A Multivariate Approach to Ordinal Data

Analyzing emotional responses to abortion

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Stat 637 Final Project

The Data

- Facebook administered Qualtrics survey of 207 people
- Highly non-random (180 women, 27 men)
- Posed situations leading to an abortion and asked about an emotional response
- Gathered demographic information as well as political and religious activity

Scenarios

- ”Liz was 23 years old when she became pregnant with her boyfriend. This was unplanned and they did not have future plans to get married. They both just started their first year in graduate school. Having a baby did not fit her career and educational goals. She wasn’t planning on settling down until her late twenties. Liz and her boyfriend chose to have an abortion.”
- ”April was homeless, 18 years old, and pregnant. Her pregnancy was the result of a rape. She has no education beyond junior high and extremely limited financial resources and family support. April chose to have an abortion.”

Scenarios

- ”Britney, who is pregnant, and her husband James find out that their baby will have down syndrome. They chose to have an abortion.”
- ”Amanda, who is married, just found out that she is pregnant. Shortly after, she learned that she has cervical cancer. Her doctors told her that she wouldn’t be able to receive treatment while she was pregnant, so she chose to have an abortion.”

Question of Interest

Our response variable will be the Likert scaled value of how compassionate they felt about the situation (Not at all-Extremely), but other emotions measured were: angered, disturbed, grieved, frustrated, impassioned, warm, tender, and alarmed. Our questions of interest are:

- What factors influence the amount of compassion expressed?
- How do the four situations relate (essential dimensionality)?

Compassion Scores

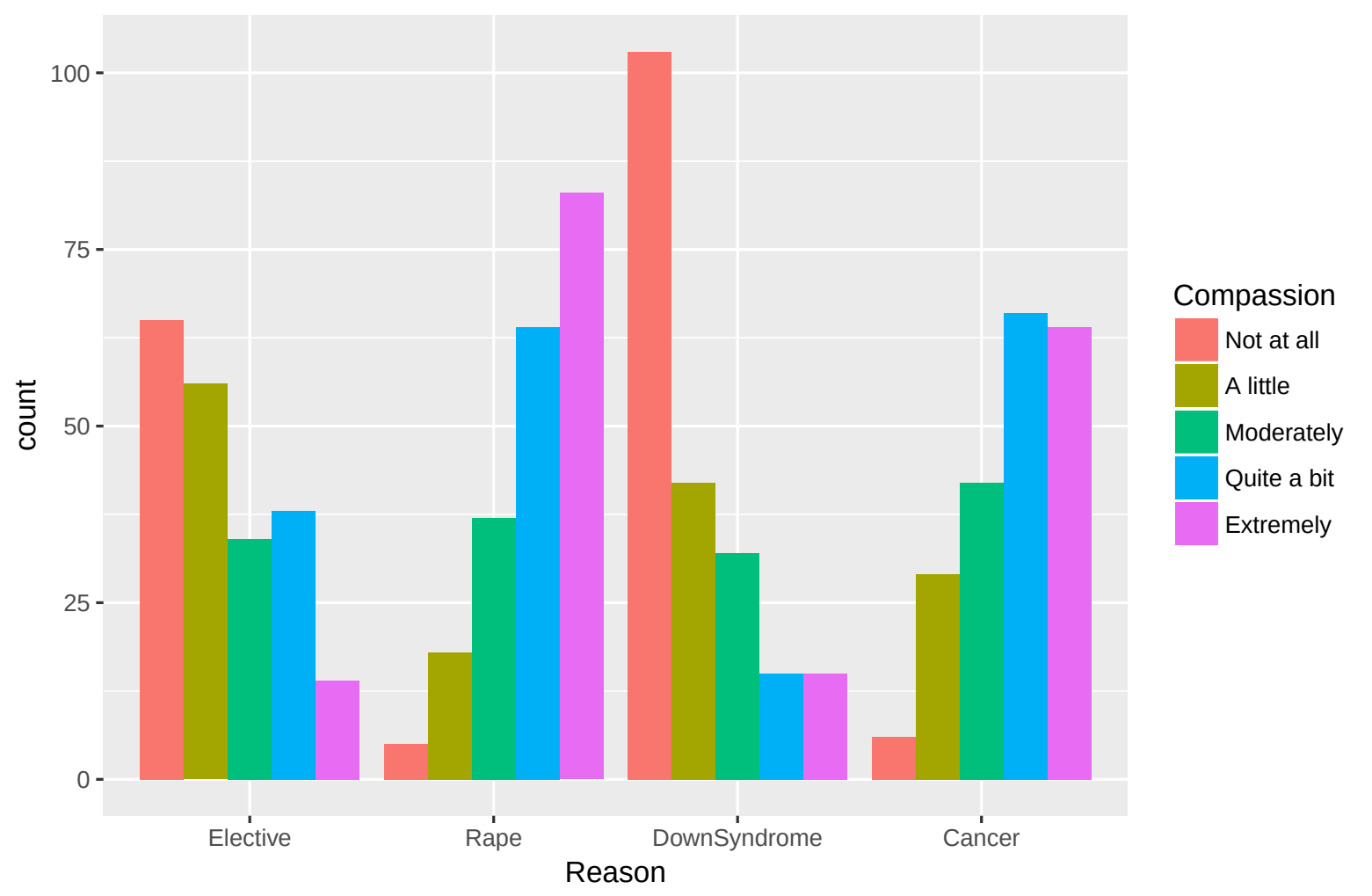

Figure 1: Reported compassion for each situation

Covariate Correlation

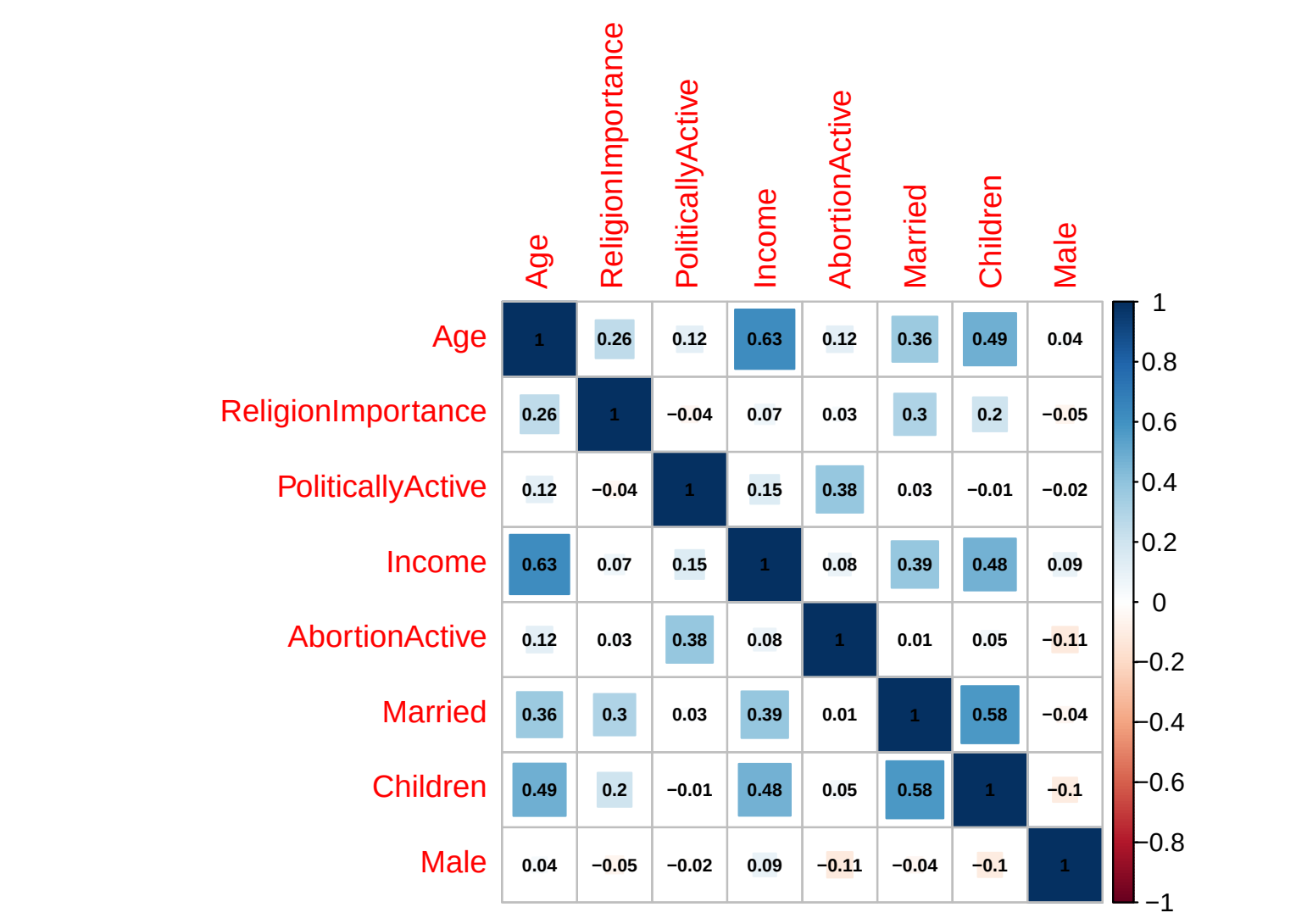

Figure 2: Spearman correlation matrix for all predictor variables

Response Correlation for Compassion Score

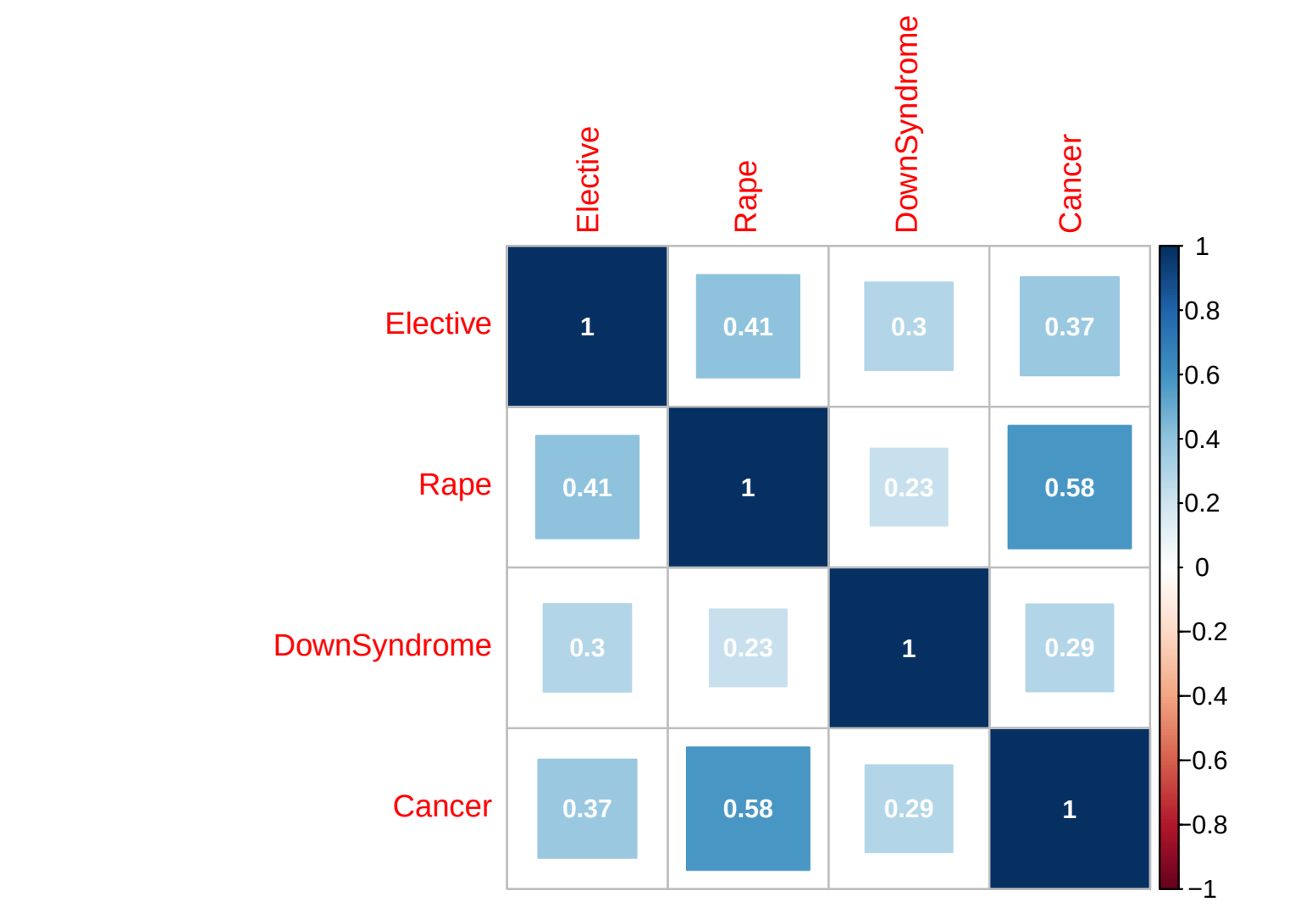

Figure 3: Spearman correlation matrix for reported compassion scores

The Model

We will fit a multivariate ordinal (latent variable) model using the mvord package in R:

$$Y_{ij} = r_j$$

where i indexes the person and j indexes the abortion scenario. r_j is the Likert response to situation j. Y_{ij} is assumed to be a discretized version of $\tilde{Y}_{ij}$ where $Y_{ij} = r_j$ if:

$$\theta_{j,r_{ij}-1} < \tilde{Y}_{ij} \leq \theta_{j,r_{ij}}$$

The θs are the cutoff points between one ordinal response and the next.

The Model

$$\tilde{Y}_{ij} = X\beta_j + \epsilon_{ij}$$

Each individuals response will have a vector of errors distributed as:

$$\epsilon_i \sim MVN(\mathbf{0}, \mathbf{\Sigma})$$

The package will estimate the β_js, θs and Σ, but to ensure identifiability we fix the $\theta_1 = 0$ and $\theta_2 = 1$.

Model Notes

- Centered and scaled covariates so coefficients would have comparable sizes and magnitudes
    - Had the unexpected benefit cutting computation from 10 minutes to 1
- Model allows different covariates and different ordinal levels for each response (we didn't use this feature)
- Predict function is nonsensical, created my own
- 'Logit' model (using a t-copula??) also supported, had worse fit
- Composite Likelihood AIC (CLAIC) is the only model comparison tool supported in the package

Model Coefficients

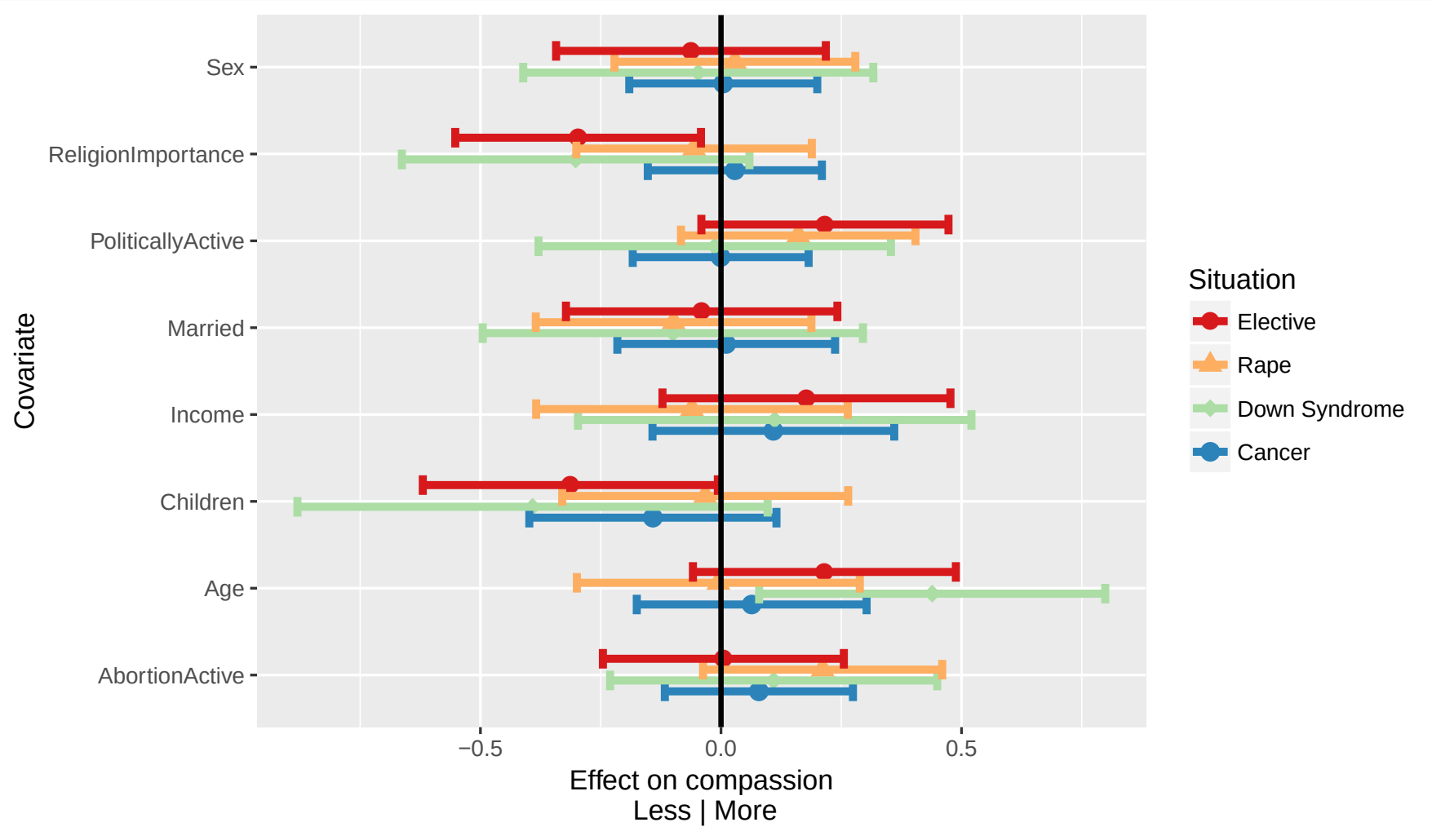

Figure 4: Estimated coefficients and 95% confidence intervals

Discriminative Power

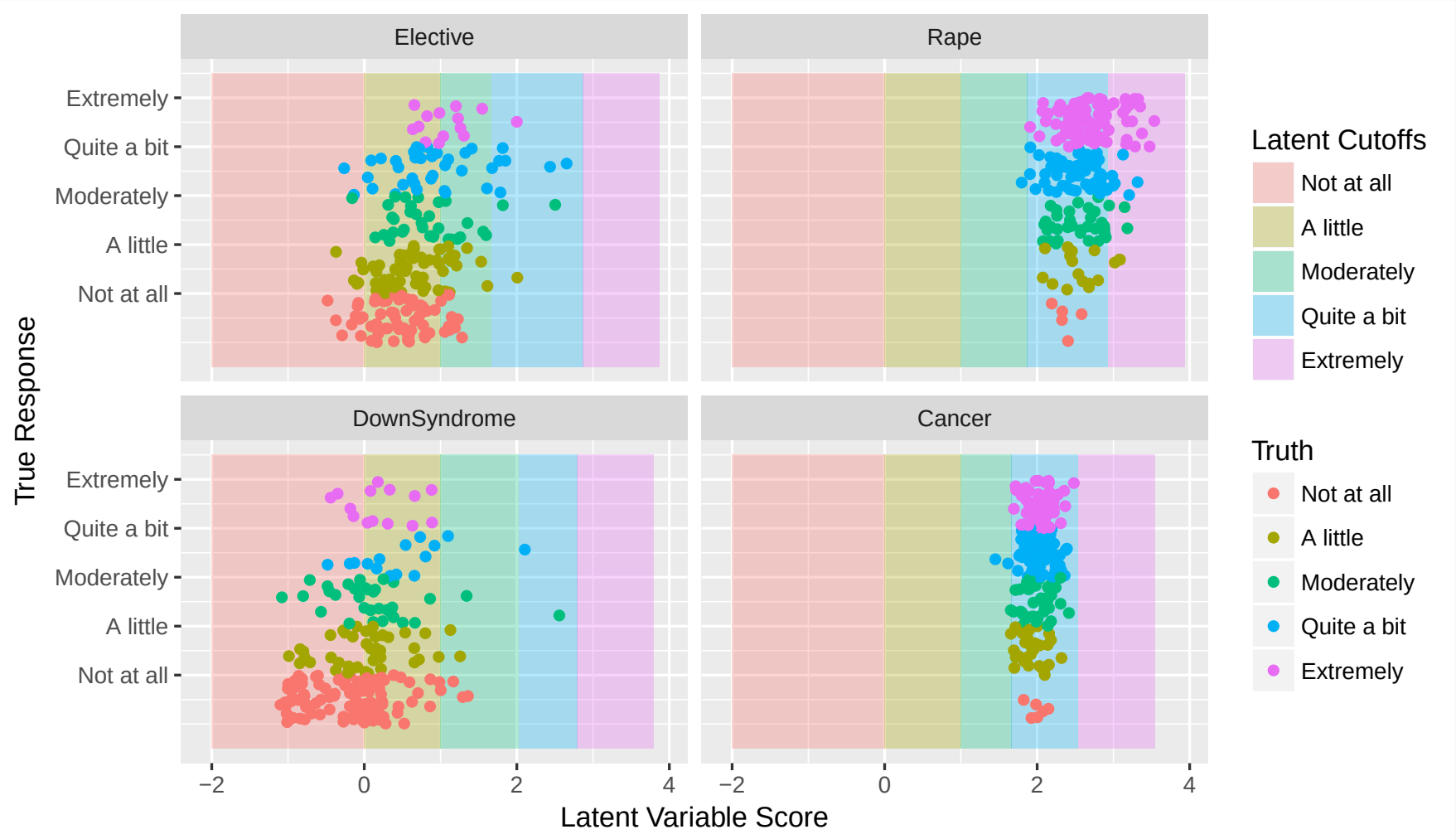

Figure 5: θ estimates and actual vs. predicted levels of compassion

Residual Error

We can analyze $\hat{\Sigma}$ to learn about the variability we're not capturing in the coefficients. All positive correlation suggests a general sense of compassion or lack thereof for abortion in general.

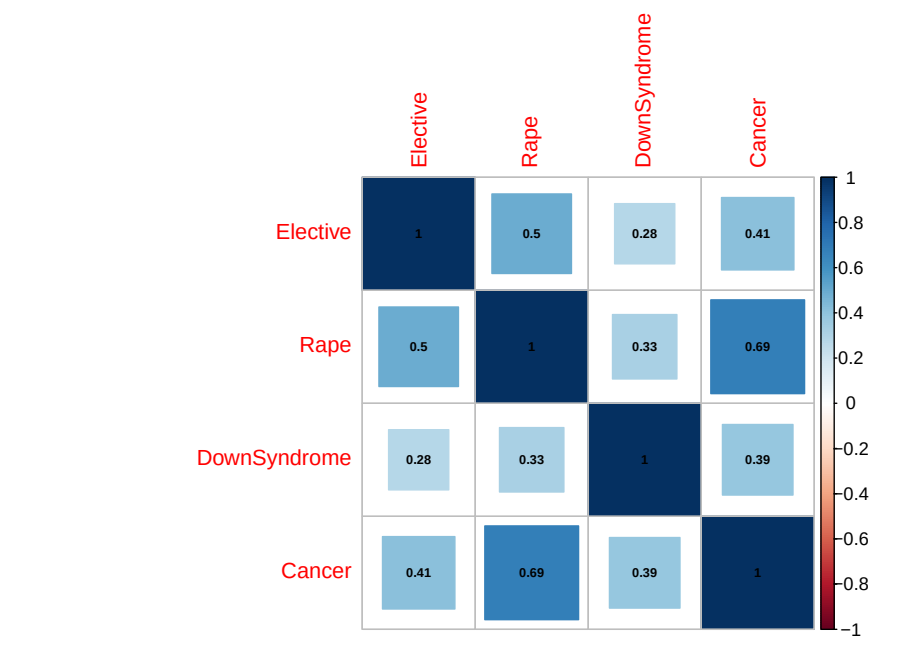

Figure 6: Estimated correlation matrix of our error terms

Situation	Elective	Rape	Down Syndrome	Cancer
σ	1.32	1.29	1.77	1.04

Conclusions

- Human morality is complex (a few demographic covariates don't cut it)
- Latent variable model for multivariate ordinal model conceptually simple and not too difficult to fit
- Would be easy to port to other, more scientifically rigorous, surveys with Likert responses
- Ongoing work: Find the best fitting (AIC) model (Religion, age, and children seem to be the most relevant variables so far).