# Supporting information for "The effects of perspective taking on multiple dimensions of discrimination"

## Contents

# 1 Model specification

## 1.1 Equation

Model description:

$$
\begin{aligned}
Y_o &\sim \mathcal{B}(\pi_o) && \text{Main data component} \\
\pi_o &= \text{logit}(\beta_{i,f} F_f) && \text{Linear relationship} \\
\beta_{i,f} &\sim \mathcal{MN}(\mu_{i,f}, \Sigma_\beta) && \\
\Sigma_\beta &\sim \mathcal{IW}(0, 9) && \text{VCov for individual effects} \\
\mu_{i,f} &= (\theta_{f,v} C_{i,v}) && \text{Explanation of individual behavior} \\
\theta_{f,v} &\sim \mathcal{N}(\omega_f, \sigma_\theta) && \text{Priors for explanatory variables of individual behavior} \\
\omega_f &\sim \mathcal{N}(0, 2.5) && \text{Prior for the effects shared by outcome} \\
\sigma_{\theta_{f,v}} &\sim \mathcal{U}(0, 1) && \text{Prior for SD of individual behavior}
\end{aligned}
$$

Where:

- $Y$: Outcome variable capturing whether a profile has been prioritized (1) or not (0).
- $o$: Observation
- $i$: Individual
- $F$: Matrix with the observations of features (the discrimination sources, plus intercept and first shown profile), for each experimental data point.
- $C$: Matrix with the characteristics $v$ of the respondents, including their population $p$ and the treatment $t$.
- $f$: Feature
- $\theta_{f,v}$: Main parameters of interest capturing the individual variables affecting discrimination effects by profiles' feature.
- $\omega_f$: Hyper-parameters capturing the shared effect of individual characteristics on features.
- $\Sigma_\beta$: Variance-covariance matrix of the individual effects prioritizing the different profiles.
- $\sigma_\theta$: Within feature/individual characteristic's standard deviations.

## 1.2 Software implementation

The JAGS code for the model is the following:

```
model {
  for (o in 1:nO) {
    Y[o] ~ dbern(p[o])
    logit(p[o]) <- inprod(beta[id[o],1:nF], X[o,1:nF])
  }
  #
  # Priors for effects
  #
  for (id in 1:nId) {
    for (f in 1:nF) {
      beta[id,f] ~ dnorm(mu[id,f], 2.5^-2)
    }
  }
  for (f in 1:nF) {
    for (id in 1:nId) {
      mu[id,f] <- inprod(theta[f,1:nCov], C[id,1:nCov])
    }
    for (cov in 1:nCov) {
      theta[f,cov] ~ dnorm(omega[f,cov], tau_theta[f,cov])
    }
  }
  for (cov in 1:nCov) {
    omega[f,cov] ~ dnorm(0, 2.5^-2)
    tau_theta[f,cov] <- pow(sigma_theta[f,cov], -2)
    sigma_theta[f,cov] ~ dt(0, 0.5^-2, 3)T(0,)
  }
  #
  # Missing data
  #
  for (id in 1:nId) {
    for (v in cov.missing) {
      C[id,v] ~ dnorm(0, 1^-2)
    }
  }
}
```

## 2 Sample description

Table 1: Summary descriptives table by groups of 'Treatment'

| | No N=534 | Complier (Language) N=375 | Complier (Bureaucracy) N=73 | Non-complier (No idea) N=62 | Non-complier (Bad quality) N=32 | p.overall |
|---|---|---|---|---|---|---|
| Gender: | | | | | | 0.681 |
| Female | 278 (52.1%) | 193 (51.5%) | 33 (45.2%) | 36 (58.1%) | 17 (53.1%) | |
| Male | 256 (47.9%) | 182 (48.5%) | 40 (54.8%) | 26 (41.9%) | 15 (46.9%) | |
| Age | 50.0 (16.0) | 50.8 (16.1) | 50.1 (17.8) | 50.0 (15.1) | 43.7 (15.4) | 0.212 |
| Education: | | | | | | . |
| Primary | 148 (27.7%) | 90 (24.0%) | 17 (23.3%) | 25 (40.3%) | 11 (34.4%) | |
| Secondary | 193 (36.1%) | 140 (37.3%) | 27 (37.0%) | 23 (37.1%) | 10 (31.2%) | |
| Still studying | 11 (2.06%) | 9 (2.40%) | 1 (1.37%) | 0 (0.00%) | 2 (6.25%) | |
| Tertiary | 182 (34.1%) | 136 (36.3%) | 28 (38.4%) | 14 (22.6%) | 9 (28.1%) | |
| Ideology | 4.72 (1.95) | 4.71 (1.86) | 4.42 (1.65) | 4.68 (1.47) | 5.34 (1.66) | 0.246 |
| Migration: | | | | | | 0.188 |
| No | 466 (87.3%) | 338 (90.1%) | 62 (84.9%) | 51 (82.3%) | 26 (81.2%) | |
| Yes | 68 (12.7%) | 37 (9.87%) | 11 (15.1%) | 11 (17.7%) | 6 (18.8%) | |
| Income availability: | | | | | | 0.040 |
| Not reported | 427 (80.0%) | 307 (81.9%) | 66 (90.4%) | 48 (77.4%) | 21 (65.6%) | |
| Reported | 107 (20.0%) | 68 (18.1%) | 7 (9.59%) | 14 (22.6%) | 11 (34.4%) | |
| Income level (low): | | | | | | 0.348 |
| Above €1,500 | 429 (80.3%) | 308 (82.1%) | 64 (87.7%) | 46 (74.2%) | 26 (81.2%) | |
| Below €1,500 | 105 (19.7%) | 67 (17.9%) | 9 (12.3%) | 16 (25.8%) | 6 (18.8%) | |
| Income level (high): | | | | | | 0.181 |
| Above €4,000 | 85 (15.9%) | 66 (17.6%) | 15 (20.5%) | 4 (6.45%) | 4 (12.5%) | |
| Below €4,000 | 449 (84.1%) | 309 (82.4%) | 58 (79.5%) | 58 (93.5%) | 28 (87.5%) | |

## 2.1 Time taken

Table 2: (#tab:tab-time-completion-median.tex)Median time to complete the survey, by Treatment.

| Treatment | Median time | Median time (seconds) |
|---|---|---|
| No | 5.733 | 344.0 |
| Yes | 6.042 | 362.5 |

## 2.2 Vignettes assigned

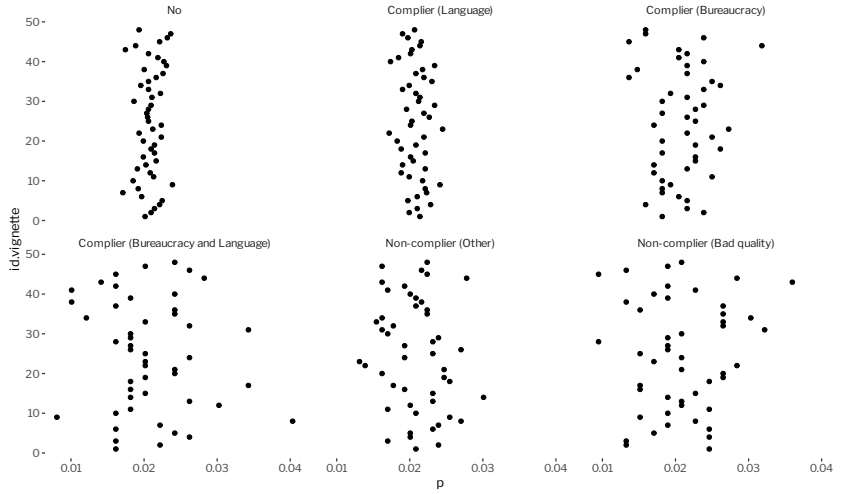


Figure 1: Distribution of vignette ids by treatment. Each unique vignette id (with up to 48 unique combinations) is shown against the proportion of individuals in each of the treatment groups that has received them. Bigger groups (the control group, which is half the sample) have less variable percentages due to its size, and each vignette is shown about two percent of the time (which corresponds to the 48 vignette combinations).

# 3 Full model results

Table 3 presents the model fit in terms of percent correcty predicted.

| Treatment | Median PCP |
|---|---|
| No | 78% |
| Yes | 79% |

Table 3: Posterior median percent correctly predicted.

The Hierarchical Bayes model estimated (see equation in Section 1.1) produces utilities for each individual (1,075) and each of the features. These are the $\beta$ parameters that have subscripts over $i$ individuals and $f$ features. The point estimates of such $\beta_{i,f}$ parameters are shown in Figure 2 in this document (Online Appendix).

The main Figures in the text come from simply taking means of the two treatment groups. The grey densities show the distribution of the average utility for untreated individuals, whereas the black line represents the distribution of the average utility for treated individuals. Hence, the average treatment effect reported in the figures is the difference between the two distributions.

For practical reasons, we can not provide a tabular form of the 1,076 * 8 = 8,608 parameters estimated, but their point estimate distribution is shown in Figure 2. In addition, the tables with the summaries of the posterior distributions of the effects are shown in Tables 4 to 6

Figure 3 in this document (Online Appendix) shows the parameters of the model reported in the article.

Table 4: Summary of the posterior distributions of the utilities. Median and standard deviations (Figure 2 in the main article).

| Feature | Treatment | Median | SD |
|---|---|---|---|
| Nationality Netherlands | No | 0.642 | 0.078 |
| Nationality Netherlands | Yes | 0.428 | 0.079 |
| Gender Female | No | 0.524 | 0.079 |
| Gender Female | Yes | 0.795 | 0.079 |
| Profession Nurse | No | 0.706 | 0.078 |
| Profession Nurse | Yes | 0.772 | 0.079 |
| Language Full | No | 1.447 | 0.080 |
| Language Full | Yes | 1.501 | 0.079 |
| Age 40 | No | 0.305 | 0.093 |
| Age 40 | Yes | 0.356 | 0.094 |
| Age 55 | No | 0.227 | 0.094 |
| Age 55 | Yes | 0.159 | 0.097 |
| First shown | No | 0.389 | 0.078 |
| First shown | Yes | 0.361 | 0.080 |

Table 5: Summary of the posterior distributions of the utilities. Median and standard deviations (Figure 3 in the main article).

| Feature | Treatment | Median | SD |
|---|---|---|---|
| Nationality Netherlands | Complier (Bureaucracy) | -0.033 | 0.193 |
| Nationality Netherlands | Complier (Language) | 0.507 | 0.101 |
| Nationality Netherlands | No | 0.642 | 0.078 |
| Nationality Netherlands | Non-complier (Bad quality) | 1.027 | 0.311 |
| Nationality Netherlands | Non-complier (Other) | 0.327 | 0.203 |
| Gender Female | Complier (Bureaucracy) | 0.737 | 0.196 |
| Gender Female | Complier (Language) | 0.858 | 0.099 |
| Gender Female | No | 0.524 | 0.079 |
| Gender Female | Non-complier (Bad quality) | 0.298 | 0.301 |
| Gender Female | Non-complier (Other) | 0.798 | 0.202 |
| Profession Nurse | Complier (Bureaucracy) | 1.234 | 0.191 |
| Profession Nurse | Complier (Language) | 0.995 | 0.102 |
| Profession Nurse | No | 0.706 | 0.078 |
| Profession Nurse | Non-complier (Bad quality) | -0.636 | 0.307 |
| Profession Nurse | Non-complier (Other) | -0.090 | 0.205 |
| Language Full | Complier (Bureaucracy) | 0.989 | 0.193 |
| Language Full | Complier (Language) | 1.710 | 0.101 |
| Language Full | No | 1.447 | 0.080 |
| Language Full | Non-complier (Bad quality) | 0.629 | 0.301 |
| Language Full | Non-complier (Other) | 1.525 | 0.202 |
| Age 40 | Complier (Bureaucracy) | 0.085 | 0.234 |
| Age 40 | Complier (Language) | 0.472 | 0.119 |
| Age 40 | No | 0.305 | 0.093 |
| Age 40 | Non-complier (Bad quality) | 0.024 | 0.369 |
| Age 40 | Non-complier (Other) | 0.273 | 0.238 |
| Age 55 | Complier (Bureaucracy) | 0.901 | 0.237 |
| Age 55 | Complier (Language) | -0.062 | 0.123 |
| Age 55 | No | 0.227 | 0.094 |
| Age 55 | Non-complier (Bad quality) | 0.325 | 0.376 |
| Age 55 | Non-complier (Other) | 0.235 | 0.250 |
| First shown | Complier (Bureaucracy) | -0.098 | 0.201 |
| First shown | Complier (Language) | 0.329 | 0.101 |
| First shown | No | 0.389 | 0.078 |
| First shown | Non-complier (Bad quality) | 0.599 | 0.314 |
| First shown | Non-complier (Other) | 0.892 | 0.207 |

Table 6: Summary of the posterior distributions of the utilities. Median and standard deviations (Figure 4 in the article).

| Feature | Treatment | Variable | Group | Median | SD |
|---|---|---|---|---|---|
| Nationality Netherlands | No | Ideology (Right) | Remaining sample | 0.552 | 0.084 |
| Nationality Netherlands | No | Ideology (Right) | Subgroup | 0.962 | 0.139 |
| Nationality Netherlands | No | Income (Low) | Remaining sample | 0.666 | 0.080 |
| Nationality Netherlands | No | Income (Low) | Subgroup | 0.414 | 0.212 |
| Nationality Netherlands | No | Migrant | Remaining sample | 0.698 | 0.082 |
| Nationality Netherlands | No | Migrant | Subgroup | 0.262 | 0.179 |
| Nationality Netherlands | No | Not favourable to immigration | Remaining sample | 0.544 | 0.100 |

| | | | | | |
|---|---|---|---|---|---|
| Nationality Netherlands | No | Not favourable to immigration | Subgroup | 0.736 | 0.099 |
| Nationality Netherlands | Yes | Ideology (Right) | Remaining sample | 0.329 | 0.085 |
| Nationality Netherlands | Yes | Ideology (Right) | Subgroup | 0.777 | 0.143 |
| Nationality Netherlands | Yes | Income (Low) | Remaining sample | 0.427 | 0.081 |
| Nationality Netherlands | Yes | Income (Low) | Subgroup | 0.439 | 0.235 |
| Nationality Netherlands | Yes | Migrant | Remaining sample | 0.474 | 0.082 |
| Nationality Netherlands | Yes | Migrant | Subgroup | 0.085 | 0.190 |
| Nationality Netherlands | Yes | Not favourable to immigration | Remaining sample | 0.149 | 0.099 |
| Nationality Netherlands | Yes | Not favourable to immigration | Subgroup | 0.714 | 0.100 |
| Gender Female | No | Ideology (Right) | Remaining sample | 0.571 | 0.085 |
| Gender Female | No | Ideology (Right) | Subgroup | 0.361 | 0.140 |
| Gender Female | No | Income (Low) | Remaining sample | 0.555 | 0.081 |
| Gender Female | No | Income (Low) | Subgroup | 0.221 | 0.212 |
| Gender Female | No | Migrant | Remaining sample | 0.558 | 0.082 |
| Gender Female | No | Migrant | Subgroup | 0.293 | 0.179 |
| Gender Female | No | Not favourable to immigration | Remaining sample | 0.463 | 0.101 |
| Gender Female | No | Not favourable to immigration | Subgroup | 0.584 | 0.100 |
| Gender Female | Yes | Ideology (Right) | Remaining sample | 0.774 | 0.086 |
| Gender Female | Yes | Ideology (Right) | Subgroup | 0.877 | 0.141 |
| Gender Female | Yes | Income (Low) | Remaining sample | 0.786 | 0.081 |
| Gender Female | Yes | Income (Low) | Subgroup | 0.931 | 0.245 |
| Gender Female | Yes | Migrant | Remaining sample | 0.825 | 0.083 |
| Gender Female | Yes | Migrant | Subgroup | 0.581 | 0.187 |
| Gender Female | Yes | Not favourable to immigration | Remaining sample | 0.870 | 0.100 |
| Gender Female | Yes | Not favourable to immigration | Subgroup | 0.721 | 0.101 |
| Profession Nurse | No | Ideology (Right) | Remaining sample | 0.676 | 0.085 |
| Profession Nurse | No | Ideology (Right) | Subgroup | 0.803 | 0.138 |
| Profession Nurse | No | Income (Low) | Remaining sample | 0.749 | 0.080 |
| Profession Nurse | No | Income (Low) | Subgroup | 0.256 | 0.211 |
| Profession Nurse | No | Migrant | Remaining sample | 0.730 | 0.082 |
| Profession Nurse | No | Migrant | Subgroup | 0.540 | 0.178 |
| Profession Nurse | No | Not favourable to immigration | Remaining sample | 0.744 | 0.100 |
| Profession Nurse | No | Not favourable to immigration | Subgroup | 0.672 | 0.100 |
| Profession Nurse | Yes | Ideology (Right) | Remaining sample | 0.778 | 0.085 |
| Profession Nurse | Yes | Ideology (Right) | Subgroup | 0.753 | 0.142 |
| Profession Nurse | Yes | Income (Low) | Remaining sample | 0.792 | 0.081 |
| Profession Nurse | Yes | Income (Low) | Subgroup | 0.509 | 0.245 |
| Profession Nurse | Yes | Migrant | Remaining sample | 0.805 | 0.082 |
| Profession Nurse | Yes | Migrant | Subgroup | 0.526 | 0.187 |
| Profession Nurse | Yes | Not favourable to immigration | Remaining sample | 0.716 | 0.100 |
| Profession Nurse | Yes | Not favourable to immigration | Subgroup | 0.827 | 0.101 |
| Language Full | No | Ideology (Right) | Remaining sample | 1.441 | 0.087 |
| Language Full | No | Ideology (Right) | Subgroup | 1.467 | 0.141 |
| Language Full | No | Income (Low) | Remaining sample | 1.408 | 0.083 |
| Language Full | No | Income (Low) | Subgroup | 1.846 | 0.214 |
| Language Full | No | Migrant | Remaining sample | 1.456 | 0.083 |
| Language Full | No | Migrant | Subgroup | 1.380 | 0.180 |
| Language Full | No | Not favourable to immigration | Remaining sample | 1.210 | 0.103 |
| Language Full | No | Not favourable to immigration | Subgroup | 1.668 | 0.101 |

| | | | | | |
|---|---|---|---|---|---|
| Language Full | Yes | Ideology (Right) | Remaining sample | 1.478 | 0.086 |
| Language Full | Yes | Ideology (Right) | Subgroup | 1.582 | 0.141 |
| Language Full | Yes | Income (Low) | Remaining sample | 1.511 | 0.081 |
| Language Full | Yes | Income (Low) | Subgroup | 1.375 | 0.241 |
| Language Full | Yes | Migrant | Remaining sample | 1.530 | 0.083 |
| Language Full | Yes | Migrant | Subgroup | 1.289 | 0.190 |
| Language Full | Yes | Not favourable to immigration | Remaining sample | 1.284 | 0.100 |
| Language Full | Yes | Not favourable to immigration | Subgroup | 1.722 | 0.104 |
| Age 40 | No | Ideology (Right) | Remaining sample | 0.253 | 0.099 |
| Age 40 | No | Ideology (Right) | Subgroup | 0.488 | 0.161 |
| Age 40 | No | Income (Low) | Remaining sample | 0.348 | 0.095 |
| Age 40 | No | Income (Low) | Subgroup | -0.136 | 0.241 |
| Age 40 | No | Migrant | Remaining sample | 0.271 | 0.096 |
| Age 40 | No | Migrant | Subgroup | 0.536 | 0.200 |
| Age 40 | No | Not favourable to immigration | Remaining sample | 0.294 | 0.116 |
| Age 40 | No | Not favourable to immigration | Subgroup | 0.316 | 0.114 |
| Age 40 | Yes | Ideology (Right) | Remaining sample | 0.322 | 0.101 |
| Age 40 | Yes | Ideology (Right) | Subgroup | 0.474 | 0.158 |
| Age 40 | Yes | Income (Low) | Remaining sample | 0.377 | 0.096 |
| Age 40 | Yes | Income (Low) | Subgroup | 0.084 | 0.265 |
| Age 40 | Yes | Migrant | Remaining sample | 0.366 | 0.098 |
| Age 40 | Yes | Migrant | Subgroup | 0.272 | 0.207 |
| Age 40 | Yes | Not favourable to immigration | Remaining sample | 0.289 | 0.116 |
| Age 40 | Yes | Not favourable to immigration | Subgroup | 0.423 | 0.116 |
| Age 55 | No | Ideology (Right) | Remaining sample | 0.180 | 0.100 |
| Age 55 | No | Ideology (Right) | Subgroup | 0.393 | 0.157 |
| Age 55 | No | Income (Low) | Remaining sample | 0.215 | 0.097 |
| Age 55 | No | Income (Low) | Subgroup | 0.344 | 0.230 |
| Age 55 | No | Migrant | Remaining sample | 0.242 | 0.097 |
| Age 55 | No | Migrant | Subgroup | 0.133 | 0.204 |
| Age 55 | No | Not favourable to immigration | Remaining sample | 0.232 | 0.117 |
| Age 55 | No | Not favourable to immigration | Subgroup | 0.223 | 0.115 |
| Age 55 | Yes | Ideology (Right) | Remaining sample | 0.179 | 0.103 |
| Age 55 | Yes | Ideology (Right) | Subgroup | 0.087 | 0.167 |
| Age 55 | Yes | Income (Low) | Remaining sample | 0.160 | 0.098 |
| Age 55 | Yes | Income (Low) | Subgroup | 0.155 | 0.272 |
| Age 55 | Yes | Migrant | Remaining sample | 0.109 | 0.100 |
| Age 55 | Yes | Migrant | Subgroup | 0.527 | 0.212 |
| Age 55 | Yes | Not favourable to immigration | Remaining sample | 0.111 | 0.117 |
| Age 55 | Yes | Not favourable to immigration | Subgroup | 0.207 | 0.120 |
| First shown | No | Ideology (Right) | Remaining sample | 0.507 | 0.086 |
| First shown | No | Ideology (Right) | Subgroup | -0.030 | 0.140 |
| First shown | No | Income (Low) | Remaining sample | 0.349 | 0.081 |
| First shown | No | Income (Low) | Subgroup | 0.791 | 0.213 |
| First shown | No | Migrant | Remaining sample | 0.373 | 0.082 |
| First shown | No | Migrant | Subgroup | 0.495 | 0.184 |
| First shown | No | Not favourable to immigration | Remaining sample | 0.529 | 0.102 |
| First shown | No | Not favourable to immigration | Subgroup | 0.257 | 0.099 |
| First shown | Yes | Ideology (Right) | Remaining sample | 0.383 | 0.086 |

| | | | | | |
|---|---|---|---|---|---|
| First shown | Yes | Ideology (Right) | Subgroup | 0.286 | 0.142 |
| First shown | Yes | Income (Low) | Remaining sample | 0.288 | 0.081 |
| First shown | Yes | Income (Low) | Subgroup | 1.313 | 0.246 |
| First shown | Yes | Migrant | Remaining sample | 0.386 | 0.083 |
| First shown | Yes | Migrant | Subgroup | 0.191 | 0.189 |
| First shown | Yes | Not favourable to immigration | Remaining sample | 0.432 | 0.100 |
| First shown | Yes | Not favourable to immigration | Subgroup | 0.289 | 0.102 |

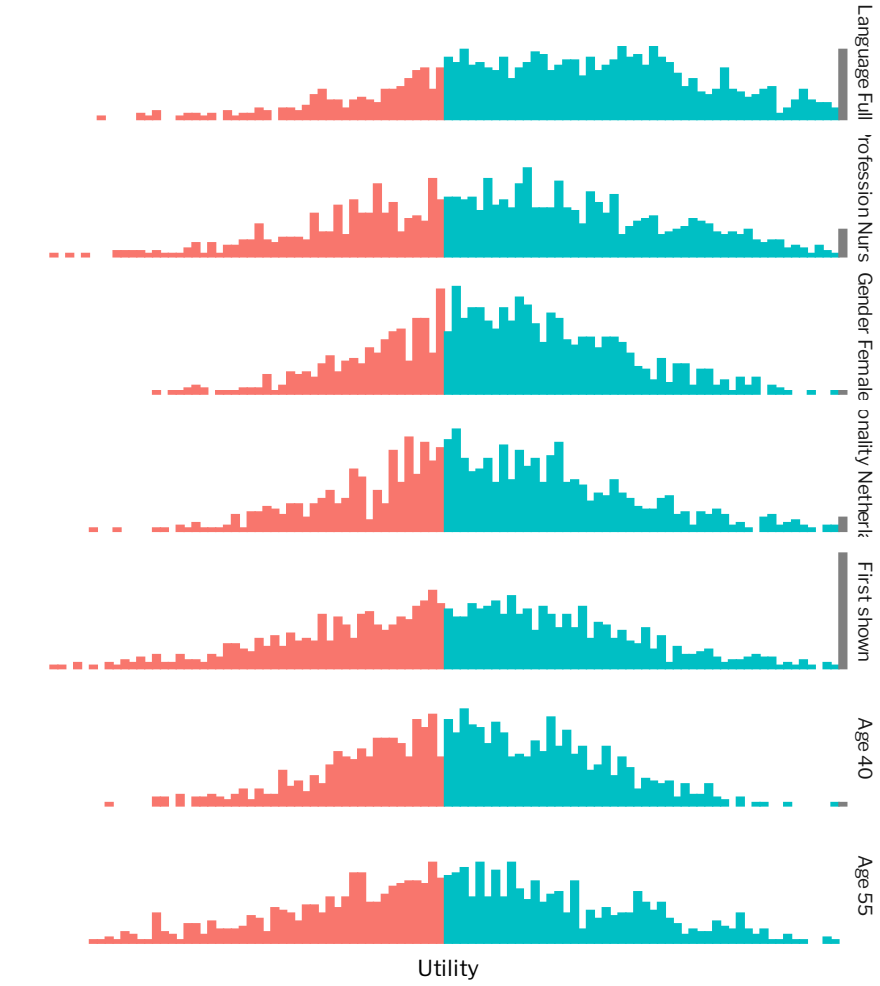


Figure 2: Individual utilities for each conjoint feature ($\beta$), as summarized by the median of the posterior distribution.

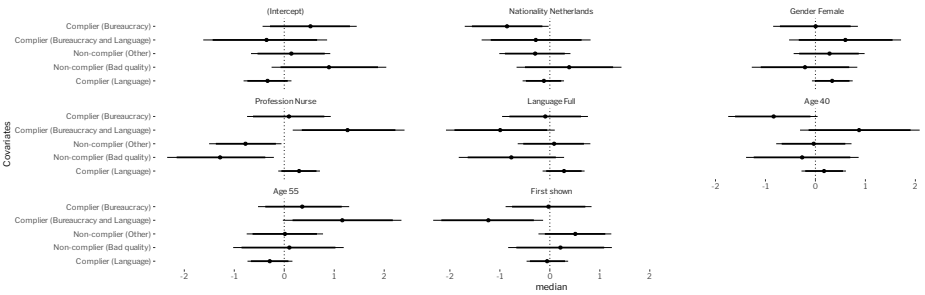


Figure 3: Posterior distributions for the model parameters that capture the differences for the sociodemographical variables ($\theta$). Dots represent the median effect, while thick and thin lines cover the 90 and 95 percent of the credibility interval of the parameter.

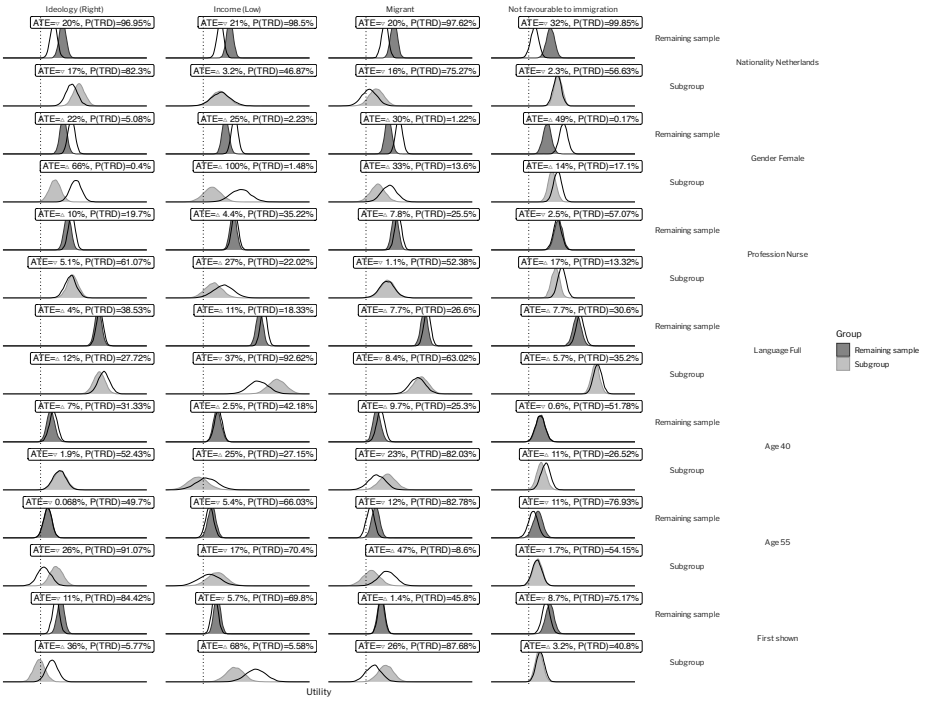


Figure 4: Average treatment effects. Comparison showing the average effect for treated individuals (curve with the line), and the effect for non-treated individuals (filled density curve). The shadows of grey compare subgroups of the population against the temaining sample (those with right ideology against the rest of individuals; those with low income against the rest of individuals, and so on). All individual features are displayed.

# 4 Robustness checks and sensitivity analysis

## 4.1 Sensitivity to priors

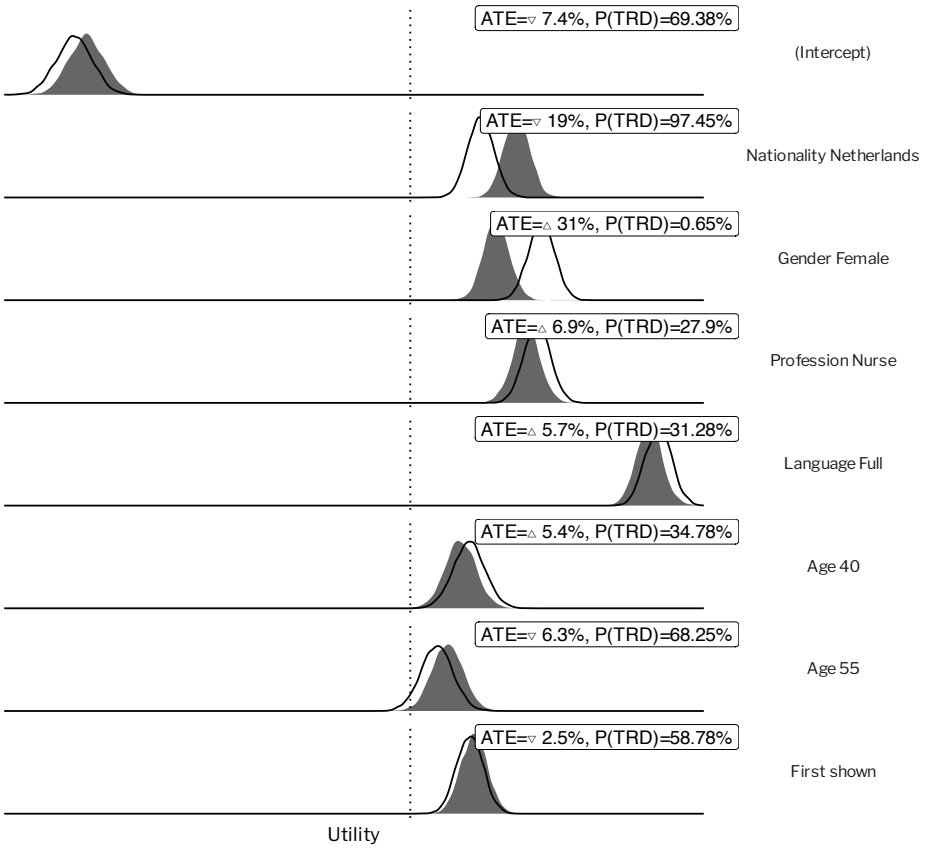


Figure 5: Average treatment effects. These results correspond to a model like the one shown in the main text, but the priors for the individual utilities are even more vague ($\sigma = 10$). Shown here for sensitivity.

## 4.2 Low quality individuals - Quick replies

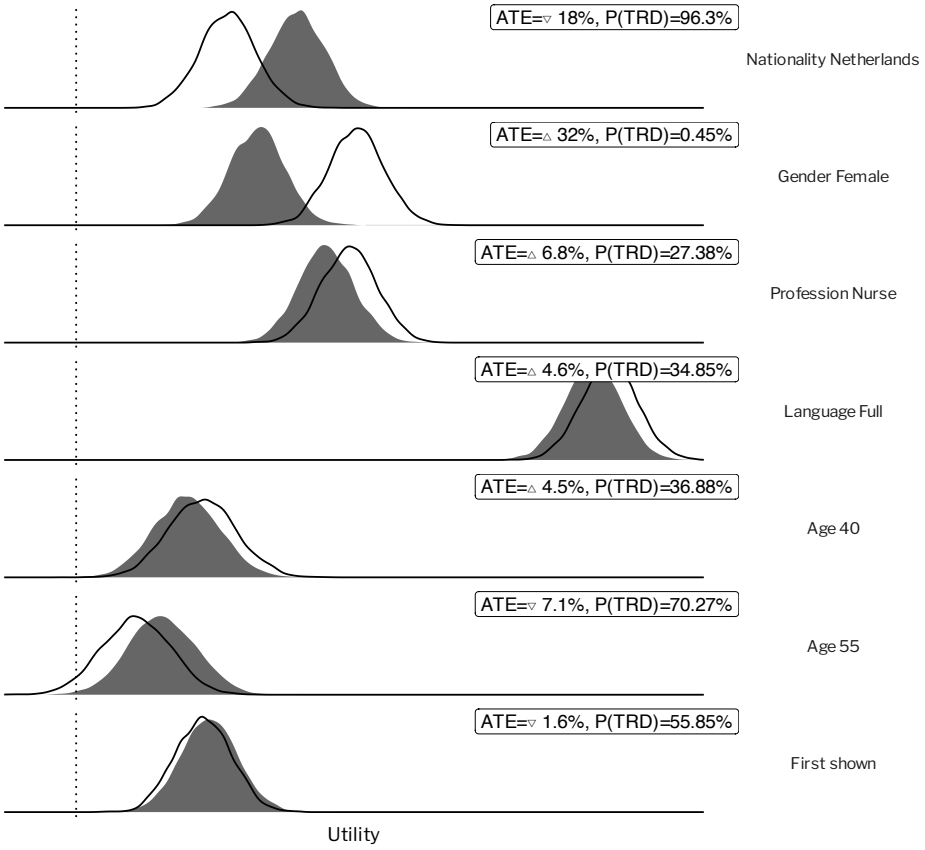


Figure 6: Average treatment effects. These results correspond to a model like the one shown in the main text, but without individuals that take the survey very quick (below 2 standard deviations of the geometric mean).

## 4.3 Low quality individuals - Same profile order

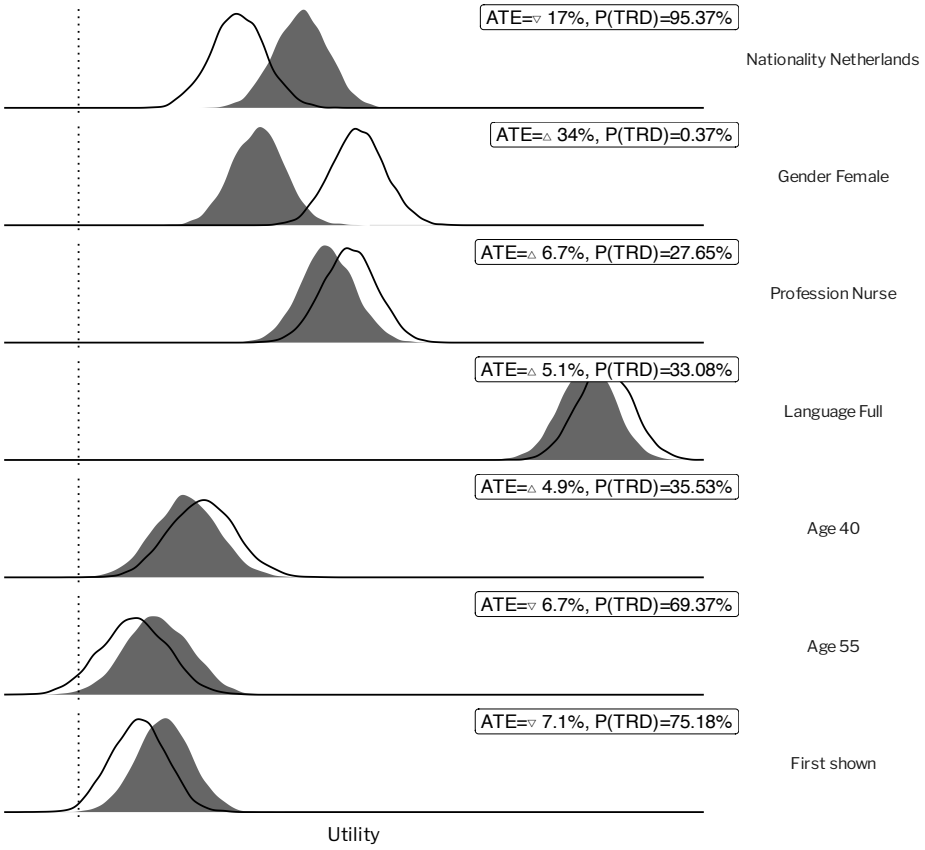


Figure 7: Average treatment effects. These results correspond to a model like the one shown in the main text, but without individuals that always respond to the same profile (first or second) throughout the survey.

## 4.4 Compliance

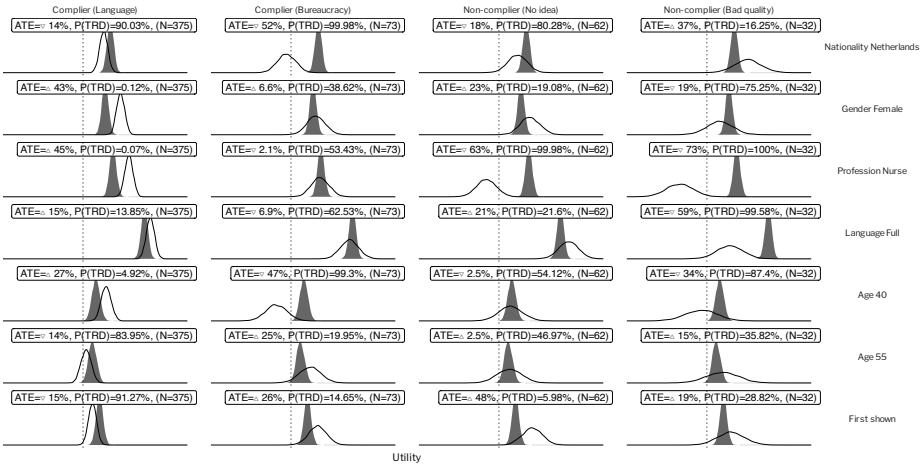


Figure 8: Average treatment effects. All details about compliers (as shown in the main text), as well as non-compliers, divided between those who reply that they have no idea, and those who provide an erratic text.

## 4.5 NLP coding of open responses

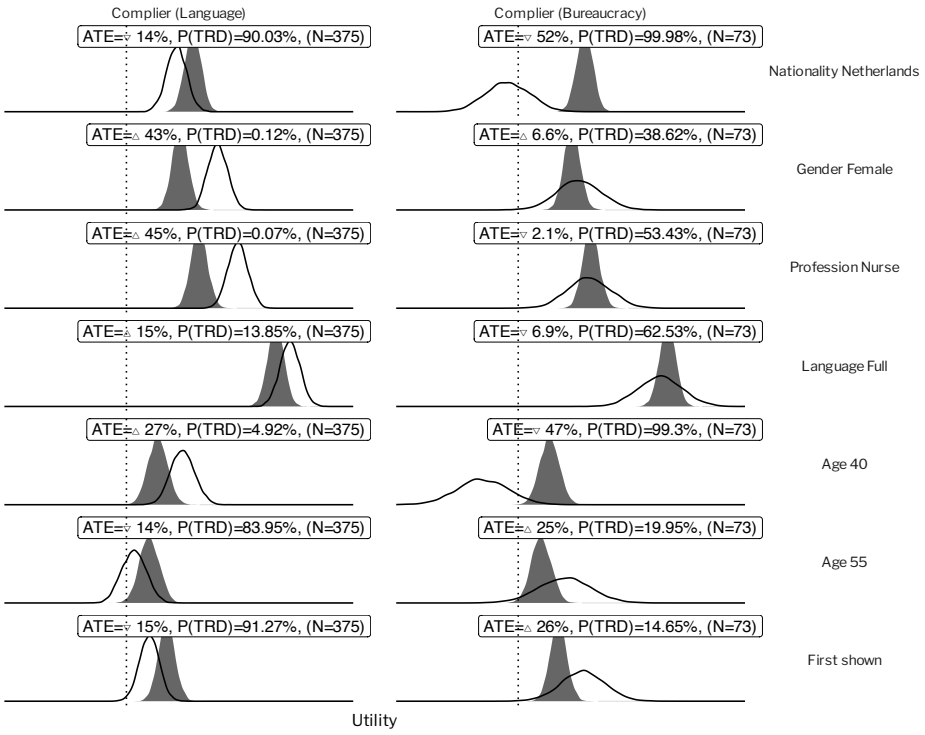


Figure 9: Average treatment effects. Same as Figure 2 in the main text, but with natural language processing for coding the compliance group.

# 5 Certainty of the response

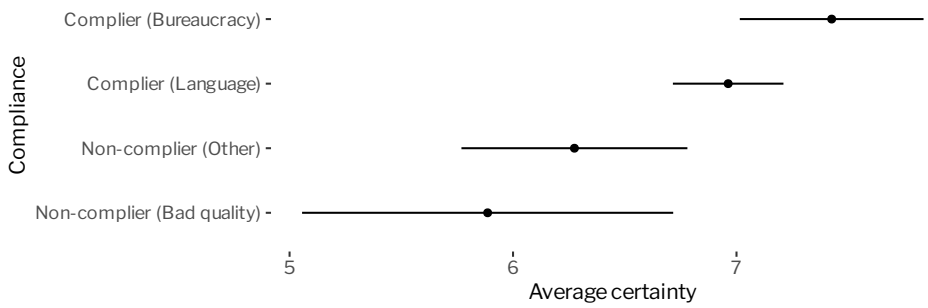


Figure 10: Average certainty (and confidence interval) by treatment / compliance.

| Treatment | Mean | low | high |
|---|---|---|---|
| Non-complier (Bad quality) | 5.89 | 5.06 | 6.72 |
| Non-complier (Other) | 6.27 | 5.77 | 6.78 |
| Complier (Language) | 6.96 | 6.72 | 7.21 |
| No | 7.28 | 7.10 | 7.45 |
| Complier (Bureaucracy) | 7.43 | 7.01 | 7.84 |

Table 7: Average certainty of each respondent, by treatment and compliance.

# 6 Convergence tests

This section includes Bayesian convergence tests for the prioritizations, the main parameters of interest ($\beta$). The rest of the parameters can be provided by request.

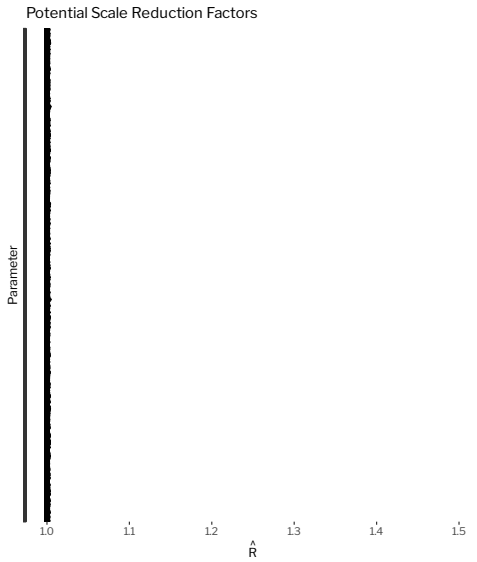


Figure 11: Potential Scale Reduction Factor ($\hat{R}$).

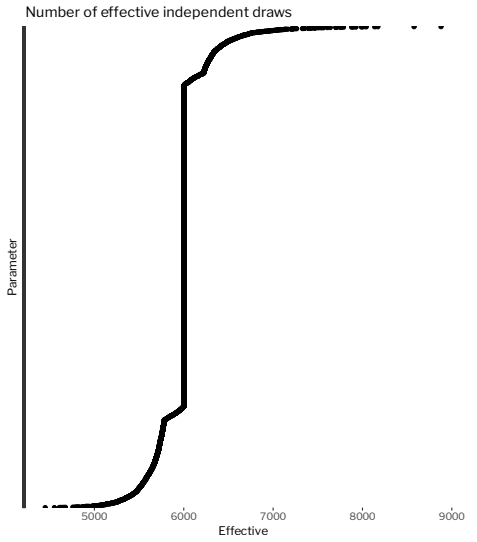


Figure 12: Number of effective parameters ($\hat{R}$).