Assessing US Personality Structure and Cross Cultural Comparisons

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Abstract

Several studies have supported the replicability of the Big 5 model across cultures, languages and populations. First, this study looks at the factor structure of personality in a karge US sample. A parallel analysis suggested extracting 7 factors which were further subjected to a principal components analysis. Factors structures emerging from varimax and oblimin rotations were examined. Second, this study compared personality differences across gender (male vs. female) and regions (Great Britain vs. India) Two separate Between-Subjects ANOVAs were run to examine regional and gender differences in extraversion (Model 1) and in openness to experience (Model 2).

Keywords: Big 5, personality, parallel analysis, varimax, oblimin, cultural differences, gender differences

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Introduction

The Five Factor Model of personality structure (FFM) proposes that personality can be divided into five unique facets: Extraversion, Openness to Experience, Agreeableness, Conscientiousness, and Neuroticism. Typically, the Big Five Personality Inventory (BFI; **???**) has garnered support due to a strict extraction of these five factors. However, this has limited the scope of how personality has been understood across cultures. There is a need to understand the emic structures over imposing etic structures on datasets. We need to focus on how we could add a more stringent way of unearthing personality models. A more robust model would be the one that emerges through emic methods rather than etic methods. Using a large, open-source dataset, we will investigate whether the FFM remains true for U.S. participants. As an exploratory analysis, there is no prediction as to the number of factors that may emerge.

The comparison of personality factors between genders and countries is important to our understanding of general human variation (**???**). The trait of openness to experience (OE) reflects imagination, creativity, intellectual curiosity, and an appreciation for new, complex, aesthetic experiences (**???**). Gender comparisons on this trait are mixed world-wide. As an overall factor, very few gender differences are found (baer2008; **???**; **???**). It is only when this factor is broken down into sub-categories that gender differences emerge. For example, men tend to score higher on openness to ideas, while women have been found to score higher than men on openness to aesthetics and feelings (**???**; **???**). Further, the extent of gender differences in openness differs by country, with larger differences found in countries with more traditional male and female gender roles, such as in eastern cultures (**???**). Therefore, comparing personality differences by gender and country can identify important cultural distinctions on typical gender stereotypes.

This study investigated gender differences by country, comparing Great Britain

(including England, Whales, and Scotland, but not Northern Ireland) to India. These countries are compared because they are represented in roughly even numbers in this dataset, and because of their cultural differences in gender stereotypes. Great Britain has had more open and accepting views of gender roles over a longer period of time compared to more conservative, traditional stereotypes upheld in many Indian cultures until relatively recently (**???**). Thus, we predict a main effect of country such that Great Britain will display higher overall openness scores compared to India. Given mixed findings on gender differences (**???**) no prediction was made for a main effect of gender on openness. Finally, it was predicted that gender differences will emerge in Great Britain, but not in India, with men scoring higher than women in Great Britain on this trait. Due to the more relaxed attitudes towards gender role conformity in Great Britain, it is likely that men are more comfortable reporting openness traits of creativity, intellectual curiosity, and an appreciation for aesthetics in Great Britain, while Indian men are more likely to conform to traditionalist views.

Methods

Procedure

The dataset for the analysis was obtained from the Open-Source Psychometrics Project repository:Open Source Psychometric project.It contains data on the Big 5 personality variables ($Extraversion, Neuroticism, Agreeableness, Conscientiousness, OpennesstoExperience$) and demographics ($race, age, gender, country$). 6761 participants voluntarily responded to the questionnaires. We retained participants between the ages of 18 and 80 based on the strogheld assumption that personality develops at the age of 18. For the principal components analysis, only participants from United states of America were used. Participants (*Females* = 4473, *Males*= 2288) in this study were between the ages, as

mentioned previously, of 18 and 80 ($M = 30.07$, $SD = 12.77$). For the country and gender comparisons, we included participants from either Great Britain or India who identified as either male or female.

Data analysis

We used R (Version 4.0.2; R Core Team, 2019) and the R-packages *dbplyr* (Version 2.0.0; Wickham & Ruiz, 2019), *devtools* (Version 2.3.2; Wickham et al., 2020b), *dplyr* (Version 1.0.2; Wickham et al., 2020a), *forcats* (Version 0.5.0; Wickham, 2019a), *gapminder* (Bryan, 2017), *ggplot2* (Version 3.3.2; Wickham, 2016), *ggpubr* (Version 0.4.0; Kassambara, 2020a), *GPArotation* (Version 2014.11.1; Bernaards & I.Jennrich, 2005), *here* (Version 0.1; Müller, 2017), *janitor* (Version 2.0.1; Firke, 2020), *kableExtra* (Version 1.3.1; Zhu, 2020), *knitr* (Version 1.30; Xie, 2015), *MASS* (Version 7.3.53; Venables & Ripley, 2002), *papaja* (Version 0.1.0.9997; Aust & Barth, 2020), *paran* (Version 1.5.2; Dinno, 2018), *psych* (Version 2.0.9; Revelle, 2020), *purrr* (Version 0.3.4; Henry & Wickham, 2020), *readr* (Version 1.4.0; Wickham, Hester, & Francois, 2018), *rio* (Version 0.5.16; Chan, Chan, Leeper, & Becker, 2018), *rstatix* (Version 0.6.0; Kassambara, 2020b), *scales* (Version 1.1.1; Wickham & Seidel, 2019), *stringr* (Version 1.4.0; Wickham, 2019b), *tibble* (Version 3.0.4; Müller & Wickham, 2020), *tidyr* (Version 1.1.2; Wickham, 2020), *tidyverse* (Version 1.3.0; Wickham, Averick, et al., 2019), *tinytex* (Version 0.27; Xie, 2019), and *usethis* (Version 1.6.3; Wickham & Bryan, 2020) for all our analyses. Items were reverse scored if needed and total scores were obtained on the Big 5 variables for every participant. We obtained descriptive statistics for all the Big five variables. We used Principal components analysis to study the factor structure of the present data. Parallel analysis was computed to determine the number of factors to be extracted. These factors were further rotated using varimax and oblimin rotations.

Then, we gathered data only from Great Britain and Indian participants who identified as either male or female, and were between the ages of 18 and 80. A 2x2

between-subjects ANOVA was used to analyze main effects and interactions on openness scores for both country (Great Britain vs. India) and gender (Male vs. Female).

```
##
## Note: parallel analysis suggests 7 components.
```

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## Warning: `fun.y` is deprecated. Use `fun` instead.
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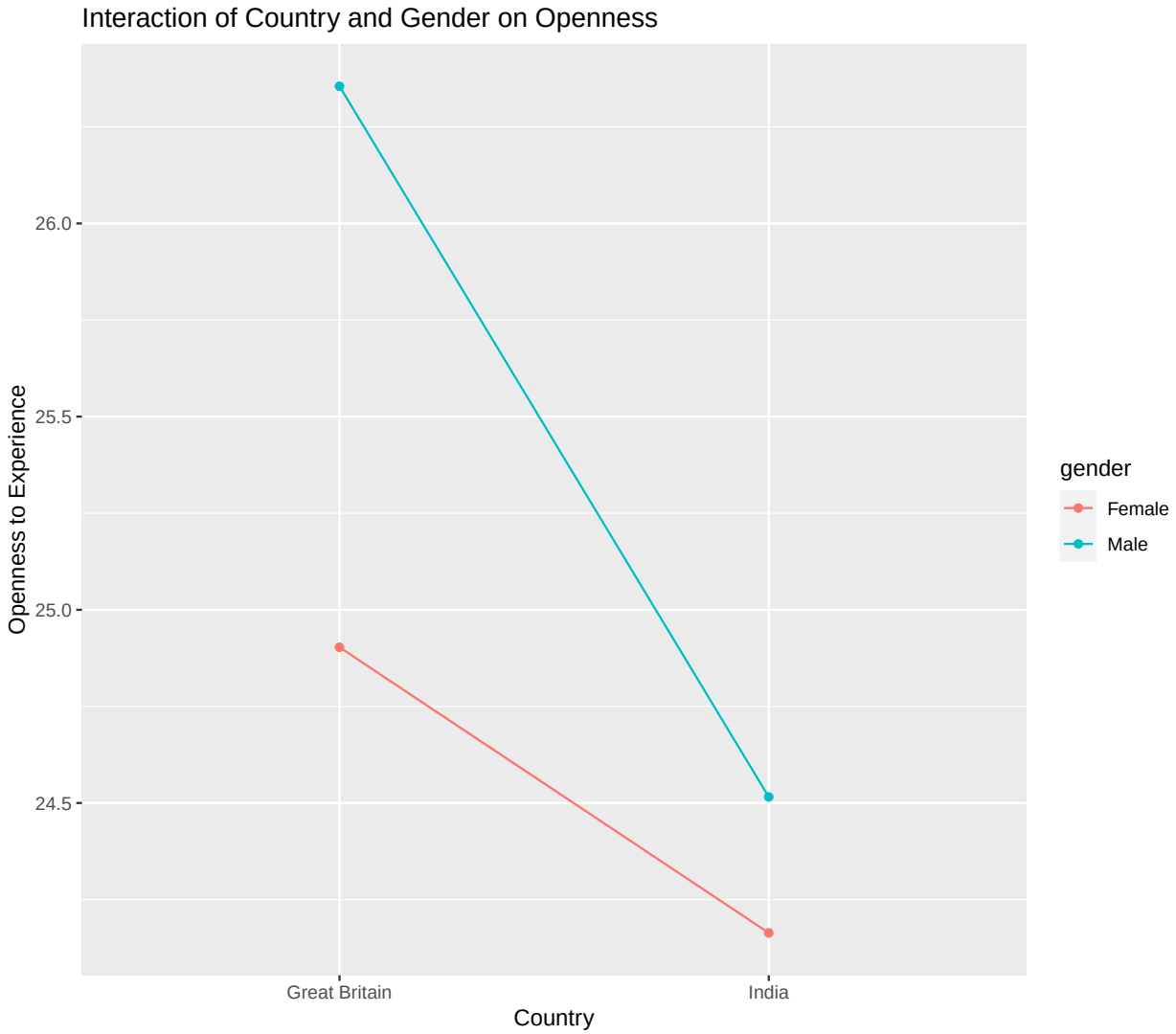
```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```



Results Table 1 displays a summary of differences between males and females and

Chronbach's alpha value for all Big 5 variables. There is a significant difference in all the variables for males and females except for Extraversion in this sample. We took a closer look at the error bars to see if there is any overlap. Figure 1 indicates a very high overlap for genders across Big 5 variables with an almost exact range for Extraversion. This indicates that there is not much difference in the levels of Big 5 in males and females in this sample. All the alpha values seem reasonably acceptable except for a low value for Openness.

Parallel analysis (Horn's method) suggested 7 factors to be retained as seen in Figure 2. The seven factor solution was rotated using varimax and oblimin rotations. An examination of loadings matrix for varimax rotation Table 2 and structure matrix for oblimin rotation Table 3 indicate a clear emergence of the first three factors -Extraversion, Neuroticism, Agreeableness - indicating the respective items with highest loading on those factors. The last two factors - Conscientiousness and Openness - tend to split into multiple factors.

A 2x2 (Country: Great Britain vs. India; Gender: Male vs. Female) between-subjects ANOVA was run to analyze a main effect of country, a main effect of gender, and an interaction between the two on the personality trait openness. It was hypothesized first, that there would be a main effect of country where Great Britain would show higher openness scores compared to India. Second, we predicted an interaction where males would score higher than females on trait openness in Great Britain, but not in India. There was no prediction for overall gender differences in openness. See
Table @ref(tab:anova_summary_table) for a summary of openness means and standard deviations by country and gender.

Results found a main effect of country () such that participants from Great Britain (—-) showed higher levels of openness compared to India (–). An overall main effect of gender was discovered (), finding that Males (–) scored higher than females (M–). See

Figure 3 and Figure 4 for graphical representations of group means. Finally, there was a significant interaction between country and gender (—). Males in Great Britain showed the highest levels of openness (—-), and gender differences were more pronounced in Great Britain compared to India (see Figure @ref(fig:interaction_plot)).

Discussion

Althought the t-test indicated significant differences overlaps seen in the errorbars indicate that no main differences can be seen in the plots. Openness and conscientiousness split into more factors which indicate a rather interesting groupings of variables into factors for this data. One could further look at inter item consistency values for these groups of 7 factors for the data.

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Footnotes

Table 1

Summary statistics

variables	Female	Male	t	p	alpha
A	40.96	37.21	20.40	0.00	0.85
C	35.19	34.46	3.87	0.00	0.83
E	30.10	29.82	1.44	0.15	0.81
N	33.70	30.41	13.32	0.00	0.89
O	25.17	26.41	-14.19	0.00	0.49

Note. E = Extraversion, N = Neuroticism, A = Agreeableness, C = Conscientiousness, O = Openness/Intellect, t = t statistic value, p =p values for corresponding t values, a = Chronbach's alpha

Table 2

Varimax rotation loadings matrix

Items	RC1	RC2	RC4	RC3	RC5	RC7	RC6
E4r	0.81	-0.11	0.07	0.06	-0.03	-0.02	0.09
E5	0.77	-0.08	0.23	0.07	0.08	0.02	-0.07
E2	-0.76	-0.03	-0.12	-0.01	-0.01	0.05	-0.09
E7	0.76	-0.12	0.17	0.03	0.01	0.04	-0.12
E10r	0.75	-0.16	0.07	0.04	-0.02	-0.02	0.10
E1	0.74	-0.05	0.05	0.00	0.03	0.09	-0.19
E9	0.71	-0.06	-0.03	-0.04	0.09	0.12	-0.07
E3	0.68	-0.28	0.25	0.11	0.05	-0.01	-0.15
E6r	0.66	-0.05	0.16	0.04	0.15	0.04	0.23
E8r	0.65	-0.02	-0.07	-0.08	-0.03	0.07	0.09
N6	-0.06	0.79	0.01	-0.08	-0.07	-0.01	-0.10
N8	-0.02	0.77	-0.07	-0.14	-0.05	0.10	-0.08
N1	-0.09	0.76	0.09	-0.01	-0.06	-0.09	0.04
N9	-0.05	0.74	-0.19	-0.04	0.02	-0.02	-0.13
N7	-0.01	0.74	-0.07	-0.15	-0.03	0.11	-0.10
N3	-0.13	0.69	0.17	0.04	0.03	-0.06	-0.01
N10	-0.27	0.68	-0.05	-0.17	-0.01	0.03	0.14
N2r	-0.05	0.64	-0.04	0.06	-0.08	-0.18	0.34
N5	-0.07	0.60	-0.02	-0.07	-0.13	0.01	-0.20
N4r	-0.20	0.53	0.01	-0.13	-0.06	0.01	0.29
A4	0.02	0.04	0.82	0.03	0.00	0.05	-0.04
A9	0.08	0.09	0.75	0.04	0.04	0.10	-0.09
A5r	0.14	0.01	0.71	0.00	-0.02	-0.03	0.18
A6	-0.02	0.12	0.69	0.01	-0.09	0.07	-0.17
A7r	0.32	-0.08	0.68	0.00	-0.02	0.00	0.17
A8	0.12	-0.06	0.67	0.09	0.08	0.02	-0.12
A2	0.36	-0.07	0.59	-0.03	0.08	0.02	0.01
A1r	0.05	0.00	0.56	0.03	-0.01	-0.08	0.32
A3r	-0.13	-0.25	0.46	0.22	-0.13	0.00	0.15
A10	0.35	-0.20	0.45	0.10	0.14	0.11	-0.24
C6r	0.02	-0.15	-0.02	0.73	-0.15	0.04	0.16
C5	0.08	-0.09	0.06	0.72	-0.03	0.02	-0.12
C2r	-0.03	-0.09	-0.07	0.71	-0.25	0.09	0.12
C9	0.06	0.04	0.09	0.65	0.12	-0.10	-0.16
C7	-0.05	0.10	0.03	0.65	0.17	-0.07	-0.11
C4r	0.07	-0.35	0.05	0.64	-0.04	0.01	0.10
C1	0.00	-0.09	0.00	0.61	0.31	-0.08	-0.10
C8r	0.08	-0.20	0.15	0.52	0.13	-0.07	0.20
C3	-0.06	-0.01	0.08	0.43	0.42	0.05	-0.10
O7	0.07	-0.16	0.00	0.07	0.70	0.06	0.05
O1	0.05	-0.03	-0.04	-0.05	0.62	0.12	0.27
O5	0.22	-0.08	-0.03	0.09	0.52	0.39	-0.05
C10	-0.01	-0.01	0.04	0.45	0.50	-0.05	-0.10
O6	-0.11	0.05	-0.09	0.02	-0.09	-0.81	-0.13
O3	0.06	0.09	0.07	-0.10	0.17	0.80	0.02
O4r	0.03	-0.09	0.10	-0.10	0.30	0.37	0.53
O2r	0.05	-0.20	-0.01	-0.05	0.46	0.30	0.52

Note. E = Extraversion, N = Neuroticism, A = Agreeableness, C = Conscientiousness, O = Openness/Intellect

Table 3

Oblimin rotation loadings matrix

Items	TC1	TC2	TC4	TC3	TC5	TC7	TC6
E4r	0.81	-0.20	0.16	0.07	0.04	0.05	0.05
E5	0.79	-0.18	0.32	0.08	0.16	0.10	-0.09
E7	0.78	-0.21	0.26	0.04	0.08	0.11	-0.15
E2	-0.76	0.06	-0.20	-0.02	-0.06	-0.03	-0.05
E10r	0.76	-0.24	0.15	0.07	0.04	0.05	0.07
E1	0.74	-0.13	0.13	-0.01	0.09	0.15	-0.22
E3	0.72	-0.37	0.34	0.14	0.14	0.05	-0.16
E9	0.71	-0.14	0.05	-0.05	0.13	0.20	-0.08
E6r	0.69	-0.14	0.23	0.05	0.19	0.14	0.21
E8r	0.64	-0.08	0.00	-0.08	-0.01	0.13	0.06
N6	-0.13	0.80	-0.02	-0.17	-0.11	-0.04	-0.14
N8	-0.10	0.78	-0.10	-0.23	-0.11	0.08	-0.11
N1	-0.16	0.76	0.06	-0.09	-0.10	-0.12	0.00
N9	-0.14	0.75	-0.22	-0.14	-0.02	-0.04	-0.16
N7	-0.09	0.75	-0.10	-0.24	-0.09	0.10	-0.13
N10	-0.34	0.71	-0.10	-0.24	-0.11	0.01	0.13
N3	-0.17	0.69	0.14	-0.03	0.01	-0.09	-0.03
N2r	-0.11	0.65	-0.05	0.01	-0.12	-0.21	0.28
N5	-0.14	0.62	-0.05	-0.14	-0.16	-0.03	-0.23
N4r	-0.25	0.55	-0.03	-0.16	-0.15	0.00	0.27
A4	0.10	0.01	0.82	0.06	0.03	0.05	-0.01
A9	0.14	0.05	0.76	0.06	0.08	0.10	-0.06
A5r	0.20	-0.03	0.72	0.04	-0.01	0.00	0.20
A7r	0.39	-0.13	0.71	0.05	0.00	0.04	0.18
A6	0.03	0.10	0.68	0.03	-0.06	0.05	-0.16
A8	0.19	-0.10	0.68	0.11	0.14	0.03	-0.10
A2	0.42	-0.13	0.62	-0.01	0.10	0.08	0.03
A1r	0.11	-0.02	0.57	0.07	-0.01	-0.06	0.33
A10	0.41	-0.26	0.49	0.12	0.22	0.14	-0.22
A3r	-0.07	-0.26	0.46	0.28	-0.06	-0.05	0.14
C6r	0.03	-0.19	0.04	0.76	0.06	-0.08	0.07
C2r	-0.03	-0.12	-0.01	0.74	-0.04	-0.06	0.02
C5	0.09	-0.14	0.12	0.72	0.19	-0.09	-0.19
C4r	0.11	-0.40	0.11	0.68	0.16	-0.07	0.04
C9	0.07	-0.01	0.14	0.62	0.32	-0.17	-0.21
C7	-0.04	0.05	0.07	0.61	0.35	-0.14	-0.16
C1	0.02	-0.15	0.05	0.58	0.48	-0.11	-0.11
C8r	0.12	-0.25	0.20	0.54	0.26	-0.10	0.17
O7	0.12	-0.21	0.01	0.03	0.70	0.19	0.14
C10	0.02	-0.06	0.07	0.39	0.61	-0.02	-0.08
O1	0.08	-0.06	-0.03	-0.10	0.56	0.26	0.34
O5	0.25	-0.14	0.00	0.04	0.56	0.48	0.00
C3	-0.03	-0.05	0.10	0.38	0.53	0.05	-0.08
O3	0.08	0.06	0.07	-0.13	0.16	0.83	0.05
O6	-0.15	0.08	-0.11	0.01	-0.11	-0.82	-0.14
O2r	0.11	-0.23	0.00	-0.05	0.40	0.42	0.58
O4r	0.07	-0.12	0.10	-0.09	0.23	0.45	0.58

Note. E = Extraversion, N = Neuroticism, A = Agreeableness, C = Conscientiousness, O = Openness/Intellect

Table 4

Summary Table for Openness Scores by Country and Gender

country	gender	mean_o	sd_o
GB	Female	24.90	3.36
GB	Male	26.35	3.32
IN	Female	24.16	3.59
IN	Male	24.52	3.58

Note. GB = Great Britain, IN = India

Table 5

ANOVA table for Openness by Country and Gender

Effect	F	df_1	df_2	MSE	p	$\hat{\eta}_p^2$
Country	63.84	1	2,444	12.07	$< .001$	.025
Gender	36.03	1	2,444	12.07	$< .001$	.015
Country × Gender	14.70	1	2,444	12.07	$< .001$	.006

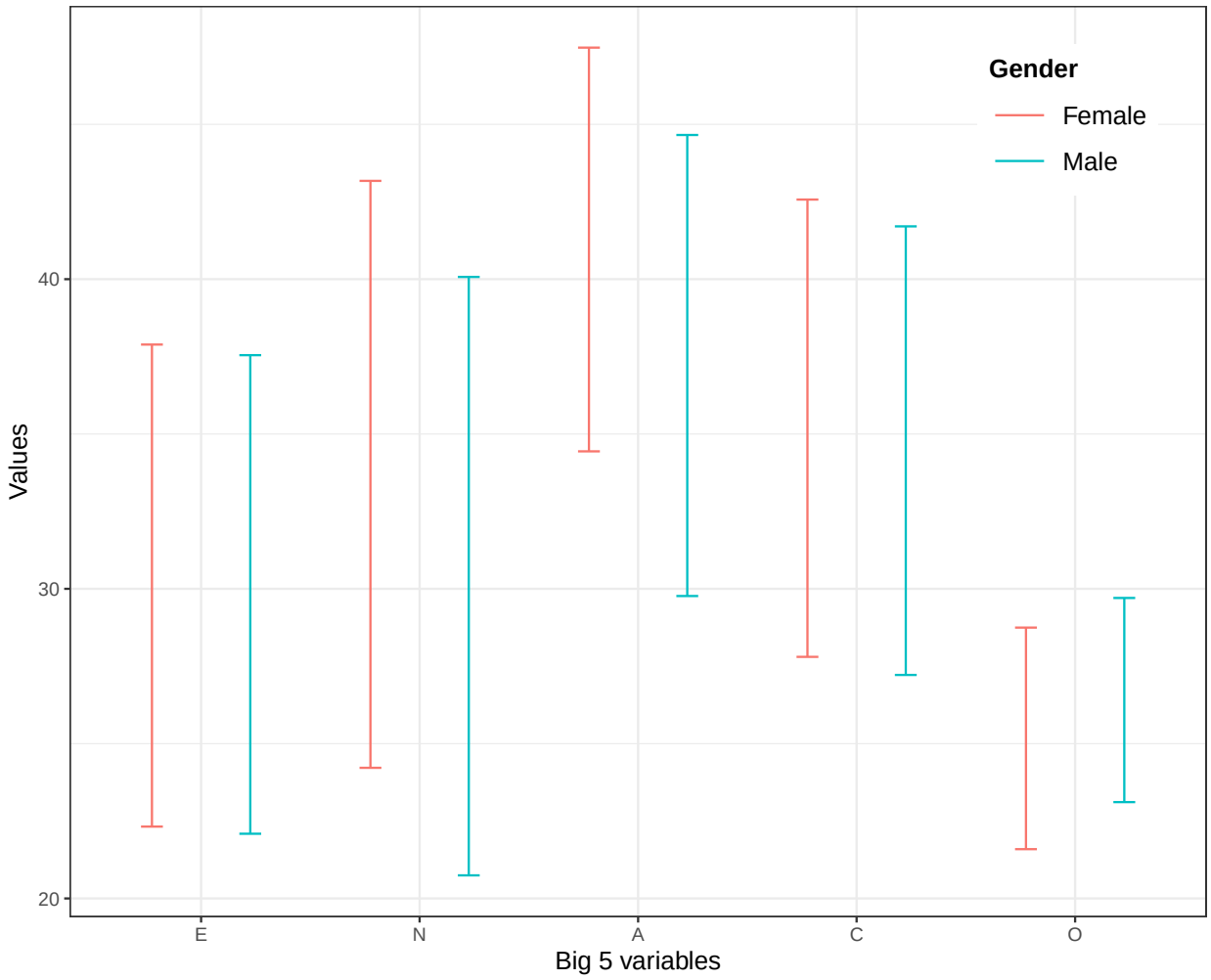

Figure 1. Difference between Males and Females on Big 5 variables

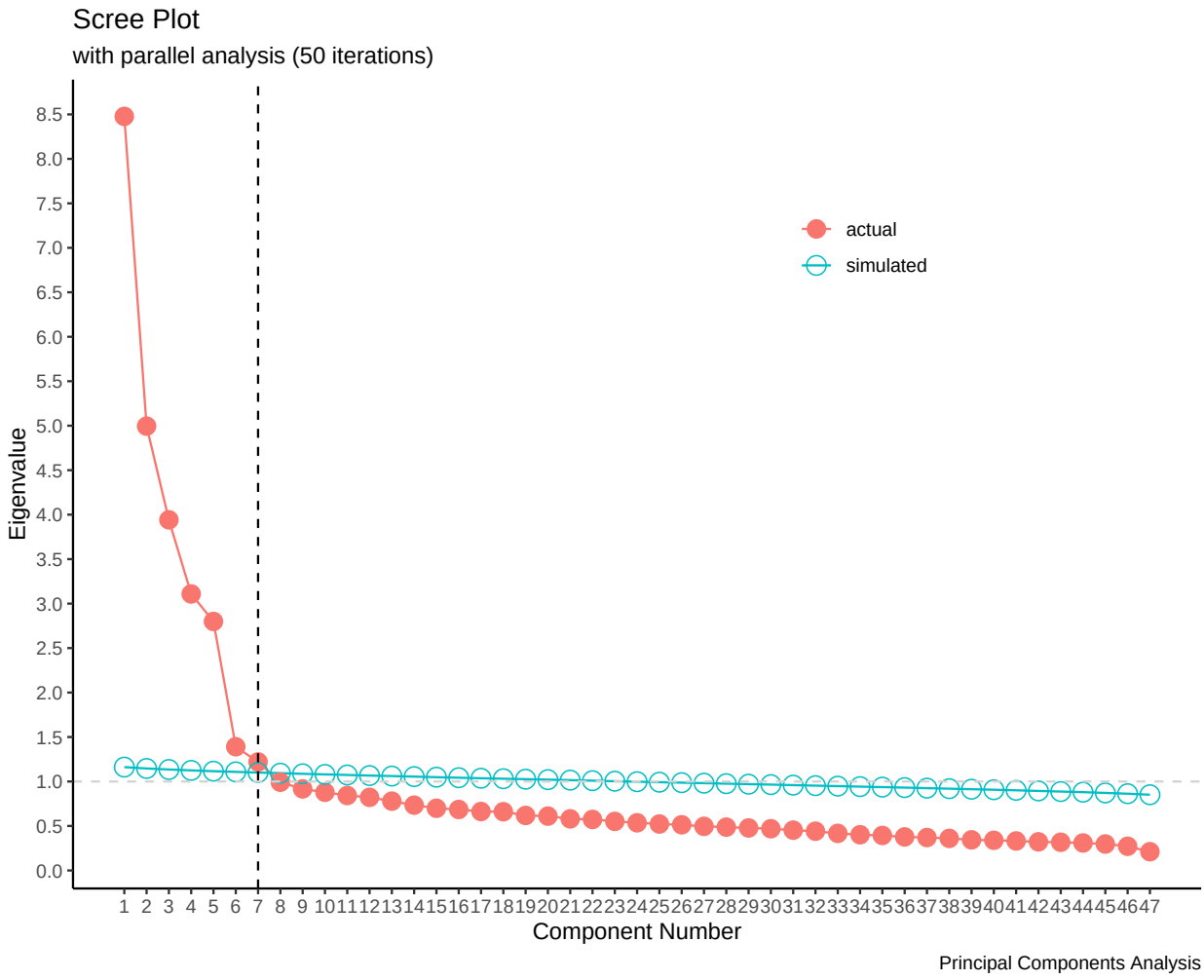

Figure 2. Parallel analysis

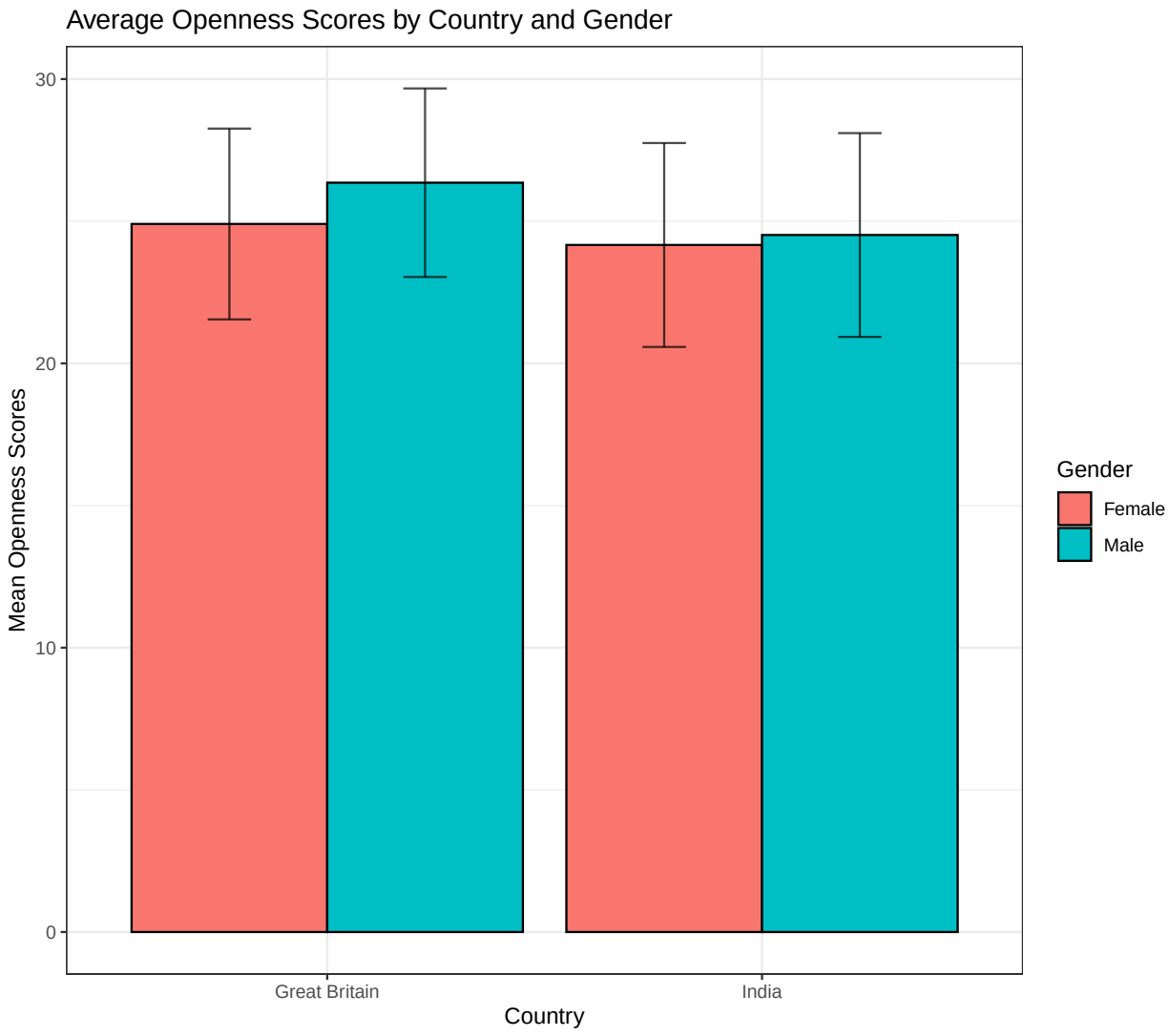

Figure 3. Average Openness Scores by Country and Gender

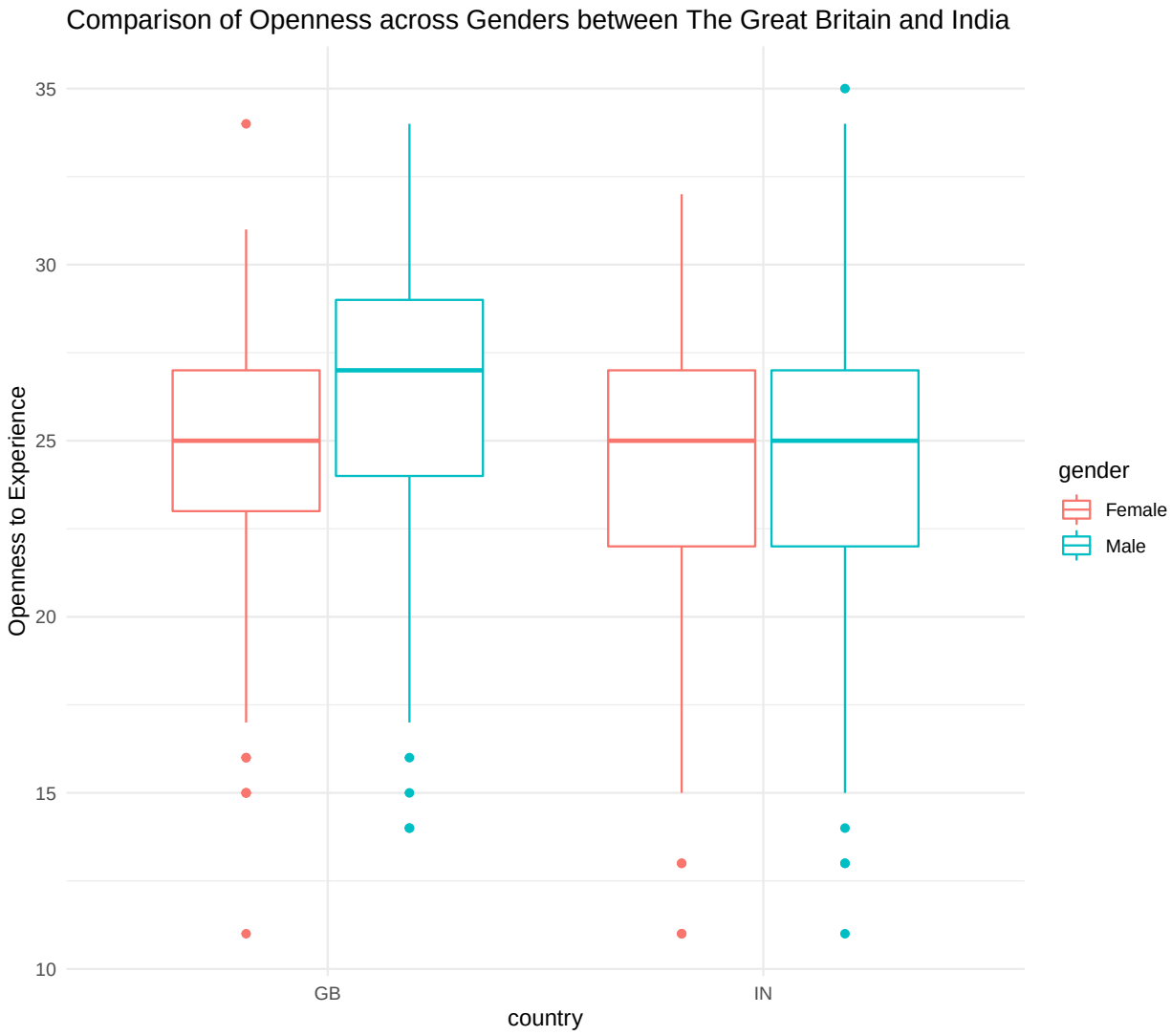

Figure 4. Boxplot of Openness Scores by Country and Gender