Multilevel Visualization

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2024-03-24

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# 1. Multilevel Visualization

## 1.1 Introduction

Below, I describe the use of [Stata](https://www.stata.com/) (StataCorp 2021), [R](https://www.r-project.org/) (R Core Team 2023), and [Julia](https://www.julialang.org/) (Bezanson et al. 2017) to visualize multilevel models.

## 1.2 The Data

The examples use the simulated\_multilevel\_data.dta file from [*Multilevel Thinking*](https://agrogan1.github.io/multilevel-thinking/simulated-multi-country-data.html). Here is a [direct link](https://github.com/agrogan1/multilevel-multilingual/raw/main/simulated_multilevel_data.dta) to download the data.

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| Table 1.1: Sample of Simulated Multilevel Data   | country | HDI | family | id | group | physical\_punishment | warmth | outcome | | --- | --- | --- | --- | --- | --- | --- | --- | | 1 | 69 | 1 | 1.1 | 2 | 2 | 3 | 59.18 | | 1 | 69 | 2 | 1.2 | 2 | 4 | 0 | 61.54 | | 1 | 69 | 3 | 1.3 | 1 | 4 | 4 | 51.87 | | 1 | 69 | 4 | 1.4 | 2 | 0 | 6 | 51.71 | | 1 | 69 | 5 | 1.5 | 2 | 3 | 2 | 55.88 | | 1 | 69 | 6 | 1.6 | 1 | 5 | 3 | 60.78 | |

# 2. Graphs

## 2.1 Scatterplots

### Stata

#### 2.1.0.1 Get The Data

use simulated\_multilevel\_data.dta

#### 2.1.0.2 Scatterplot

twoway scatter outcome warmth, ///  
 xtitle("warmth") ytitle("outcome") ///  
 title("Outcome by Parental Warmth")   
  
quietly graph export scatter.png, replace

|  |
| --- |
| Figure 2.1: Outcome by Parental Warmth (Stata) |

### R

#### 2.1.0.3 Get The Data

library(haven)  
  
df <- read\_dta("simulated\_multilevel\_data.dta")

#### 2.1.0.4 Scatterplot

library(ggplot2)  
  
ggplot(df,  
 aes(x = warmth,  
 y = outcome)) +  
 geom\_point() +  
 labs(title = "Outcome by Parental Warmth")

|  |
| --- |
| Figure 2.2: Outcome by Parental Warmth (R) |

### Julia

#### 2.1.0.5 Get The Data

using Tables, MixedModels, StatFiles, DataFrames, CategoricalArrays, DataFramesMeta  
  
df = DataFrame(load("simulated\_multilevel\_data.dta"))

#### 2.1.0.6 Scatterplot

using StatsPlots  
  
@df df scatter(:outcome, :warmth,   
 title = "Outcome by Parental Warmth",  
 ylabel = "outcome",  
 xlabel = "parental warmth")

|  |
| --- |
| Figure 2.3: Outcome by Parental Warmth (Julia) |

## 2.2 Line Graph

### Stata

#### 2.2.0.1 Get The Data

use simulated\_multilevel\_longitudinal\_data.dta

#### 2.2.0.2 Line Graph

twoway lfit outcome t, ///  
 xtitle("time") ytitle("outcome") ///  
 title("Outcome by Time")   
  
quietly graph export lfitlongitudinal.png, replace

|  |
| --- |
| Figure 2.4: Outcome by Parental Warmth (Stata) |

### R

#### 2.2.0.3 Get The Data

use simulated\_multilevel\_longitudinal\_data.dta

#### 2.2.0.4 Line Graph

twoway lfit outcome t, ///  
 xtitle("time") ytitle("outcome") ///  
 title("Outcome by Time")   
  
quietly graph export lfitlongitudinal.png, replace

|  |
| --- |
| Figure 2.5: Outcome by Parental Warmth (Stata) |

### Julia

#### 2.2.0.5 Get The Data

using Tables, MixedModels, StatFiles, DataFrames, CategoricalArrays, DataFramesMeta  
  
dfL = DataFrame(load("simulated\_multilevel\_longitudinal\_data.dta"))

#### 2.2.0.6 Line Graph

To make our plot with a smoother in Julia, we set the markercolor and markerstrokecolor to be *white*, and the smooth option to :true.

using StatsPlots  
  
@df dfL scatter(:outcome, :t,   
 title = "Outcome by Time",  
 ylabel = "outcome",  
 xlabel = "time",  
 markercolor = "white",  
 markerstrokecolor = "white",  
 smooth=:true)

|  |
| --- |
| Figure 2.6: Outcome by Parental Warmth (Julia) |

## 2.3 Spaghetti Plots

### Stata

### R

### Julia

# References

Bezanson, Jeff, Alan Edelman, Stefan Karpinski, and Viral B. Shah. 2017. “Julia: A Fresh Approach to Numerical Computing.” *SIAM Review* 59 (1): 65–98. <https://doi.org/10.1137/141000671>.

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