Lab 3: Random Slope Model

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In this assignment, you will fit a random intercept & slope model in R. While grading your assignment, I will focus on your professional presentation, your understanding of multilevel models, your ability to convey that understanding to an audience not necessarily familiar with multilevel models, and your ability to follow directions.

To assist in my grading, please answer these questions in order with section headers letting me know which element you are addressing.

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| Points | Element |
| 5 | **Research question.** You will briefly describe what question you are trying to answer with this analysis. |
|  | State upfront what your hypotheses are regarding cross-level interactions. Do you have a strong reason to believe that one or more of your level-1 predictors will vary across the macro-units? Do you have any expectations for a particular cross-level interaction? |
| 1 | **Level 1 and Level 2.** Explicitly state what your “level 1” and “level 2” units of analysis are. |
|  | You will use the phrases “level 1” and “level 2” at most ONCE (to just explain what the first and second levels are). |
| 4 | **Data source.** You will describe your data source and make clear **where**, **when** and **how** your cases were selected. To what extent were they randomly sampled? |
|  | How was data collected from individuals (e.g. online survey, phone interview, in-person diagnostic assessment)? |
|  | If you are using an experiment, what were the procedures used for the treatment/control conditions, and how were subjects assigned to those different conditions? |
|  | If you are using longitudinal data you will be clear about the timing of follow-ups. |
|  | Do not get around answering these questions by citing some other article. |
| 5 | **Dropped Cases.** How many level-1 and level-2 cases do you have before you drop cases due to scope conditions? |
|  | How many level-1 and level-2 cases do you have after you drop cases due to scope conditions? |
|  | How many level-1 and level-2 cases do you have after you drop cases due to missingness (i.e. subject noncompliance)? |
| 10 | **Variables.** You will describe each of your variables. |
|  | Make clear the role they play in your analysis (outcome, focal predictor, control variable, mediator, moderator, etc.) and what level they vary (level-1 or level-2). |
|  | Briefly describe how they were measured. |
|  | Their valence and unit of measurement should be clear. |
|  | Are you using any standardizations or transformations? |
|  | For Level-1 predictors, outline your centering and aggregation strategy. |
|  | What is the meaning of your Level-1 predictors—are they getting at within-group (or within-person) associations? Or do they represent a mixture of within- and between group (person) effects? |
| 5 | **Scatterplot matrix.** Present a scatterplot matrix of your outcome and ALL of your predictors using the ggpairs function. |
|  | Suggested order of variables: continuous predictors, outcome, then categorical predictors. |
|  | Categorical variables should be treated as factor variables |
|  | You may want to opt for cryptic one-letter category labels so the graph is legible. |
| 5 | **Distribution of Outcome.** You present a histogram of your outcome using ggplot2. |
|  | If the outcome is binary or severely skewed articulate the problems with analyzing a skewed outcome. |
| 5 | **Summary Statistics.** Create a professional table of summary statistics (not R output), giving the mean and standard deviation of variables (use proportions for categorical variables). |
|  | The outcome(s) should be listed first, followed by the level-1 predictors, followed by the level-2 predictors. |
|  | ALL variables should be presented the way they are entered into your regression models–if you standardize/transform/center a variable, you should present summary statistics on the standardized/transformed variable (it is optional to present summary statistics on the raw values). |
|  | Means and standard deviations should be calculated across observations for the outcome and observation-level predictors; means and standard deviations should be calculated across subjects for the person-level predictors. These should be estimated from a dataframe AFTER you do listwise deletion (if you work with multiple samples for different outcomes, just choose one sample). |
|  | No cryptic variable names. |
|  | Variable names should clearly indicate the valence of the variable, and no dummy variable names like “gender” or “race”. |
|  | Acronyms should be explained in a note. |
|  | Do not just copy and paste tables directly from a statistical package in your paper. |
|  | The unit of measurement & valence should be clear, especially if the variable lacks a concrete metric or if it is z-standardized (with a “z” or “SD”). |
|  | Everything should be clearly labeled and titled. |
| 5 | **Estimation Technique.** Explicitly state if you are using restricted maximum likelihood (the default; your deviance tests will only refer to variance components) or full maximum likelihood (your deviance tests will refer to variance components plus slopes, but at the cost of getting relatively poorer estimates of the variance components). If you have two observations per macro-unit please use full ML. |
| 5 | **Regressions.** Estimate the following models: |
|  | • Empty model (random-effects ANOVA). Note you cannot calculate for this model. |
|  | • A within- and between-person (or group) model without any interactions. If one average there are more than two observations per person/group, have a level-1 predictor have a randomly varying slope. |
|  | • Add a “cross-level” interaction–an interaction between your level-1 predictor with the random slope and a level-2 predictor. |
| 10 | **Results table.** |
|  | Your predictors should be grouped by their level, and these levels should be labeled. |
|  | Make sure you indicate *z*-standardization / transformations (including for the outcome). |
|  | Make sure the valence of all variables are clear. |
|  | If you decide to omit control variables from your table, you should add a note listing them. |
|  | I should be able to read your table by itself and interpret all main effects and interaction effects (if any) without consulting your text. |
|  | Your presentation should be compact–you should give me the slope and standard errors and stars (do not present the standard error AND the *t*-statistic!). |
| 20 | **Write-Up**. Interpret the unconditional effects of the level-1 and level-2 predictors involved in the interaction (these come from the model without the interaction). Then interpret the interaction. |
|  | If you were able to estimate a random slope, report what percent of the variation in the random slope is explained by the cross-level interaction. |
|  | Your write-up should give a sense of the statistical & substantive significance of your effects. |
|  | This is one time where you should be writing using “statistics textbook interpretations” with fully elaborated interpretations rather than the concise interpretations done in publications (the point is to make sure you can make sense of interactions!) |
| 10 | **Graph**. Graph your cross-level interaction using either a line graph or a bar graph using ggplot2. |
|  | The graph should be professional looking, with a title, axis labels, a y-axis that does not exaggerate the effect of the predictor, and no cryptic variable names. |
|  | There should be no ambiguity about units of measurement or valence. |
|  | You should present error bars or ribbons to indicate the precision of the estimate. |
| 10 | **Apendix**. Your R syntax that is organized and clearly labeled. There is a logical progression from reading in data, cleaning it, creating variables, and running analyses. |
| 0 - -100 | **Glaring Errors**. There will be no glaring errors that indicate sloppiness or send a signal that you do not know what you are doing (e.g. misinterpreting coefficients). There will be consistency among all elements of the assignment. |

**Upload your assignment to Canvas. Check your submission to make sure there are no issues with formatting. If there are email the assignment to me (**[**klugman@temple.edu**](mailto:klugman@temple.edu)**).**