**Measuring Trust in Maps: development and evaluation of the MAPTRUST scale**

Data Analysis Reproduction Steps:

**To Analyze Demographic Data:**

1. Open up “EFA\_Demographics\_Data” or “CFA\_Demographics\_Data” excel files (Located in “CFA” -> “CFA Data” or “EFA”
2. Use existing filters (dropdowns) on headers to filter the data per category (e.g., gender: male)
3. Click and drag over all records to determine the number of people in a particular category.
4. Use “average” and “standard deviation” functions to determine more descriptive statistics about the age of participants.

**To Analyze EFA Data:**

1. Open excel file “EFA\_Factor\_Analysis\_Data” (Located in folder “EFA”) in SPSS, R, or other analysis software.
   1. We used SPSS, so refer to SPSS file “EFA\_Factor\_Analysis.sav” in “EFA” folder
2. Click the top tab “***Analyze” -> “Dimension reduction” -> “factor***.”
3. Add all the variables except for “Map”, “ID”, and “Duration”
4. Under “Descriptives”, check coefficients, significance levels, and KMO and Bartlett’s test of sphericity

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1. Under ***“Extraction”*** choose ***“Principal axis factoring”,*** check “***Scree plot”***

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1. Under “***Rotation***” select ‘***Promax***”

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1. Under “***Options***” select suppress small coefficients

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1. Output is the same as “Promax\_round\_1.docx” (In “EFA” folder)
2. Check KMO and Bartlett's Test, which is OK.
3. Look at “*Total Variance Explained”* table; add values under *“Extraction Sums of squared Loadings”* to Table 3.
4. Look at *Scree Plot*, Figure 2.
5. Based on steps 10 and 11, determine that only factor 1 likely should be kept.
6. Examine *Pattern Matrix* to look at whether indicators have loadings above or below 0.6. Also use this matrix to determine which indicators fall into which factor. Insignificant loadings are not shown, and if an indicator loads on two factors, the larger value is which factor we assigned to it. (E.g., complete has a value of .61 in factor 1, but .270 on factor 2, so it is assigned to factor 1).
7. Run ***Parallel Analysis*** using “[Monte Carlo PCA for Parallel Analysis](https://edpsychassociates.com/Watkins3.html)” program
   1. Choose 24 as number of variables, 295 as number of subjects, and 100 as number of replications
      1. Note that the values may differ slightly because the replications can be different

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1. Use the “Random Eigenvalue” for eigenvalue #s 1-3 for Table 3, row 2.
   1. (Output is “***Monte Carlo PCA.pdf***” in “EFA” folder) (Same as image above)
2. Compare the Random Eigenvalues to the extracted ones. Since only factor 1 has a larger extracted eigenvalue, then it is the only factor that should be retained.
3. Rerun the Factor analysis (steps 1-7), but on step 3. ONLY add variables from factor one that had loadings above 0.6 (accurate, correct, error-free, honest, trustworthy, credible, fair, reliable, reputable, objective, authentic, and balanced).
4. Output is the same as “Promax\_round\_2.docx” (In “EFA” folder)
5. Check KMO and Bartlett's Test, which is OK.
6. Look at “*Total Variance Explained*” table to determine how much variance is explained by the revised model.
7. Examine Factor Matrix to look at whether indicators have loadings above or below 0.6. All are kept since they are all above 0.6.

**To Analyze Stimuli Pretest**

1. Open “Stimuli\_Pretest” excel file (in “CFA” -> “CFA Data”) folder
2. Use Excel functions “average” and “std.s” to calculate the mean and standard deviation for each map.
3. Identify the three most and least trusted maps
4. Calculate the average and standard deviation for the number of years participants were cartographers

**To Analyze CFA Model (Model fit, loadings, errors)**

The file that has all these steps done is “AMOS\_CFA\_One\_Factor.amw” in folder “CFA”

1. Open SPSS Amos with plugin “Standardized RMR” installed
2. Draw a single unobserved variable as map trust, and add all 12 indicators as observed variables.
3. Connect the observed variables to the unobserved variable with paths
4. Add error terms for each indicator
5. Assign the initial error terms as 1
6. Assign one of the indicators a coefficient of 1
   1. This is Unit Loading Identification

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1. Click “**Plugins, Standardized RMR**”
2. Click “**Analysis Properties**,” then select the “**Output**” tab. Make sure “**Residual moments**” is checked

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1. Click “Calculate estimates”
2. Click “View text,” where you can see the output of the analysis
   1. The output will be the same as the Word document “AMOS\_CFA\_One\_Factor\_error\_fit\_loadings” in folder “CFA AMOS Results”
3. A window will also populate with the SRMR score

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**To Analyze CFA Model Discriminant Validity**

1. Open SPSS file “CFA\_SPSS\_Final.sav” ( in “CFA” -> “CFA Data”) or bring the excel data “CFA\_Factor\_Analysis\_Data” ( in “CFA” -> “CFA Data”) into the program of your choice.
2. Calculate a correlation matrix of the 12 map trust indicators as well as the indicators for *readability* and *relevance*
3. In SPSS, Click the top tab ***Analyze -> Dimension reduction -> factor***.
4. Add the 12 variables pertaining to the map trust indicators
   1. For relevance discriminant validity, also add variables “relevant-to-me”, “meaningful”, and “relevant-to-others”
   2. For readability discriminant validity, also add variables “easy-to-read” and “easy-to-explain”
5. Outputs are in folder “CFA” -> “CFA SPSS Results” as word document files “Discriminant\_Validity\_SPSS\_Output\_Readability.docx” and “Discriminant\_Validity\_SPSS\_Output\_Relevance.docx”
6. Copy the tables into an excel document (See “Discriminant\_Validity\_HTMT.xlsx” located in “CFA” -> “CFA Data” folder)
7. Determine the mean correlation value for the 12 MAPTRUST indicators with each other (Shaded in **green**)
8. Determine the mean correlation value for the 12 MAPTRUST indicators with the readability or relevance indicators (Shaded in **yellow**)
9. Determine the mean correlation value for the readability or relevance indicators with themselves (Shaded in **orange**)
10. Calculate HTMT for both tables by dividing the Mean R Y1Y2 (Yellow) divided by the square root of Mean R Y1Y1\* Mean RY2Y2

**To Analyze CFA Model Convergent Validity**

The file that has all these steps done is “AMOS\_Convergent\_Validity” in folder “CFA”

1. Open SPSS Amos with plugin “Standardized RMR” installed
2. Draw a single unobserved variable as map trust, and add all 12 indicators as observed variables.
3. Connect the observed variables to the unobserved variable with paths
4. Add error terms for each indicator
5. Assign the initial error terms as 1
6. Assign one of the indicators a coefficient of 1
   1. This is Unit Loading Identification
7. **Repeat steps 2-6 for the readability and relevance indicators.**
8. Draw double direction arrows between the 3 unobserved variables (mapTrust, readability, and relevance)

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1. Click “Calculate Estimates”
2. Click “View text,” where you can see the output of the analysis
   1. The output will be the same as the Word document “Convergent\_Validity\_AMOS\_Output” in folder “CFA AMOS Results” (Root folder “CFA”)
3. Look specifically at the tab “estimates” and the table “Correlations: (Group number 1 - Default model)”

**To Analyze CFA Model Concurrent Validity**

1. I created an excel file with only the MAPTRUST Scale composite scores for the most and least trusted maps in the pretest. This file is in the “CFA Data” folder (root folder “CFA”), titled “CFA\_Concurrent\_Validity\_Data.xlsx”
2. The first column combined the MAPTRUST Scale values assigned by CFA participants for the three most trusted maps as identified in the pretest
   1. cart\_c dasy\_c iso\_a
3. The second column combined the MAPTRUST Scale values assigned by CFA participants for the three least trusted maps as identified in the pretest
   1. cart\_b chor\_a chor\_c
4. Open SPSS file “SPSS\_CFA\_Concurrent\_Validity.sav” or bring the excel data “CFA\_Concurrent\_Validity\_Data.xlsx” into the program of your choice (in “CFA Data” folder).
5. Click ***“Analyze” -> “Compare means” -> “Paired-Samples T Test”***
6. Add the two variables to the paired variables box.
7. Click “OK” to run the analysis
8. The output should be the same as “Concurrent\_Validity\_SPSS\_Output.docx” in “CFA SPSS Results” folder

**To Analyze Multicollinearity of the 12 MAPTRUST indicators**

1. Open SPSS file “CFA\_SPSS\_Final.sav” or bring the excel data “CFA\_Factor\_Analysis\_Data” into the program of your choice (in “CFA Data” folder.
2. Calculate the composite MAPTRUST score by summing the 12 indicators together and dividing it by 12. In SPSS, click ***“Transform” -> “Compute Variable”***
3. To calculate VIF, click ***“Analyze” -> “Regression” -> “Linear”***
4. Add “MAPTRUSTscale” as the dependent variable and add the 12 indicators as the independent variables
5. Click “statistics” and make sure “Collinearity diagnostics” is checked

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1. Run the analysis
2. The VIF will be in a table titled “Coefficients”
3. The results are shown in the File “Multicolinearity\_SPSS\_Output.docx” in the folder “CFA SPSS Results”

**To Analyze Cronbach’s Alpha of the MAPTRUST Scale**

1. Open SPSS file “CFA\_SPSS\_Final.sav” or bring the excel data “CFA\_Factor\_Analysis\_Data” into the program of your choice (both are from folder “CFA Data”.
2. Click ***“Analyze” -> “Scale” -> “Reliability Analysis”***
3. Add the 12 MAPTRUST indicators to the “items” section
4. Click run, and the output will be the same thing as you see in “CronbachAlpha\_SPSS\_Output.docx” in the folder “CFA SPSS Results”