Bayesian Estimation for Measuring Persuasion in Small Groups

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Objectives of the video

- What I hope to accomplish:
  - Show how to implement the model in the paper **"When Deliberation Produces Persuasion Rather Than Polarization: Measuring and Modeling Small Group Dynamics in a Field Experiment"** by Kevin M. Esterling, Archon Fung and Taeku Lee (E.Funglee)
  - Show how to use `OpenBUGS` to replicate the results in the paper and/or to apply the general model to your own work.
- What I don't intend to accomplish:
  - Present the motivation or theory for the model or for the application to a deliberative field experiment
  - Teach you how to use `OpenBUGS` specifically, or Bayesian inference more generally

A general model for modeling dependence in small group research

E.Funglee paper proposes a method to measure and evaluate persuasion in small groups.

- This tutorial distributes code to preprocess your data and to implement the model
- The models are flexible for the kind of outcome (continuous, dichotomous or ordered), the number of questions in your pre-post survey, and the number of respondents.

When people talk to each other in groups about some topic, we typically observe that preferences among group members become **dependent**, through persuasion and other aspects of interpersonal interaction

Motivation for the model

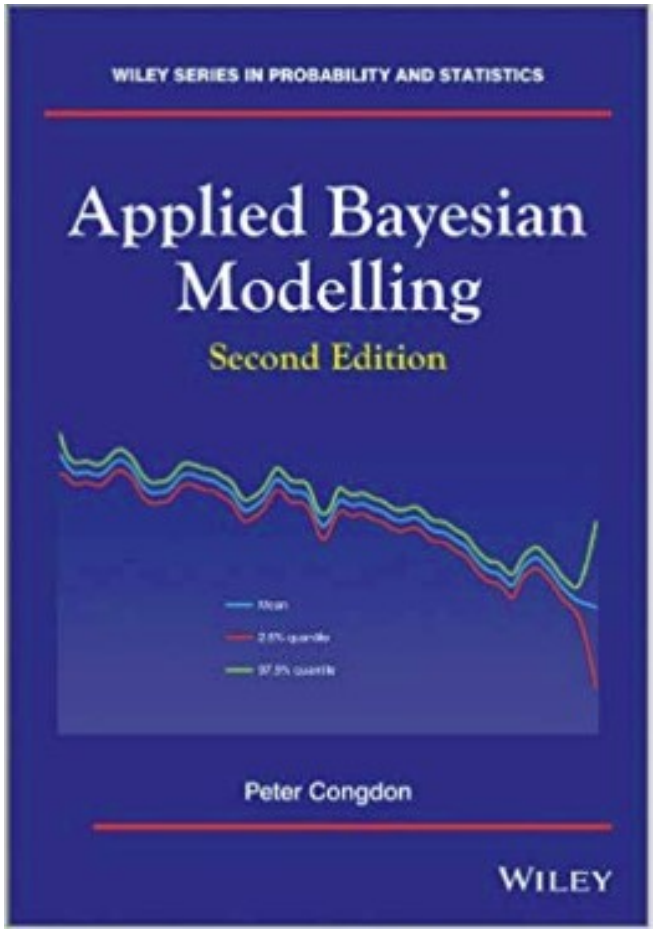
Dependence in preferences typically occurs once people are in conversation with each other

- This spatial dependence is induced by design in small group research
- There are typically two sources of dependence:
  - By homophily, similar people mutually select into groups
  - The group interaction itself can be causal, either by persuasion or by an affective process
- The model in our paper accounts for and models both types of spatial dependence
- To use the model to measure the *causal effect* of group interactions, all of the assumptions for an RCT must be met, and in particular randomization of participants to groups

Two types of causal dependence

Let's assume the RCT assumptions are met, as described in the paper, and so the model is measuring the causal impact of persuasion. There are two types of persuasion

- Group composition effects: The effect of pretreatment characteristics of others in one's group, such as the distribution of ideal points or the demographic composition
- Residual dependence within the group after accounting for any pretreatment covariates
- **In order to model all of these forms of dependence, we need the model to keep track of who is nested in which group**



We derive the model from Congdon's book, chapter 8 – please cite this book if you use this model!!

What the data would look like if there was one group of four people?

i	map	C
		0
1	2	
	3	
	4	3
2	1	
	3	
	4	6
...		
4	1	
	2	
	3	12

The two types of causal dependence modeled in the E.Funglee paper

- Group composition effects: In the paper, we test for the effect of the composition of ideal points within a group on the respondent's ideal point, which we label "latent persuasion" ($\Delta\theta$), which is identified because we nest respondents within questions
- Residual dependence after accounting for any pretreatment covariates: In the paper, we test for the dependence of preferences within a group for a given topic after accounting for changes in a respondent's ideal point, which we label "topic-specific persuasion" ($\Delta\zeta$).
- Here I'll illustrate with an example for the continuous case ...

The E.Funglee model (for the simulated data)

$$O^1_{ik} = \beta_{0k} + \beta_{1k} O^0_i + \beta_{2k} \theta^0_i + \beta_{3k} Site_i + \Delta\theta_i + \Delta\zeta_{ik} + \epsilon_{ik} \quad (1)$$

$$\Delta\theta_i \sim \phi(\Delta\theta^*_i, 1), \quad (2a)$$
$$\Delta\theta^*_i = \alpha_1 H_i + (\delta_1 \cdot Liberal_i + \delta_3 \cdot Conservative_i) \cdot H^2_i \quad (2b)$$
$$H_i = \text{mean}(\theta^0_{ij}), \quad (2c)$$
$$\theta^0_{ij} \in \left\{\theta^0_j : j \text{ is seated at } i\text{'s table}, j \neq i\right\}. \quad (2d)$$

$$\Delta\zeta_{ik} \sim \phi(\Delta\zeta^*_{ik}, 1), \quad (3a)$$
$$\Delta\zeta^*_{ik} = \rho_k \cdot \text{mean}(\Delta\zeta_{ijk}). \quad (3b)$$
$$\Delta\zeta_{ijk} \in \{\Delta\zeta_{jk} : j \text{ is seated at } i\text{'s table}, j \neq i\}, \quad (3c)$$

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$$\Delta\zeta_{ik} \sim \phi(\Delta\zeta^*_{ik}, 1), \quad (3a)$$
$$\Delta\zeta^*_{ik} = \rho_k \cdot \text{mean}(\Delta\zeta_{ijk}). \quad (3b)$$
$$\Delta\zeta_{ijk} \in \{\Delta\zeta_{jk} : j \text{ is seated at } i\text{'s table}, j \neq i\}, \quad (3c)$$

The E.Funglee model (for the simulated data)

$$O_{ik}^1 = \beta_{0k} + \beta_{1k} O_i^0 + \beta_{2k} \theta_i^0 + \beta_{3k} Site_i + \Delta\theta_i + \Delta\zeta_{ik} + \epsilon_{ik} \quad (1)$$

$$\Delta\theta_i \sim \phi(\Delta\theta_i^*, 1), \quad (2a)$$

$$\Delta\theta_i^* = \alpha_1 H_i + (\delta_1 \cdot Liberal_i + \delta_3 \cdot Conservative_i) \cdot H_i^2 \quad (2b)$$

$$H_i = \text{mean}(\theta_{ij}^0), \quad (2c)$$

$$\theta_{ij}^0 \in \left\{\theta_j^0 : j \text{ is seated at } i\text{'s table}, j \neq i\right\}. \quad (2d)$$

$$\Delta\zeta_{ik} \sim \phi(\Delta\zeta_{ik}^*, 1), \quad (3a)$$

$$\Delta\zeta_{ik}^* = \rho_k \cdot \text{mean}(\Delta\zeta_{ijk}). \quad (3b)$$

$$\Delta\zeta_{ijk} \in \{\Delta\zeta_{jk} : j \text{ is seated at } i\text{'s table}, j \neq i\}, \quad (3c)$$