- 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)[1]

- State level: Correlation between % illiterate and % foreign born:

  - $r = -.53$

- Individual level: Within-state correlation between illiteracy and foregin born status:
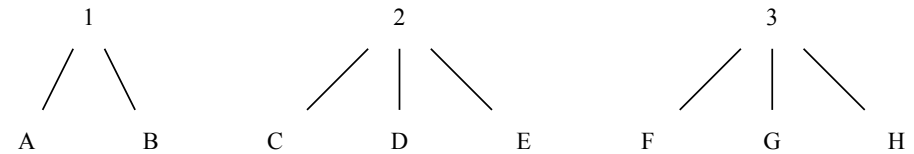
  - $r = .12$

[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

Macrosystem

Exosystem

Mesosystem

Microsystem

Lög
Reglur
Viðmið
Gildi

Félagslegar
aðstæður

umhverfi
hverfi

Fjölskylda

Skóli

ættmenni

Leikfélagar og vinir

0

Chronosystem

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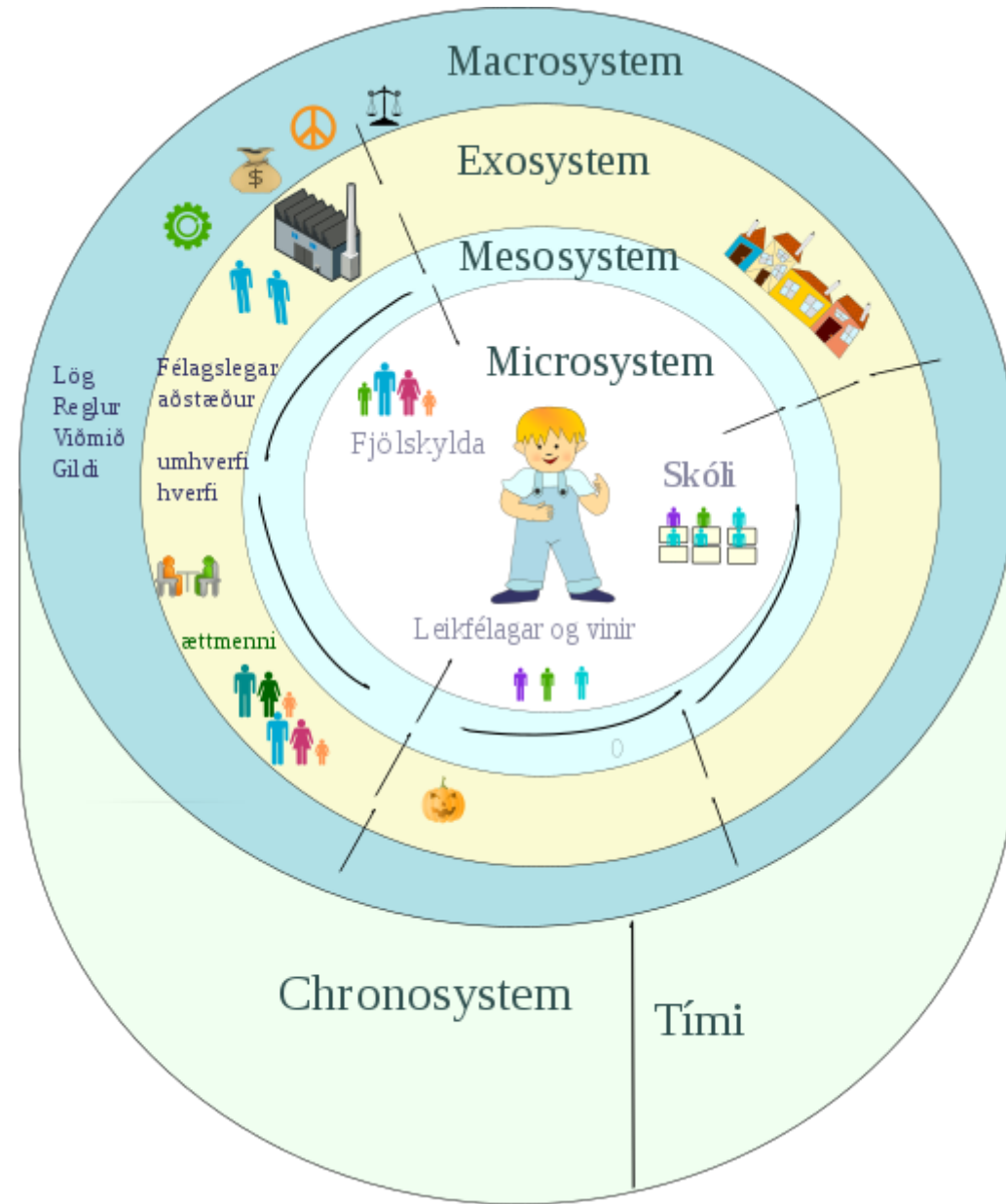
Once you know that hierarchies exist, you see them everywhere.

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, 2020 May-Aug, with keywords

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

Classification

Health & Mental Health Treatment & Prevention (48)

Psychological & Physical Disorders (27)

Neurological Disorders & Brain Damage (15)

Educational Psychology (12)

Developmental Psychology (11)

More ›

Recent literature in 2021

class: middle

- Threshold dose for intravenous nicotine self-administration in young adult non-dependent smokers

- A cross-level analysis of organizational knowledge creation: How do transformational leaders interact with their subordinates' expertise and interpersonal relationships?

- Benefits of movement-integrated learning activities in statistics and research methods courses

- Levels and instability of daily self-esteem in adolescents: Relations to depressive and anxious symptoms

- Internet-delivered cognitive processing therapy for individuals with a history of bullying victimization: A randomized controlled trial

- Problems of cross-cultural criminology no more! Testing two central tenets of self-control theory across 28 nations

- Emotional well-being in covid-19 mass quarantine: The role of personal response and life activity: A 14-day diary study in china

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