Political Cultures:
Measuring Values Heterogeneity
Supplemental Information

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1 Model

$$\begin{aligned}
\alpha_k &\sim \text{Gamma}(0.25, 1) \\
\boldsymbol{\theta}_{r,k} &\sim \text{Dirichlet}(\boldsymbol{\lambda}) \\
\boldsymbol{\pi}_i &\sim \text{Dirichlet}(\boldsymbol{\alpha}) \\
\boldsymbol{\tau}_{ij}|\boldsymbol{\pi}_i &\sim \text{Multinomial}(1, \boldsymbol{\pi}_i) \\
\boldsymbol{y}_{ijr}|\tau_{ijk} = 1, \boldsymbol{\theta}_{kr} &\sim \text{Multinomial}(1, \boldsymbol{\theta}_{kr})
\end{aligned}$$

If we assume $\boldsymbol{\lambda} = 1$, then the full posterior is given by,

$$\begin{aligned}
p(\boldsymbol{\alpha}, \boldsymbol{\theta}, \boldsymbol{\pi}, \boldsymbol{\tau}|\boldsymbol{Y}) \quad \propto \quad & \prod_{k=1}^{K} \frac{\exp(-\frac{\alpha_k}{1/4})}{1/4} \times \\
& \prod_{i=1}^{N} \left[\frac{\Gamma(\sum_{k=1}^{K} \alpha_k)}{\prod_{k=1}^{K} \Gamma(\alpha_k)} \prod_{k=1}^{K} \pi_{ik}^{\alpha_k - 1} \prod_{j=1}^{N_i} \prod_{k=1}^{K} \left[\pi_{ik} \prod_{r=1}^{R} \left(\prod_{q=1}^{Q_r} \theta_{rkq}^{I(y_{ijr}=q)} \right) \right]^{\tau_{ijk}} \right]
\end{aligned}$$

2 Estimation

Variational approximations are a deterministic method to approximate a posterior. First, we assume a specific — though still very general — functional form for an approximating distribution. Then, we use an iterative algorithm to find the member of this approximating distribution family that is closest to the true posterior.

We will assume an approximation distribution given by,

$$q(\boldsymbol{\alpha}, \boldsymbol{\theta}, \boldsymbol{\pi}, \boldsymbol{\tau}) \quad = \quad q(\boldsymbol{\alpha}) \prod_{i=1}^{N} \left[q(\boldsymbol{\pi})_i \prod_{j=1}^{N_i} q(\boldsymbol{\tau})_j \right] \prod_{r=1}^{R} \prod_{k=1}^{K} q(\boldsymbol{\theta})_{kr}$$

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We use the following algorithm to find the member of this family that is closest to the true posterior (Bishop, 2006; Grimmer, 2011)

2.1 Update for $q(\boldsymbol{\tau})_{ij}$

$q(\boldsymbol{\tau})_{ij}$ is a Multinomial(1, $\boldsymbol{r}_{ij}$) distribution with typical parameter r_{ijk}

$$r_{ijk} \quad \propto \quad \exp\left\{ \mathrm{E}[\log \pi_{ik}] + \sum_{r=1}^{R} \left(\sum_{q=1}^{Q_r} y_{ijrp} \mathrm{E}[\log \theta_{rkq}] \right) \right\}$$

We will calculate $\mathrm{E}[\log \pi_{ik}]$ and $\mathrm{E}[\log \theta_{rkp}]$ after deriving the parametric family of their approximating distributions.

2.2 Update for $q(\boldsymbol{\pi})_i$

$q(\boldsymbol{\pi})_i$ is a Dirichlet($\boldsymbol{\gamma}_i$) with typical parameter γ_{ik},

$$\gamma_{ik} \quad = \quad \alpha_k + \sum_{j=1}^{N_i} r_{ijk}$$

2.3 Update for $q(\boldsymbol{\theta})_{kr}$

$q(\boldsymbol{\theta})_{kr}$ is a Dirichlet($\boldsymbol{\eta}_{kr}$) distribution, with typical parameter η_{krq},

$$\eta_{krq} \quad = \quad \lambda_q + \sum_{i=1}^{N} \sum_{j=1}^{N_i} r_{ijk} y_{ijrq}$$

2.4 Completing $q(\boldsymbol{\sigma}_i)$ and $q(\boldsymbol{\tau})_{ij}$

To finish the updates, we calculate the following expected values, based on the derived derived distributional forms,

$$\mathrm{E}[\log \pi_{ik}] \quad = \quad \psi(\gamma_{ik}) - \psi(\sum_{z=1}^{K} \gamma_{iz})$$
$$\mathrm{E}[\log \theta_{krp}] \quad = \quad \psi(\eta_{krp}) - \psi(\sum_{z=1}^{K} \eta_{krz})$$

2.4.1 Update Steps for $\boldsymbol{\alpha}$

A closed form update step is unavailable for $\boldsymbol{\alpha}$ so we rely upon an efficient Newton-Raphson algorithm, developed in Minka (2000). Calculating the expected values and differentiating with respect to α_k shows that

$$\frac{\partial \log q(\boldsymbol{\alpha})_k^{\mathrm{new}}}{\partial \alpha_k} \quad = \quad -\frac{1}{\lambda} + N\Psi(\sum_{k=1}^{K} \alpha_k) - N\Psi(\alpha_k) + \sum_{i=1}^{N} \frac{\left(\Psi(\gamma_{itk}) - \Psi(\sum_{z=1}^{K} \gamma_{itz})\right)}{N}$$

and collect all the first derivatives into the (gradient) vector $\frac{\partial \log q(\boldsymbol{\alpha})_k^{\text{new}}}{\partial \boldsymbol{\alpha}_k}$. Define H as the Hessian (matrix of second derivatives). Typical on diagonal element $h_{jj} = N_s \Psi^{'}(\sum_{k=1}^{K} \alpha_k) - N\Psi^{'}(\alpha_j)$ where $\Psi^{'}(\cdot)$ is the trigamma function (the derivative of the digamma function) and the typical off-diagonal element $(a \neq b)$ we have $h_{ab} = N_z \Psi^{'}(\sum_{k=1}^{K} \alpha_k)$, so

$$\boldsymbol{\alpha}^{\text{new}} = \boldsymbol{\alpha}^{\text{old}} - \mathrm{H}^{-1} \frac{\partial \log q(\boldsymbol{\alpha})_k^{\text{new}}}{\partial \boldsymbol{\alpha}_k}$$

until the change in $\boldsymbol{\alpha}$ drops below a tolerance level (10^{-8} in the implementation). H's structure makes it is easily invertible, making the Newton-Raphson algorithm exceedingly fast.

3 Cross Validation

To select the number of categories we employ 10-fold cross validation (Hastie, Tibshirani and Friedman, 2001) and then use the average predicted probability of question responses. To evaluate model fit using cross validation for each fold of the data we fit our model using a specified number of clusters. For each fit we then compute the maximum a posteriori (MAP) estimates for the country specific distributions of categories. Call this $\hat{\boldsymbol{\pi}}_j$ and call the proportion of respondents in country j w_j with the J length vector of weights $\boldsymbol{w}$. We then compute the weighted average distribution of sub-cultures across countries as $\tilde{\boldsymbol{\pi}} = \hat{\boldsymbol{\pi}}_j^{'} \boldsymbol{w}$.

For each respondent and each question we then compute a response that averages over the subcultures. We compute the MAP estimate of the subculture specific distributions as $\hat{\boldsymbol{\theta}}_{kr}$. Then, for each question r we compute $\tilde{\boldsymbol{\theta}}_r = \hat{\boldsymbol{\theta}}_{kr}^{'} \tilde{\boldsymbol{\pi}}$. We then assess the predicted probability of the responses for each question and each respondent. Thus our cross validation statistic for k subcultures

$$\text{CV}_k = \sum_{i=1}^{N} \sum_{j=1}^{J} \sum_{r=1}^{R} Y_{ijr} \log \tilde{\boldsymbol{\theta}}_r$$

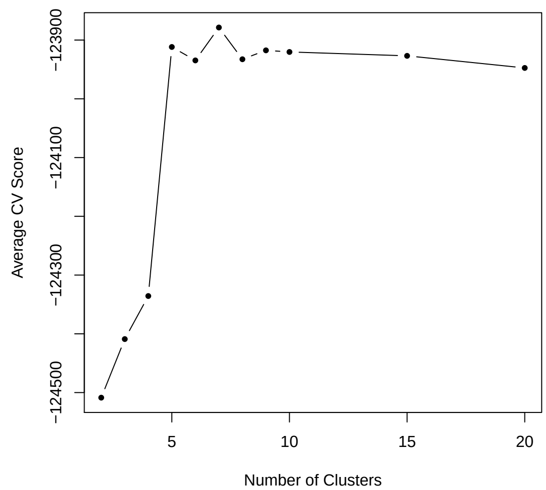
Where we use the natural logarithm to avoid computational underflow. Higher values of the cross validation statistic imply a better fit, because the model is allocating a higher probability to the actual responses.[1] Figure 1 provides the cross validation scores across different numbers of subcultures. This reveals that 7 is the highest score.

4 Validating the Results

Our cross validation procedure provides us with some assurances that our model is fitting the data as well as possible, given the specification. This provides a quantitative evaluation of model fit. But, more importantly, we need to establish that our model is providing substantive insights into the respondent behavior in our data. To establish this, we provide evidence that the types that we identify are describing meaningful variation in the data and we also describe the characteristics of individuals who adopt particular types of subcultures. We also do a "deep dive" on the variation in Figure 1 of the main text and describe country specific variation for a set of countries. Across

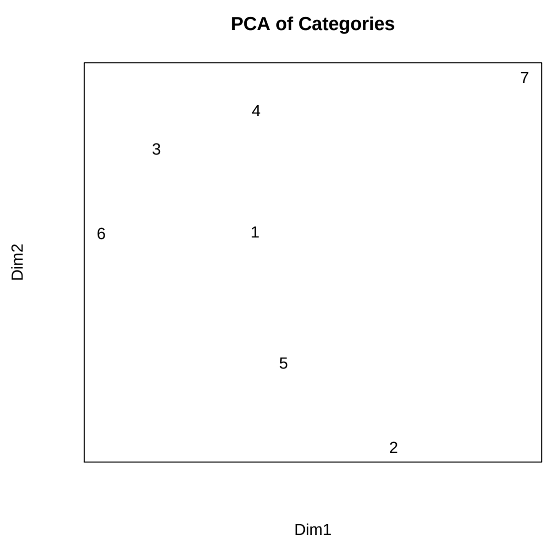
[1] Alternatively, we can compute a country specific prediction for each individual, which we discuss in our replication code.

Figure 1: Cross Validation Statistic Across Different Numbers of Clusters



these descriptions, we demonstrate that the method for identifying subcultures yields latent types that provide insights into the underlying culture.

Figure 2: Latent Category PCA



Before discussing specific differences across the categories, Figure 2 provides a PCA of the categories. To do this, we take the first two principal components obtained from trying to explain the variation of categories across countries. This provides an indication of categories that tend to appear together. As our description suggests, category 6 and 7 are quite distinct on the first dimension. Category 2 and 5 are focused more on material possessions. Overall, this provides further evidence for the description of the categories in the main text.

5 Latent Type Face Validity

In our main text we describe the questions that define what makes the sub-cultures different. In this section we first provide further evidence for the group differences. We do this in two ways.

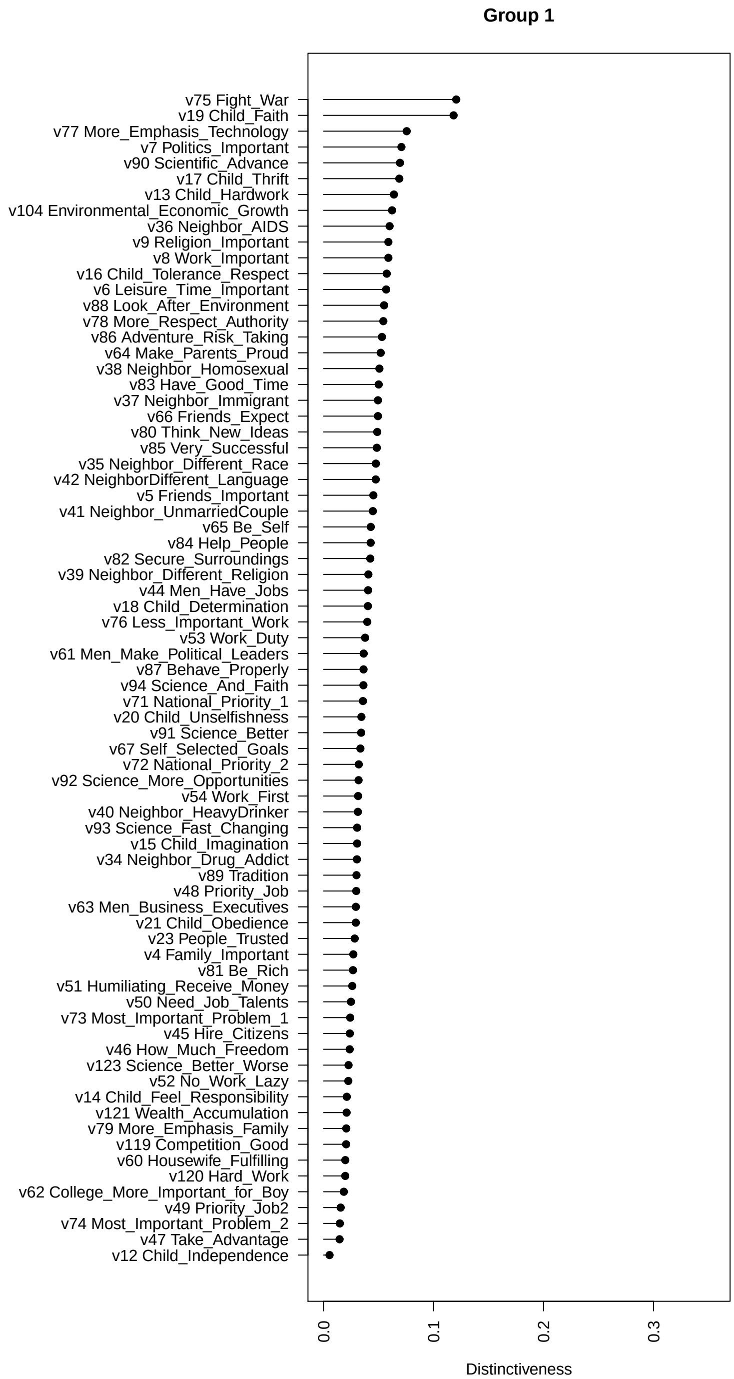
First, we provide a measure of how distinctive a culture's response is for each question. To calculate this we assign each respondent to one culture by identifying the most likely category from our model call this $\hat{\tau}_i$. Then, we measure the proportion of respondents from the culture who provided each response, including an additional "no opinion category". For culture k and for question r we measure the proprtion giving a particular response as $t_{kr} = \frac{\sum_{j=1}^{J}\sum_{i=1}^{N_j} I(\hat{\tau}_{ijk}=1) I(Y_{ijkr}=1)}{\sum_{j=1}^{J}\sum_{i=1}^{N_j} I(\hat{\tau}_{ijk}=1)}$. (Note that this will be very similar to the MAP estimates of θ_{kr} from the model).

Using this distribution of responses for each culture, me measure the each questions distinctiveness for each culture. To obtain this measure, d_{kr} we compare the distribution of a culture's responses to the average distribution across the other cultures. Specifically, suppose that for question r there are Q_r potential responses and define the average response for the other $K-1$ cultures as $t_{-kr} = \sum_{m \neq k} \frac{t_{mr}}{K-1}$. Then we define the distinctiveness for the question as the average difference for each question option:

$$d_{kr} = \sum_{q=1}^{Q_r - 1} \frac{|d_{krq} - t_{-krq}|}{Q_r - 1}$$

where we divide by $Q_r - 1$ because the final category is redundant.

Using this measure of distinctiveness, the following seven plots provide the distinctiveness for each question for each culture. The bigger the gap, the more distinct the response is. This bolsters the claims made in the main text and provides further details on what makes the groups different.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v75 Fight_War
v19 Child_Faith
v77 More_Emphasis_Technology
v7 Politics_Important
v90 Scientific_Advance
v17 Child_Thrift
v13 Child_Hardwork
v104 Environmental_Economic_Growth
v36 Neighbor_AIDS
v9 Religion_Important
v8 Work_Important
v16 Child_Tolerance_Respect
v6 Leisure_Time_Important
v88 Look_After_Environment
v78 More_Respect_Authority
v86 Adventure_Risk_Taking
v64 Make_Parents_Proud
v38 Neighbor_Homosexual
v83 Have_Good_Time
v37 Neighbor_Immigrant
v66 Friends_Expect
v80 Think_New_Ideas
v85 Very_Successful
v35 Neighbor_Different_Race
v42 NeighborDifferent_Language
v5 Friends_Important
v41 Neighbor_UnmarriedCouple
v65 Be_Self
v84 Help_People
v82 Secure_Surroundings
v39 Neighbor_Different_Religion
v44 Men_Have_Jobs
v18 Child_Determination
v76 Less_Important_Work
v53 Work_Duty
v61 Men_Make_Political_Leaders
v87 Behave_Properly
v94 Science_And_Faith
v71 National_Priority_1
v20 Child_Unselfishness
v91 Science_Better
v67 Self_Selected_Goals
v72 National_Priority_2
v92 Science_More_Opportunities
v54 Work_First
v40 Neighbor_HeavyDrinker
v93 Science_Fast_Changing
v15 Child_Imagination
v34 Neighbor_Drug_Addict
v89 Tradition
v48 Priority_Job
v63 Men_Business_Executives
v21 Child_Obedience
v23 People_Trusted
v4 Family_Important
v81 Be_Rich
v51 Humiliating_Receive_Money
v50 Need_Job_Talents
v73 Most_Important_Problem_1
v45 Hire_Citizens
v46 How_Much_Freedom
v123 Science_Better_Worse
v52 No_Work_Lazy
v14 Child_Feel_Responsibility
v121 Wealth_Accumulation
v79 More_Emphasis_Family
v119 Competition_Good
v60 Housewife_Fulfilling
v120 Hard_Work
v62 College_More_Important_for_Boy
v49 Priority_Job2
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v47 Take_Advantage
v12 Child_Independence
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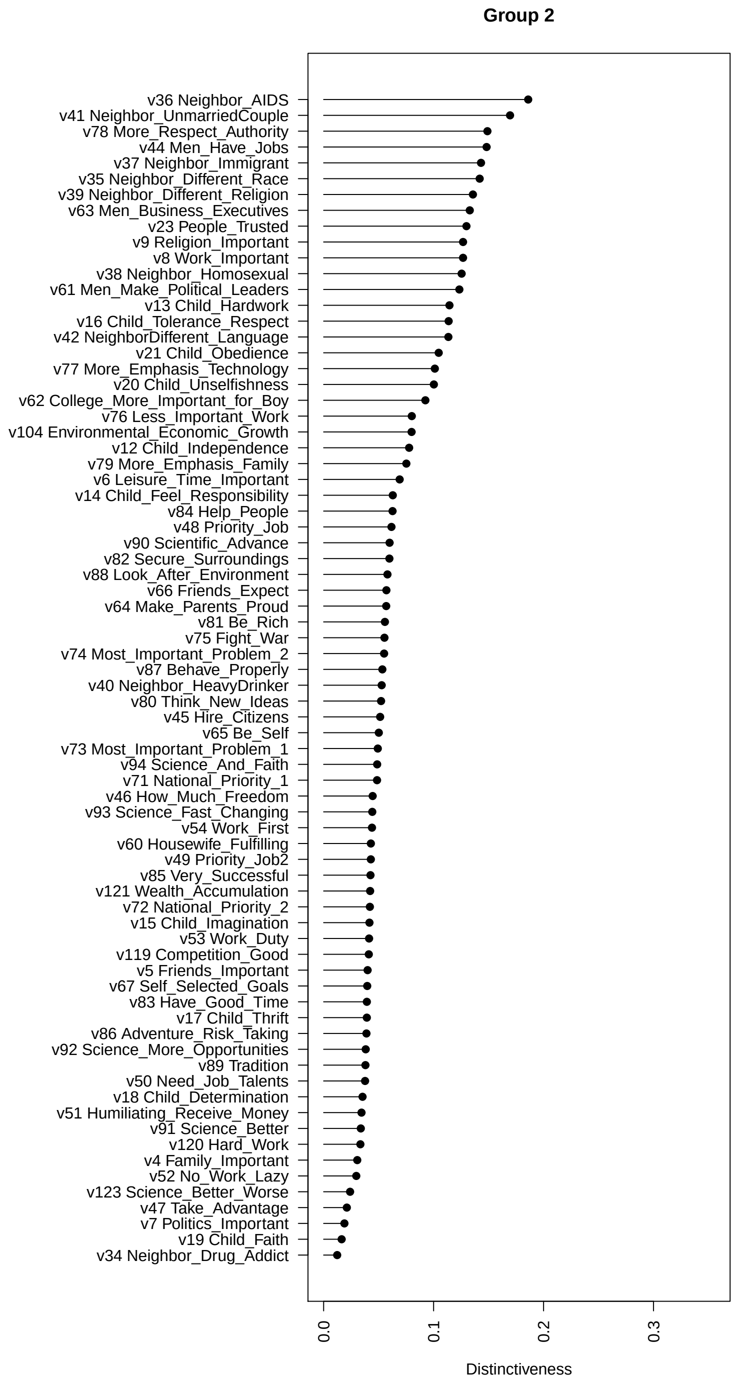
Distinctiveness


Group 2
v36 Neighbor_AIDS
v41 Neighbor_UnmarriedCouple
v78 More_Respect_Authority
v44 Men_Have_Jobs
v37 Neighbor_Immigrant
v35 Neighbor_Different_Race
v39 Neighbor_Different_Religion
v63 Men_Business_Executives
v23 People_Trusted
v9 Religion_Important
v8 Work_Important
v38 Neighbor_Homosexual
v61 Men_Make_Political_Leaders
v13 Child_Hardwork
v16 Child_Tolerance_Respect
v42 NeighborDifferent_Language
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v77 More_Emphasis_Technology
v20 Child_Unselfishness
v62 College_More_Important_for_Boy
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v82 Secure_Surroundings
v88 Look_After_Environment
v66 Friends_Expect
v64 Make_Parents_Proud
v81 Be_Rich
v75 Fight_War
v74 Most_Important_Problem_2
v87 Behave_Properly
v40 Neighbor_HeavyDrinker
v80 Think_New_Ideas
v45 Hire_Citizens
v65 Be_Self
v73 Most_Important_Problem_1
v94 Science_And_Faith
v71 National_Priority_1
v46 How_Much_Freedom
v93 Science_Fast_Changing
v54 Work_First
v60 Housewife_Fulfilling
v49 Priority_Job2
v85 Very_Successful
v121 Wealth_Accumulation
v72 National_Priority_2
v15 Child_Imagination
v53 Work_Duty
v119 Competition_Good
v5 Friends_Important
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v120 Hard_Work
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v19 Child_Faith
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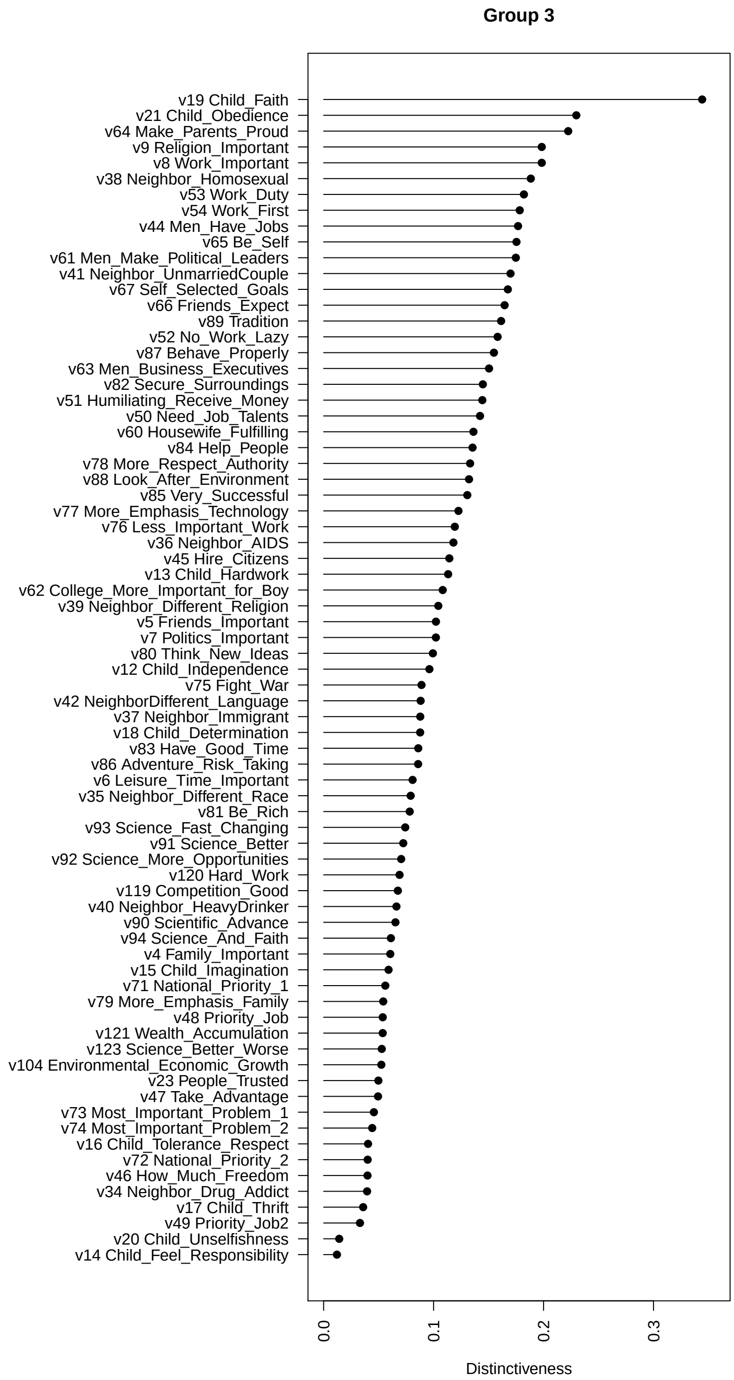
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v19 Child_Faith
v21 Child_Obedience
v64 Make_Parents_Proud
v9 Religion_Important
v8 Work_Important
v38 Neighbor_Homosexual
v53 Work_Duty
v54 Work_First
v44 Men_Have_Jobs
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v14 Child_Feel_Responsibility
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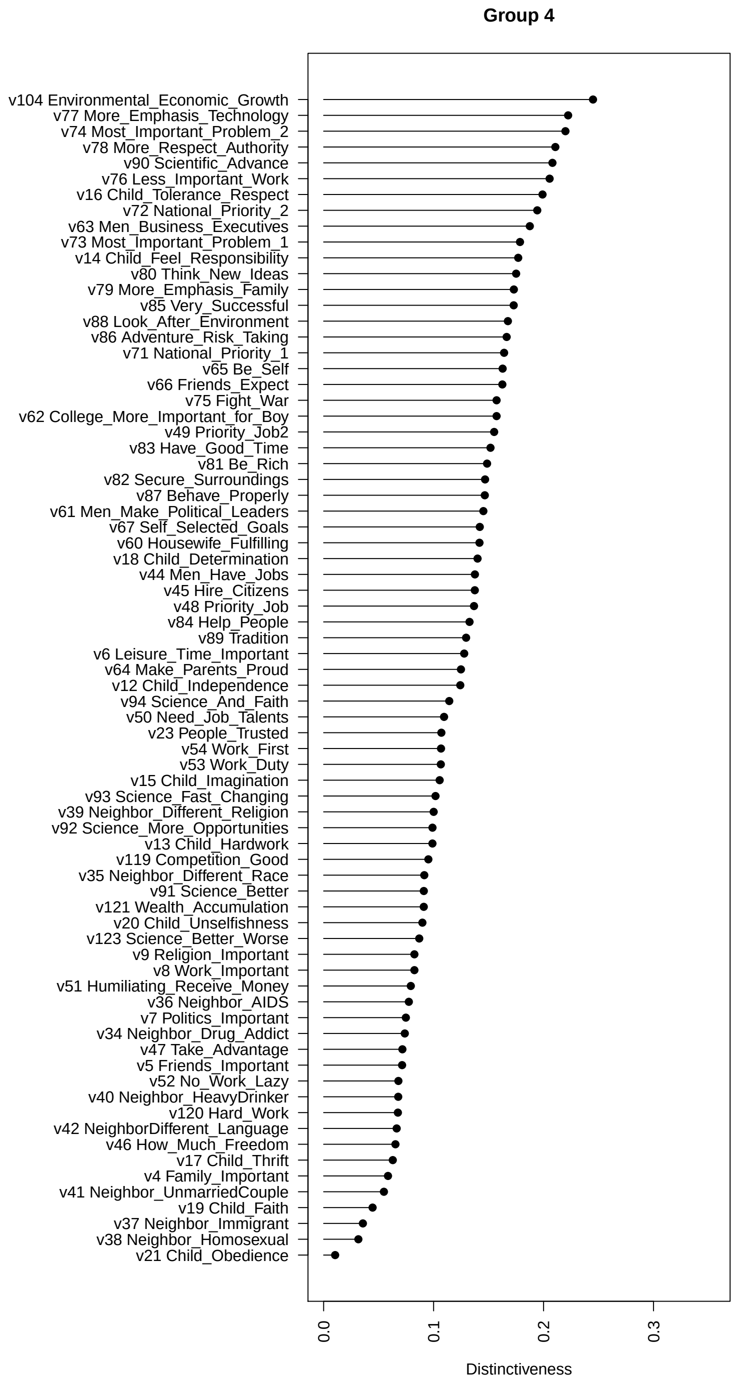
Group 4
v104 Environmental_Economic_Growth
v77 More_Emphasis_Technology
v74 Most_Important_Problem_2
v78 More_Respect_Authority
v90 Scientific_Advance
v76 Less_Important_Work
v16 Child_Tolerance_Respect
v72 National_Priority_2
v63 Men_Business_Executives
v73 Most_Important_Problem_1
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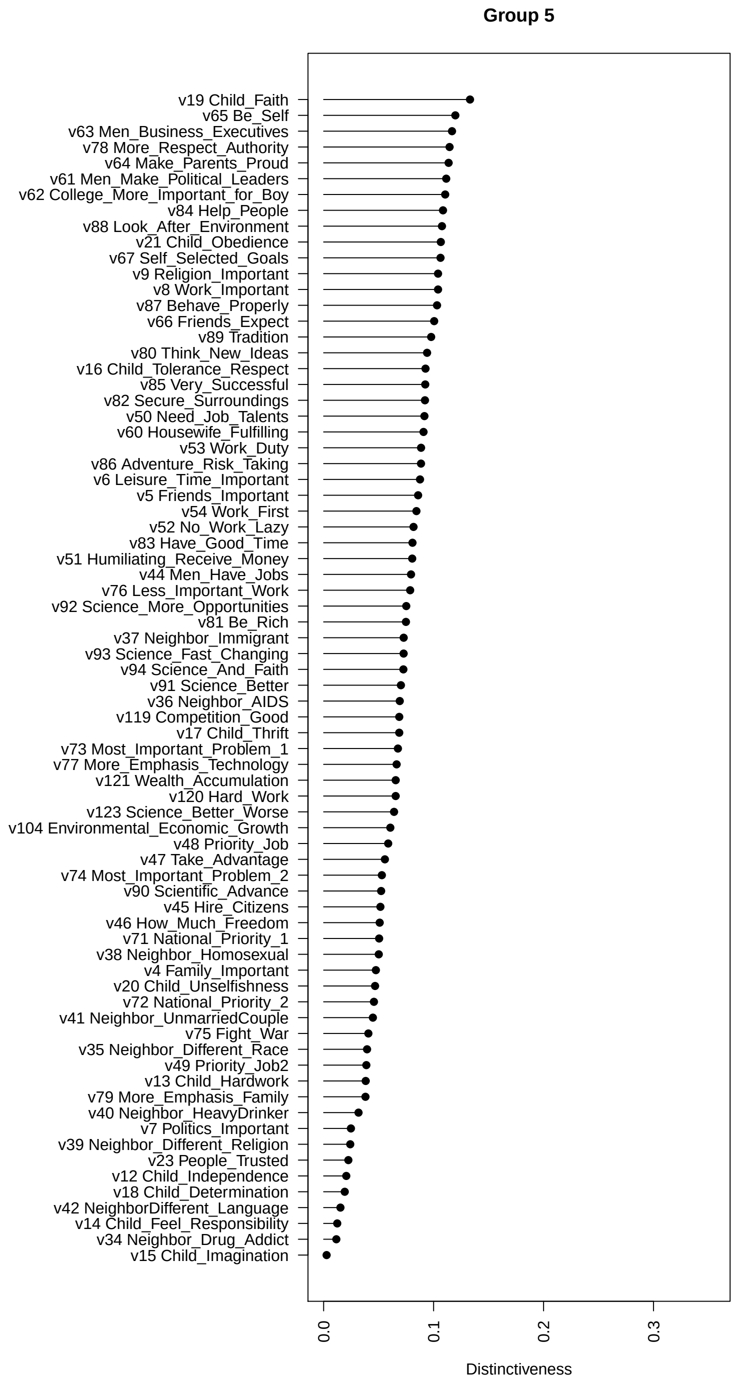

Group 5
v19 Child_Faith
v65 Be_Self
v63 Men_Business_Executives
v78 More_Respect_Authority
v64 Make_Parents_Proud
v61 Men_Make_Political_Leaders
v62 College_More_Important_for_Boy
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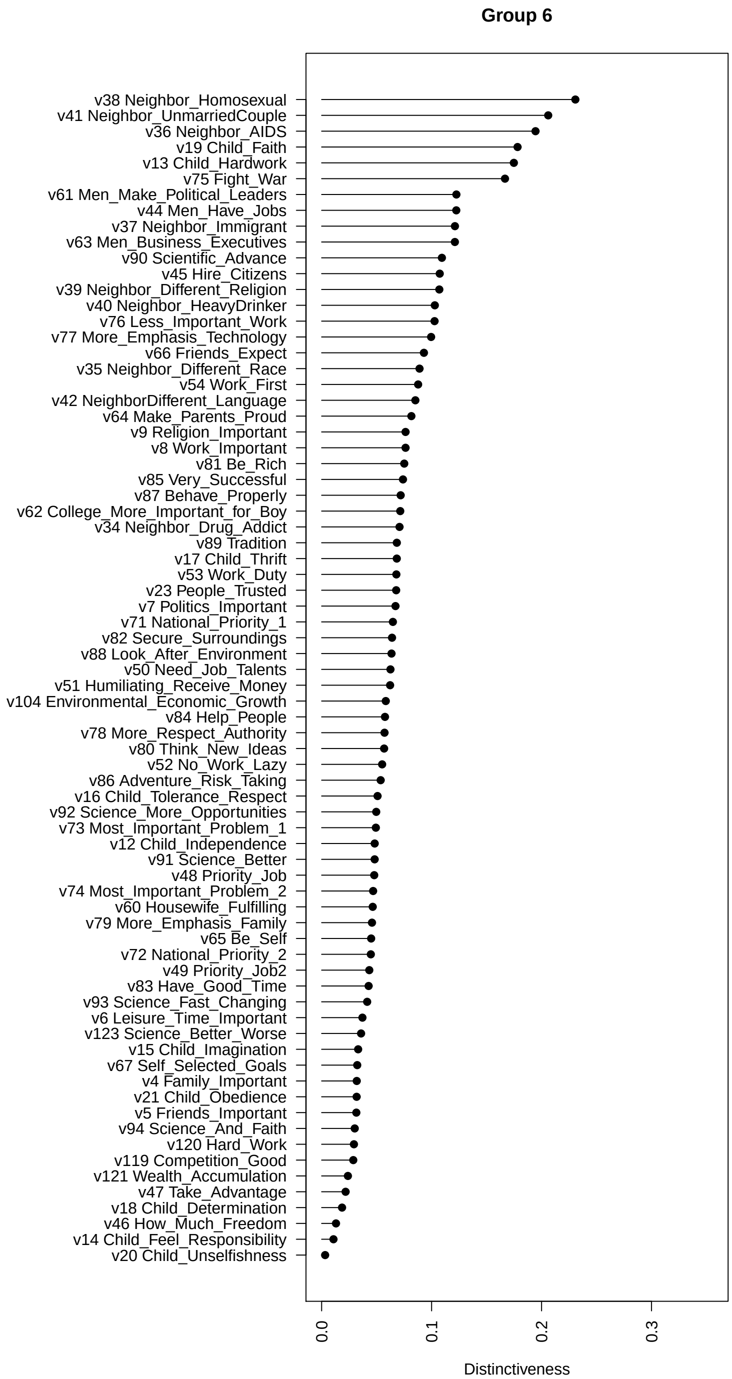
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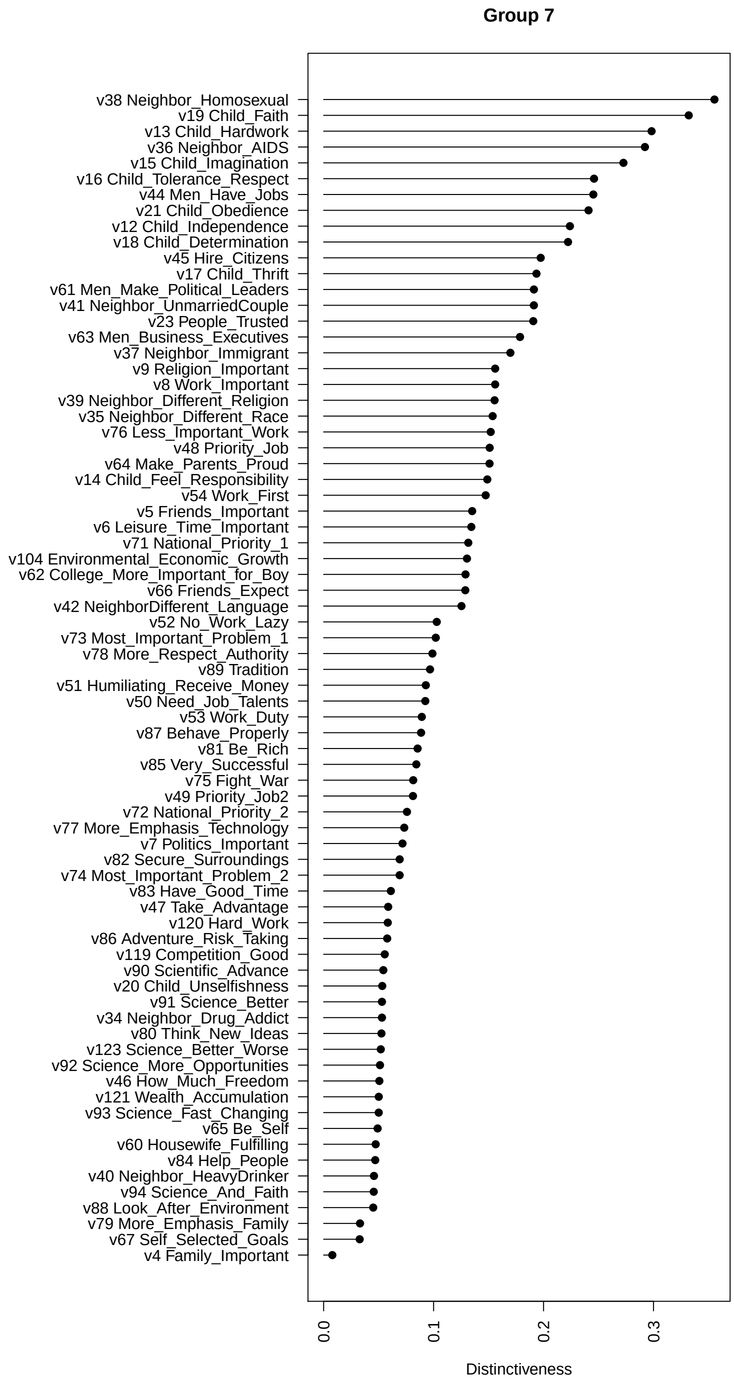
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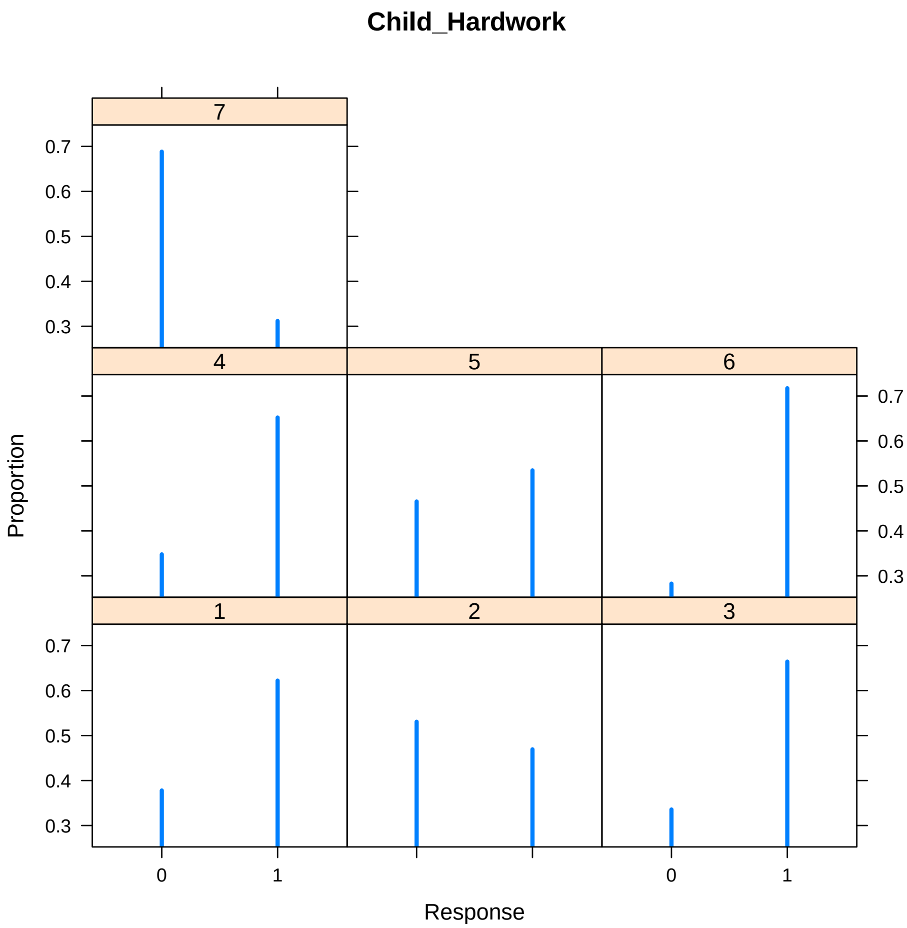
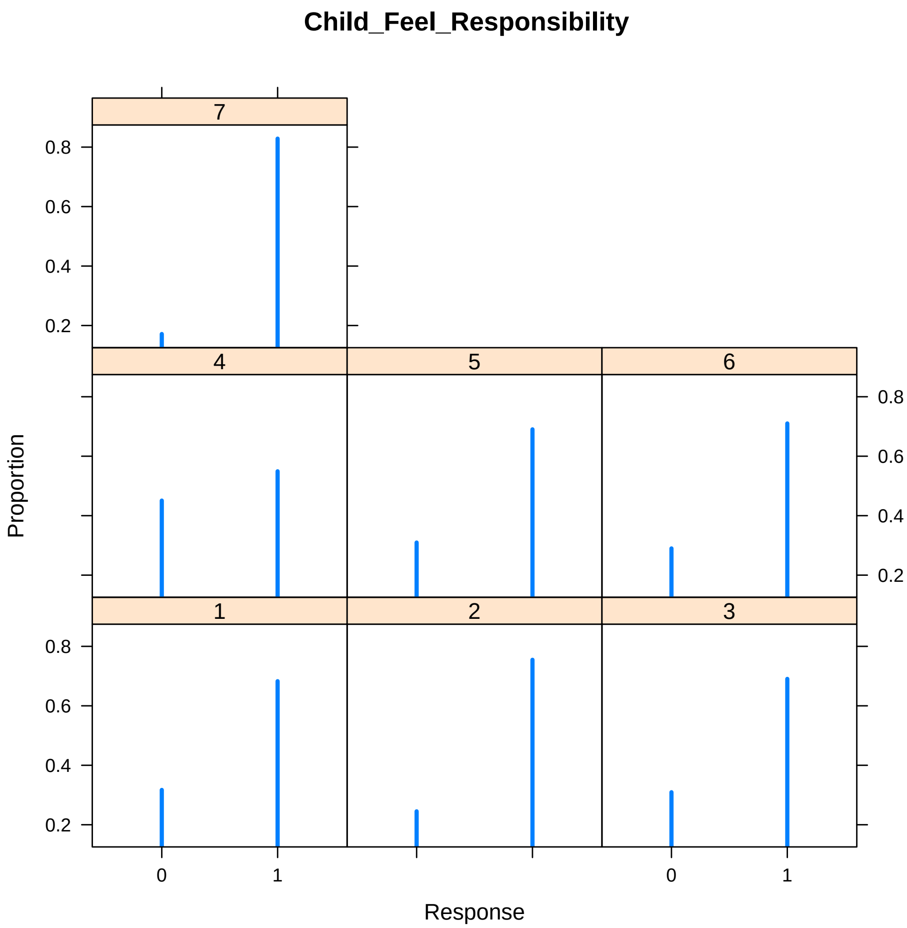
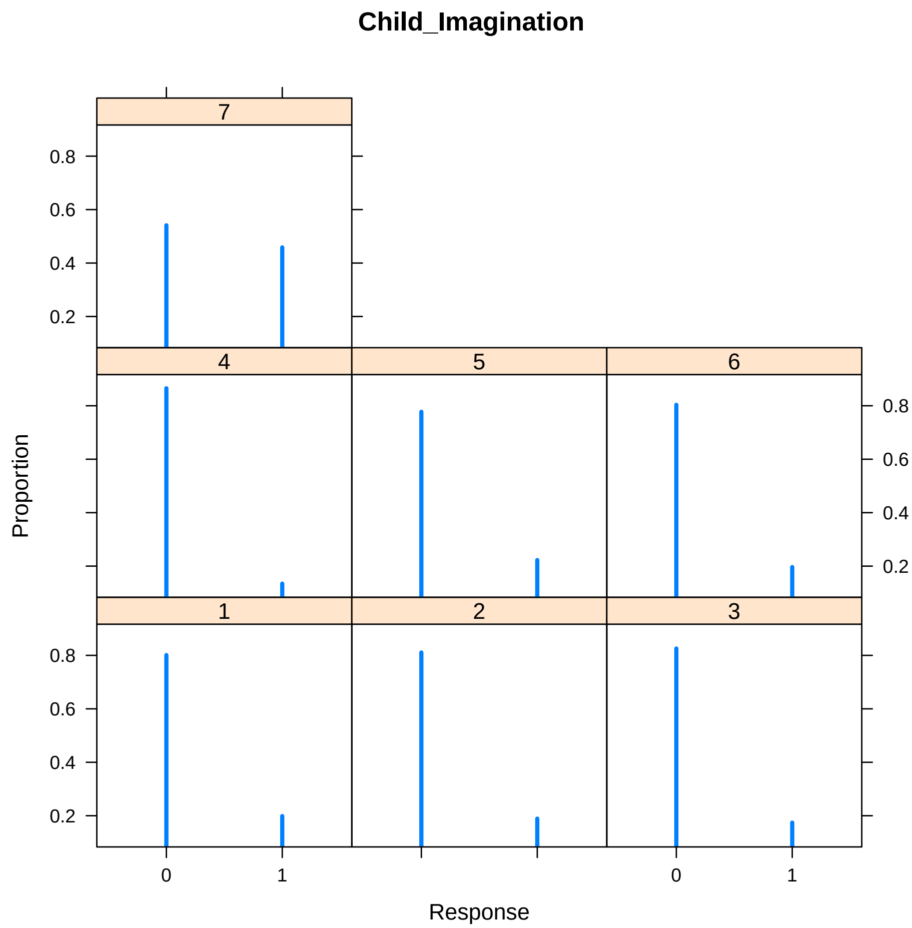
v35 Neighbor_Different_Race
v76 Less_Important_Work
v48 Priority_Job
v64 Make_Parents_Proud
v14 Child_Feel_Responsibility
v54 Work_First
v5 Friends_Important
v6 Leisure_Time_Important
v71 National_Priority_1
v104 Environmental_Economic_Growth
v62 College_More_Important_for_Boy
v66 Friends_Expect
v42 NeighborDifferent_Language
v52 No_Work_Lazy
v73 Most_Important_Problem_1
v78 More_Respect_Authority
v89 Tradition
v51 Humiliating_Receive_Money
v50 Need_Job_Talents
v53 Work_Duty
v87 Behave_Properly
v81 Be_Rich
v85 Very_Successful
v75 Fight_War
v49 Priority_Job2
v72 National_Priority_2
v77 More_Emphasis_Technology
v7 Politics_Important
v82 Secure_Surroundings
v74 Most_Important_Problem_2
v83 Have_Good_Time
v47 Take_Advantage
v120 Hard_Work
v86 Adventure_Risk_Taking
v119 Competition_Good
v90 Scientific_Advance
v20 Child_Unselfishness
v91 Science_Better
v34 Neighbor_Drug_Addict
v80 Think_New_Ideas
v123 Science_Better_Worse
v92 Science_More_Opportunities
v46 How_Much_Freedom
v121 Wealth_Accumulation
v93 Science_Fast_Changing
v65 Be_Self
v60 Housewife_Fulfilling
v84 Help_People
v40 Neighbor_HeavyDrinker
v94 Science_And_Faith
v88 Look_After_Environment
v79 More_Emphasis_Family
v67 Self_Selected_Goals
v4 Family_Important
0.0
0.1
0.2
0.3
Distinctiveness

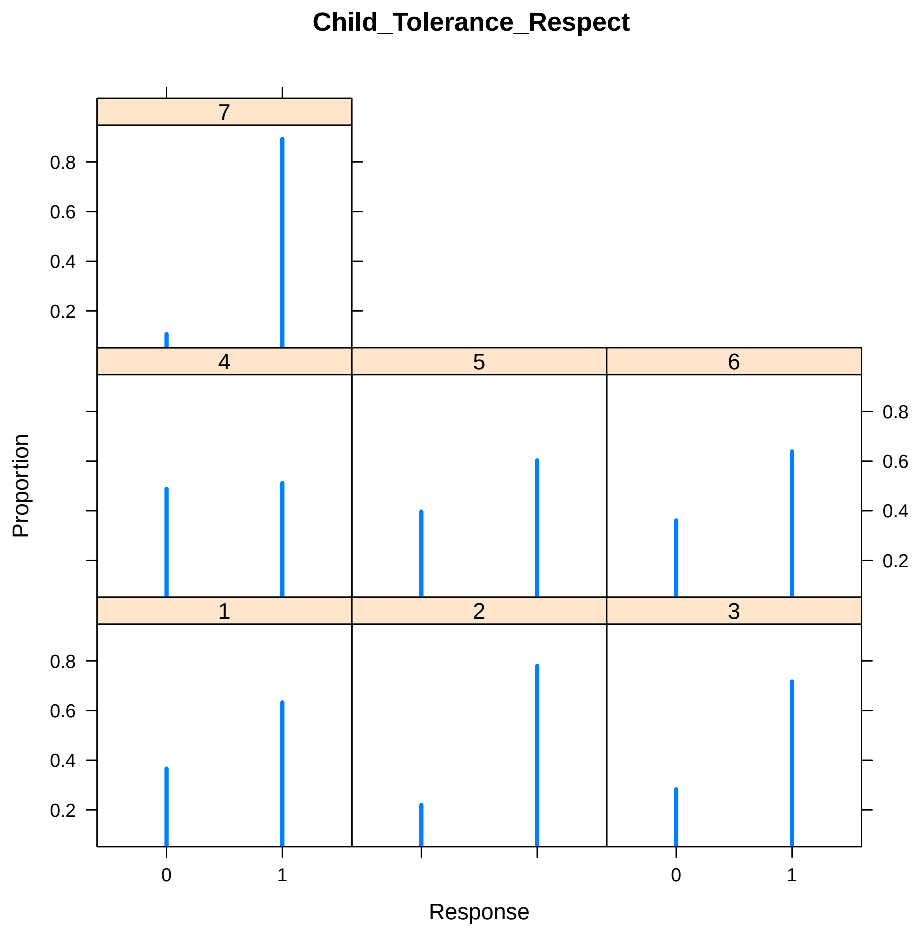


Child_Hardwork
7
4
5
6
1
2
3
0.7
0.6
0.5
0.4
0.3
Proportion
0
1
Response

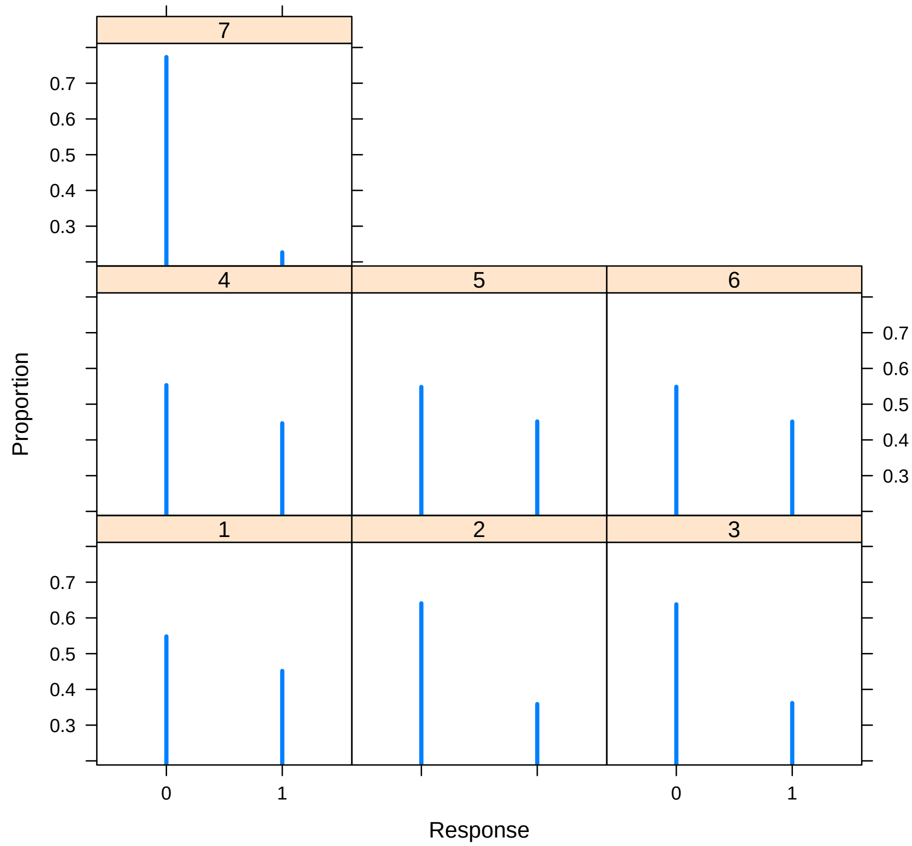

Child_Feel_Responsibility
Proportion
Response
7
4
5
6
1
2
3
0.2
0.4
0.6
0.8
0
1

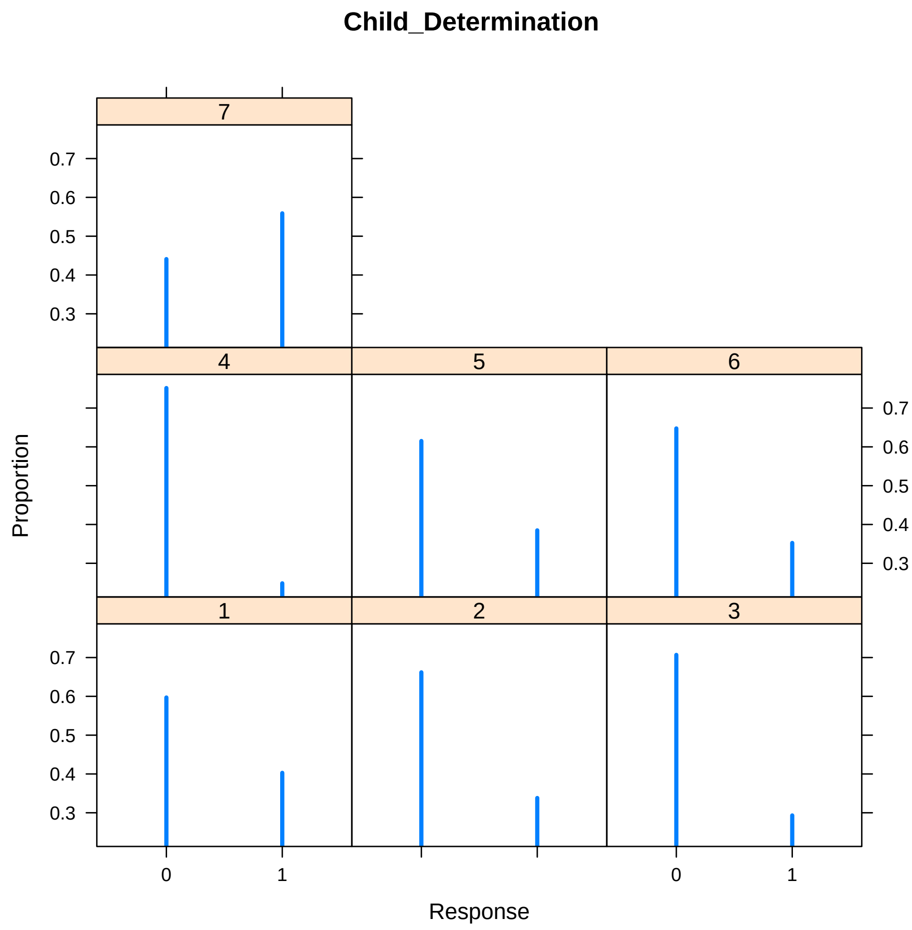


Child_Imagination
7
4
5
6
1
2
3
0.8
0.6
0.4
0.2
0
1
Proportion
Response

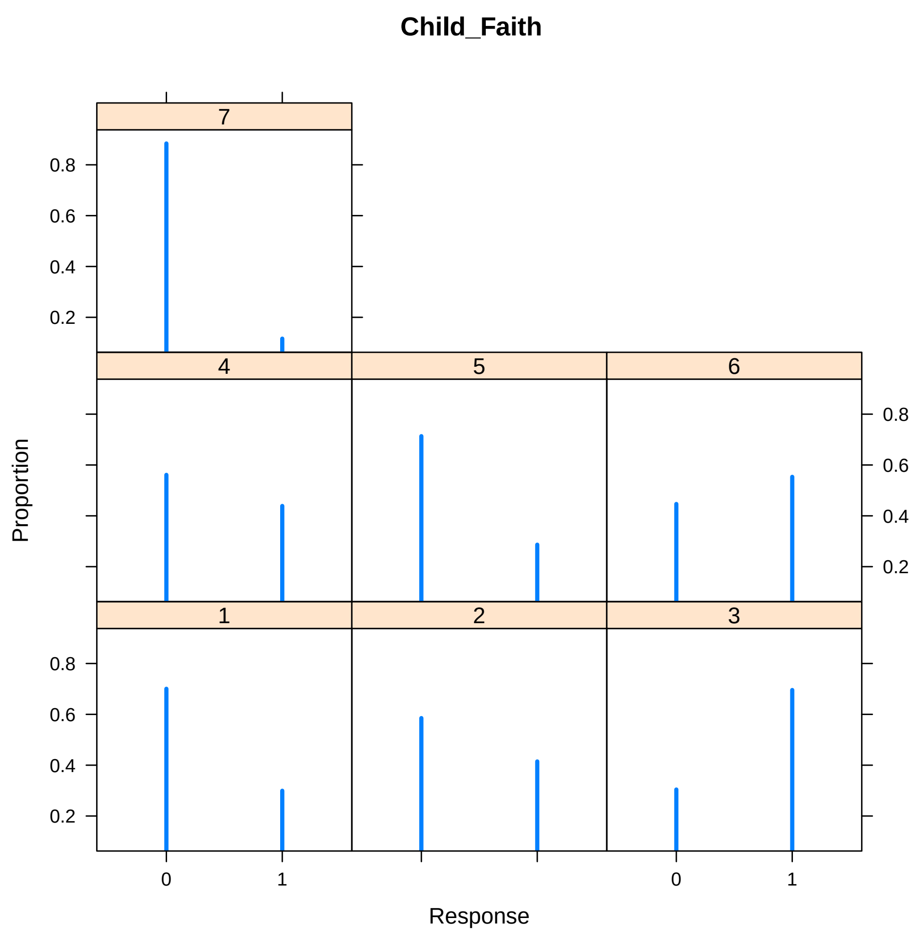

Child_Tolerance_Respect
7
4
5
6
1
2
3
0.2
0.4
0.6
0.8
Proportion
0
1
Response

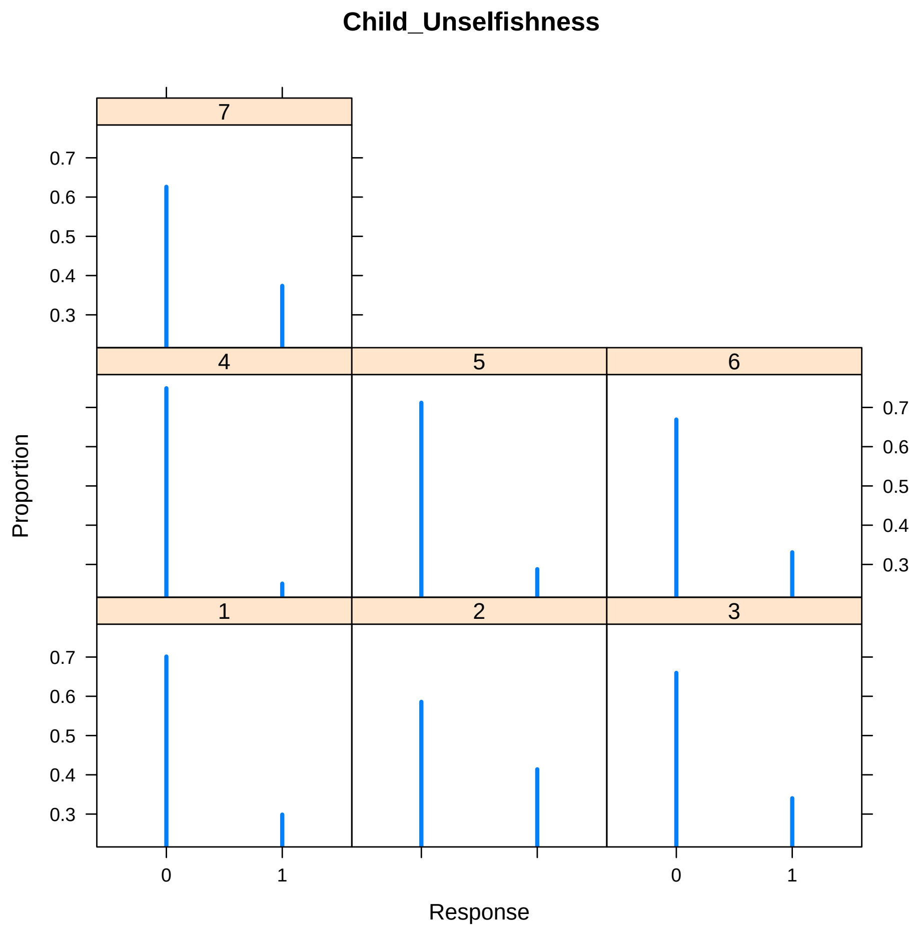
Child_Thrift

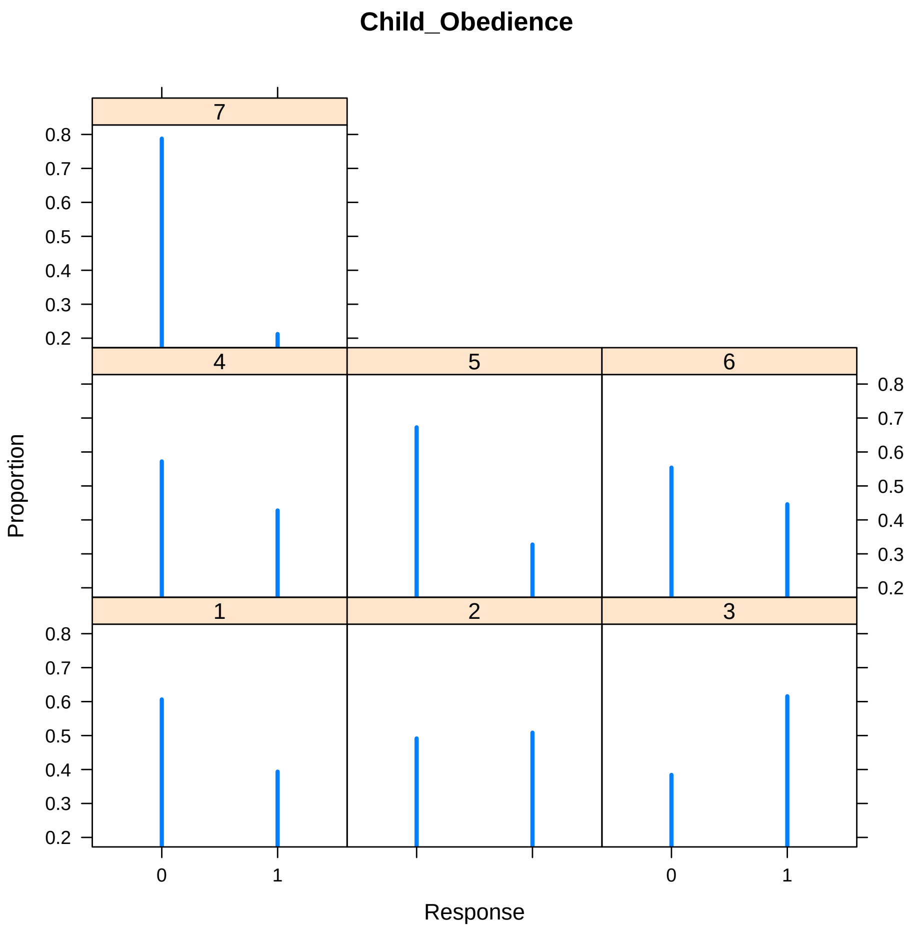




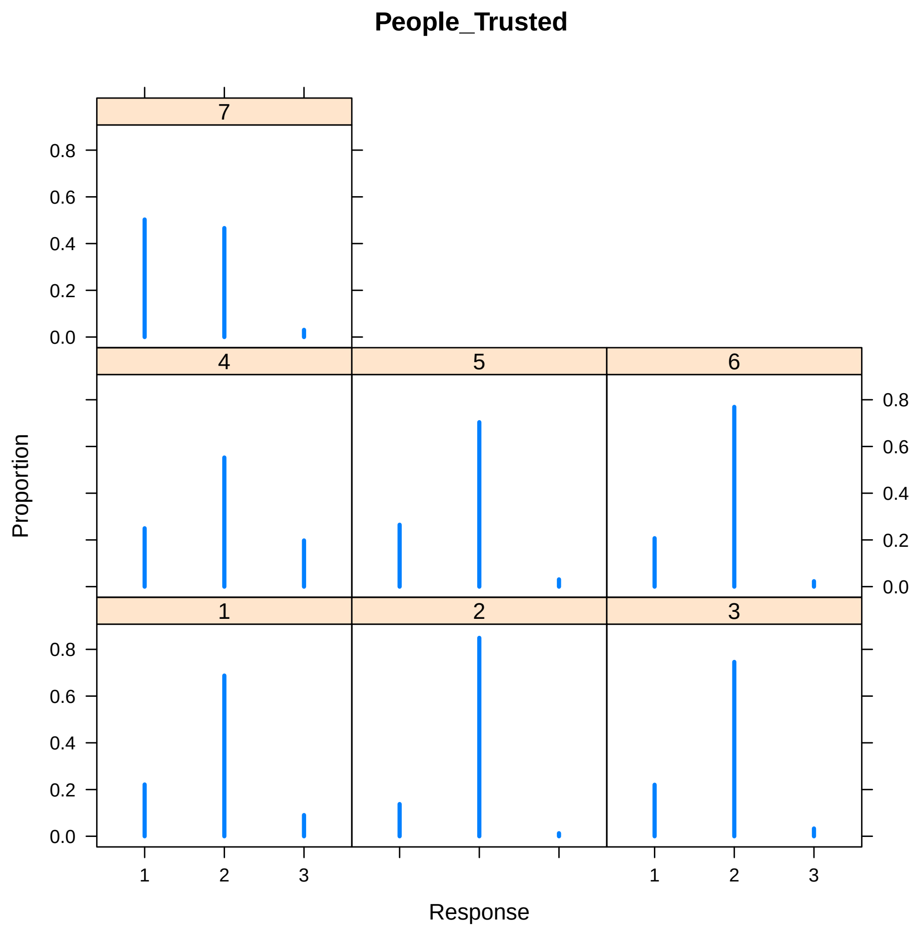
Child_Determination
7
4
5
6
1
2
3
0.3
0.4
0.5
0.6
0.7
Proportion
0
1
Response

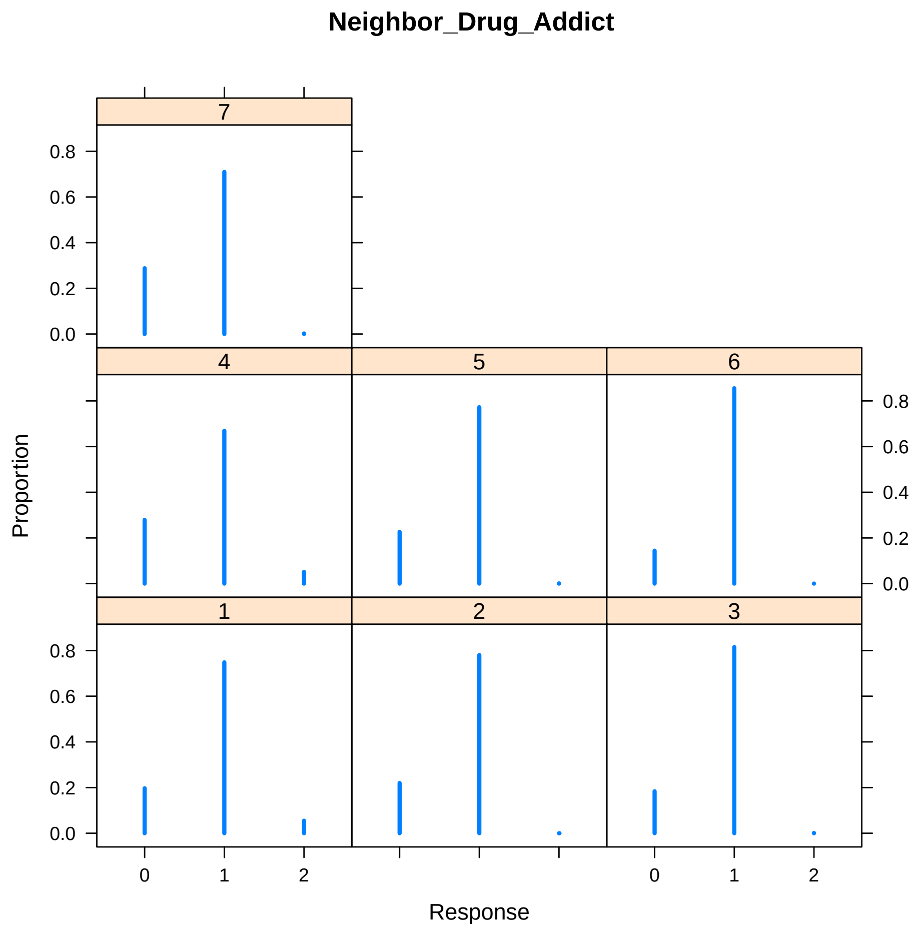

Child_Faith
7
4
5
6
1
2
3
0.2
0.4
0.6
0.8
0
1
Proportion
Response


Child_Unselfishness
Proportion
Response
7
4
5
6
1
2
3
0.3
0.4
0.5
0.6
0.7
0
1

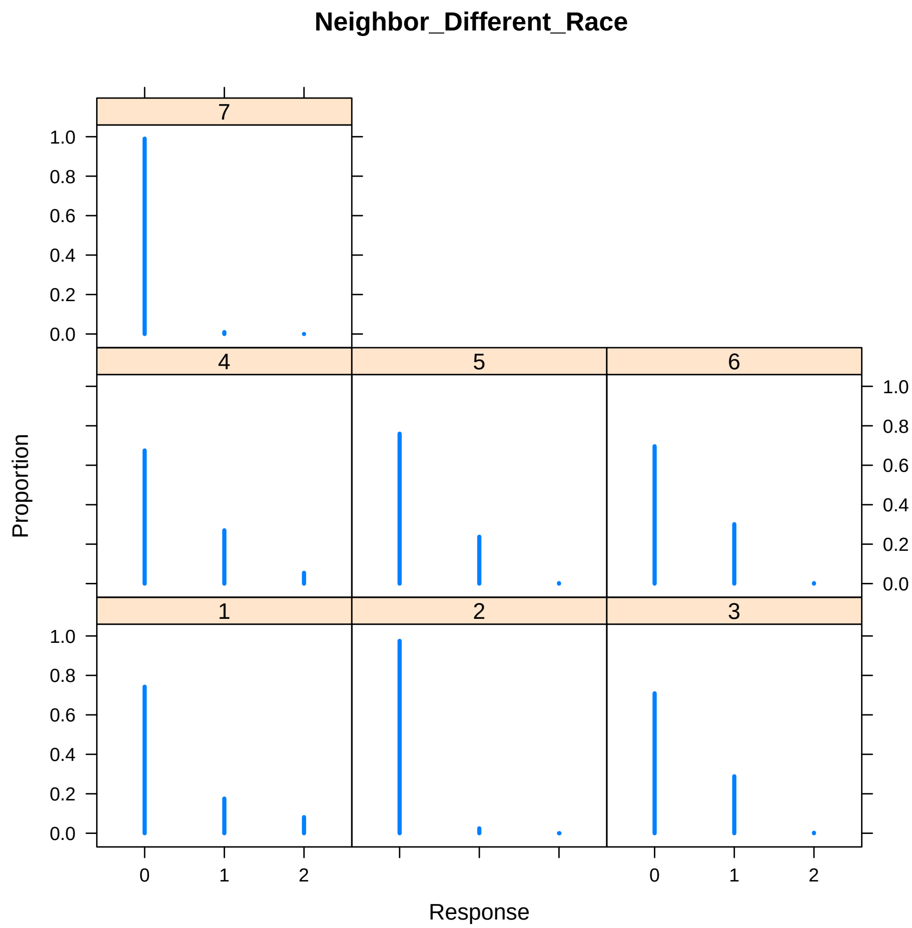


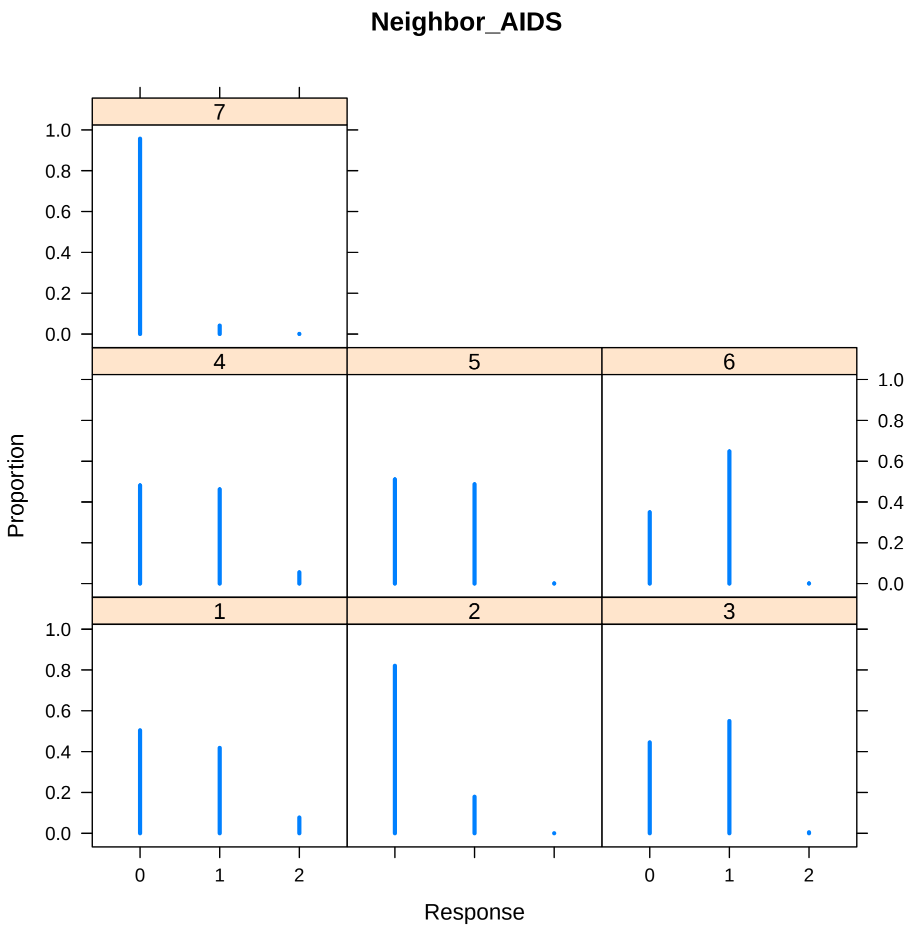
Child_Obedience
7
4
5
6
1
2
3
0.8
0.7
0.6
0.5
0.4
0.3
0.2
Proportion
0
1
Response


People_Trusted
7
4
5
6
1
2
3
Proportion
Response
0.0
0.2
0.4
0.6
0.8
1
2
3



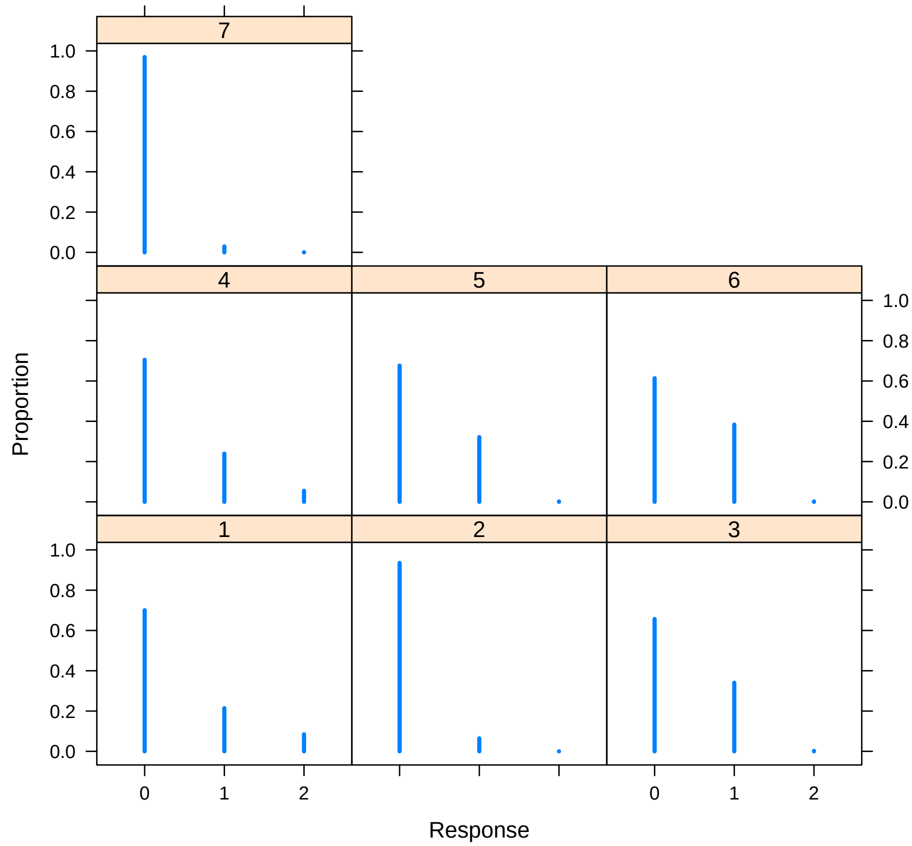
Neighbor_Drug_Addict
7
4
5
6
1
2
3
0.8
0.6
0.4
0.2
0.0
Proportion
0
1
2
Response

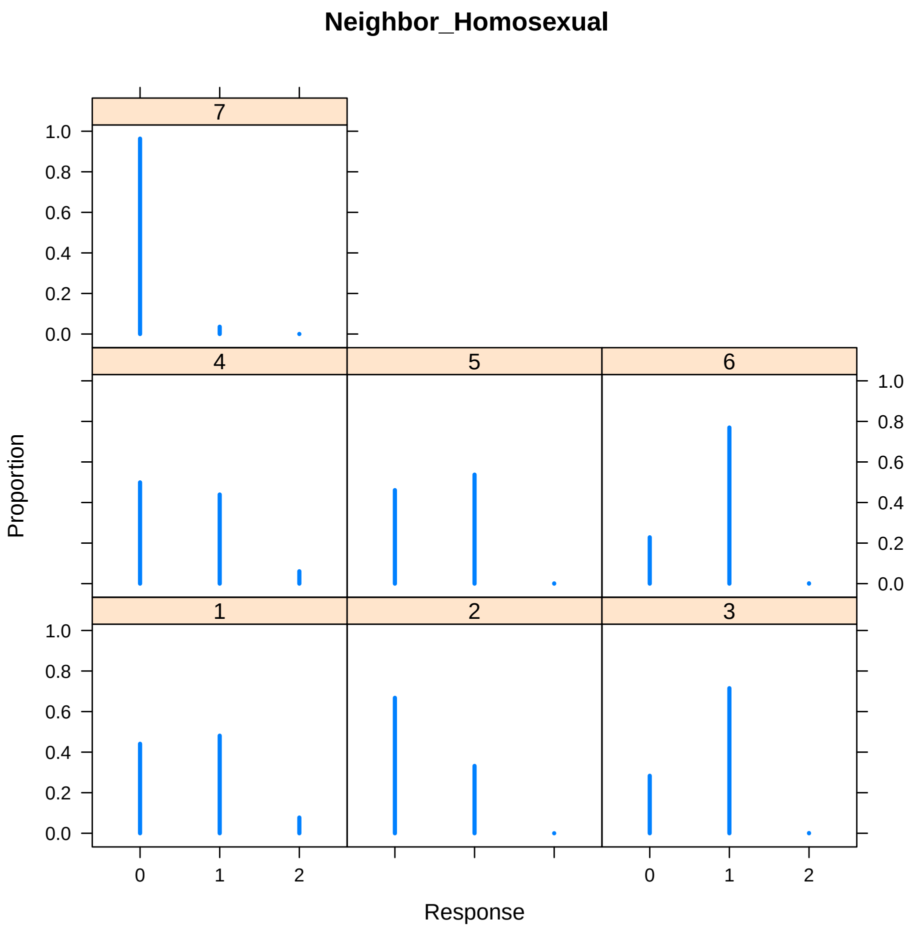

Neighbor_Different_Race
7
4
5
6
1
2
3
Proportion
1.0
0.8
0.6
0.4
0.2
0.0
0
1
2
Response

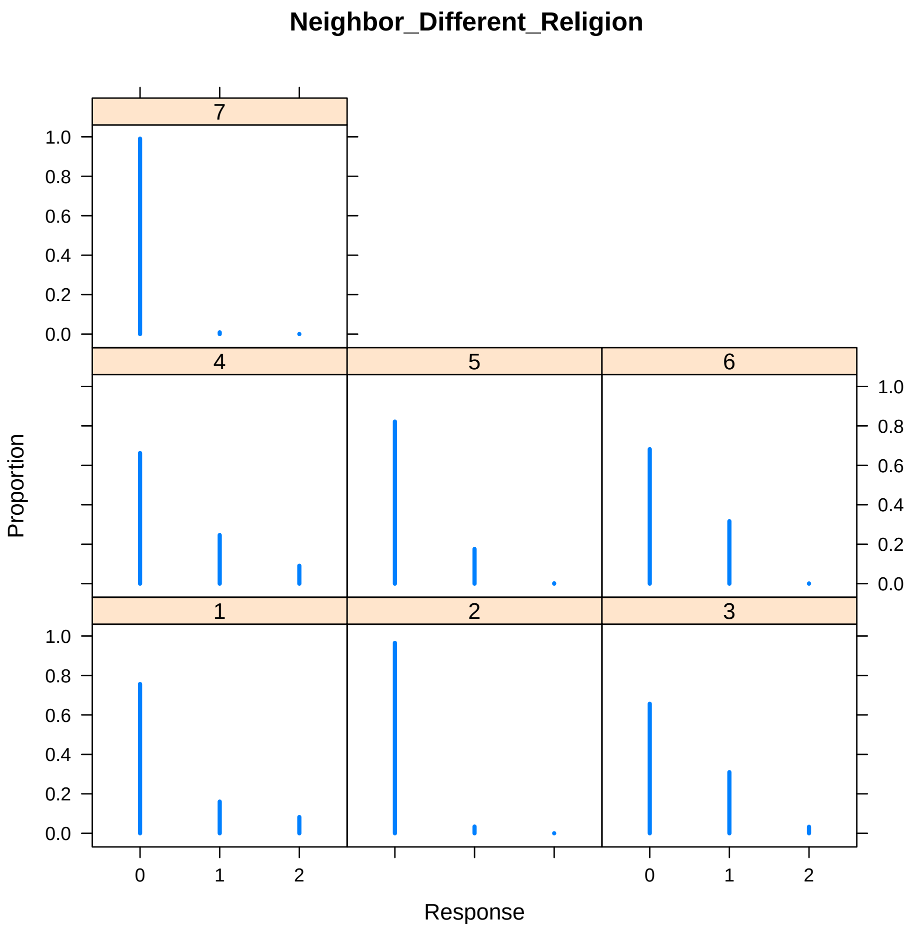


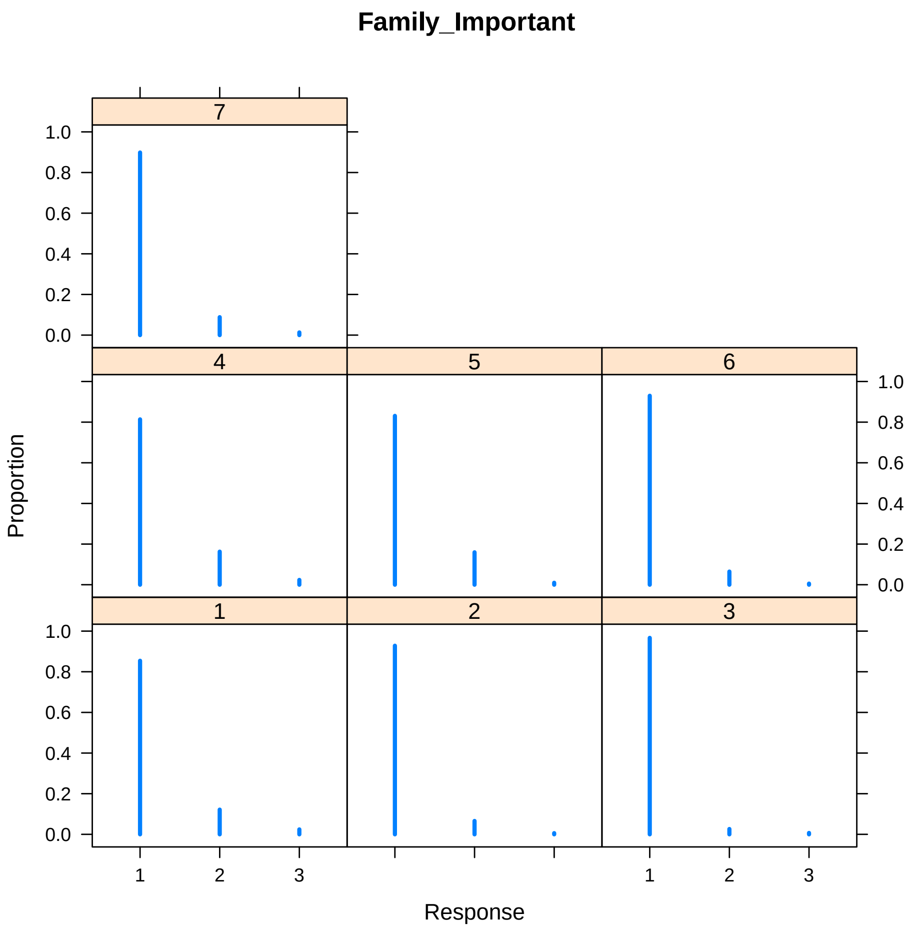
Neighbor_AIDS
7
4
5
6
1
2
3
1.0
0.8
0.6
0.4
0.2
0.0
0
1
2
Proportion
Response

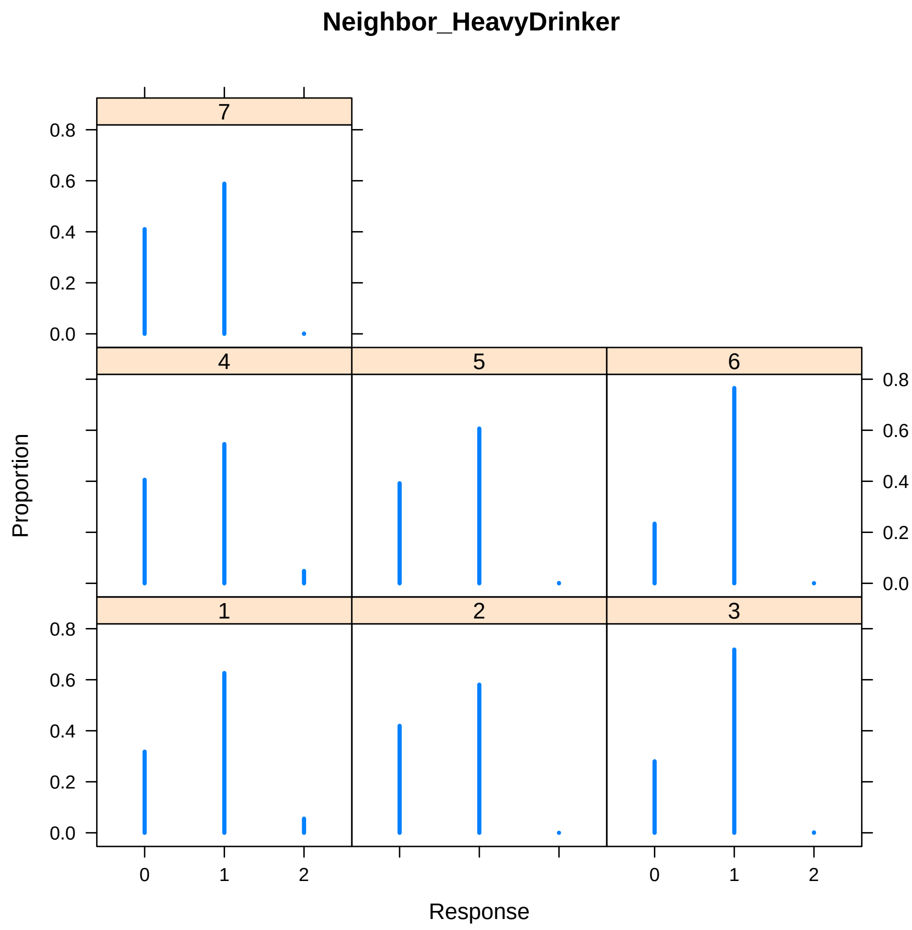
Neighbor_Immigrant

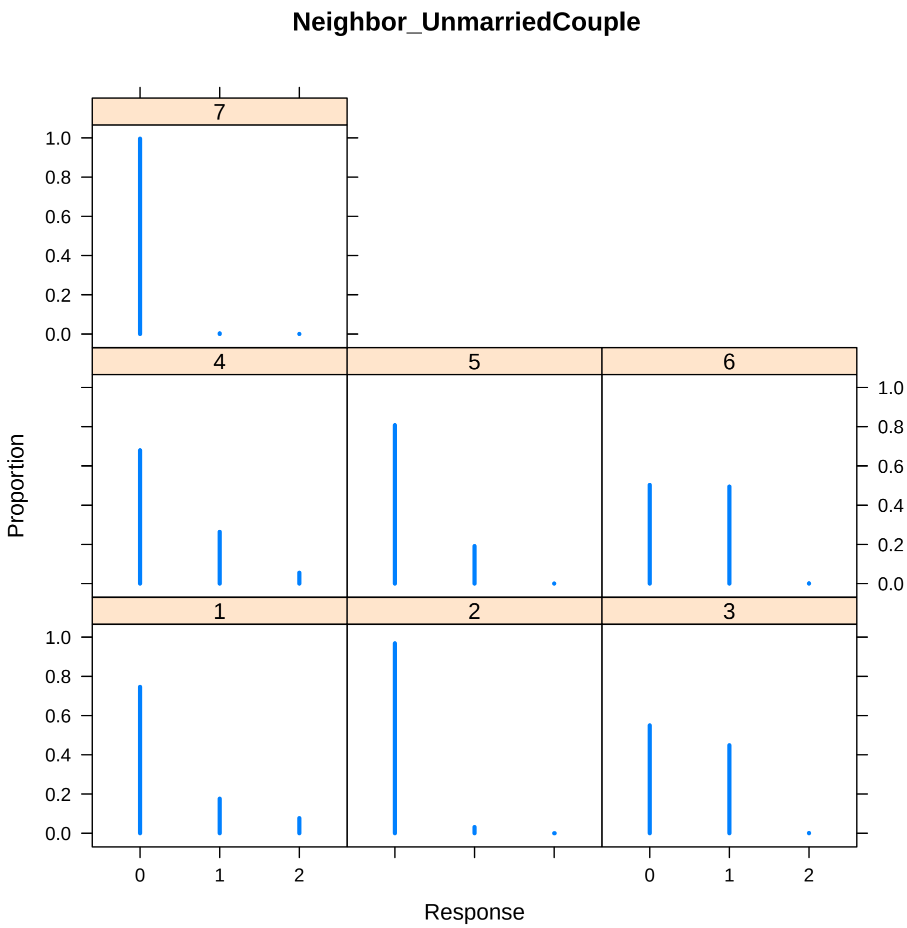



Neighbor_Homosexual
7
4
5
6
1
2
3
1.0
0.8
0.6
0.4
0.2
0.0
Proportion
0
1
2
Response

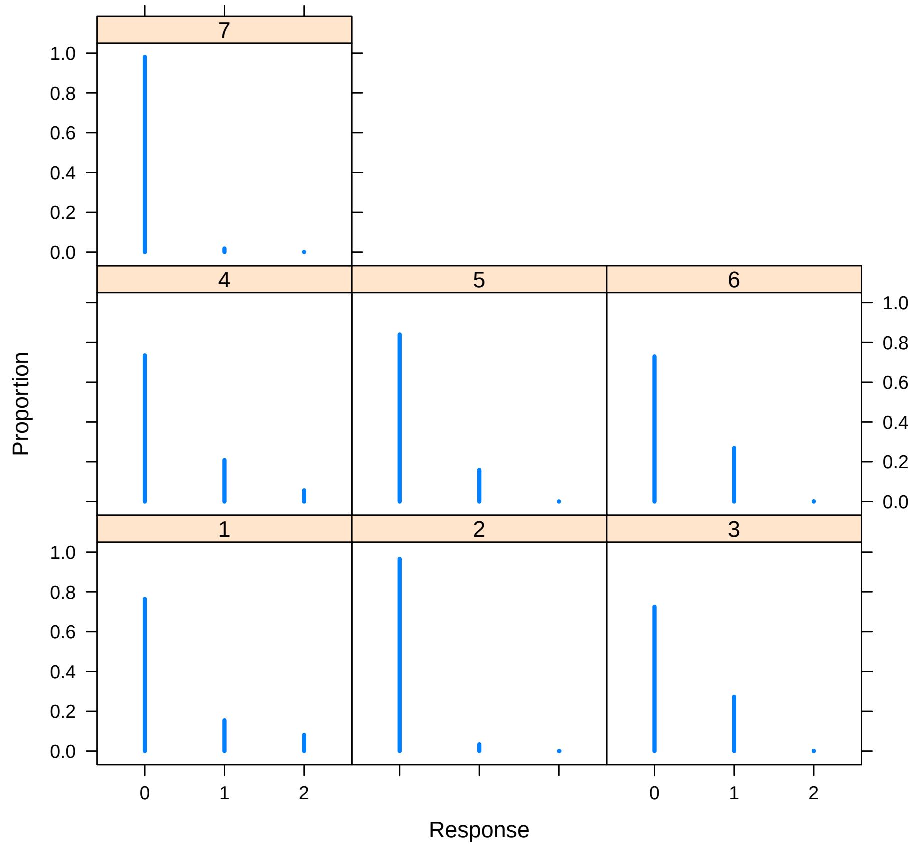

Neighbor_Different_Religion
7
4
5
6
1
2
3
1.0
0.8
0.6
0.4
0.2
0.0
Proportion
0
1
2
Response

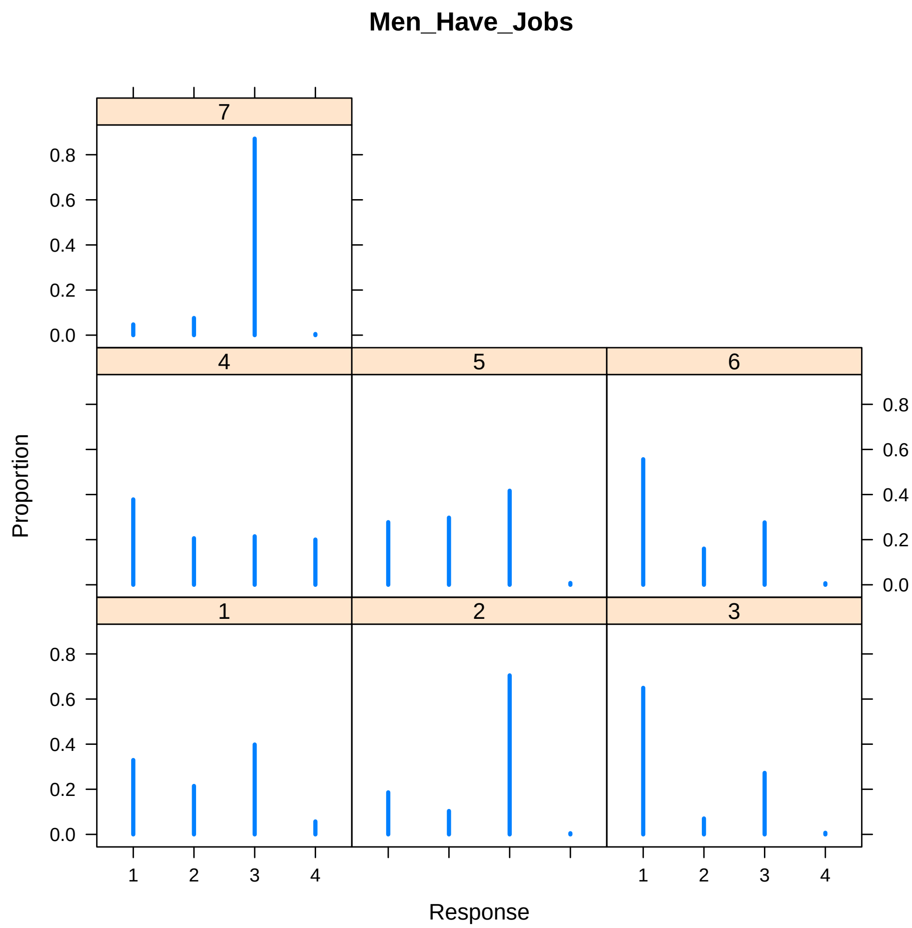

Family_Important
Proportion
Response
7
4
5
6
1
2
3
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3

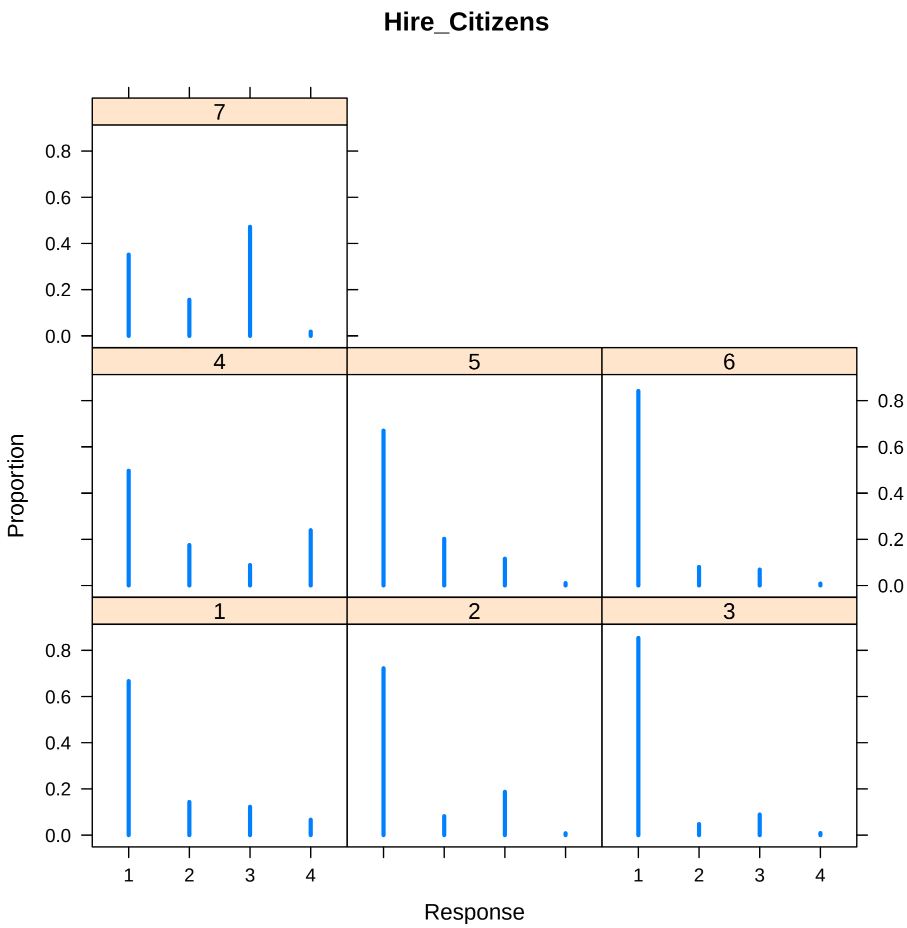

Neighbor_HeavyDrinker
7
4
5
6
1
2
3
0.0
0.2
0.4
0.6
0.8
Proportion
0
1
2
Response

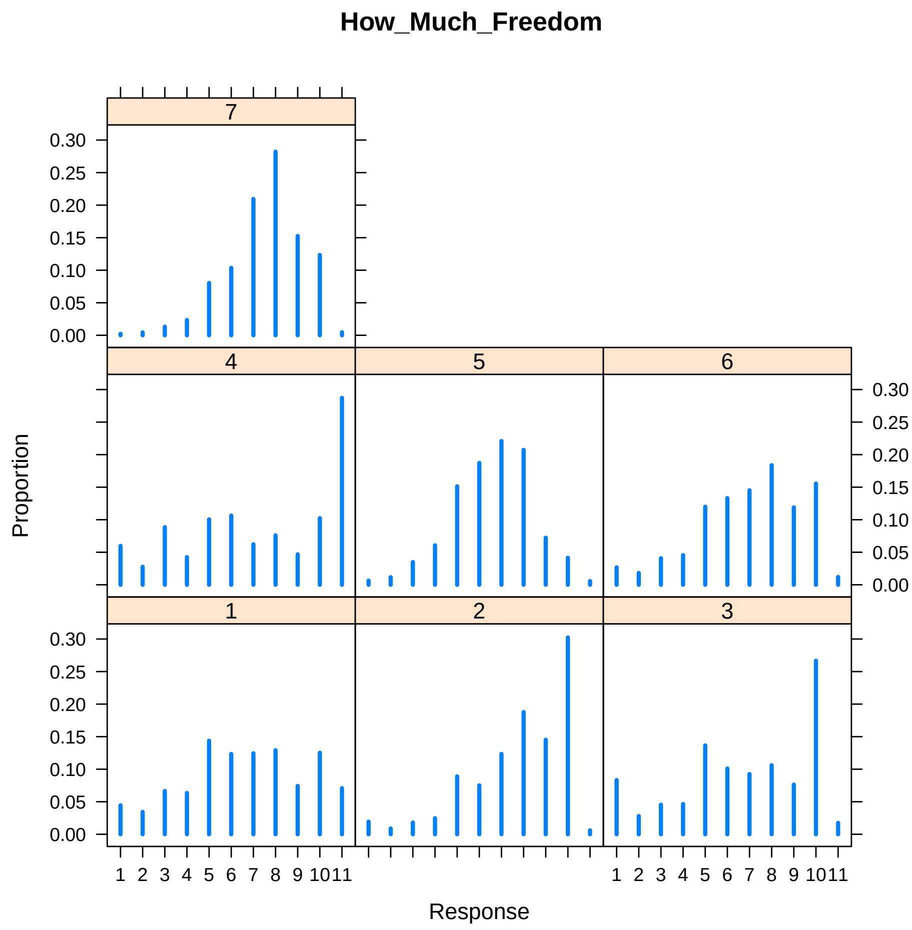

Neighbor_UnmarriedCouple
7
4
5
6
1
2
3
Proportion
Response
1.0
0.8
0.6
0.4
0.2
0.0
0
1
2

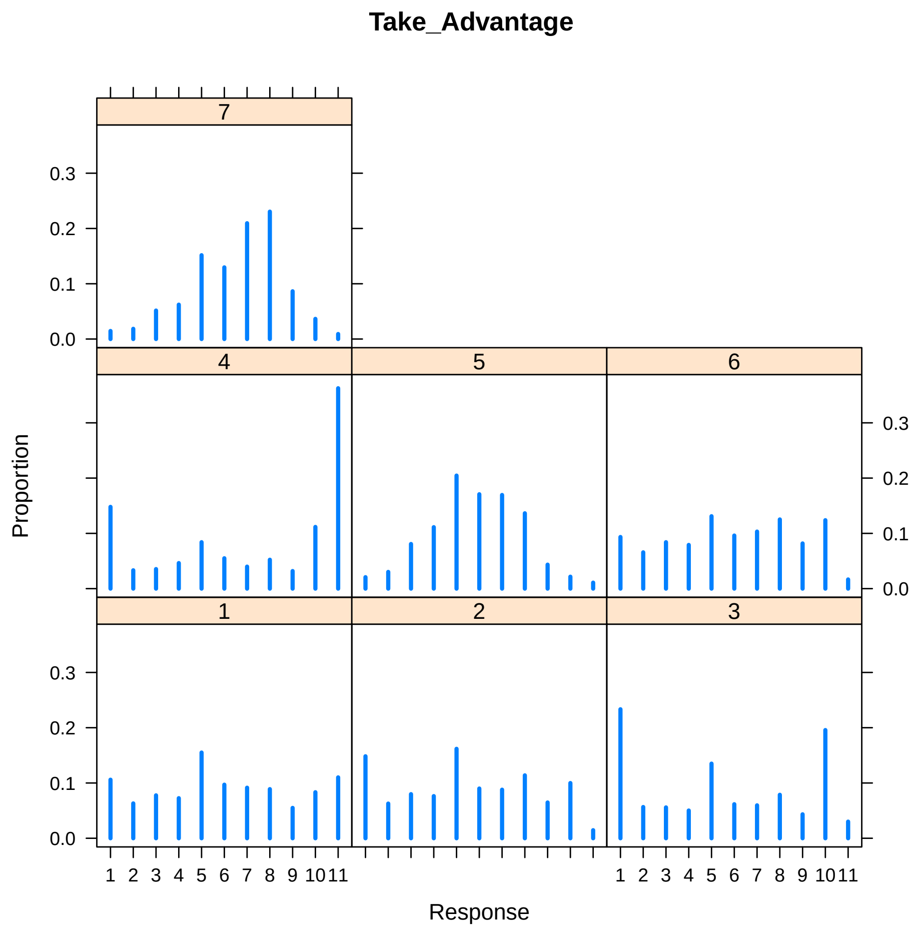
NeighborDifferent_Language



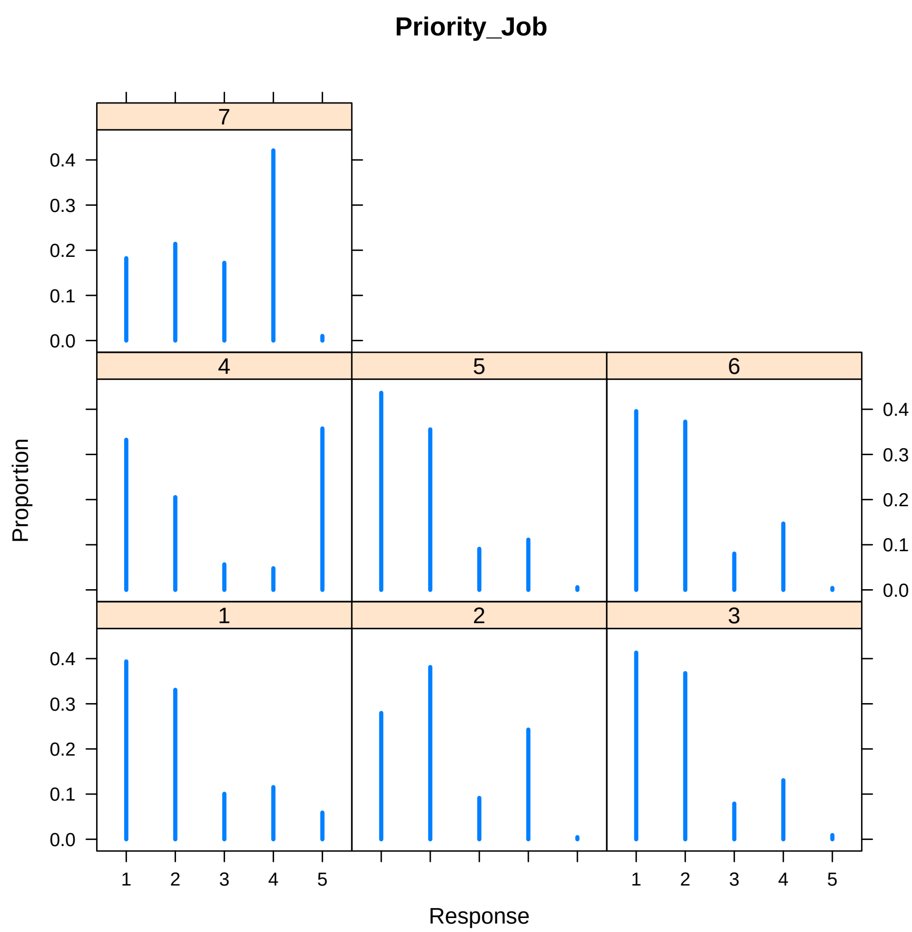

Men_Have_Jobs
7
4
5
6
1
2
3
0.0
0.2
0.4
0.6
0.8
Proportion
1
2
3
4
Response

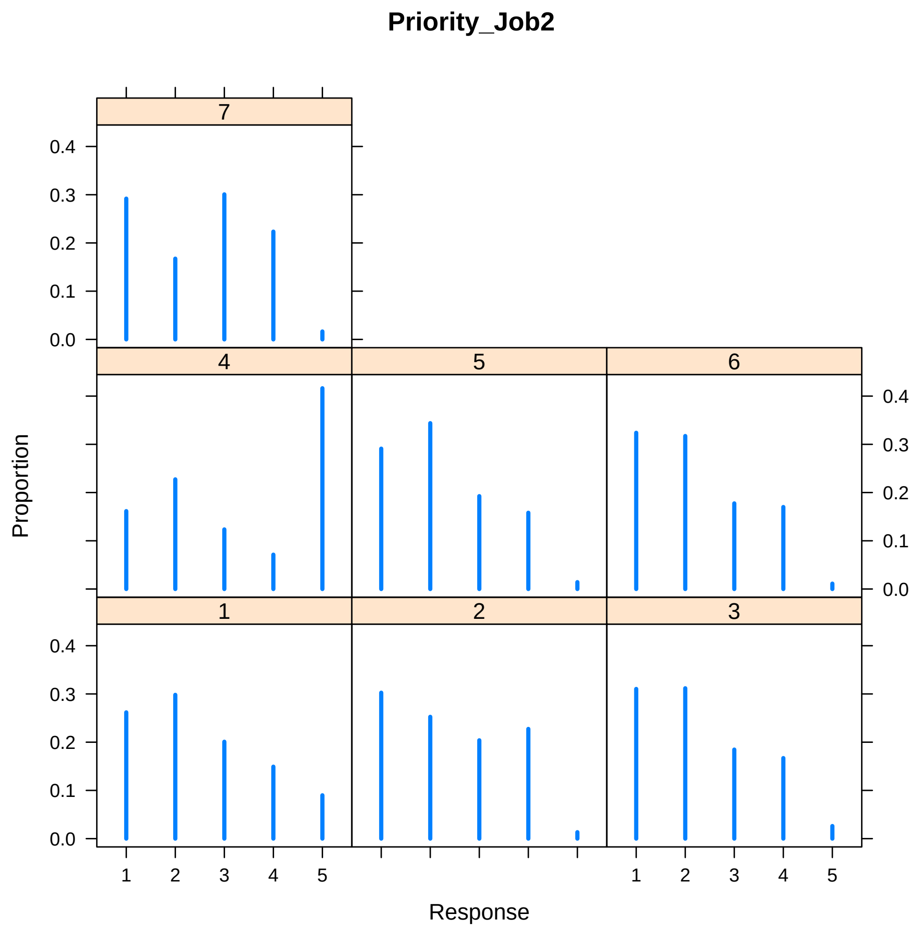

Hire_Citizens
7
4
5
6
1
2
3
0.0
0.2
0.4
0.6
0.8
Proportion
1
2
3
4
Response

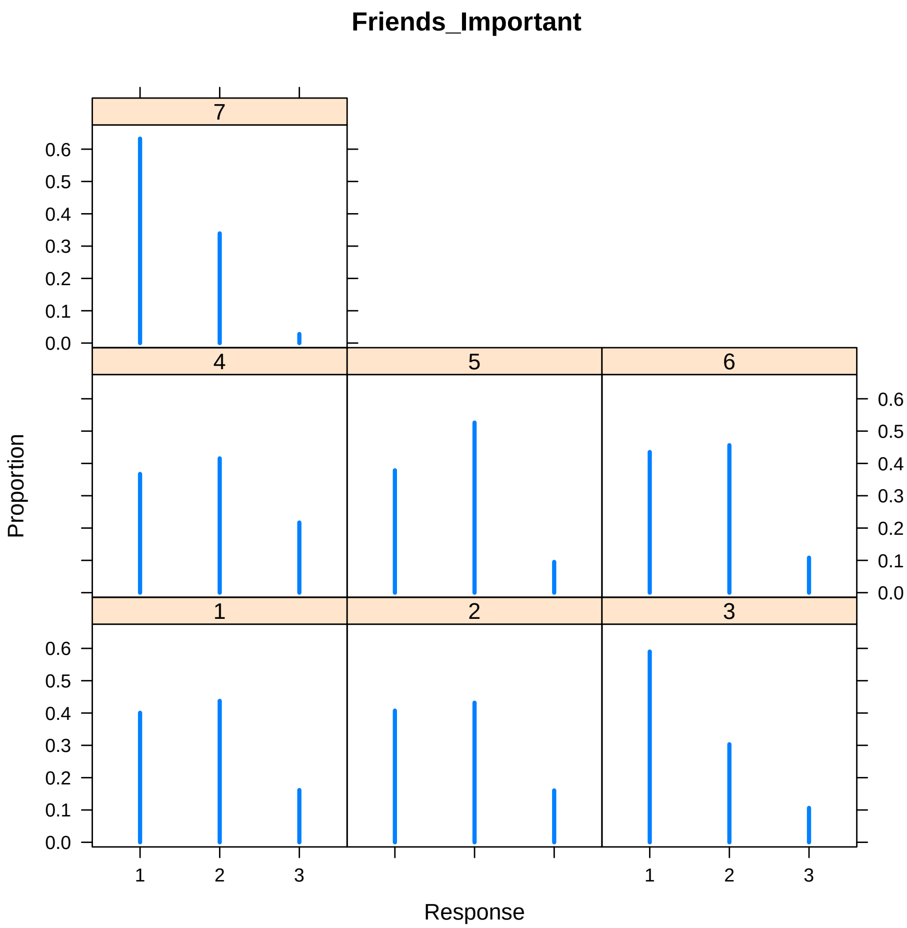

How_Much_Freedom
7
4
5
6
1
2
3
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Proportion
1 2 3 4 5 6 7 8 9 10 11
Response

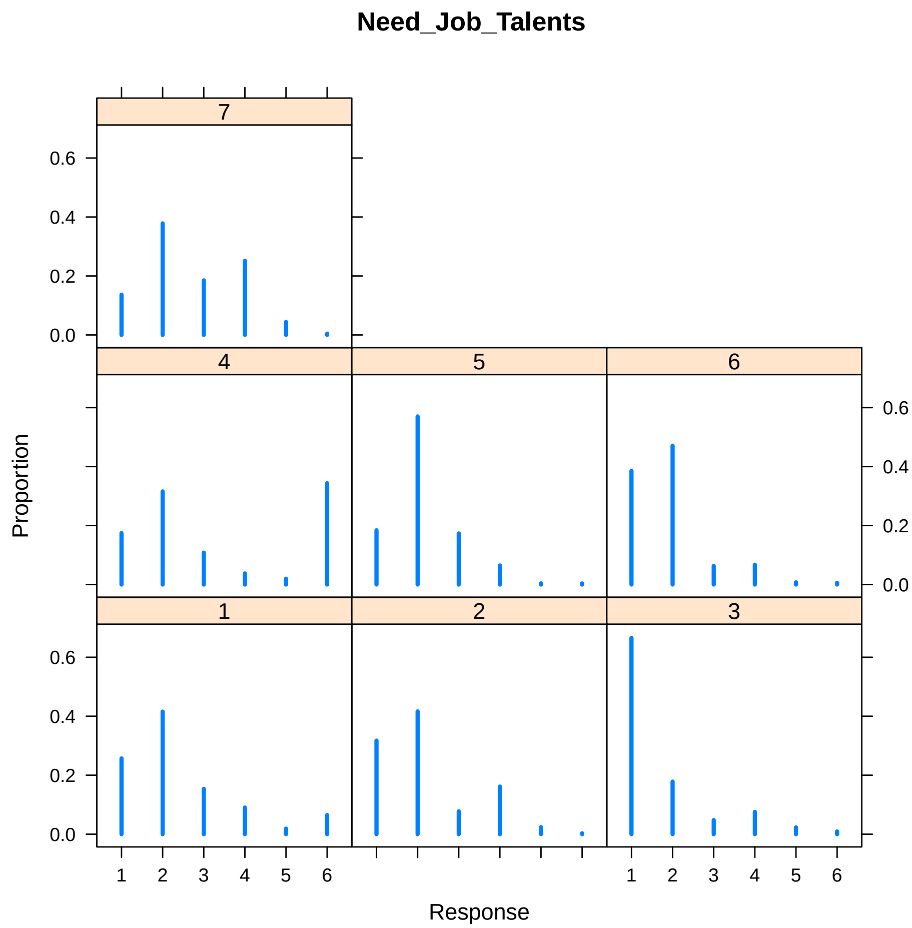


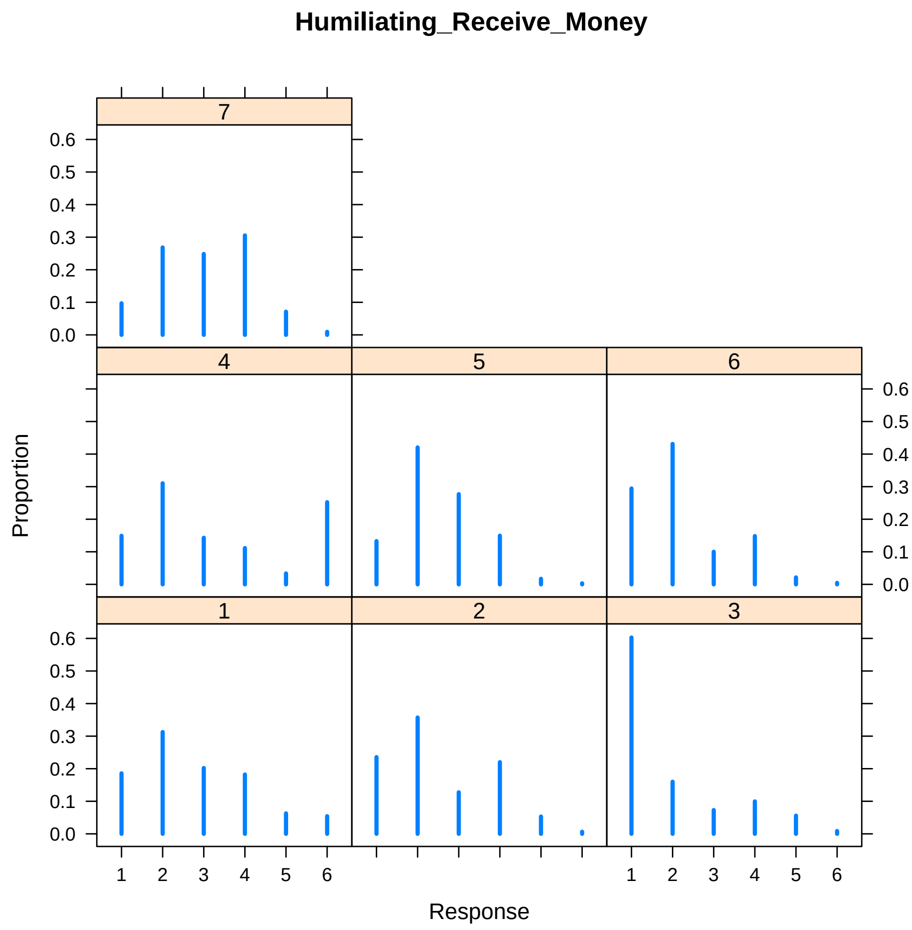
Take_Advantage
7
4
5
6
1
2
3
0.0
0.1
0.2
0.3
Proportion
1 2 3 4 5 6 7 8 9 10 11
Response


Priority_Job
7
4
5
6
1
2
3
0.0
0.1
0.2
0.3
0.4
1
2
3
4
5
Proportion
Response

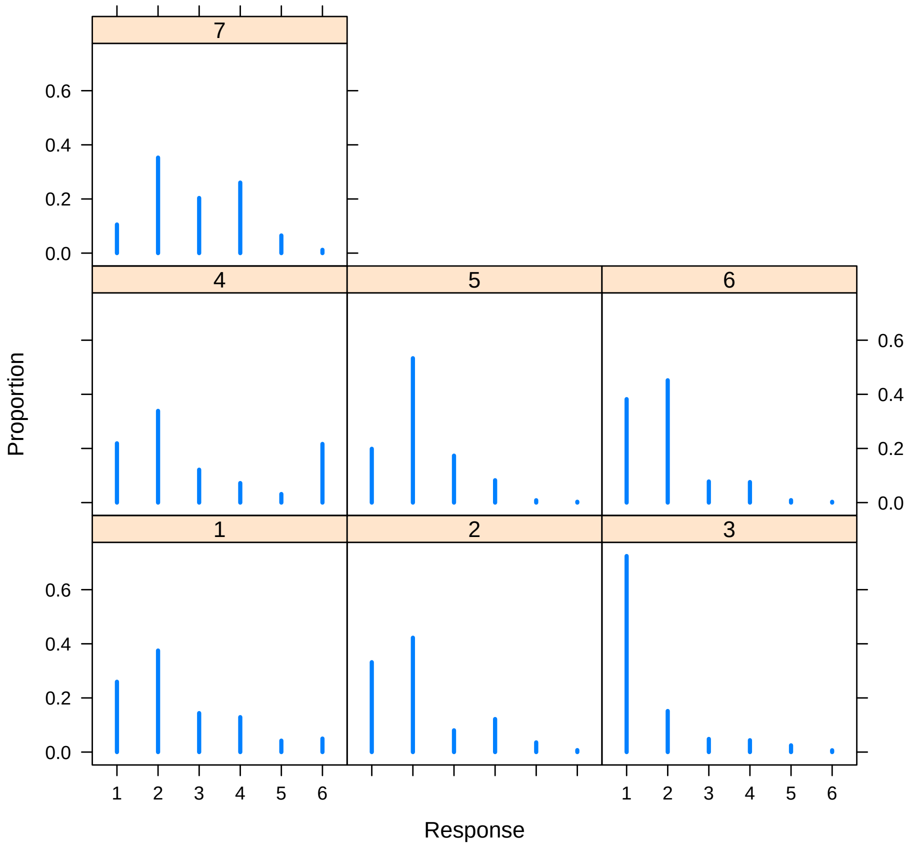

Priority_Job2
7
4
5
6
1
2
3
0.0
0.1
0.2
0.3
0.4
Proportion
Response
1
2
3
4
5

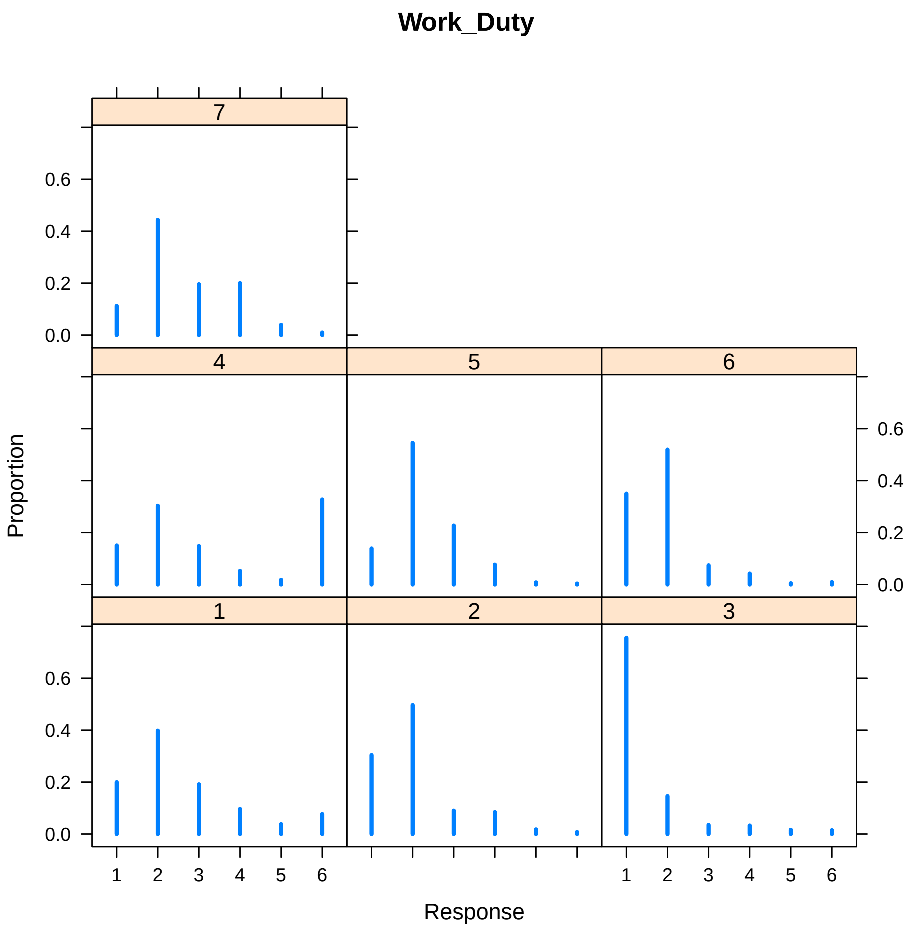

Friends_Important
7
4
5
6
1
2
3
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Proportion
Response
1
2
3

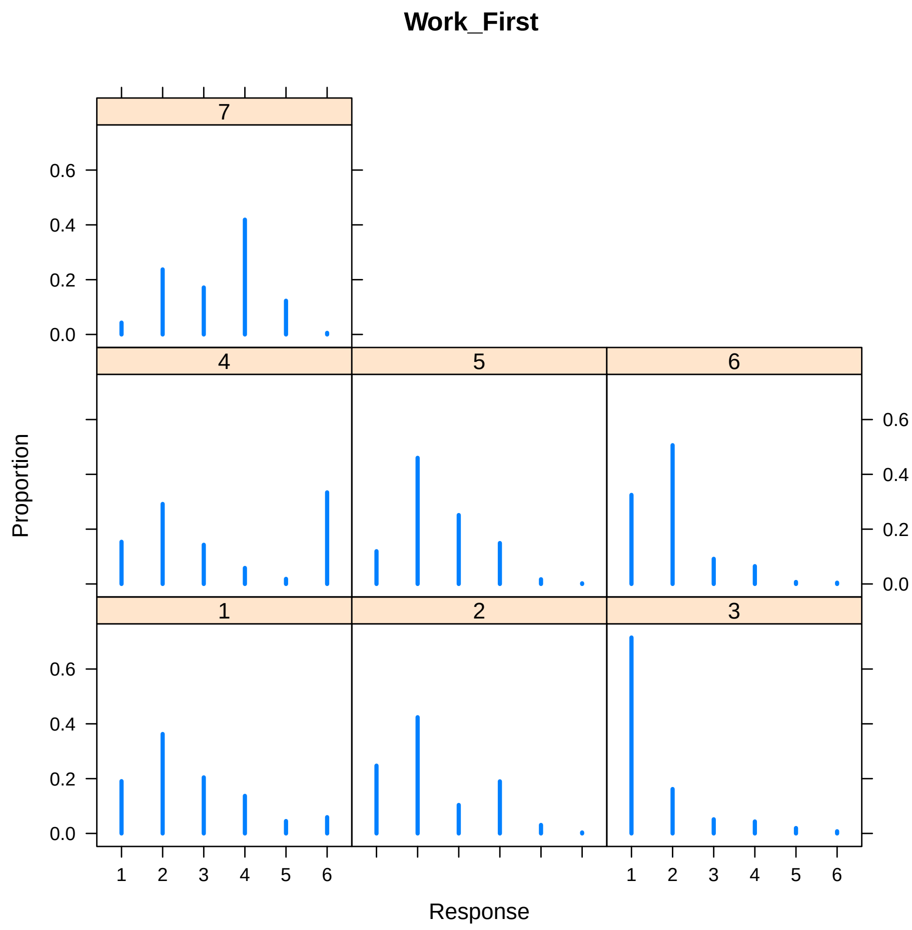

Need_Job_Talents
7
4
5
6
1
2
3
0.6
0.4
0.2
0.0
Proportion
1 2 3 4 5 6
Response

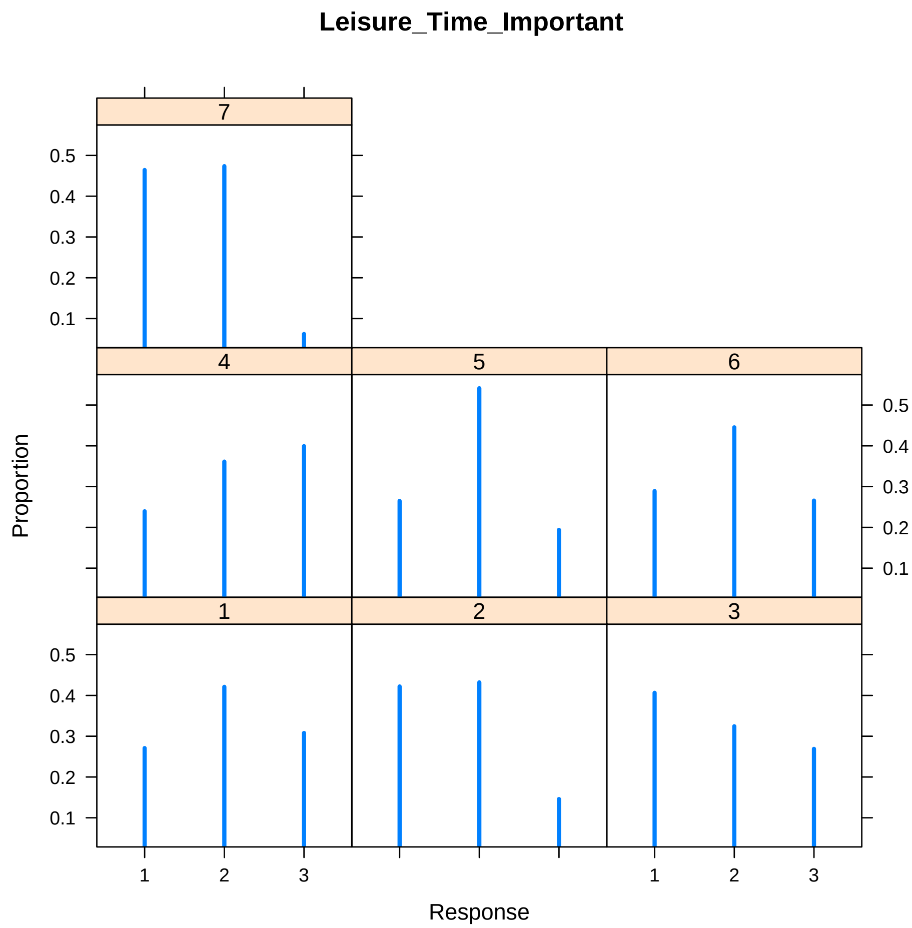

Humiliating_Receive_Money
7
4
5
6
1
2
3
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Proportion
1
2
3
4
5
6
Response

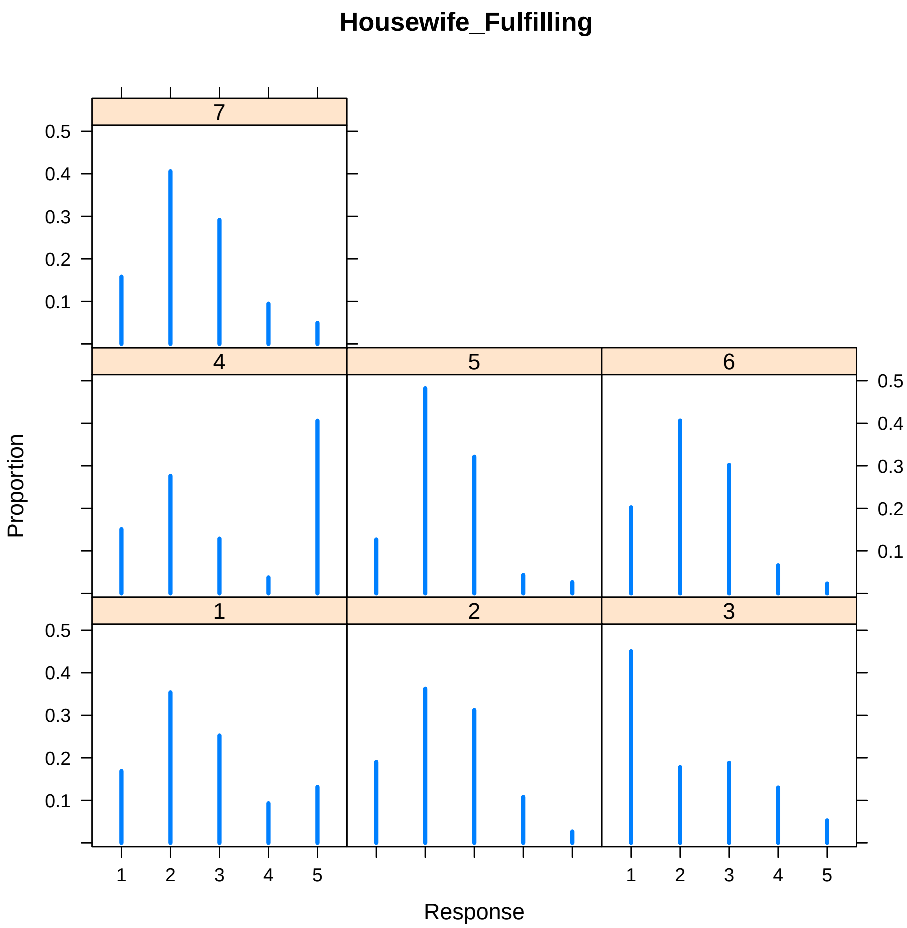
No_Work_Lazy

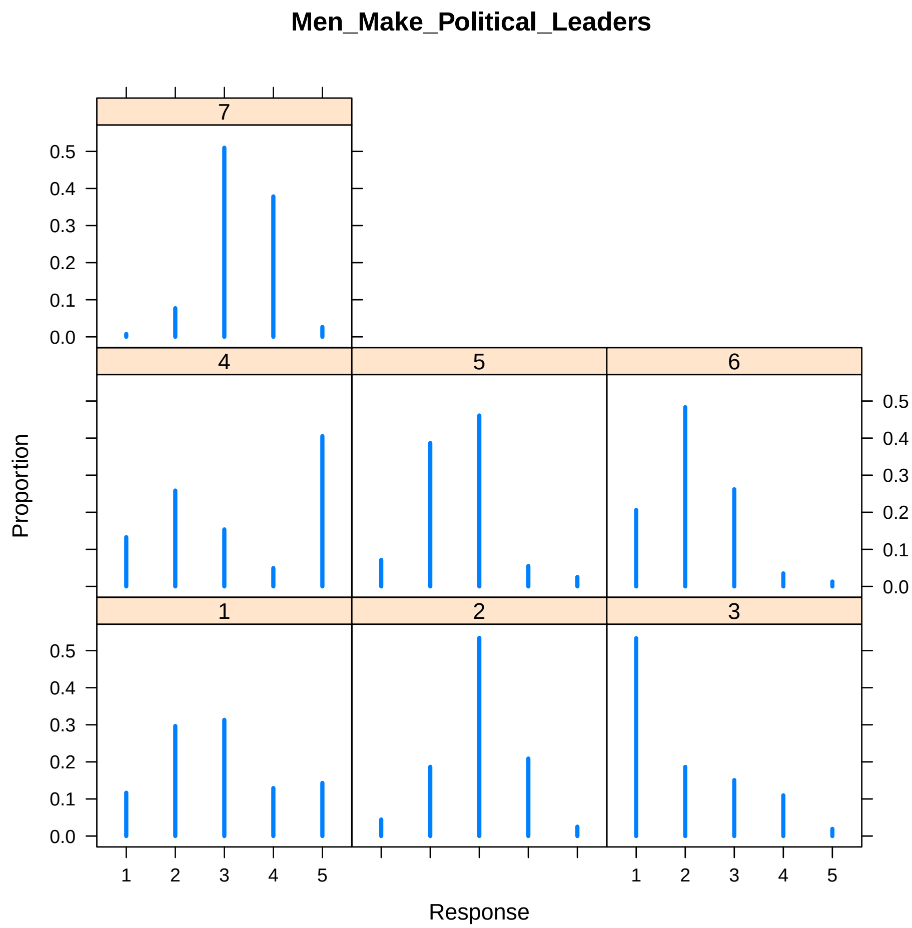



Work_Duty
7
4
5
6
1
2
3
0.0
0.2
0.4
0.6
Proportion
1
2
3
4
5
6
Response

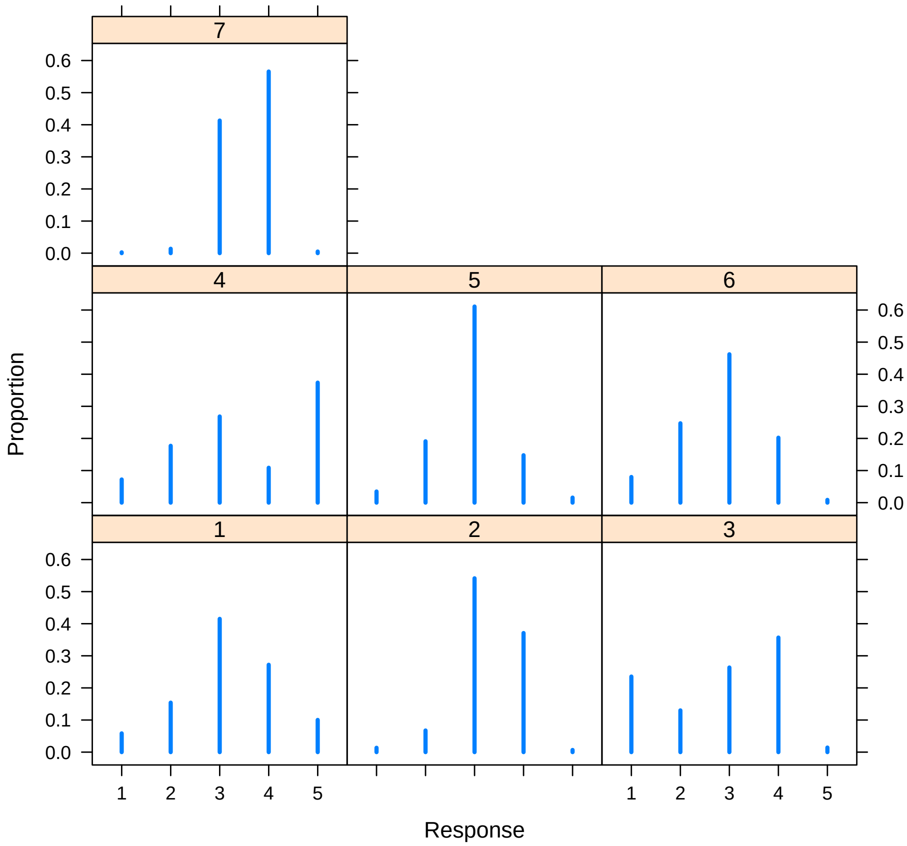

Work_First
7
4
5
6
1
2
3
Proportion
Response
0.0
0.2
0.4
0.6
1
2
3
4
5
6

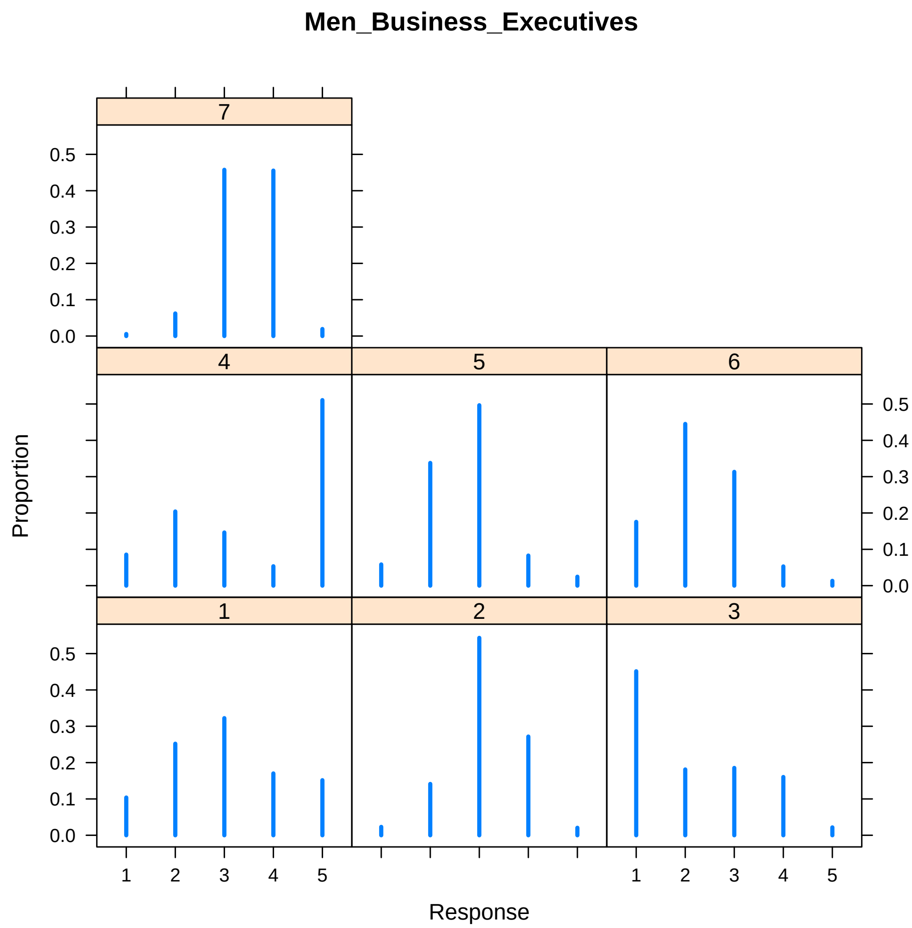

Leisure_Time_Important
7
4
5
6
1
2
3
0.5
0.4
0.3
0.2
0.1
Proportion
Response
1
2
3

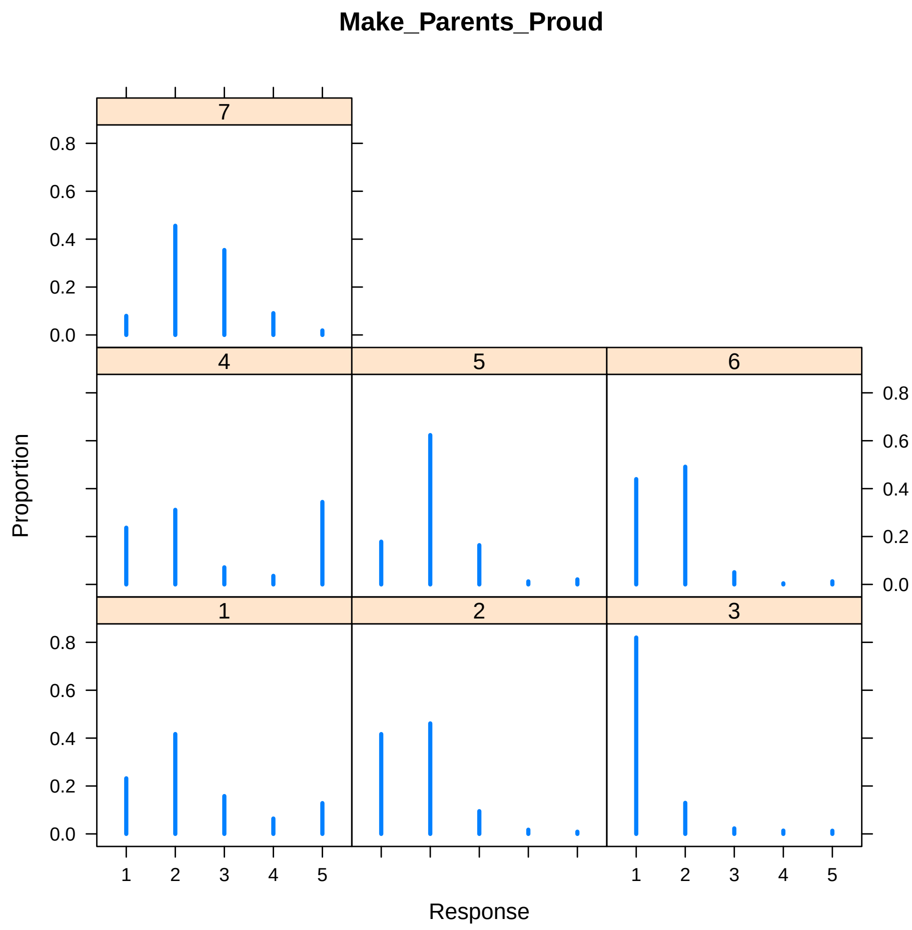

Housewife_Fulfilling
7
4
5
6
1
2
3
Proportion
Response
0.1
0.2
0.3
0.4
0.5
1
2
3
4
5

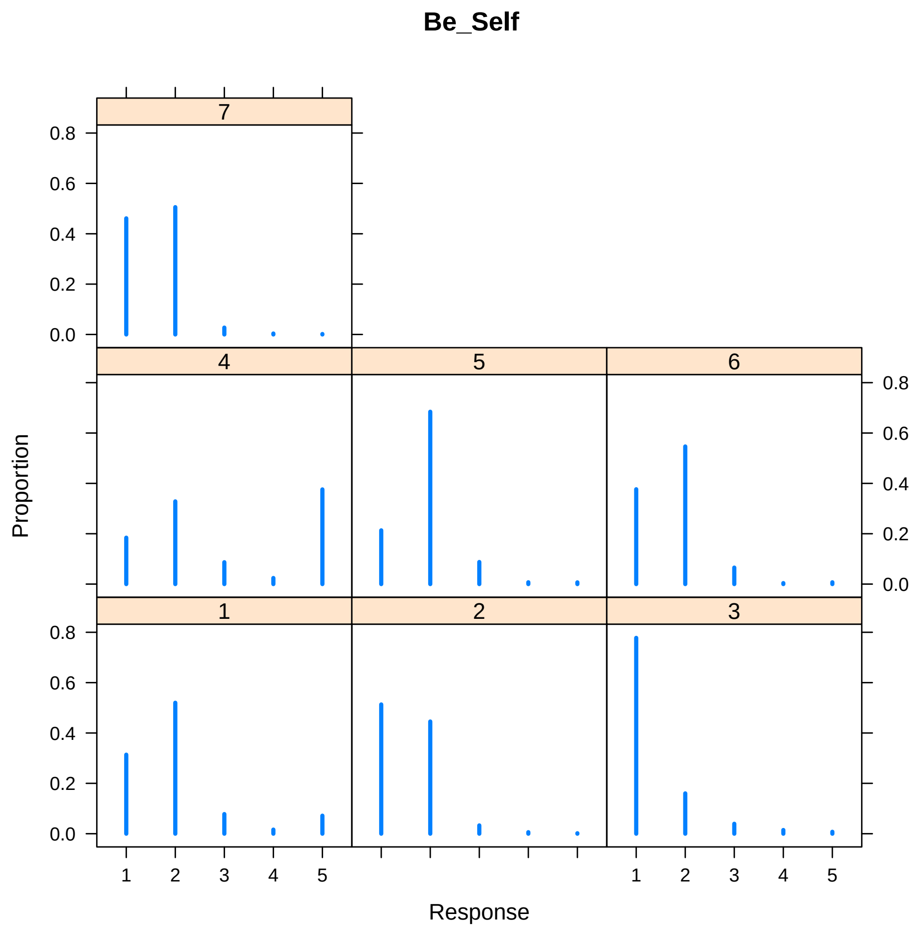

Men_Make_Political_Leaders
7
4
5
6
1
2
3
Proportion
Response
0.0
0.1
0.2
0.3
0.4
0.5
1
2
3
4
5

College_More_Important_for_Boy

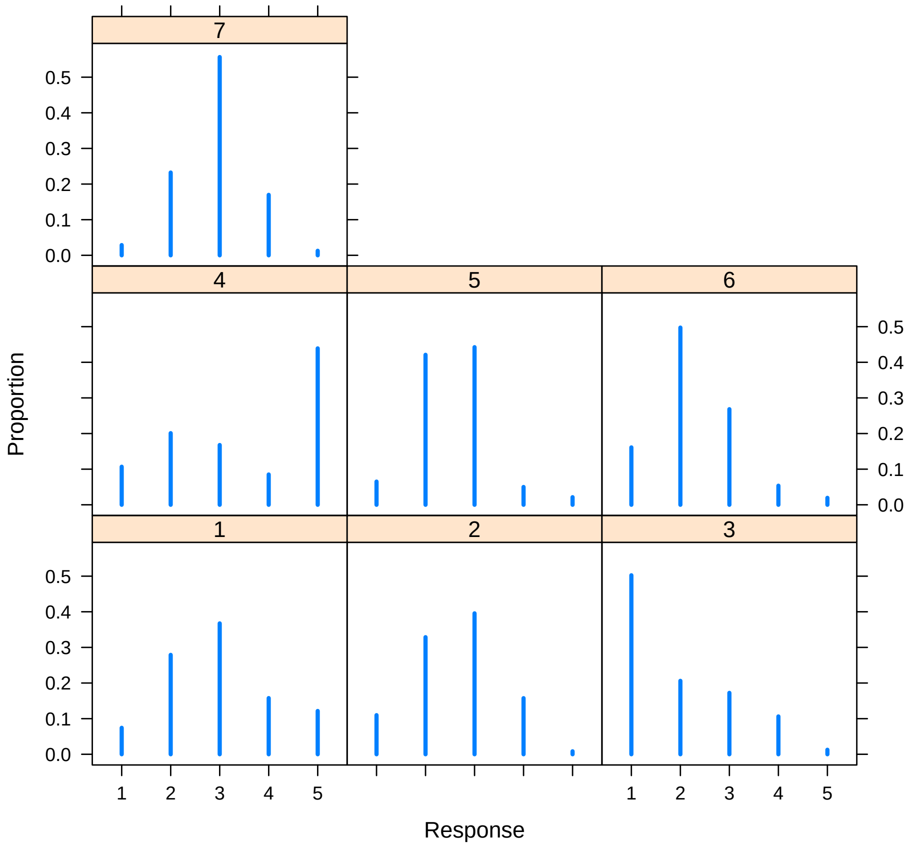



Men_Business_Executives
7
4
5
6
1
2
3
0.5
0.4
0.3
0.2
0.1
0.0
Proportion
Response
1
2
3
4
5

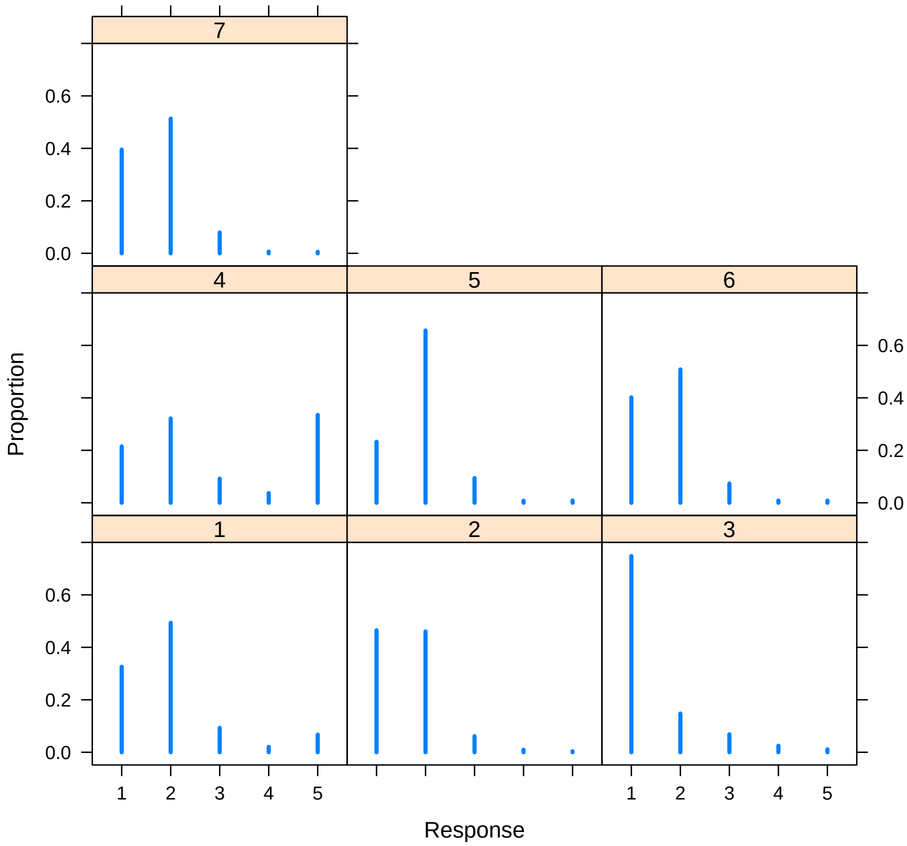

Make_Parents_Proud
7
4
5
6
1
2
3
Proportion
Response
0.0
0.2
0.4
0.6
0.8
1
2
3
4
5

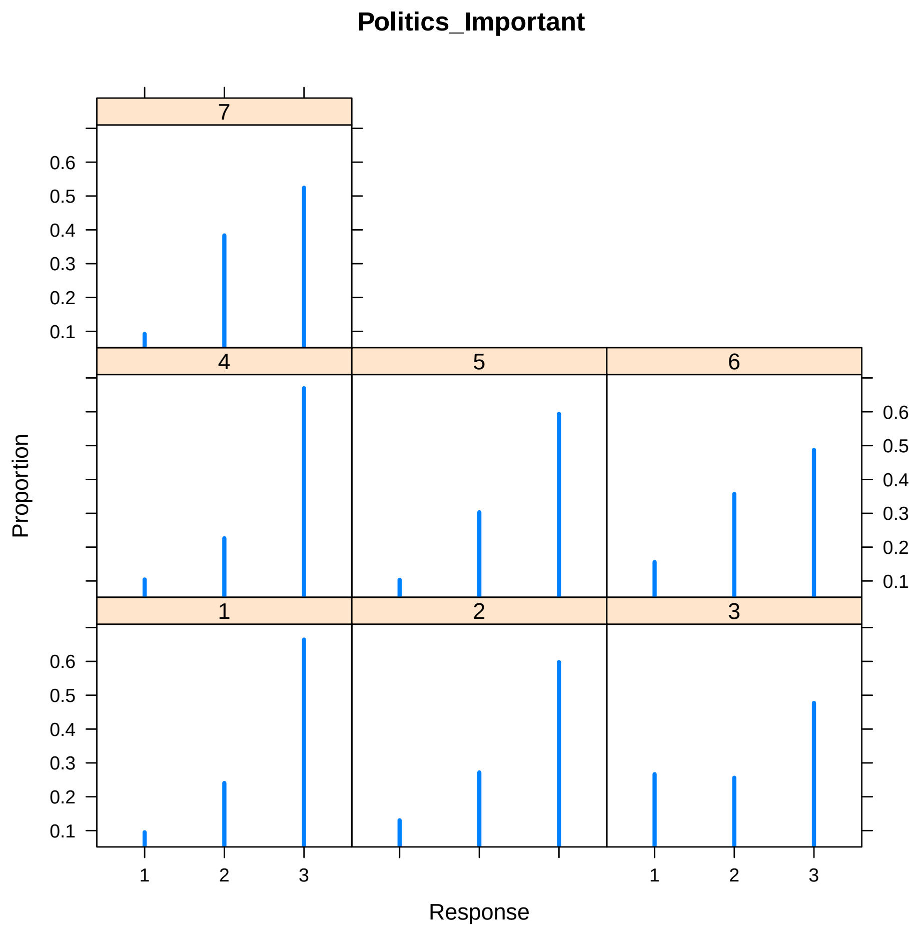

Be_Self
Proportion
Response
7
4
5
6
1
2
3
0.0
0.2
0.4
0.6
0.8
1
2
3
4
5

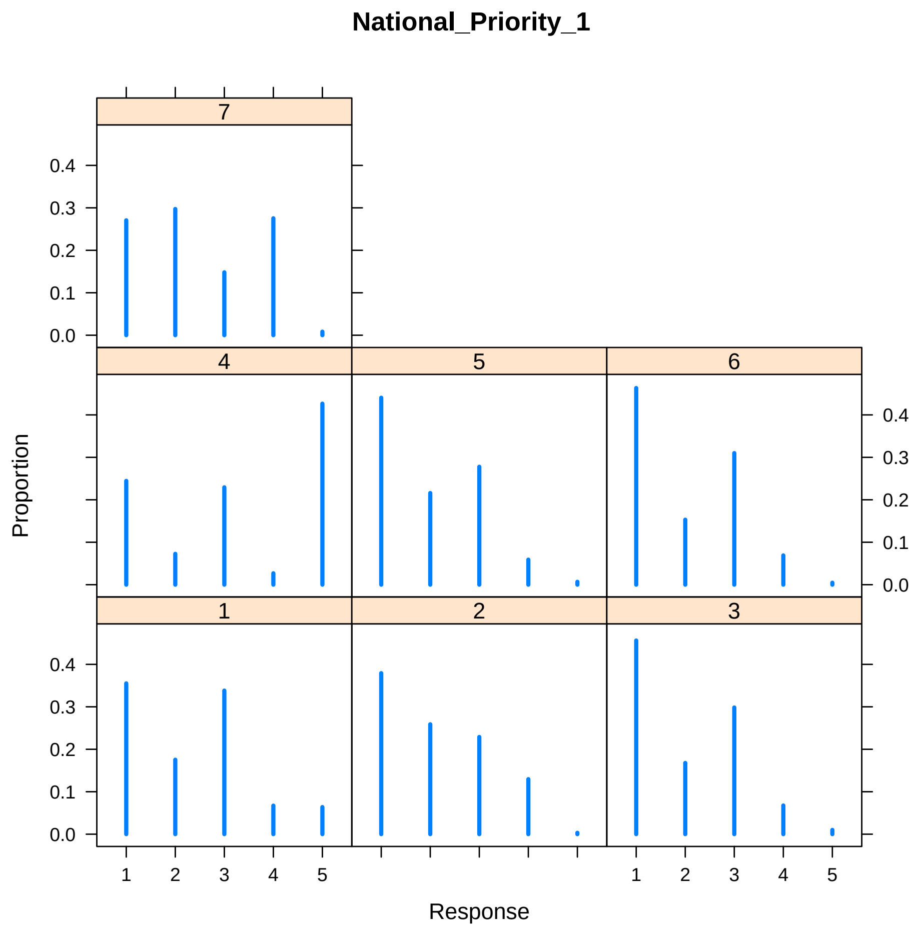
Friends_Expect



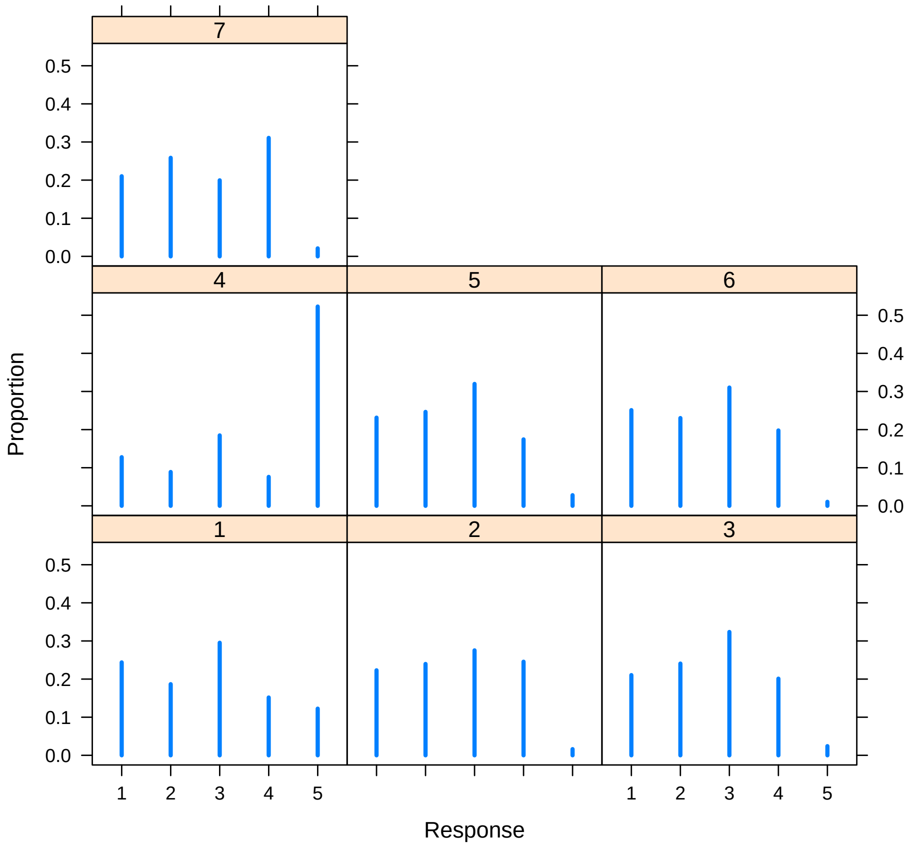
Self_Selected_Goals



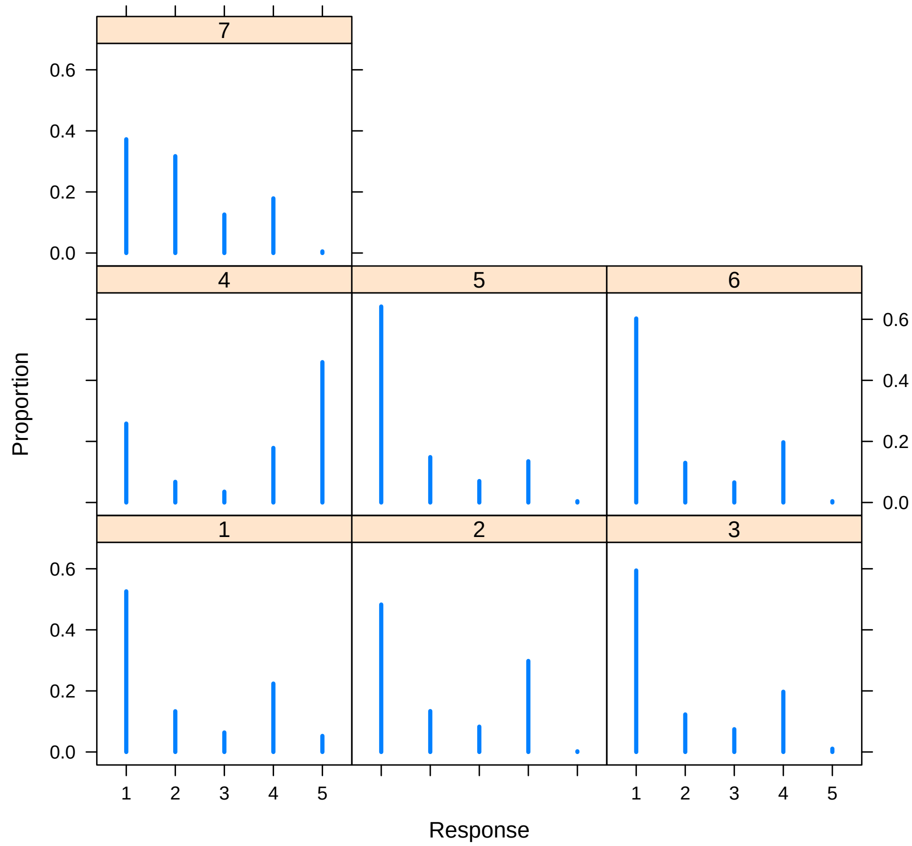

Politics_Important
7
4
5
6
1
2
3
0.1
0.2
0.3
0.4
0.5
0.6
Proportion
Response


National_Priority_1
7
4
5
6
1
2
3
Proportion
Response
0.0
0.1
0.2
0.3
0.4
1
2
3
4
5

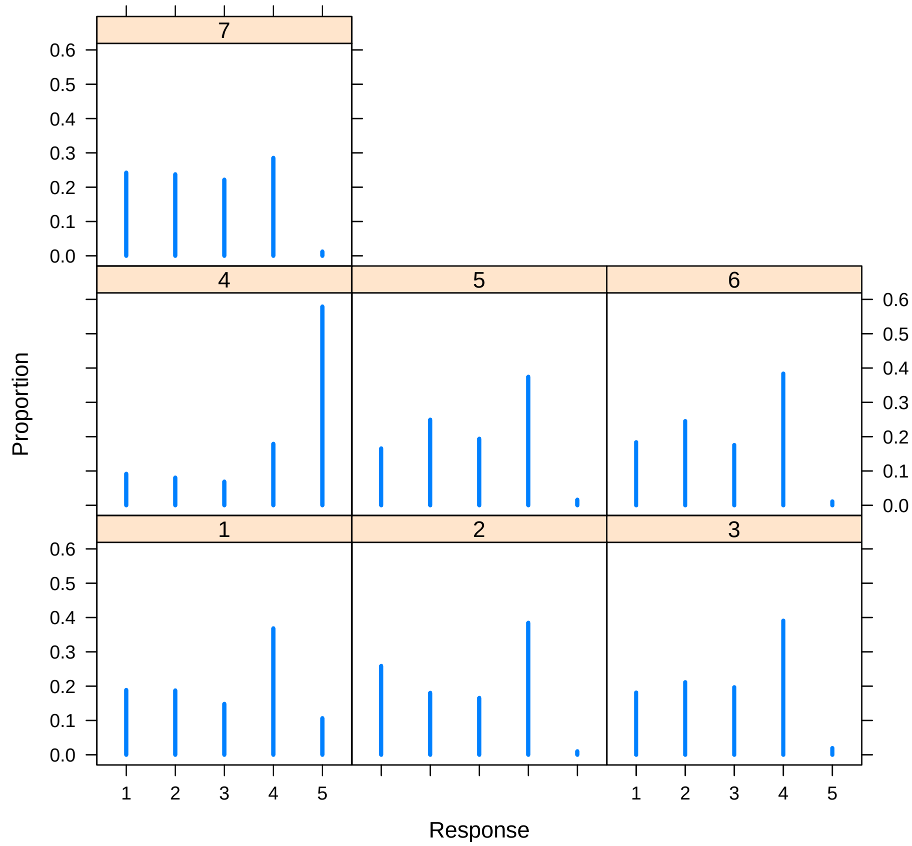
National_Priority_2

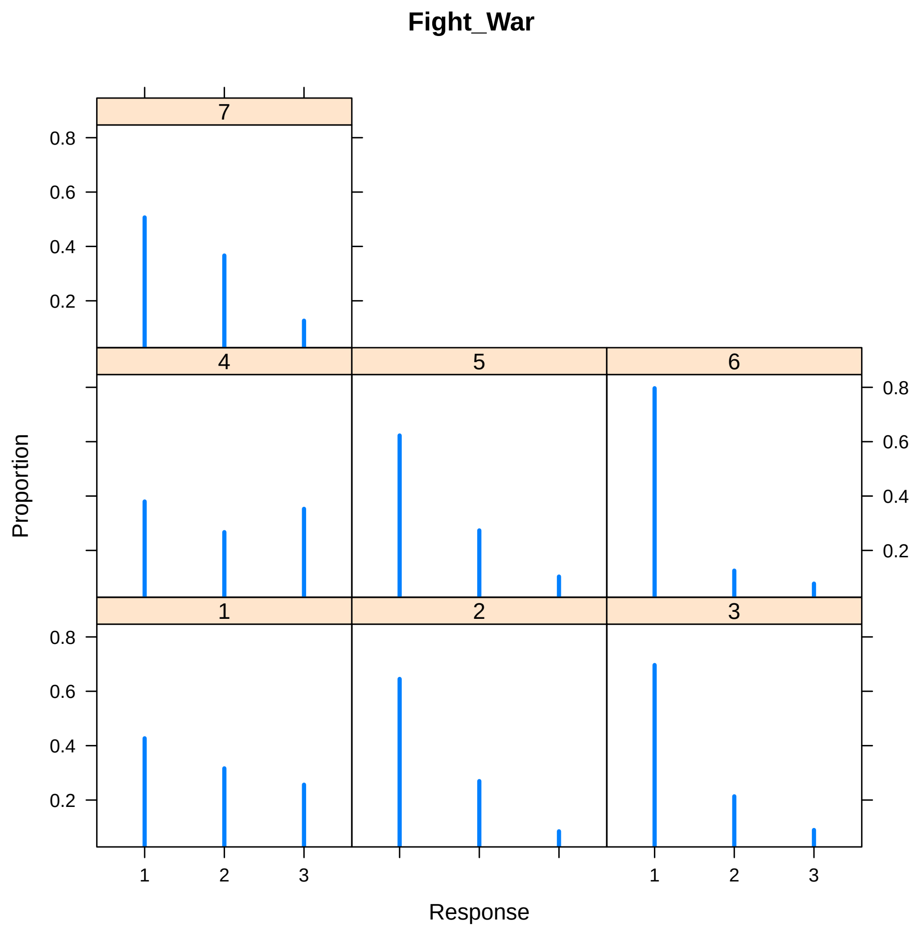


Most_Important_Problem_1

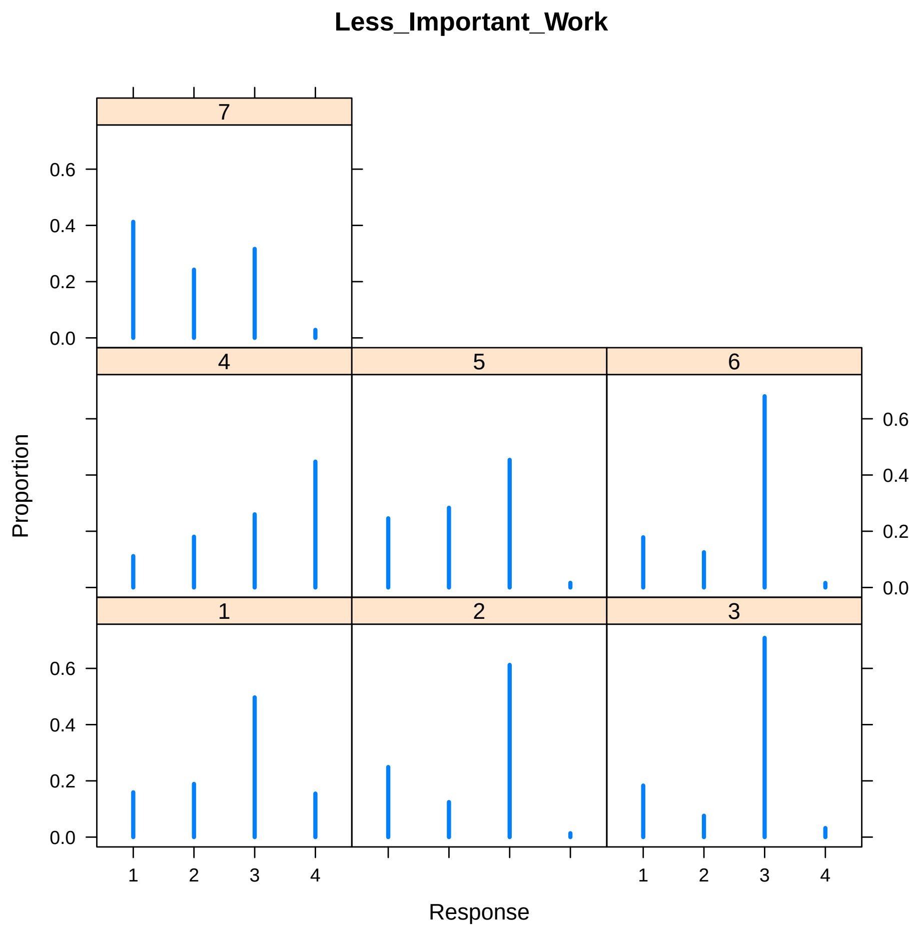


Most_Important_Problem_2





Fight_War
7
4
5
6
1
2
3
0.8
0.6
0.4
0.2
Proportion
Response
1
2
3


Less_Important_Work
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4
5
6
1
2
3
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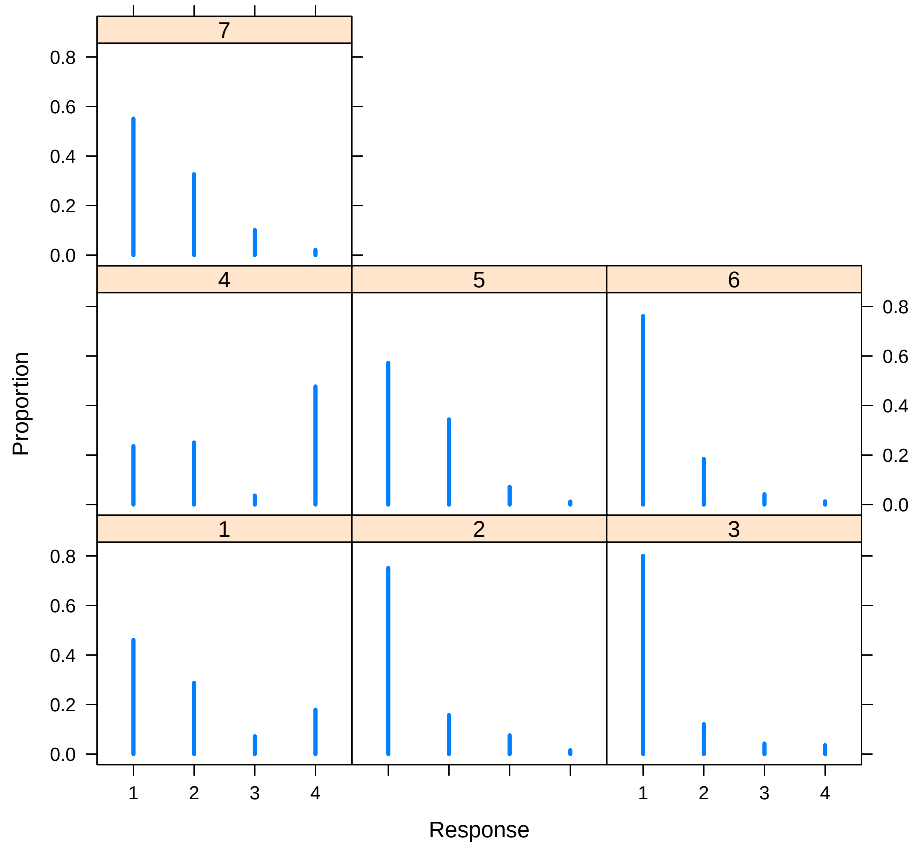
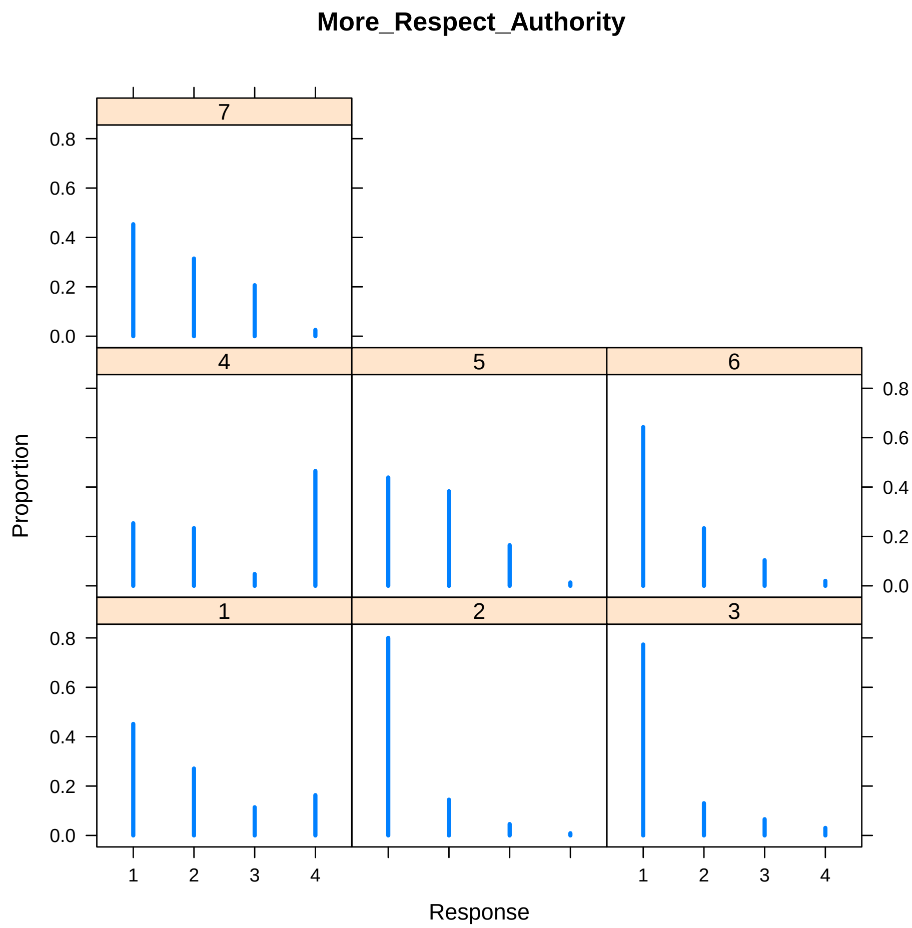
0.2
0.4
0.6
Proportion
1
2
3
4
Response

More_Emphasis_Technology





More_Respect_Authority
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4
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6
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2
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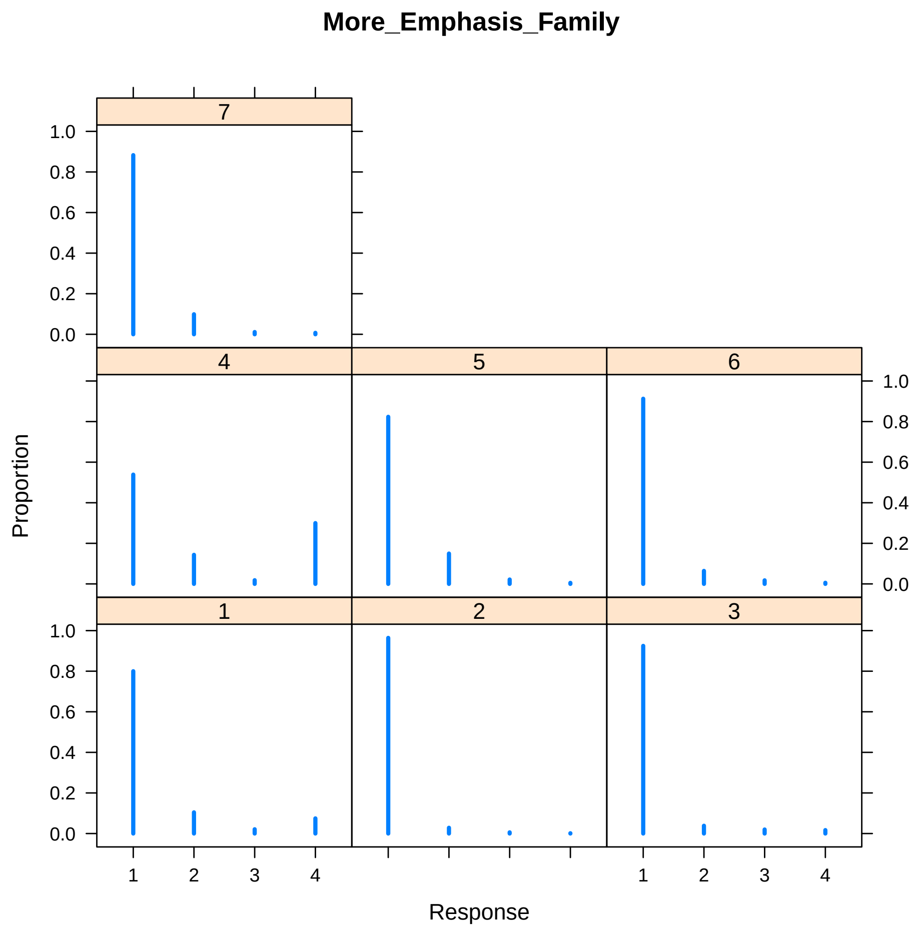
0.6
0.8
Proportion
1
2
3
4
Response


More_Emphasis_Family
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4
5
6
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2
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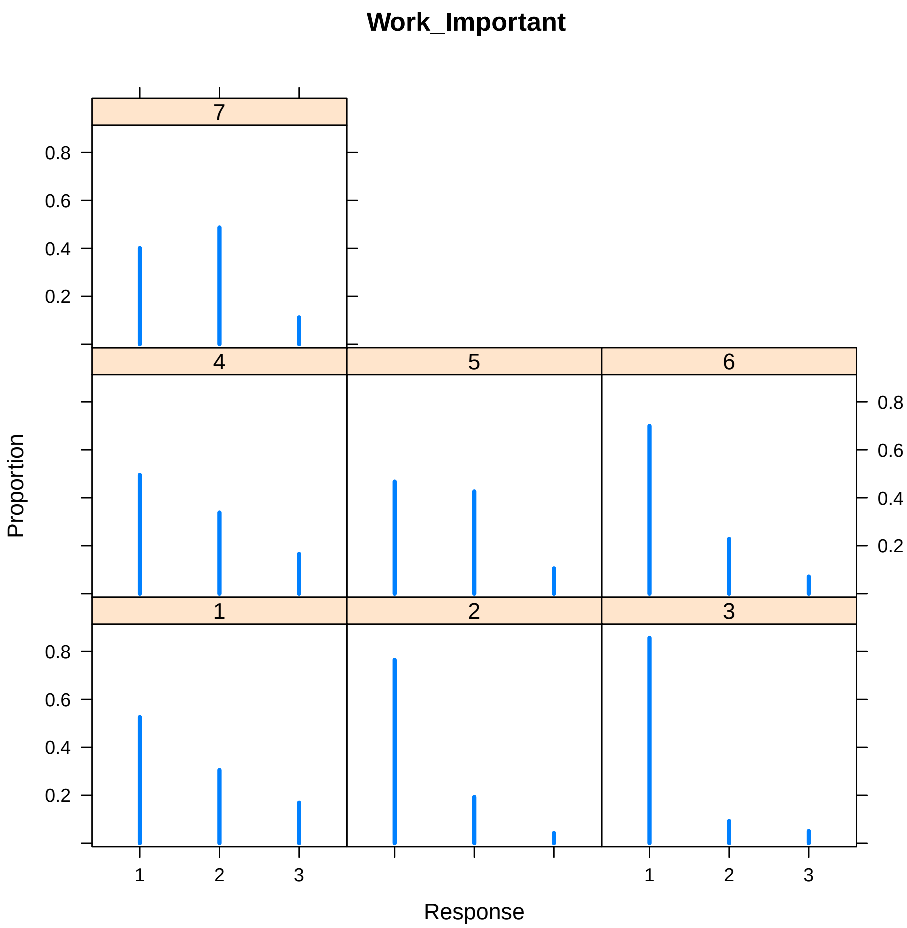
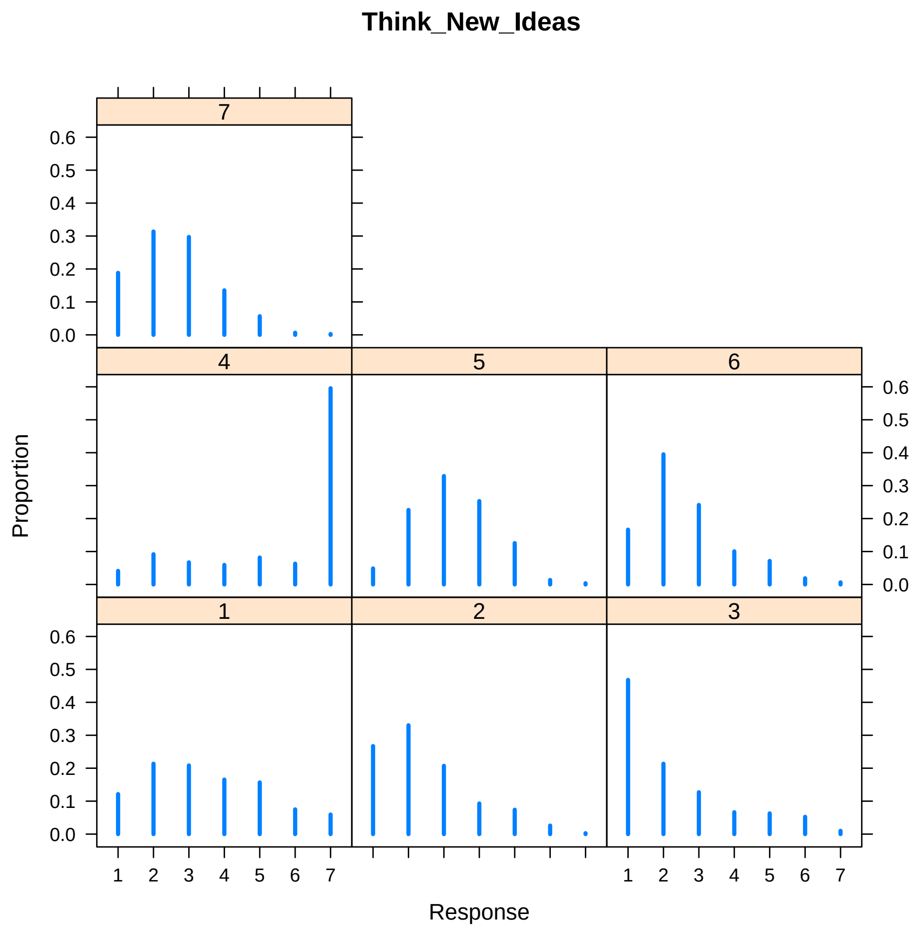
0.6
0.4
0.2
0.0
1
2
3
4
Proportion
Response



Work_Important
7
4
5
6
1
2
3
Proportion
Response
0.2
0.4
0.6
0.8
1
2
3


Think_New_Ideas
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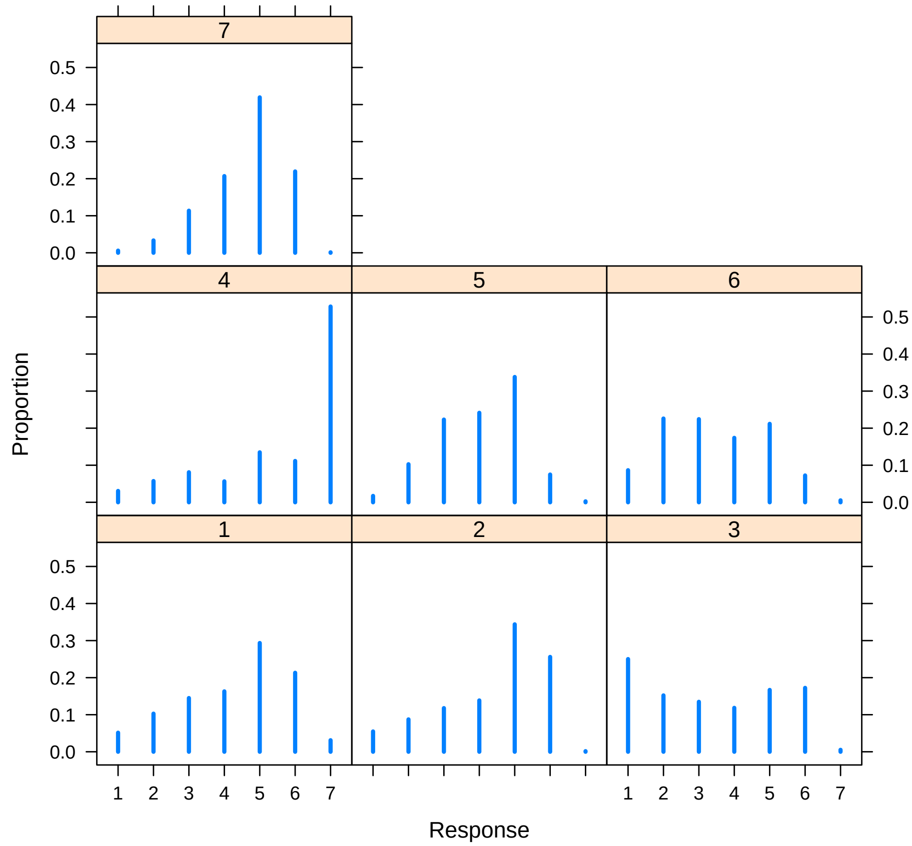
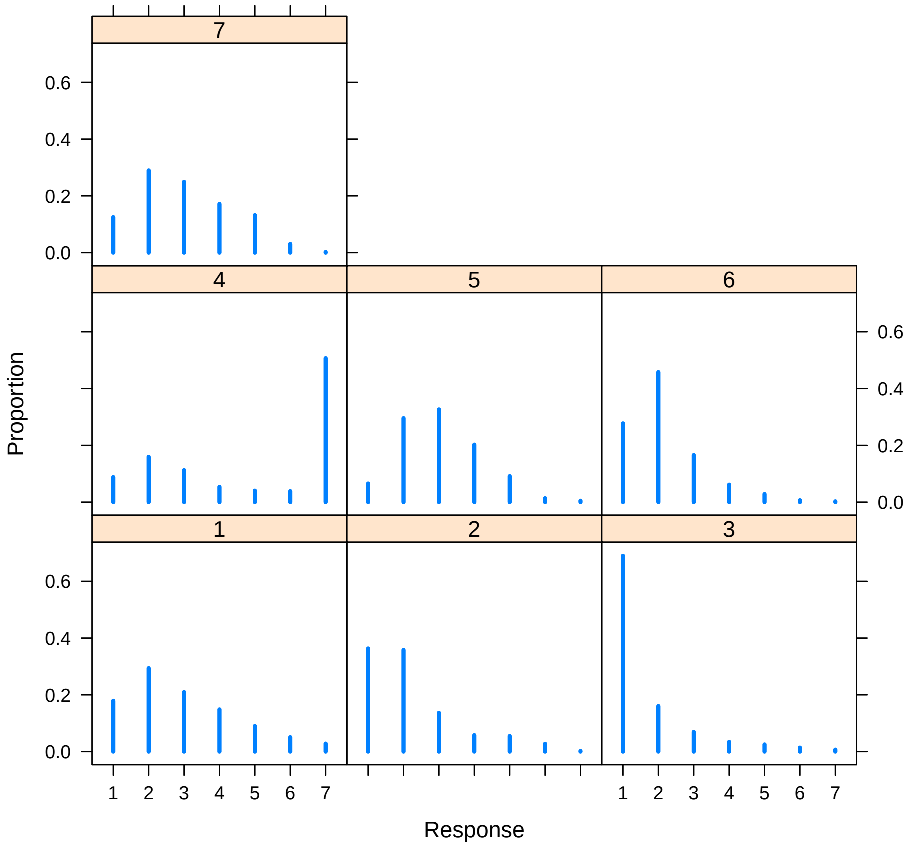
4
5
6
1
2
3
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Proportion
1
2
3
4
5
6
7
Response

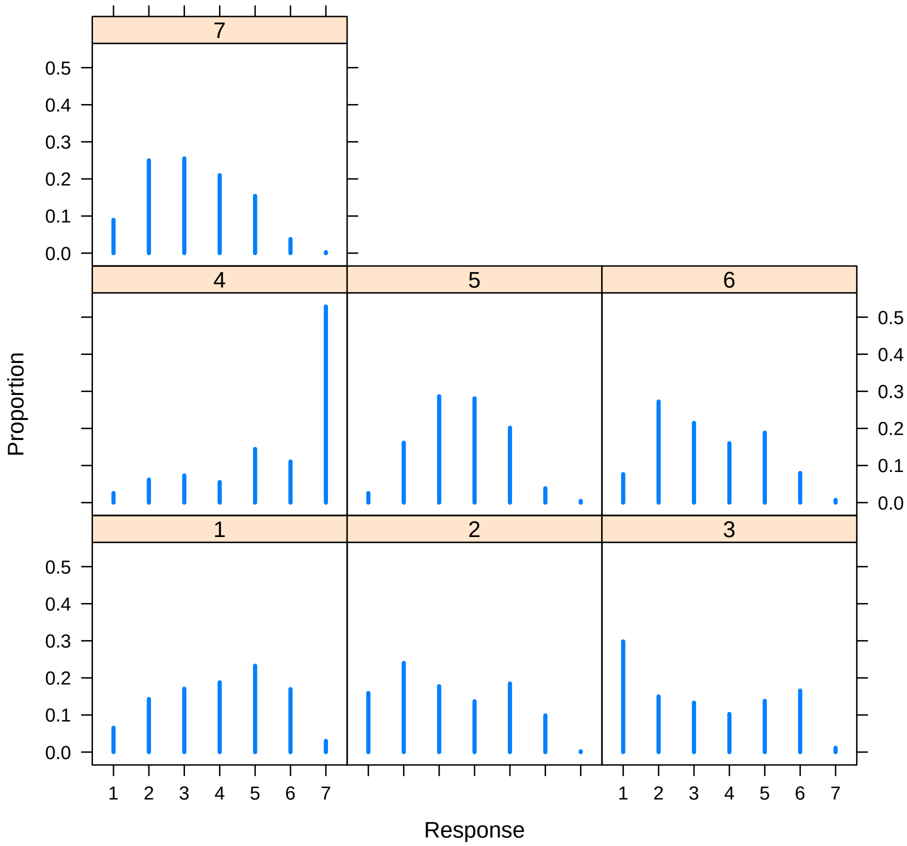
Be_Rich

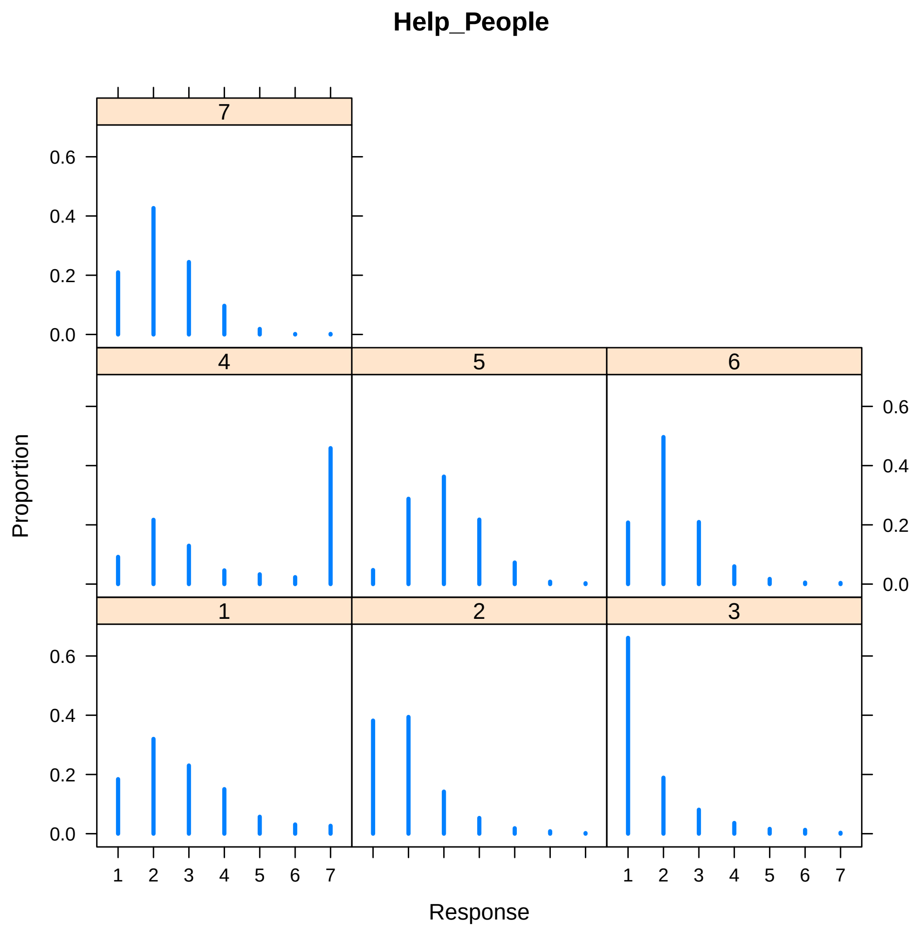


Secure_Surroundings



Have_Good_Time




Help_People
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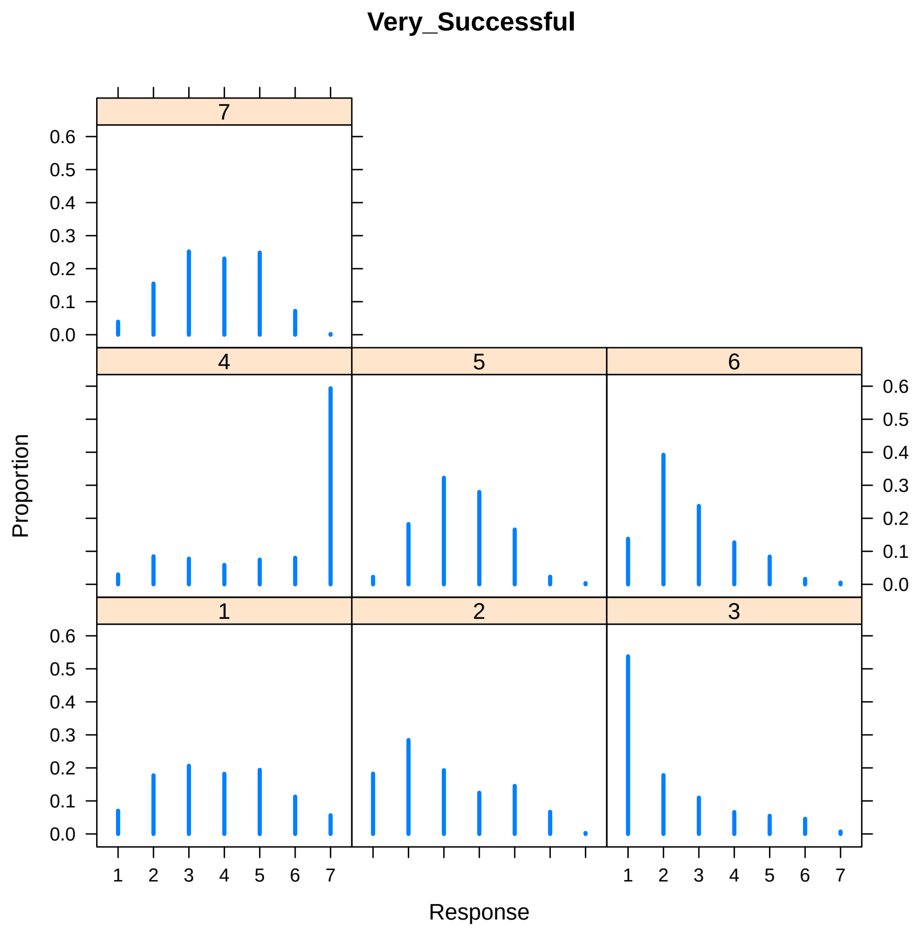
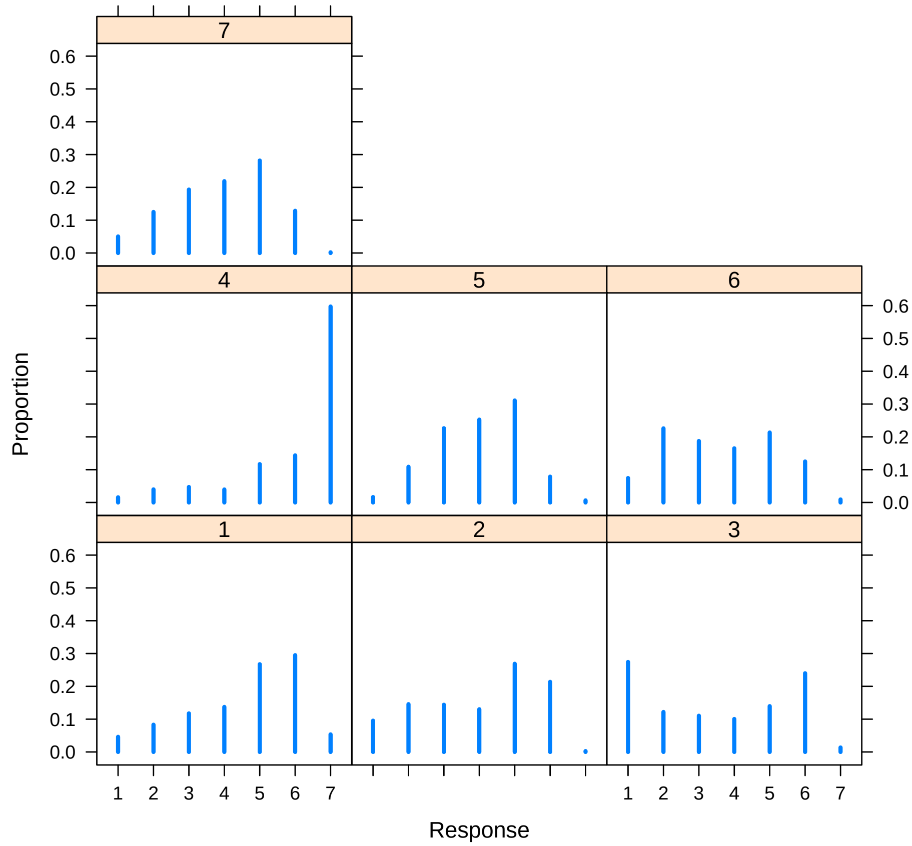
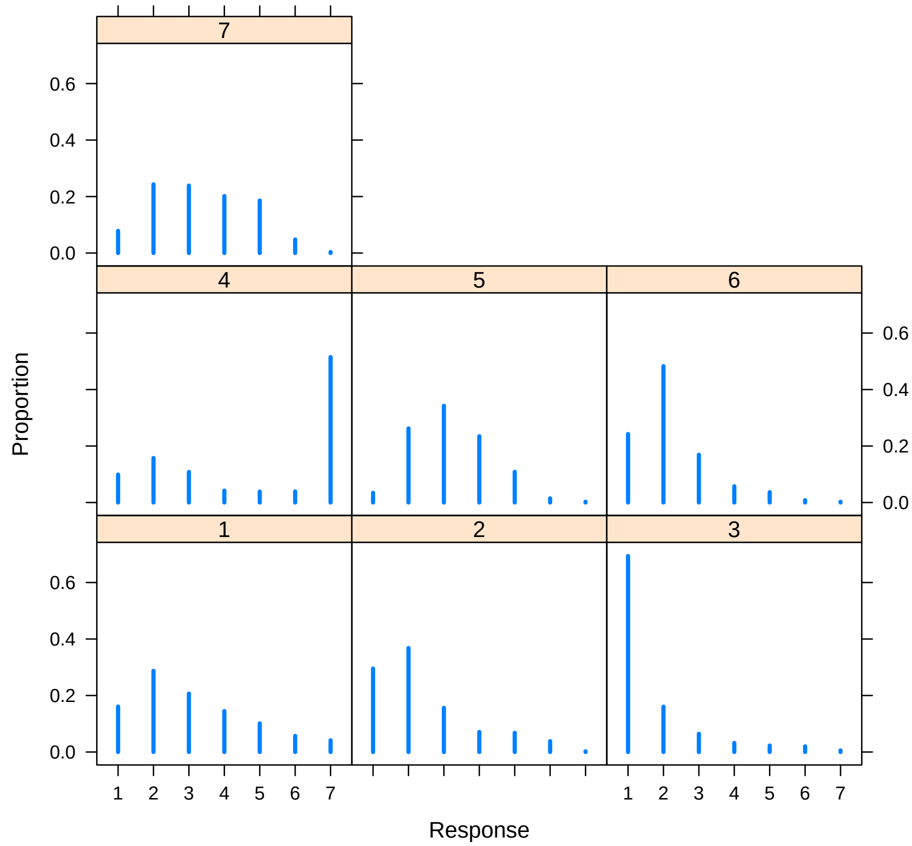
4
5
6
1
2
3
0.6
0.4
0.2
0.0
Proportion
1 2 3 4 5 6 7
Response

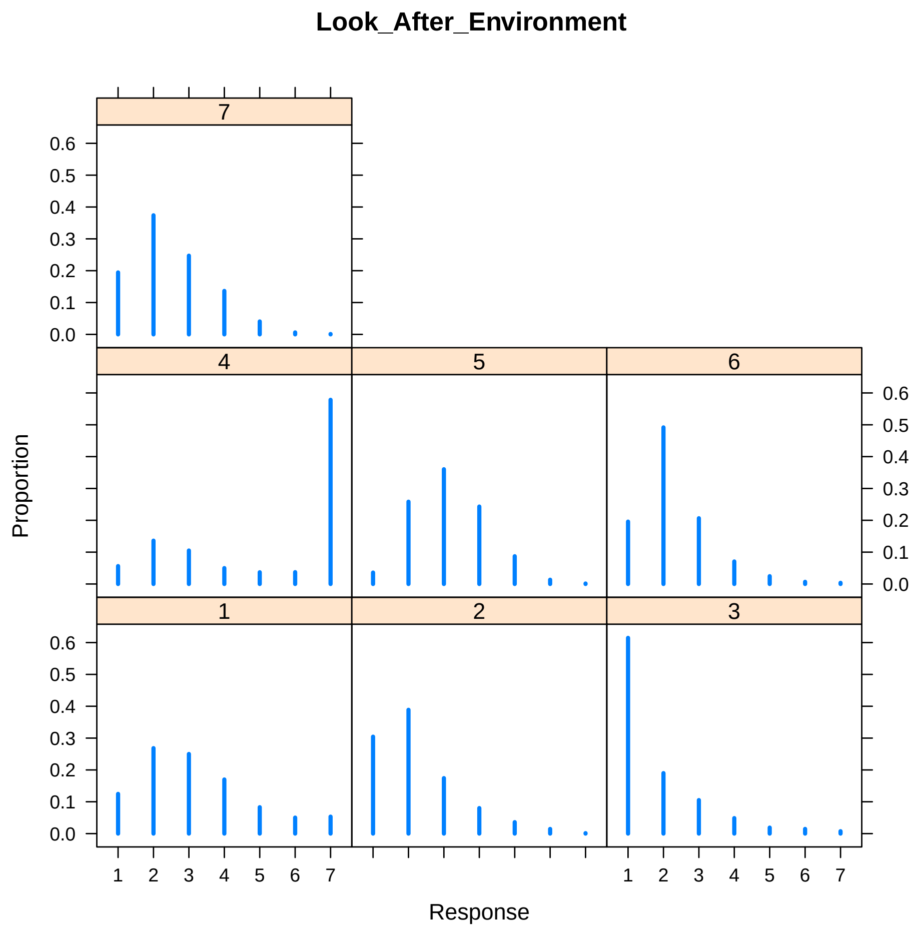

Very_Successful
7
4
5
6
1
2
3
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Proportion
1
2
3
4
5
6
7
Response

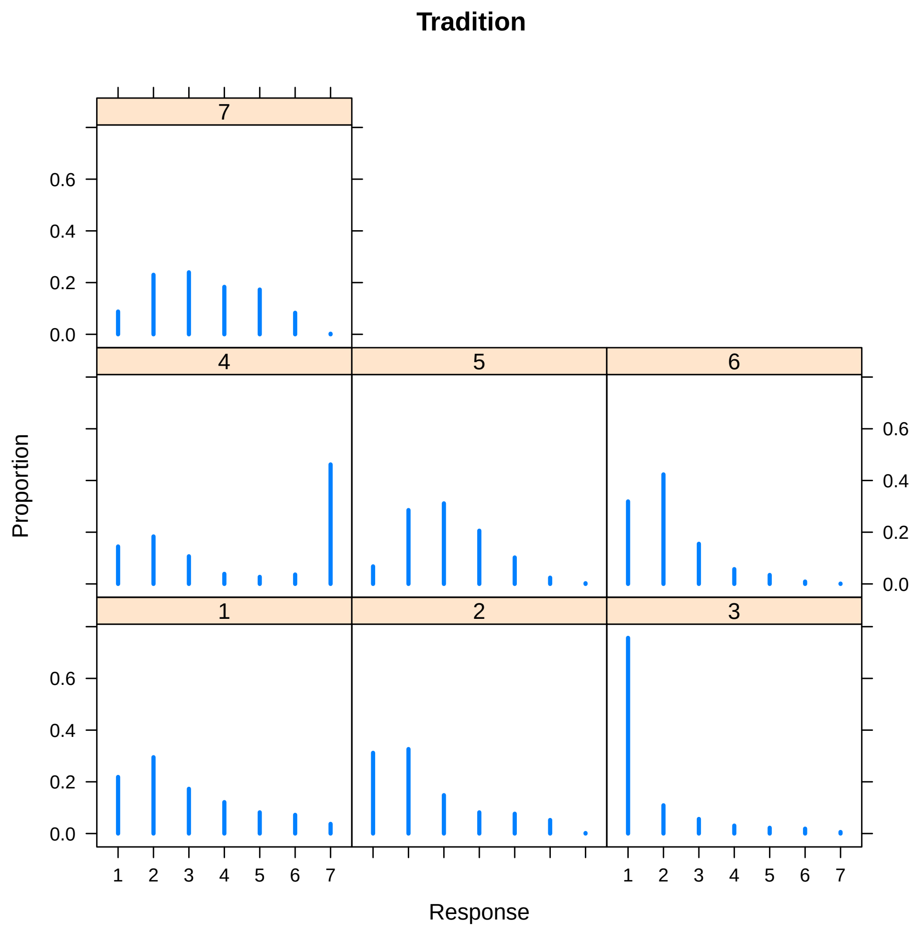
Adventure_Risk_Taking



Behave_Properly

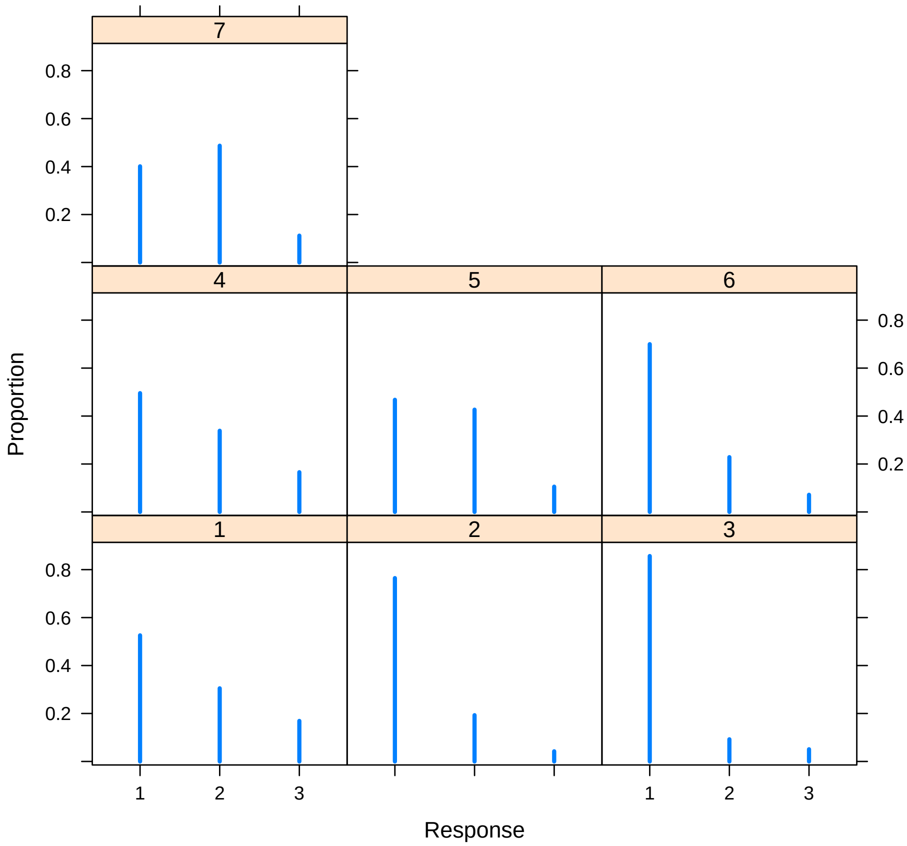


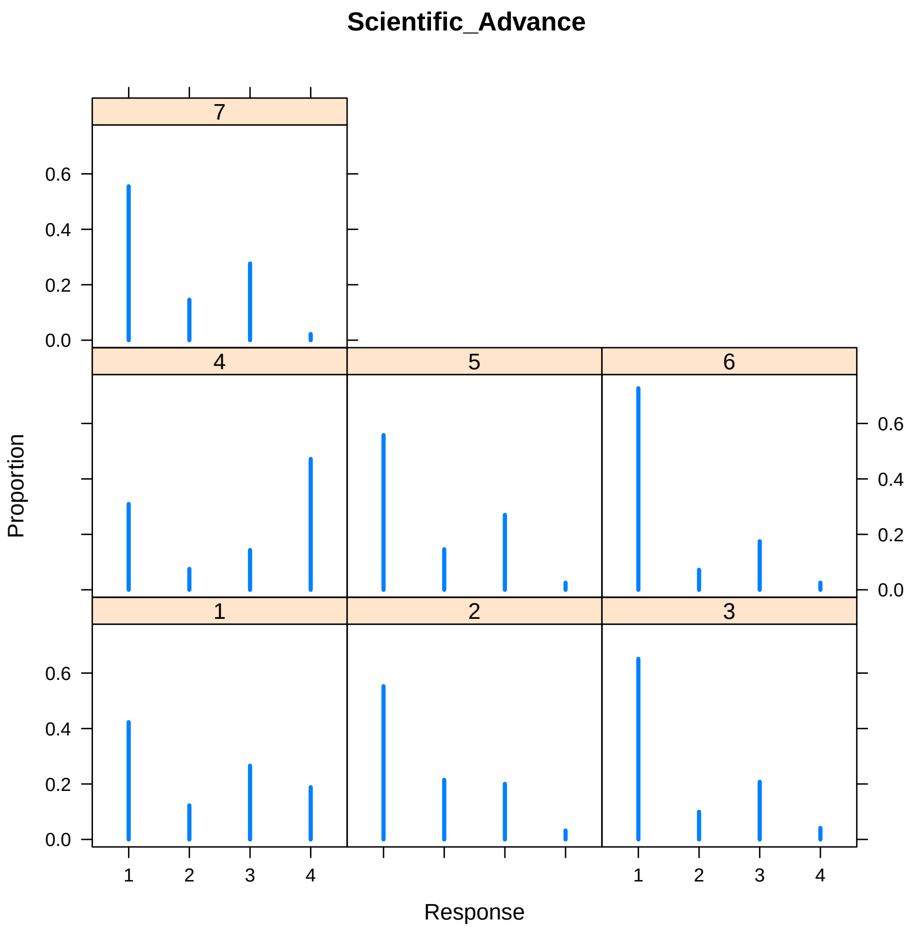

Look_After_Environment
7
4
5
6
1
2
3
0.0
0.1
0.2
0.3
0.4
0.5
0.6
1
2
3
4
5
6
7
Proportion
Response



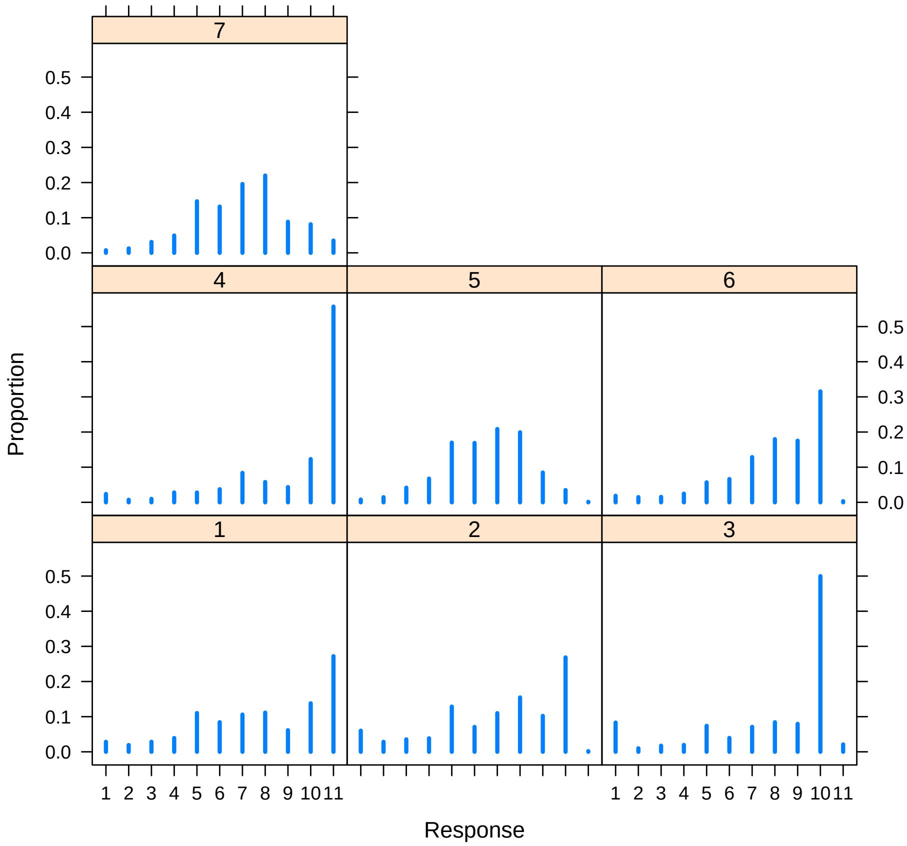
Tradition
7
4
5
6
1
2
3
0.0
0.2
0.4
0.6
Proportion
1 2 3 4 5 6 7
Response

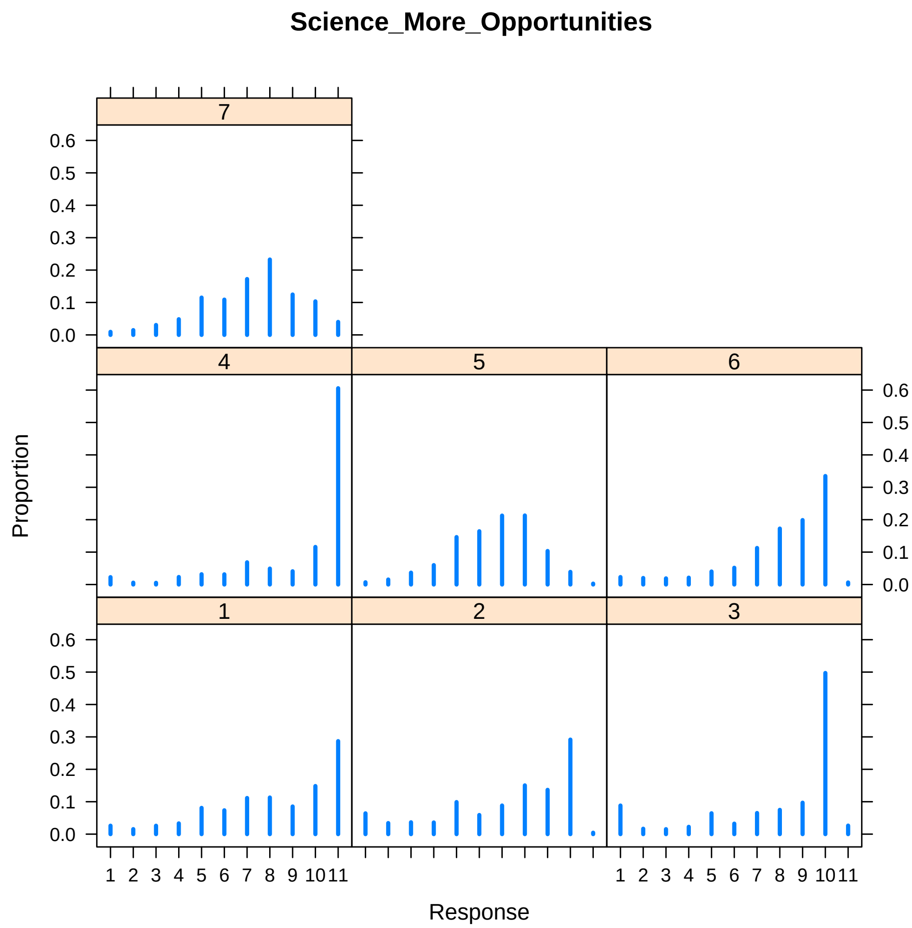
Religion_Important

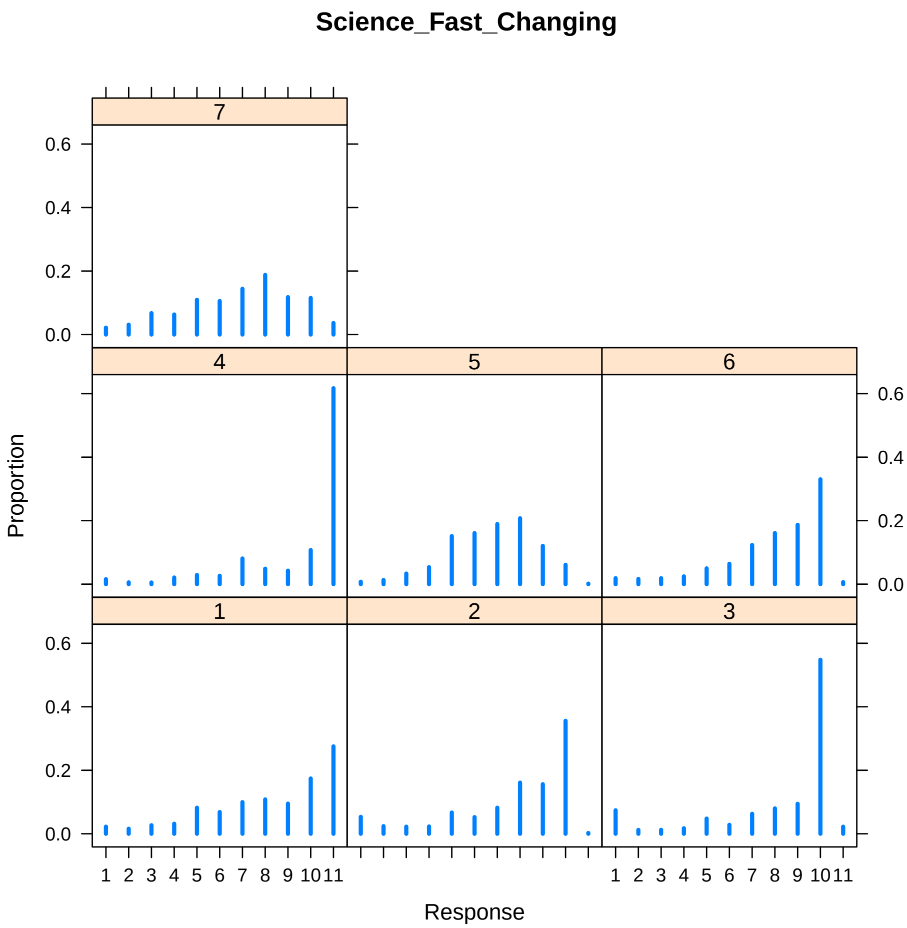



Scientific_Advance
7
4
5
6
1
2
3
0.0
0.2
0.4
0.6
Proportion
1
2
3
4
Response

Science_Better




Science_More_Opportunities
7
4
5
6
1
2
3
Proportion
Response
0.0
0.1
0.2
0.3
0.4
0.5
0.6
1 2 3 4 5 6 7 8 9 10 11



Science_Fast_Changing
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4
5
6
1
2
3
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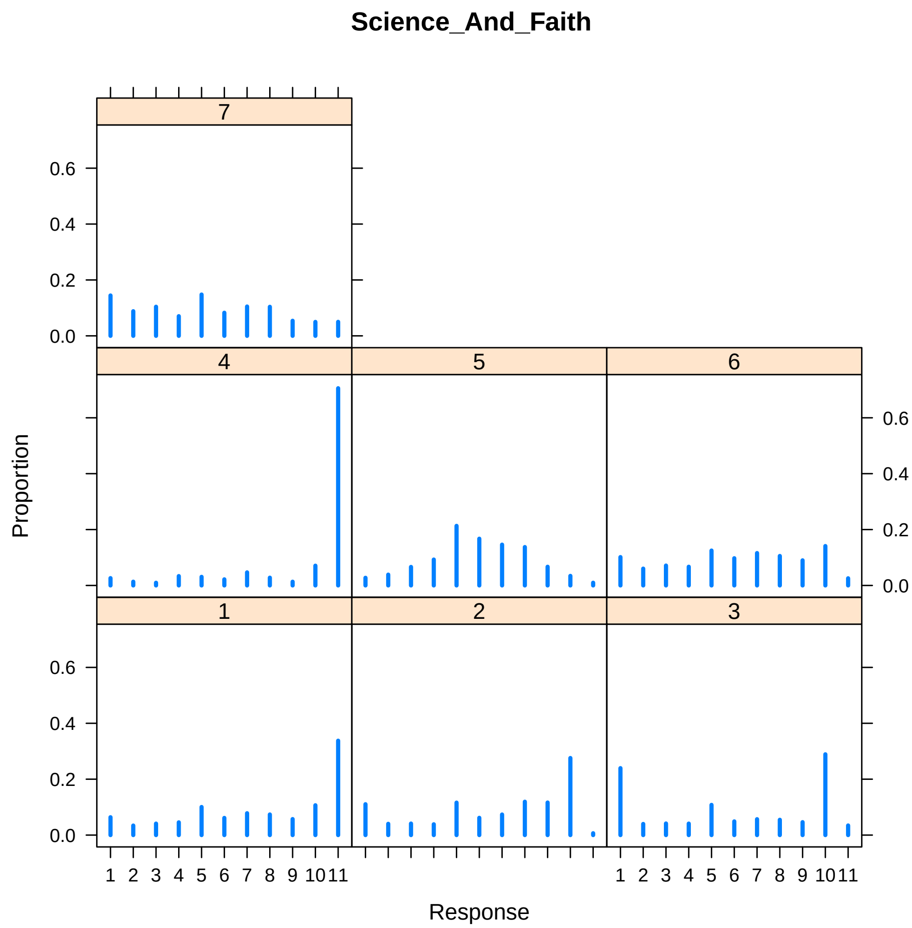
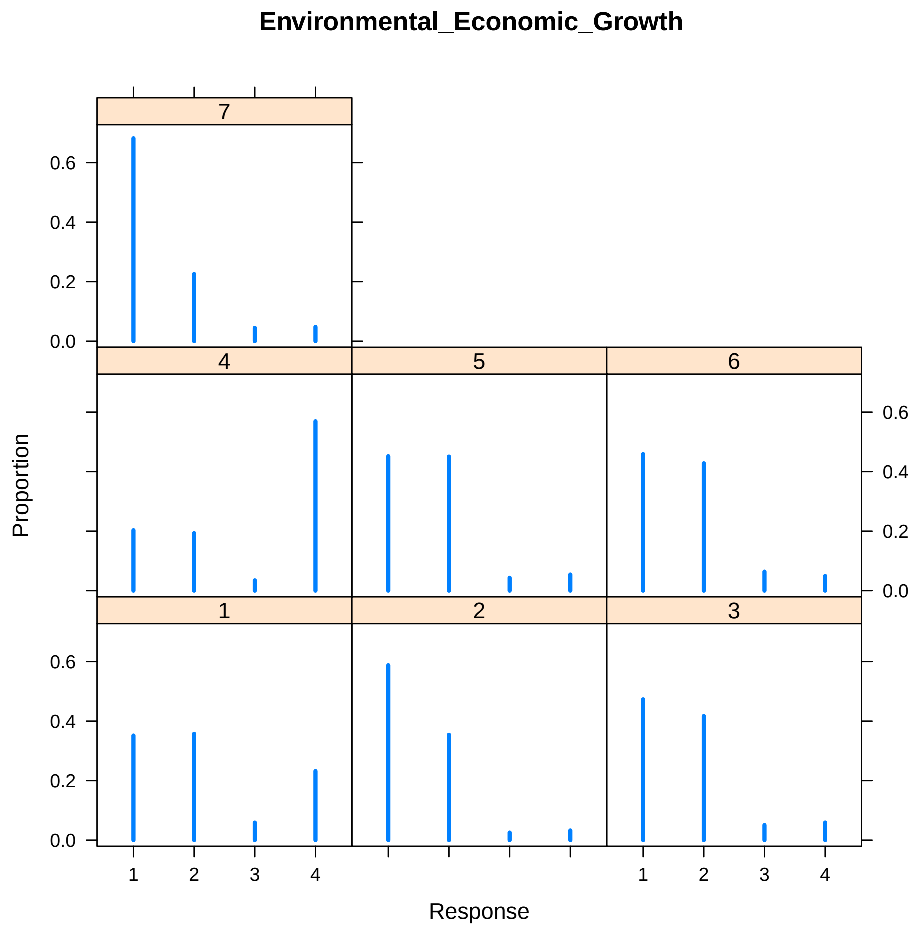
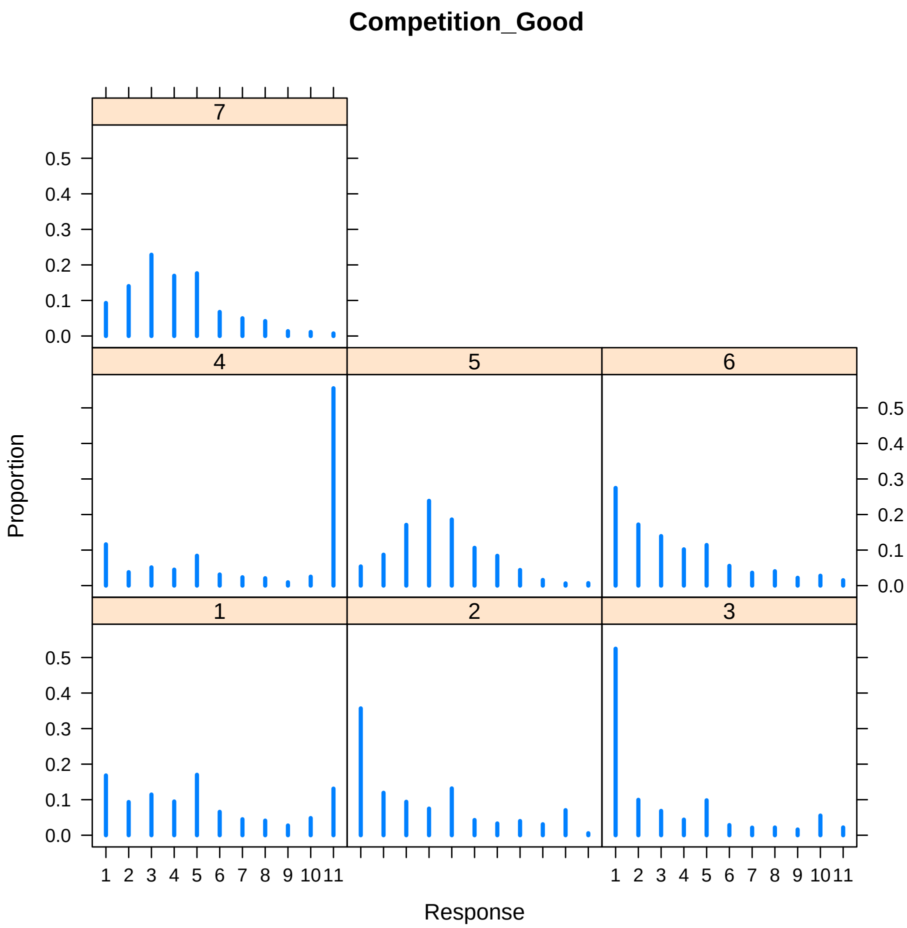
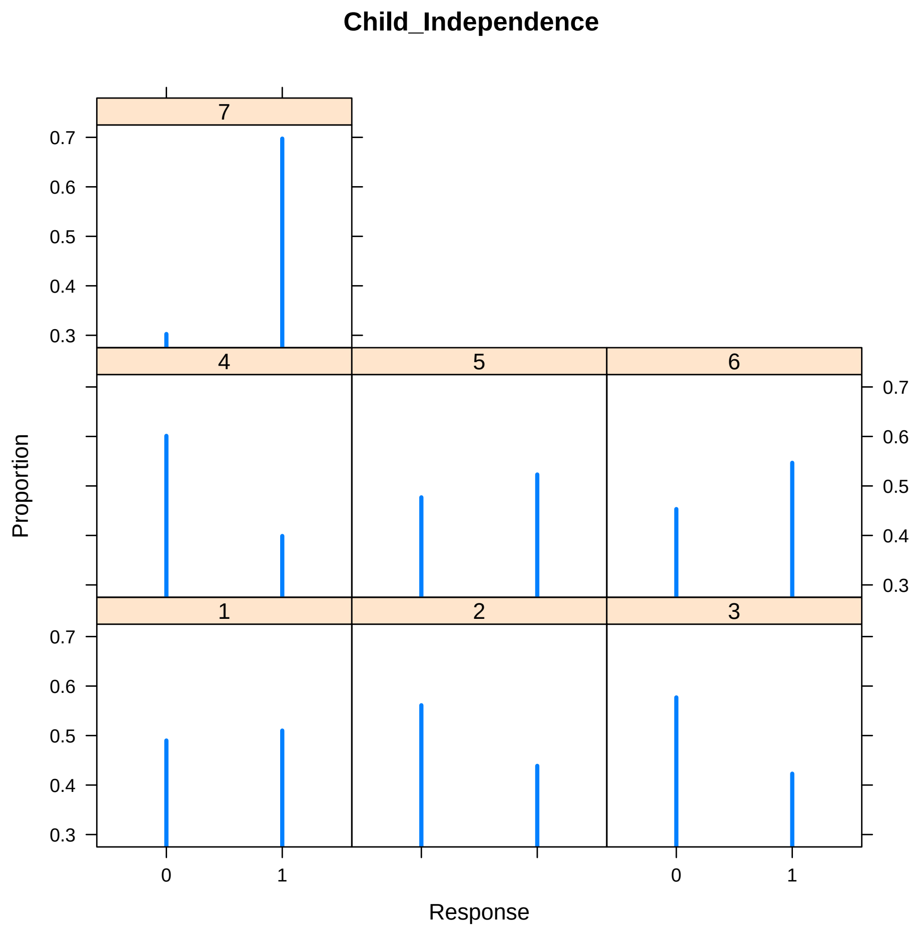
0.2
0.4
0.6
Proportion
1 2 3 4 5 6 7 8 9 10 11
Response


Science_And_Faith
7
4
5
6
1
2
3
0.0
0.2
0.4
0.6
1 2 3 4 5 6 7 8 9 10 11
Response
Proportion

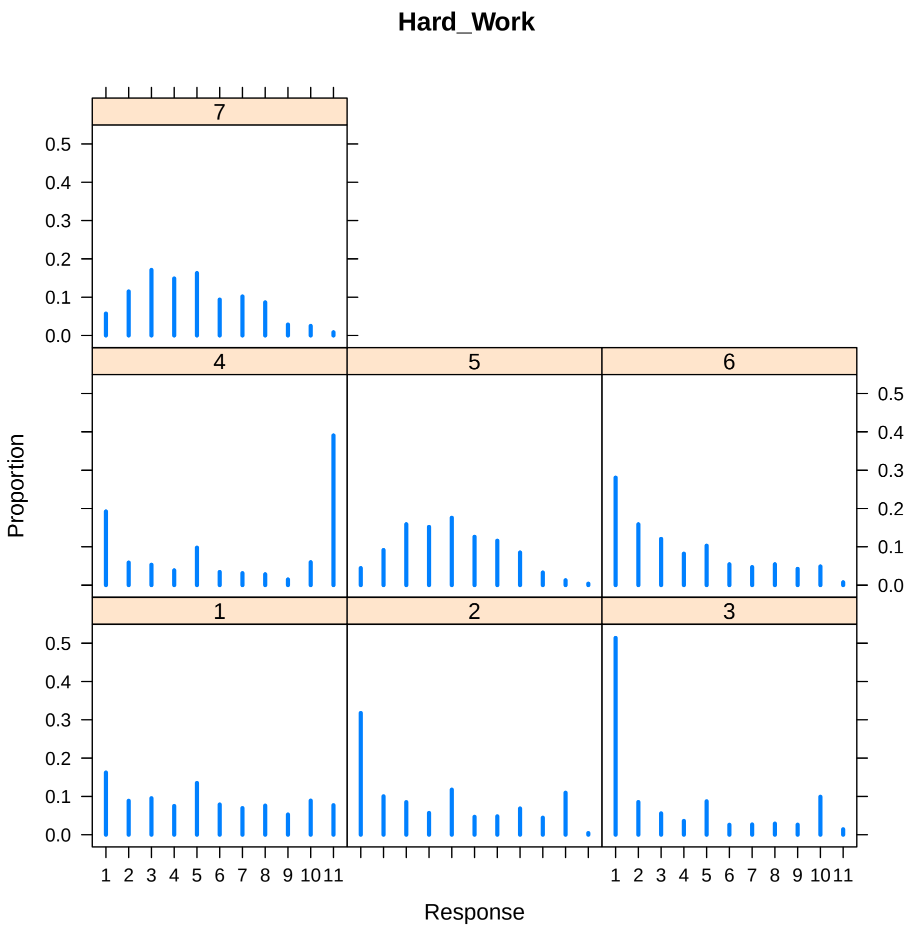


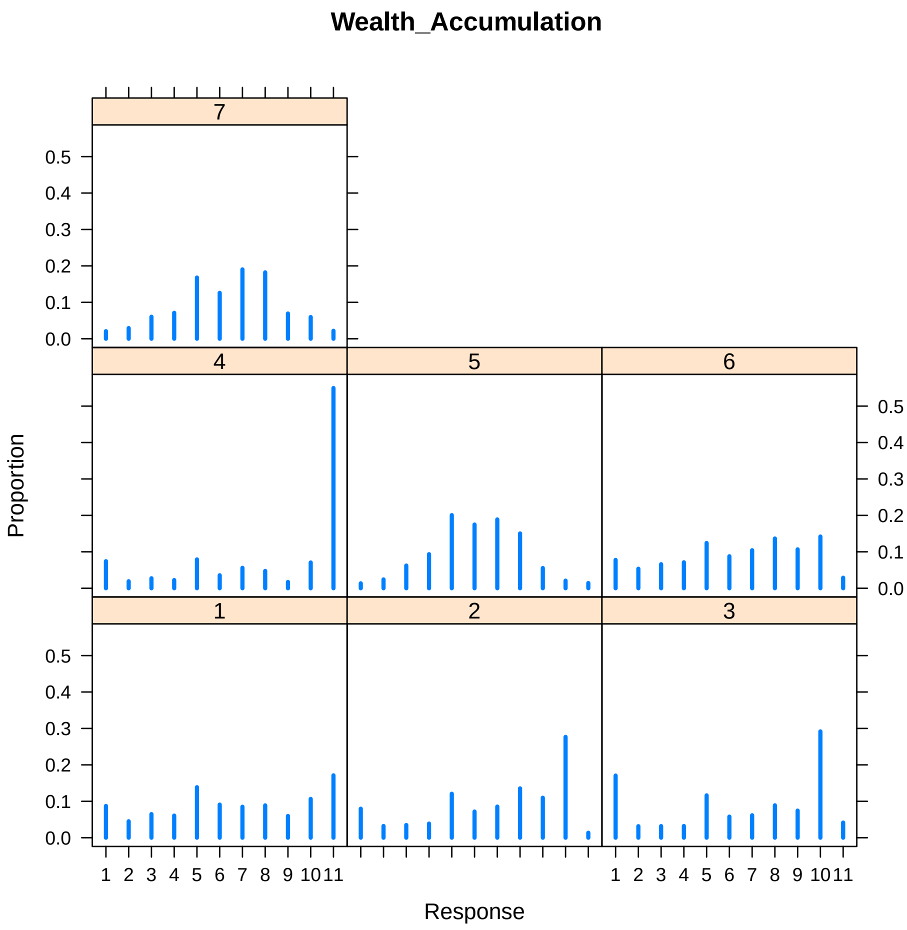
Environmental_Economic_Growth
7
4
5
6
1
2
3
0.0
0.2
0.4
0.6
Proportion
1
2
3
4
Response


Competition_Good
Proportion
Response
7
4
5
6
1
2
3
0.0
0.1
0.2
0.3
0.4
0.5
1 2 3 4 5 6 7 8 9 10 11

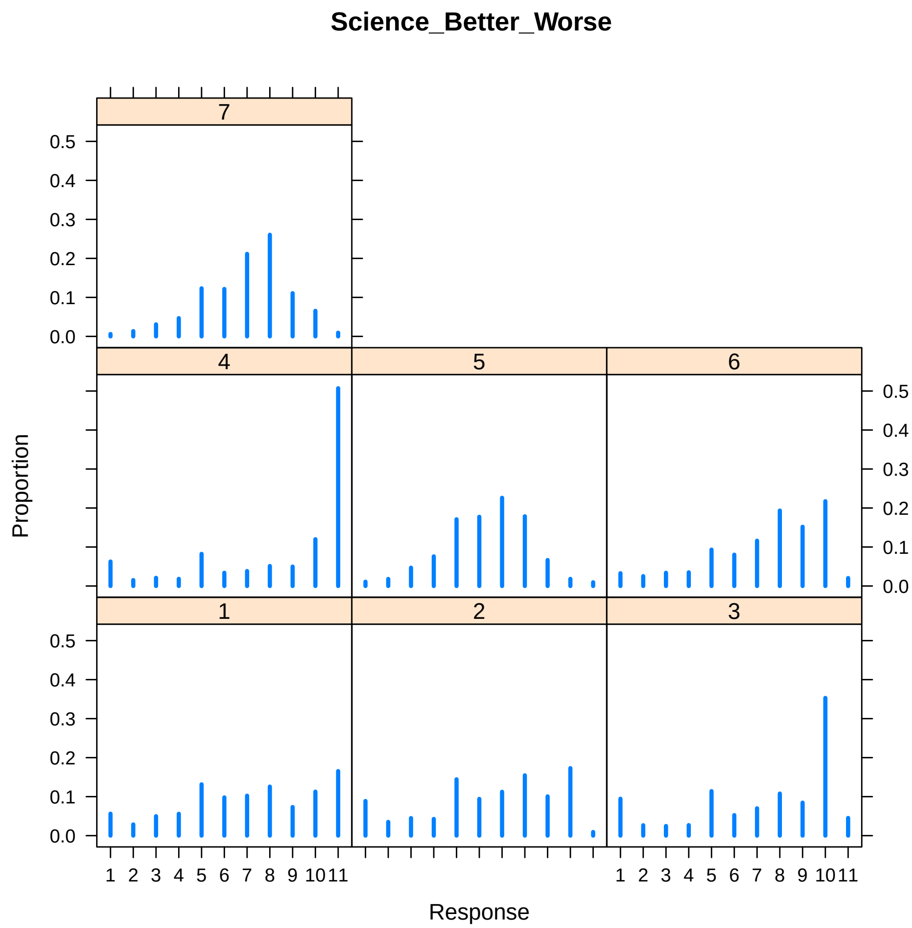


Child_Independence
7
4
5
6
1
2
3
0.7
0.6
0.5
0.4
0.3
Proportion
0
1
Response


Hard_Work
Proportion
Response
7
4
5
6
1
2
3
0.0
0.1
0.2
0.3
0.4
0.5
1 2 3 4 5 6 7 8 9 10 11



Wealth_Accumulation
7
4
5
6
1
2
3
0.0
0.1
0.2
0.3
0.4
0.5
Proportion
1 2 3 4 5 6 7 8 9 10 11
Response



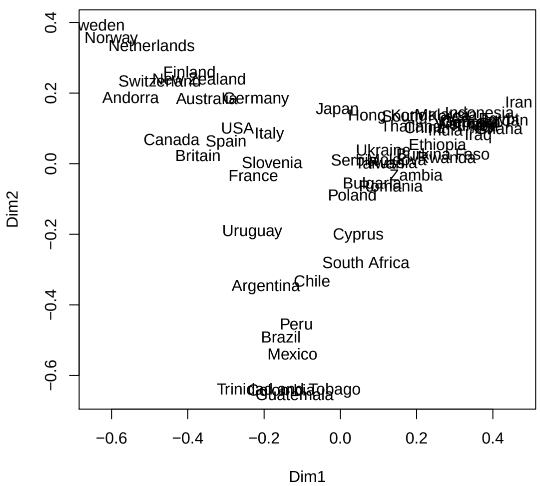
6 Country Specific Face Validity

The previous section showed that the cultures the algorithm identifies are coherent. In this section we characterize country specific variation for a subset of countries. This demonstrates that the categories that we identify align with intuitive understandings of the mix of cultures within a particular country.

Table 1: Country Specific Distribution

Country	1	2	3	4	5	6	7
Sweden	0.01	0.07	0.00	0.00	0.01	0.01	0.89
US	0.01	0.19	0.01	0.02	0.31	0.04	0.41
Iran	0.02	0.00	0.18	0.00	0.03	0.77	0.00
Mexico	0.05	0.71	0.07	0.04	0.05	0.05	0.04

Figure 3: First Two Principal Components of Country Specific SubCulture Distribution



6.1 Distribution of Sweden

The first row of Table 1 provides the distribution of types for Sweden. By far the largest category is category 7, a group that we identify in the main text as mainly "post-materialist". That is, this is a group of people who care less about the distribution of resources, are less responsive to authority, and are more worried about their friends. This aligns, broadly, with identified trends in Scandanavian countries.

The only other group of note is the second category. This group is more conservative but still tolerant. As the above figures show, this is a group open to having a variety of neighbors, but still believe religion is important. As we show below, this is broadly consistent with immigrant attitudes in the country.

6.2 Distribution of US

The United States is a mix of three primary categories. Like Sweden, the US has a substantial "post-materialist" cluster, but an even larger share of its population is in category 2.

The United States also has a large share of Category 5. This category describes respondents who tend to be focused on material issues. They care more about a stable economy than making a city beautiful. This is a group focused on the material concerns primarily, while subordinating other choices. This describes a large share of Americans who identify as pragmatic and traditional in their policy priorities.

6.3 Distribution of Iran

Iran differs sharply from the US and Sweden. In Iran members of category 3 and 6 comprise the largest share of the population. Those two categories are extremely similar, as we now detail here. As we note in the main text, members of category 6 are willing to fight wars and object to having neighbors who have AIDS, are homosexual, or are unmarried. This reflects a set of respondents who are closed minded and fearful from those who are perceived as different.

Category 3 respondents care a great deal about safety, are highly religious (even for children) and are discriminatory towards out-groups. This would reflect the most religiously conservative elements within Iran.

6.4 Distribution of Mexico

Unlike Iran, respondents from Mexico are much more tolerant. By and large the respondents from Mexico come from category 2: a category that, as we mentioned above, is much more pragmatic and focused on improving material circumstances, while still believing religion is important.

7 Calculating Distance Between Groups

To calculate the distance between types we compare the question-specific expected distributions for each type. Specifically, for type k call the expected distribution over responses for question r $\hat{\boldsymbol{\theta}}_{kr}$, which we can calculate directly from the estimated model. Using this distribution across questions, we can calculate the distance between groups. Specifically, for group k and $k^{'}$ we will define the distance, $d_{k,k'}$,

$$d_{k,k'} \quad = \quad \sum_{r=1}^{R} |\hat{\boldsymbol{\theta}}_{kr} - \hat{\boldsymbol{\theta}}_{k'r}|$$

Calculating the distance this way ensures that our comparisons capture how members of each group answer questions differently.

8 Relation to World Cultures

To what extent do these cultural categories match up to scholarly conceptualizations of differences between world cultures? Huntington (1996) argues that the world can be divided into a series of world civilizations (i.e., Western, Orthodox, African, Latin American, Islamic, Buddhist, etc). From a cultural values perspective, Huntington's typology only holds up in a very limited way and not in the manner he predicted. Latin American countries tend to be quite homogenous with regard to stated beliefs and values. Muslim-majority countries seem to be predominantly split between categories 3 and 6, which are relatively similar to each other but differ on the dimension of women's rights. Most societies Huntington categorizes as "Western" appear to be a mix of category 7 values and the values of a variety of subcultures. The countries in the former Soviet-influenced space exhibit strikingly little cultural homogeneity. Most East Asian countries have large clusters of citizens with category 5 values; it is not clear that these values parallel Buddhist teachings and it is notable that there is considerable variation in cultural values across China.

One dimension on which Huntington (1996) may enjoy some support relates to the *distance* between what might be called "Western" values and the cultural values of Muslim-majority societies. Although there is considerable diversity within the Islamic world, the world cultures that appear to be most dissimilar are 3 — typically found of Egypt, Iraq and Jordan — and 7 — typically found in Finland, Sweden and, to a lesser degree, the United States.

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