

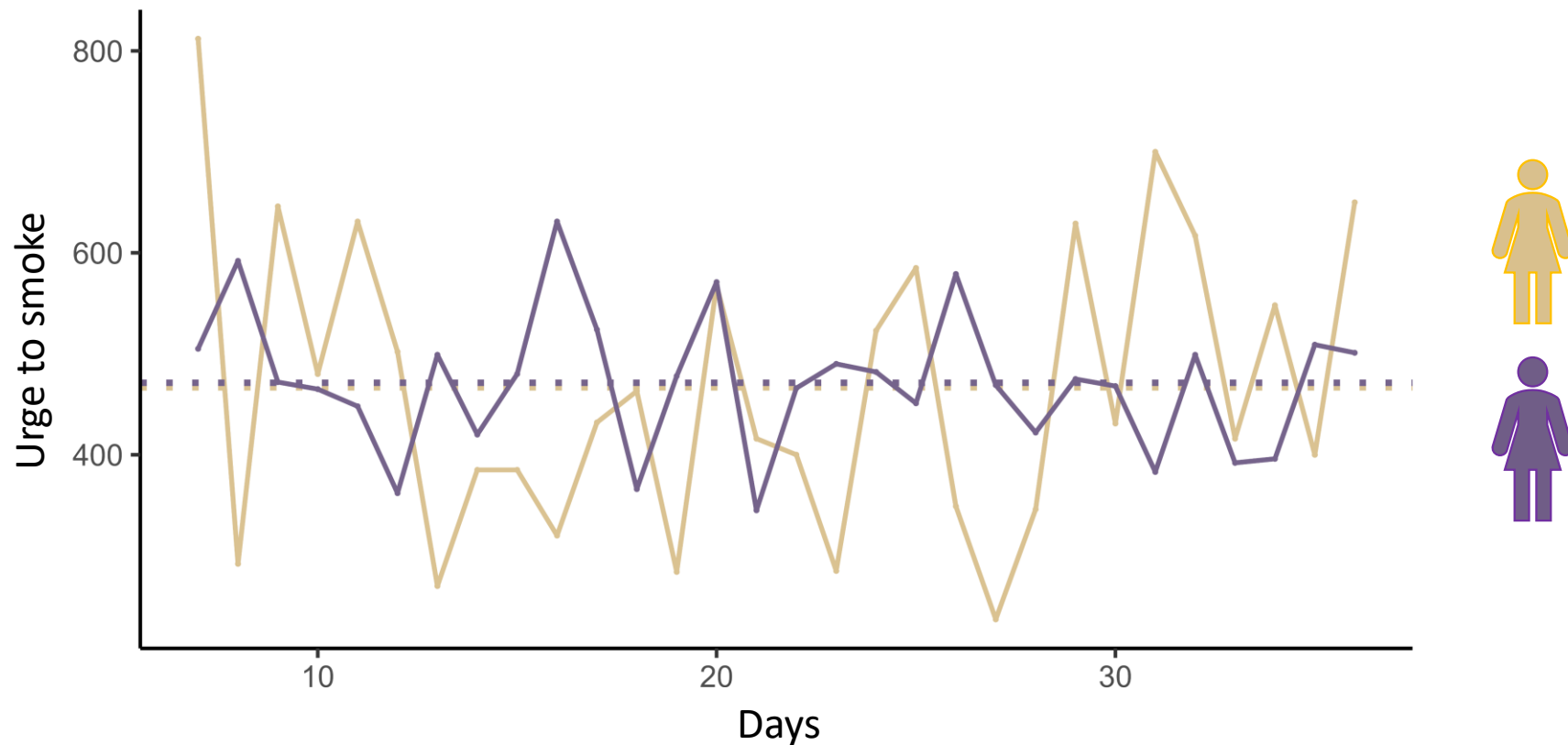
DSEM using Stan

Michael Aristodemou

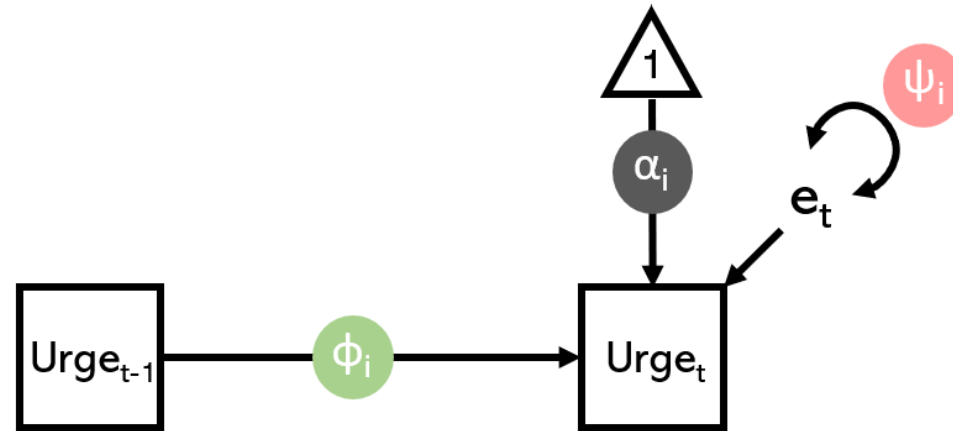
11th February 2025

So, you have time series data

- Multiple observations (time points)
- 1 or more people

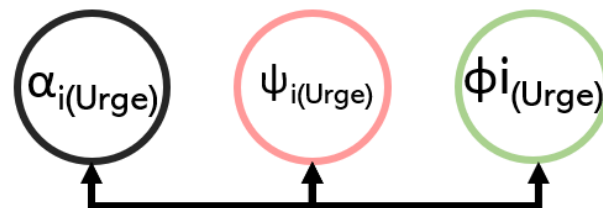


Intro to Dynamic Structural Equation Modeling

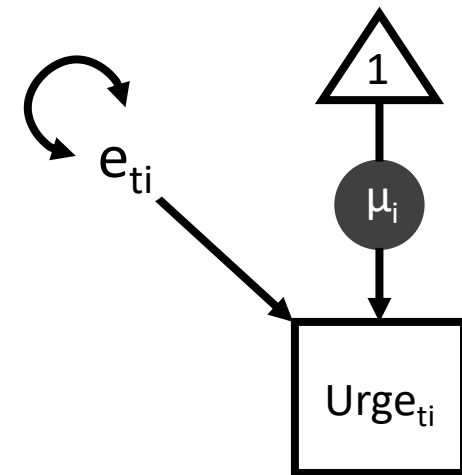
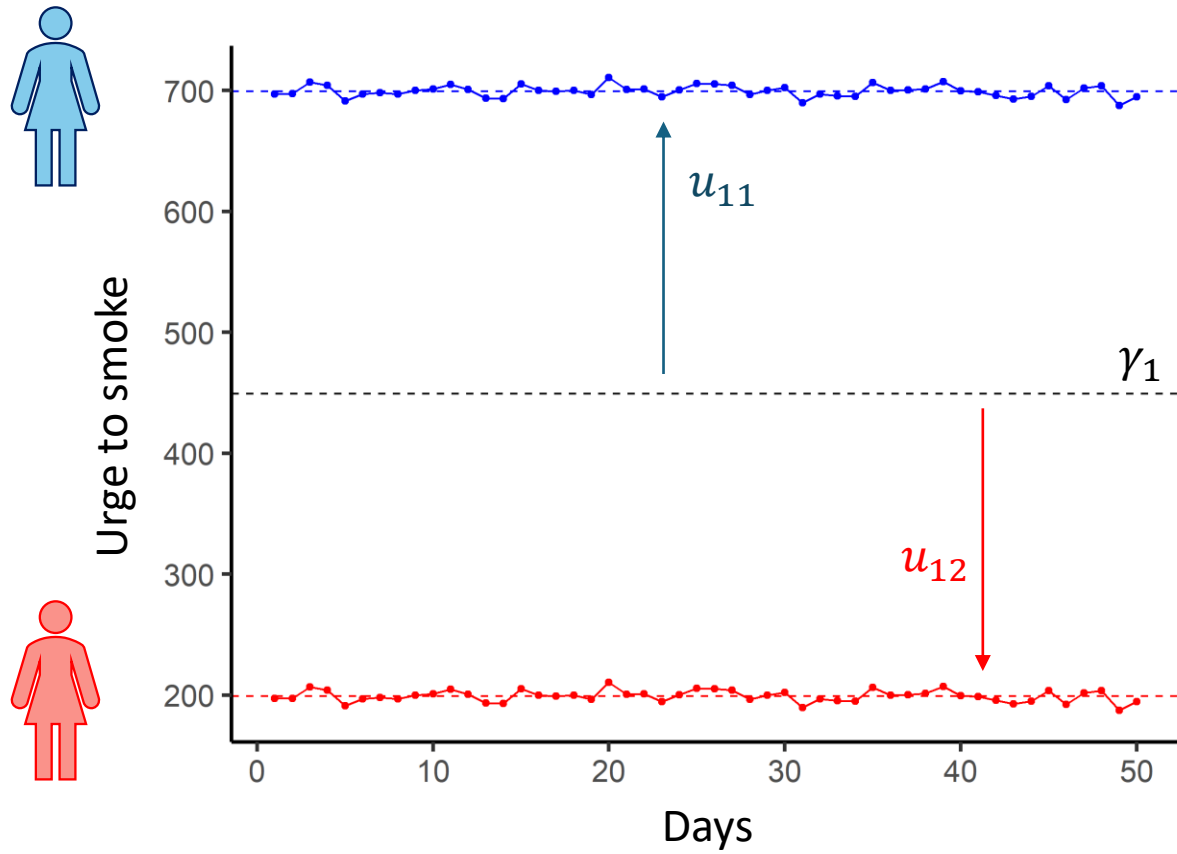


Within subject

Between subject



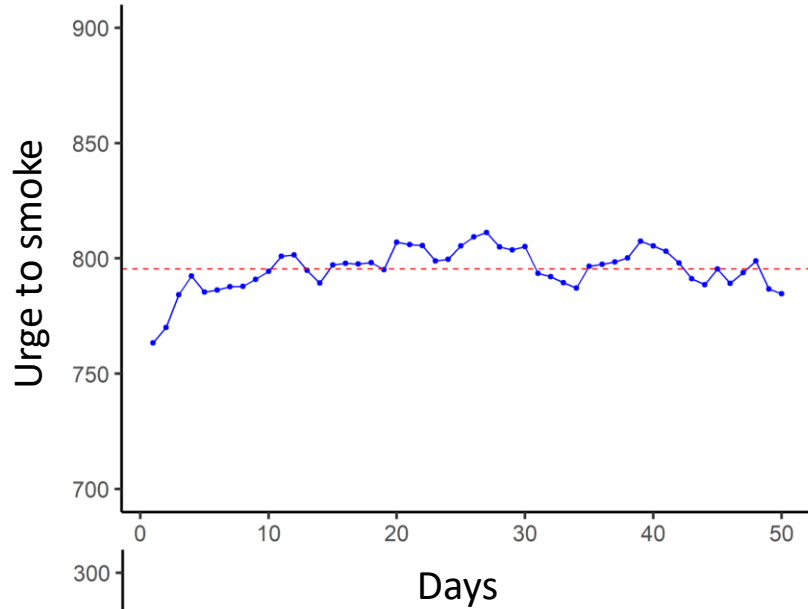
MEAN URGE



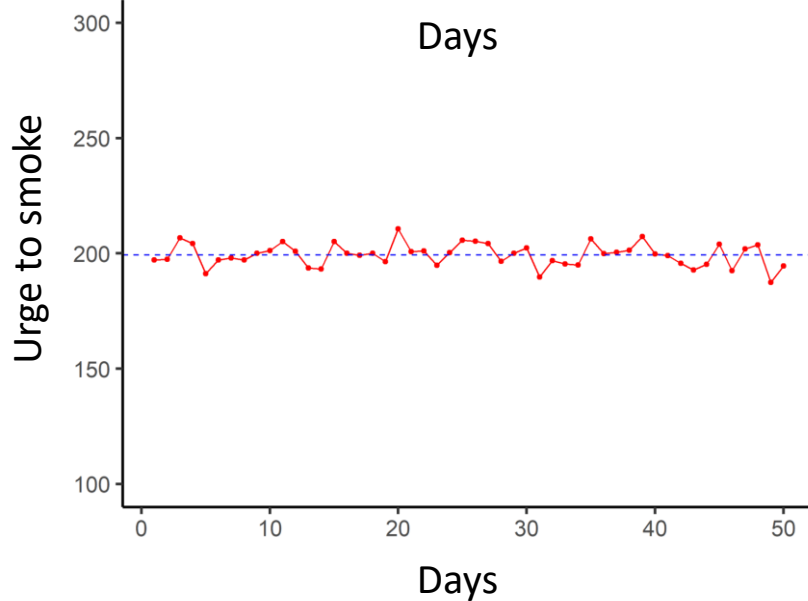
$$Urge_{ti} = \mu_i + e_{ti}$$

$$\mu_i = \gamma_1 + v_{1i}$$

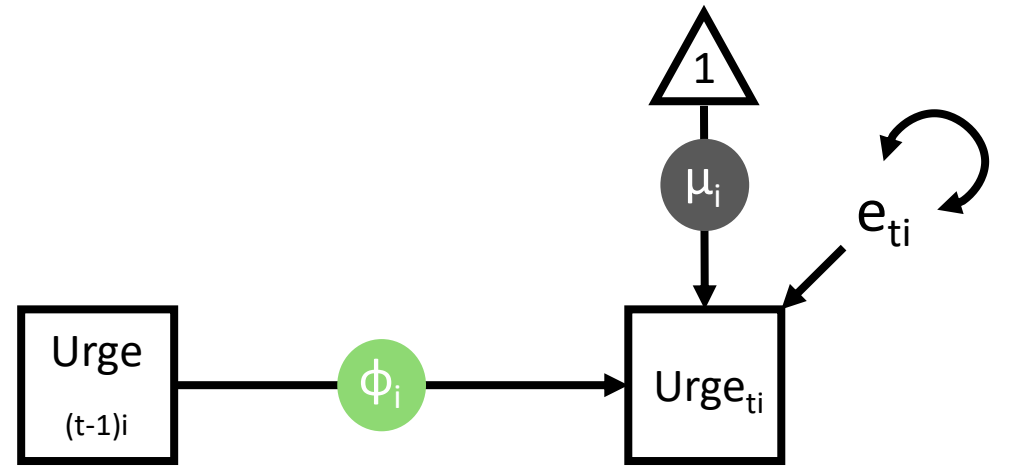
Autoregression (AR-1)



High
 ϕ



Low
 ϕ

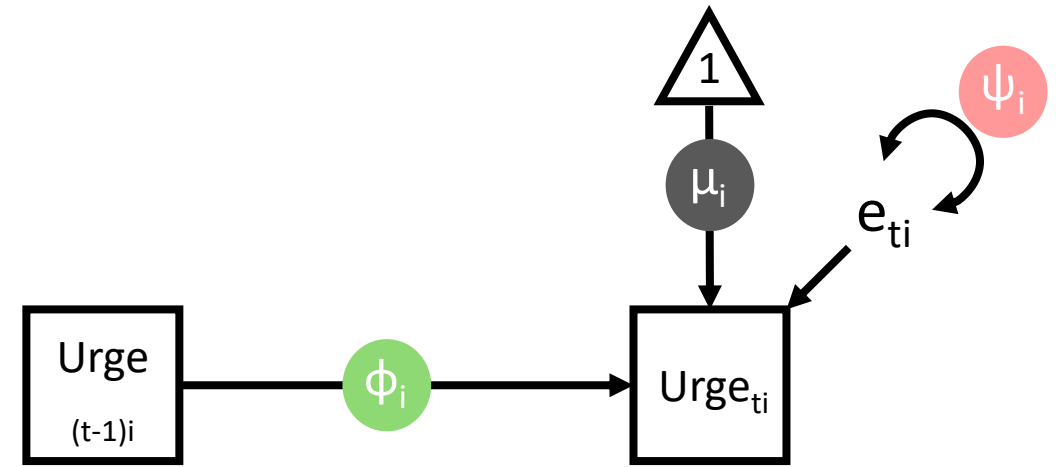
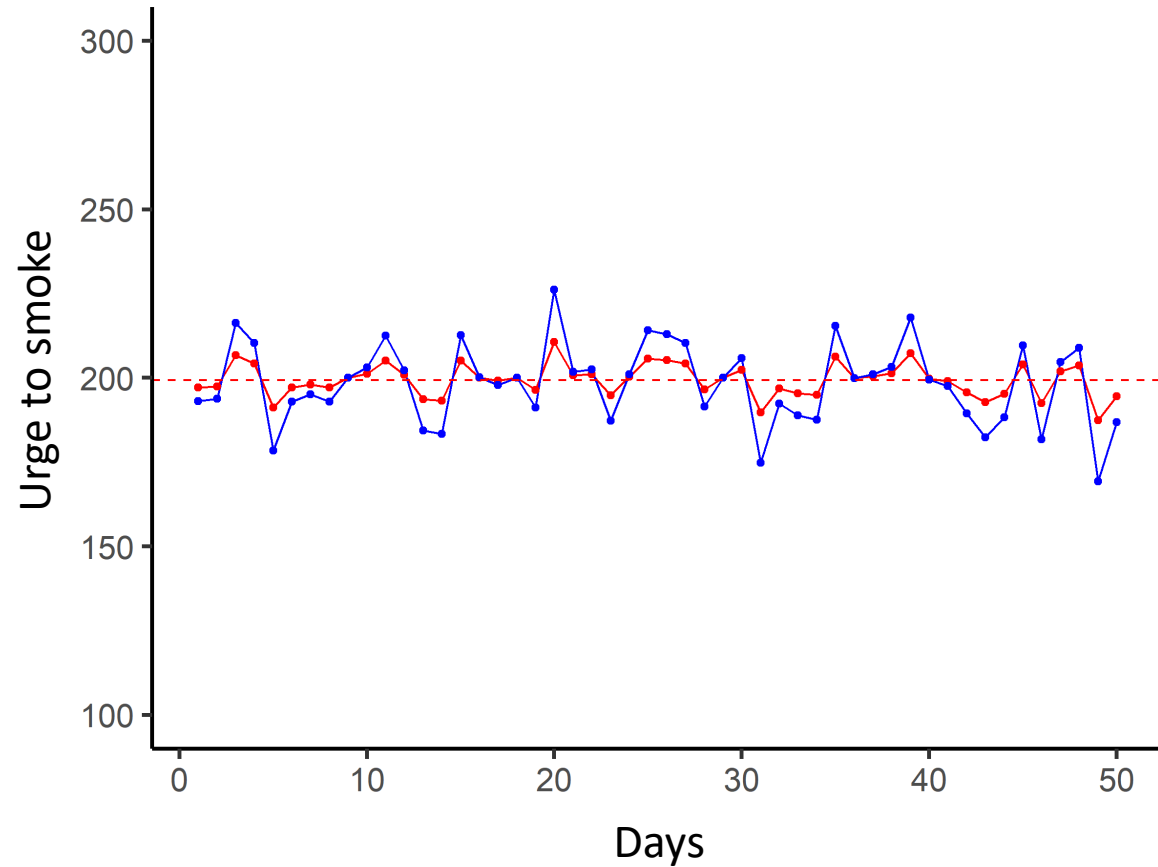


$$Urge_{ti} = \mu_i + \phi_i (Urge_{(t-1)i} - \mu_i) + e_{ti}$$

$$\mu_i = \gamma_1 + v_{1i}$$

$$\phi_i = \gamma_2 + v_{2i}$$

Innovations (day-to-day variability in urges)



$$Urge_{ti} = \mu_i + \phi_i(Urge_{(t-1)i} - \mu_i) + e_{ti}$$

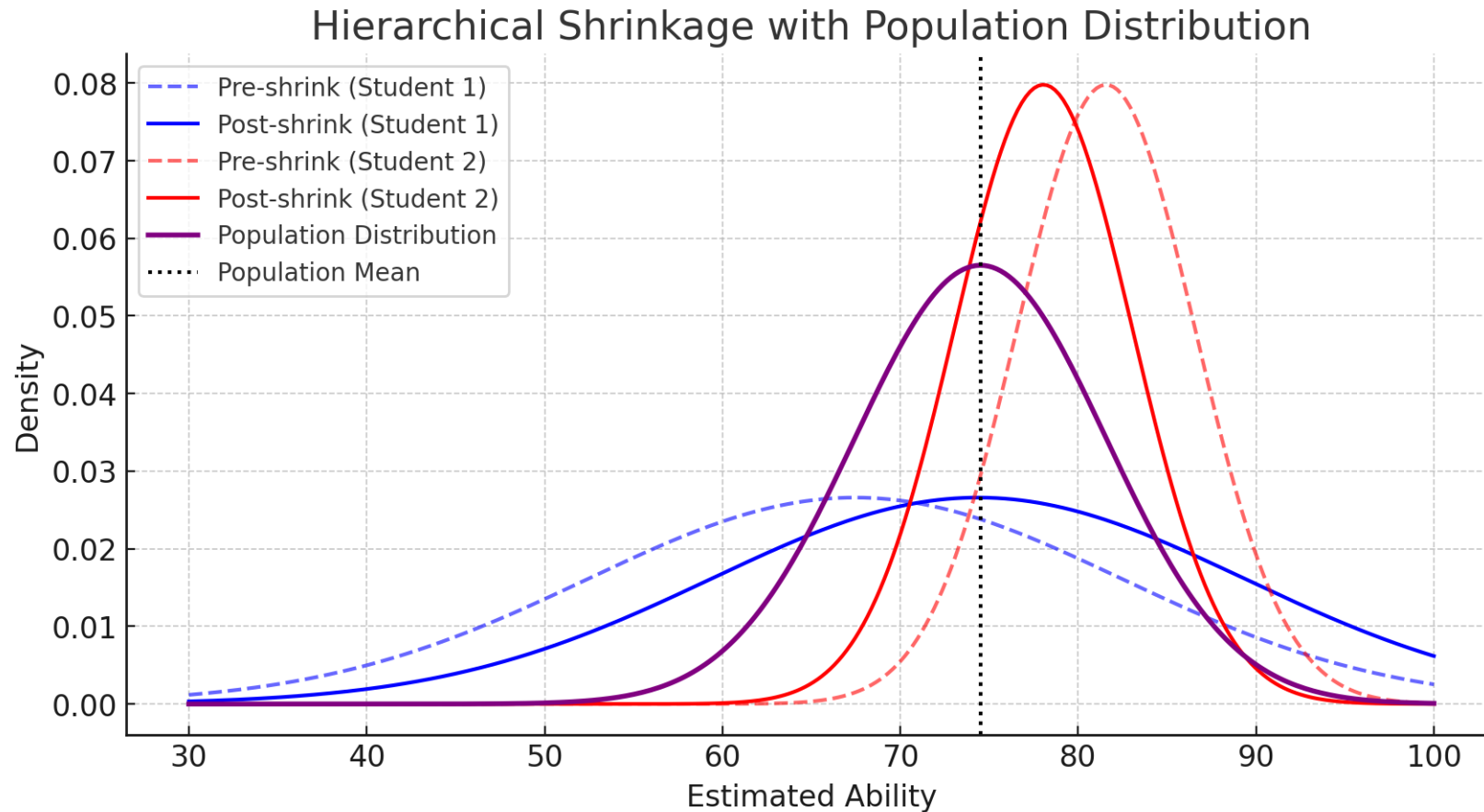
$$e_{ti} \sim N(0, \psi_i)$$

$$\mu_i = \gamma_1 + v_{1i}$$

$$\phi_i = \gamma_2 + v_{2i}$$

$$\psi_i = \exp(\gamma_3 + v_{3i})$$

One for all and all for one



DSEM in Stan: Why Stan?

- Free (!)
- Flexible
- Bayesian estimation
- Interface with popular languages (e.g., R, Python, Julia)
- Active support (online community, Stan guides)



Workshop: First steps

1. Go to: https://github.com/mearistodemou/DSEM_workshop
2. Grab “workshop_assignment.html” from “Assignments” folder
3. Open New R Script
4. Go through exercises
5. Click “Show/Code” to get the answer
6. Feel free to ask questions

I live and breathe Stan, this workshop is boring

- Multivariate DSEM
- [Adding a between-subject covariate](#)
- [Prior/posterior predictive checks](#)
- Model comparison ([log-likelihood and loo](#); [R²](#))
- Binary DSEM
- [Dealing with missingness](#)
- [Nonlinear DSEM \(phi & more\)](#)
- Different growth trajectories
- [Modeling measurement error](#)
- [Vectorize](#)
- Within/between-person latent variables

Thank you for listening!

