

**MCMC Z-G IRT Model
Computer Program User's Guide
(Mac OS[®] Version 1.1)**

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The MCMC Z-G computer program estimates the Zinnes–Griggs (Z-G) item response theory model (Z-G IRT; Zinnes & Griggs, 1974). Contrast to the GGUM2004 (Roberts, Fang, Cui, & Y. Wang, 2006) and the MCMC GGUM (W. Wang, de la Torre, & Drasgow, 2014) that calibrate the single-stimulus response data, the MCMC Z-G calibrate response data from the forced-choice measurement formats, which potentially address the response style and bias problem that are typically caused by the popular single-stimulus measurement formats. Similar to the MCMC GGUM (Wang, et al., 2014), the MCMC Z-G computer program also employs the Metropolis-within-Gibbs algorithm based Markov chain Monte Carlo method (Hastings, 1970; Metropolis, A. Rosenbluth, M. Rosenbluth, A. Teller, & E. Teller, 1953) and estimates both the item and person parameters, and it can handle missing values in the data. The MCMC Z-G program provides user friendly graphical interface; this User’s Guide is written to provide some basic guidelines on using the program.

Download and Installation

The Mac OS version installer is available to download for free from the website at <http://computationalpsychology.org/resources/>. When it is properly downloaded, the installer file, named as **MCMCZG-1.1.0.dmg**, looks like the icon on the left side Figure 1. Then double click the dmg installer, it creates an installation drive, named **zgEstimation**. Open the zgEstimation drive to access the specific installer file.

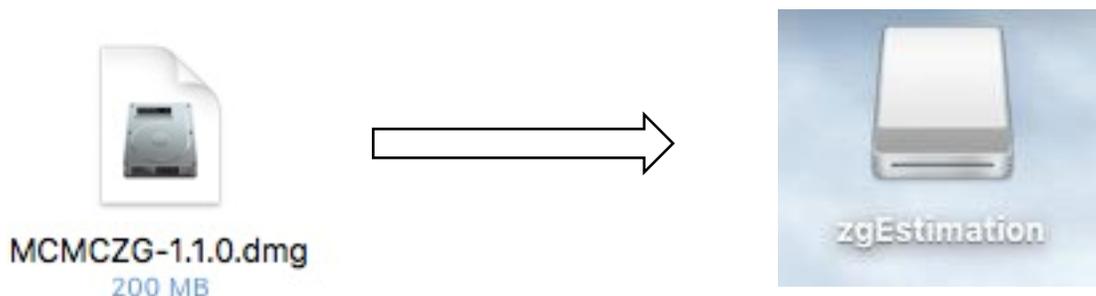


Figure 1

The screenshot in Figure 2 shows all the files included in the zgEstimation drive. Find the executable file named **runzg**. You may double click it, or right click it (or click with the control key pressed) and then click Open to run the program (see Figure 3).

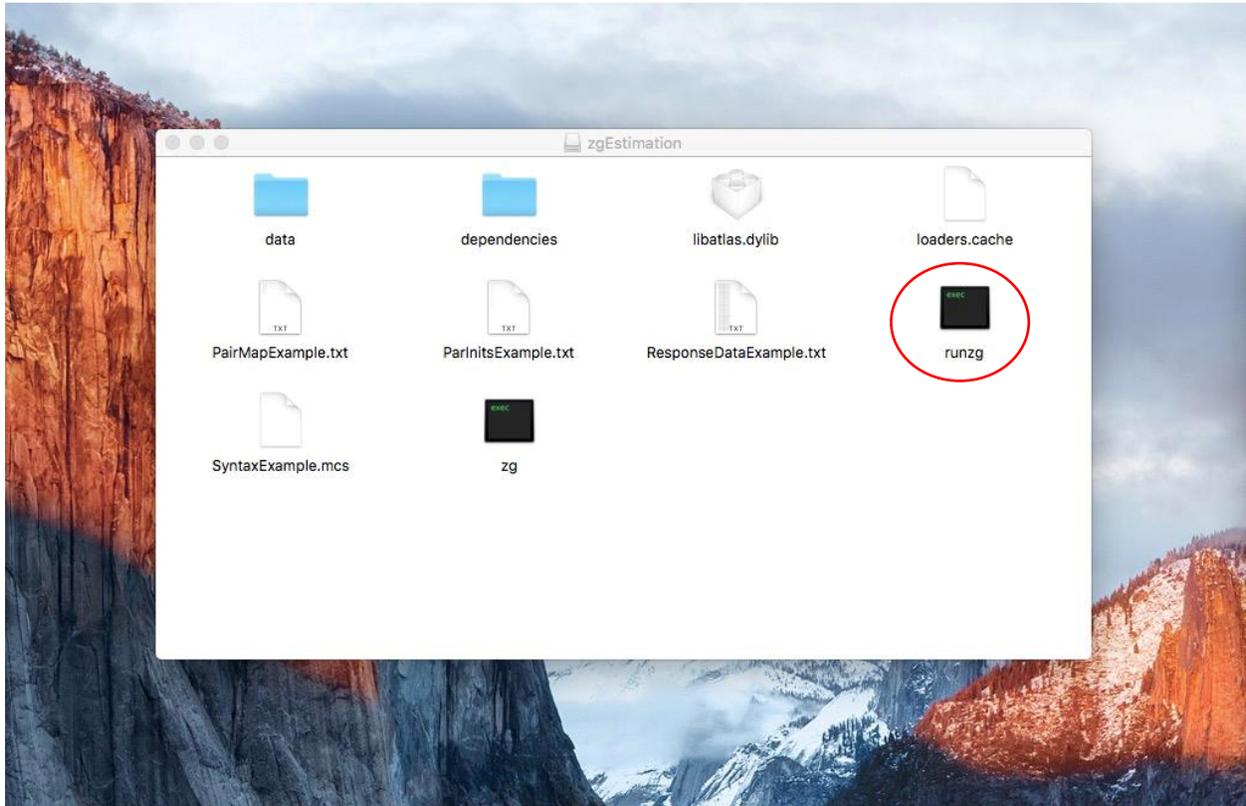


Figure 2

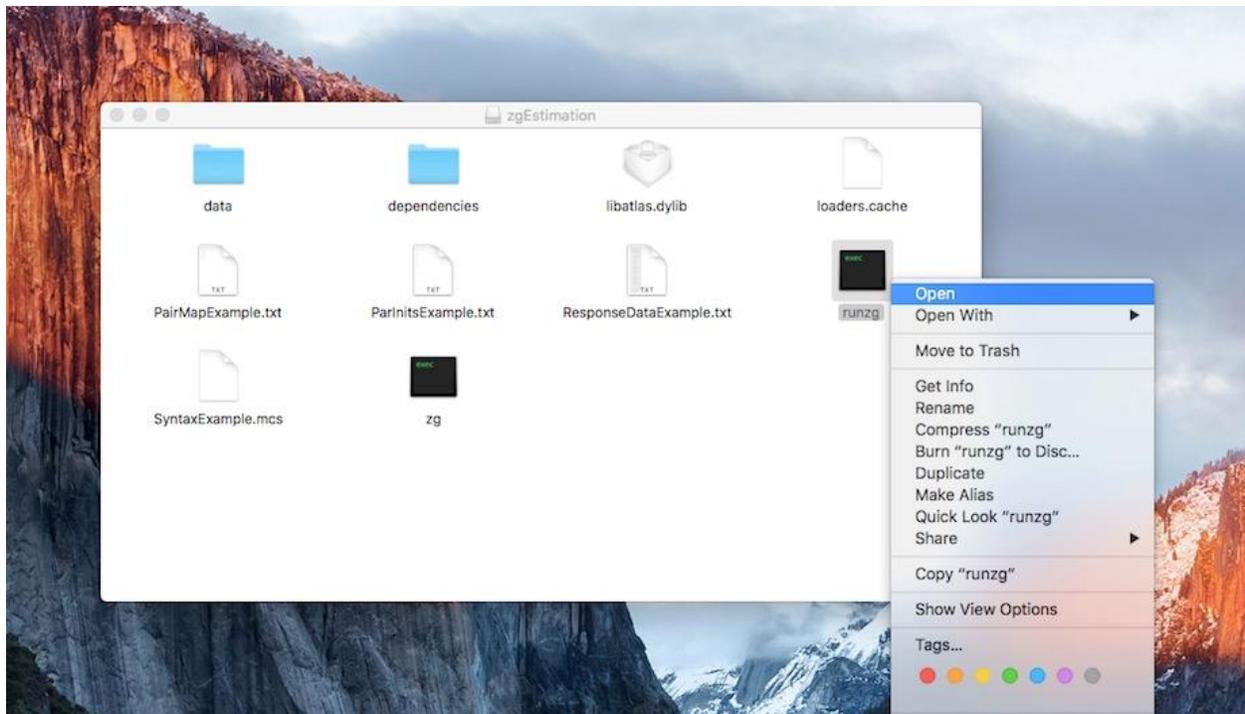


Figure 3

Running the Program

To run the program properly, first, make sure that both the syntax file and the data file are located in the main folder of the installation folder. The details of a syntax file will be discussed in the following section.

The following two screenshots (Figures 4 and 5) show the interfaces of the Mac OS version MCMC Z-G Program. Click on the “Import Syntax” button on the right side to locate and import a syntax file. The default directory leads to the **zgEstimation** drive but users may locate a specific folder if desired. If a syntax file is properly written and no error message would appear, you may click “Run” button to run the program.

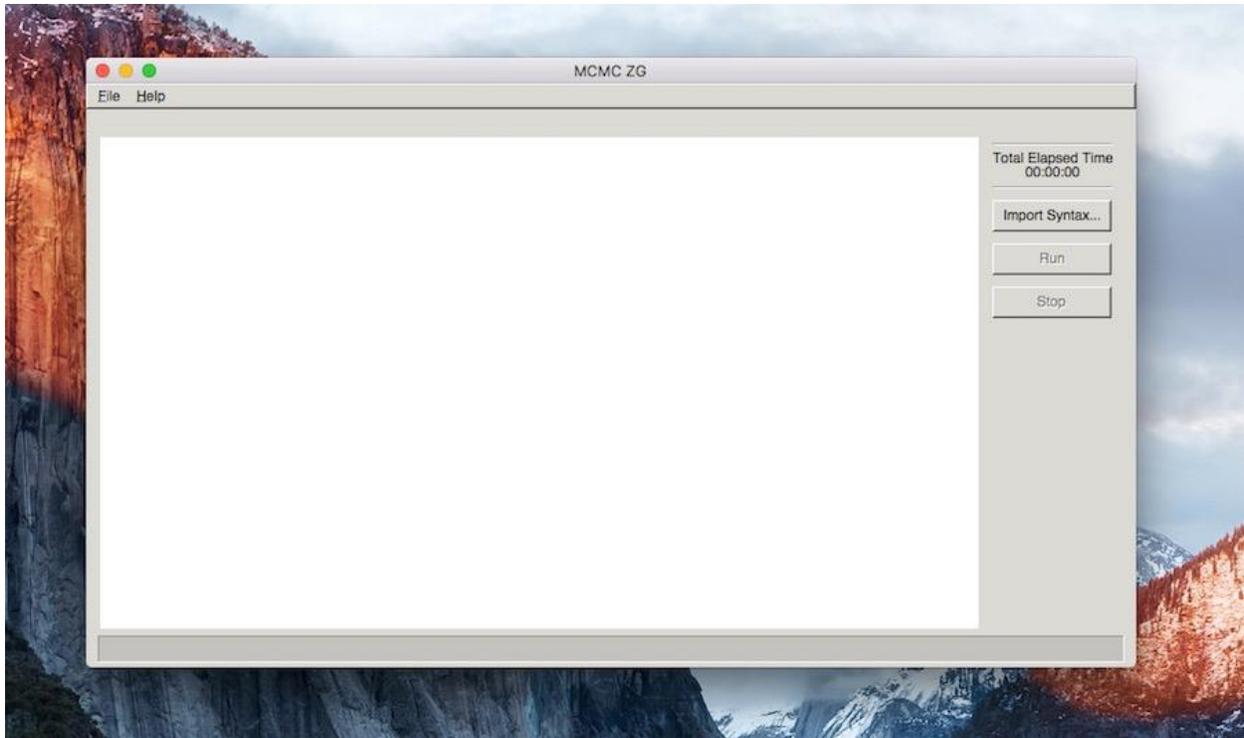


Figure 4

Clicking the Import Syntax button will open a new pop-up window as shown below, which allows for a syntax file to be appropriately located. Once the designated syntax file is found and highlighted as shown in Figure 4, click “Open” to close the new window and get the program ready to run.

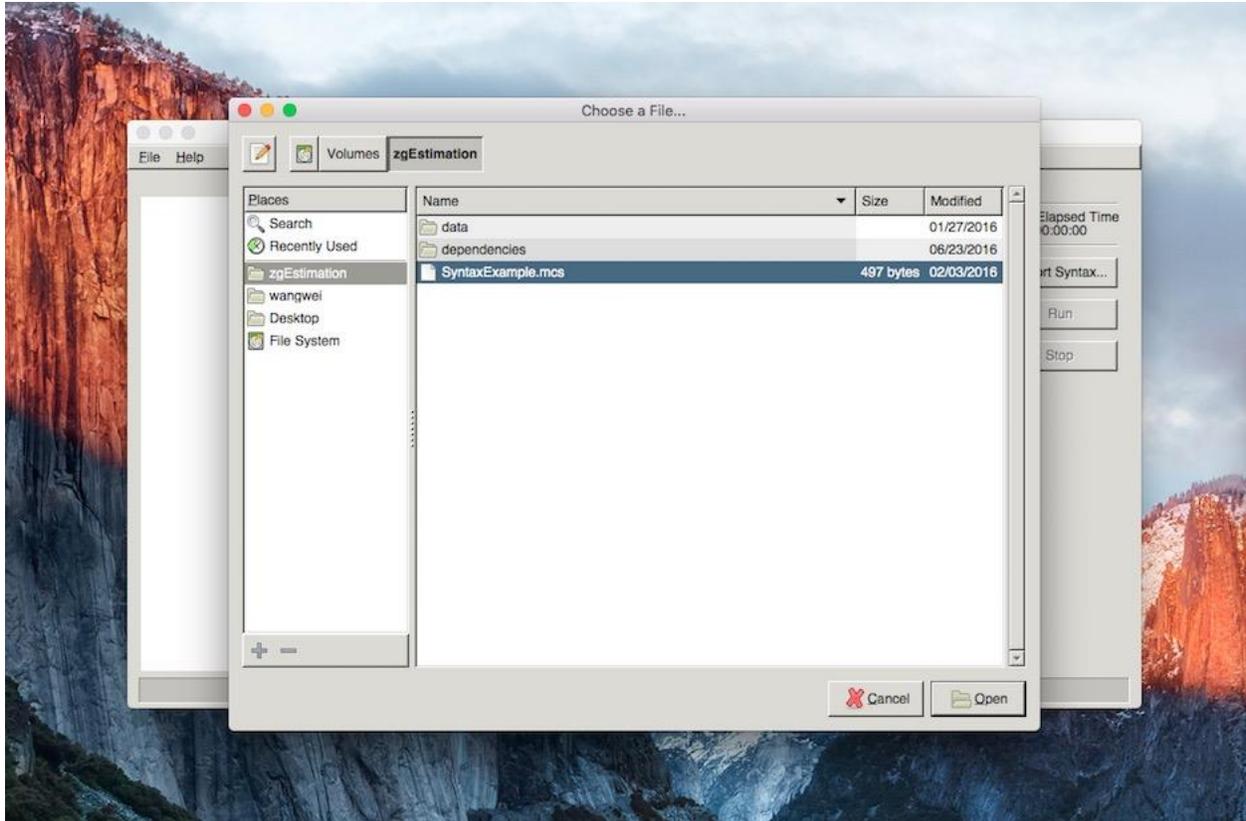


Figure 5

An error message as the screenshot in Figure 6 may appear if a syntax file contains an error. Common errors include a misspecification of data location or data information (e.g., numbers of rows and columns). Other common errors may be mismatched vectors for the parameters.

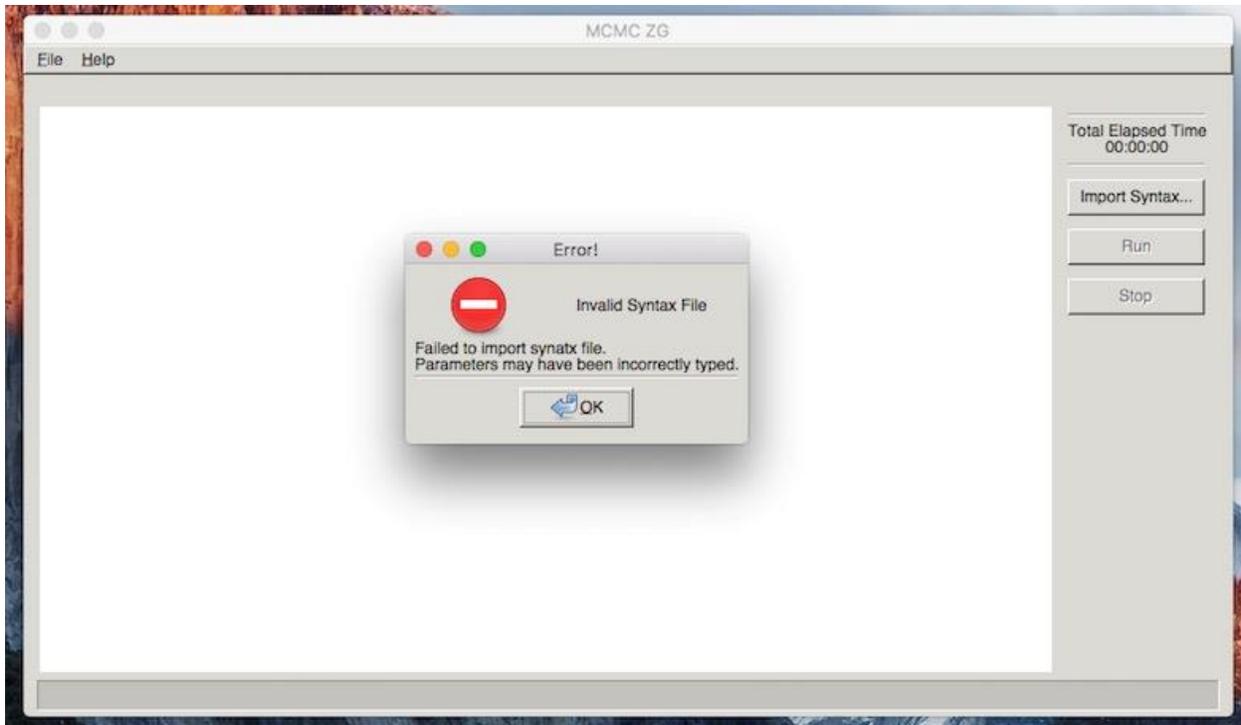


Figure 6

If a syntax file contains no errors and is imported properly, the window interface displays the correct directory of the syntax file at the upper left corner of the window. The program is ready to run.

When the program is running, the time elapsed will be displayed on the right side above the "Import Syntax" button, and a blue bar at the bottom of the interface will present the progress of the completed iterations, as shown in the screenshot in Figure 7.

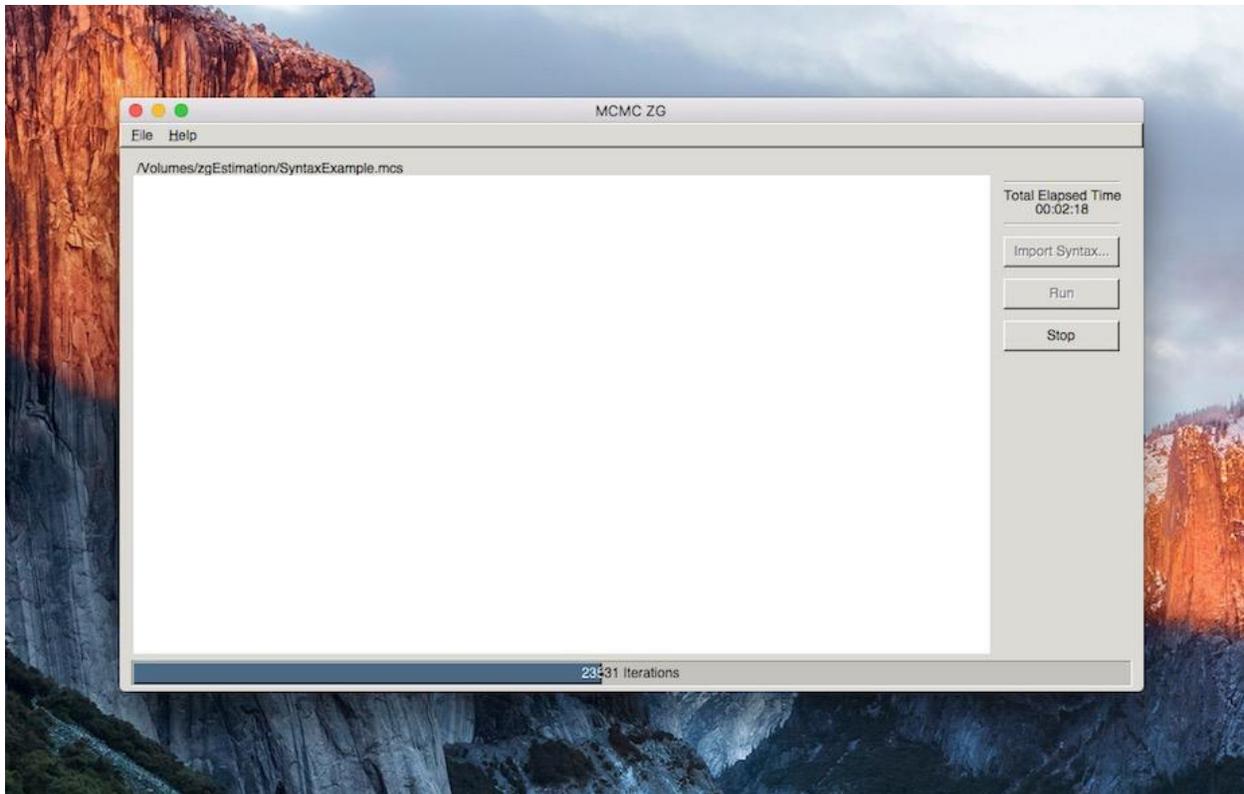


Figure 7

When the program finishes the prescribed length of iterations, the parameter estimates and output information are displayed in the main window of the program as shown in Figure 8. The output information will be further discussed in a separate section later on.

There are two buttons in the menus at the upper-left corner of the window interface: **File** and **Help**. The drop-down list of File menu includes Save As and Quit (see Figure 9). The Save As option is used to save the output file. The Help menu provide brief “About” information regarding this computer program. Note it took about 5 minutes to finish three chains of 50,000 iterations, which is considered fast for MCMC estimation.

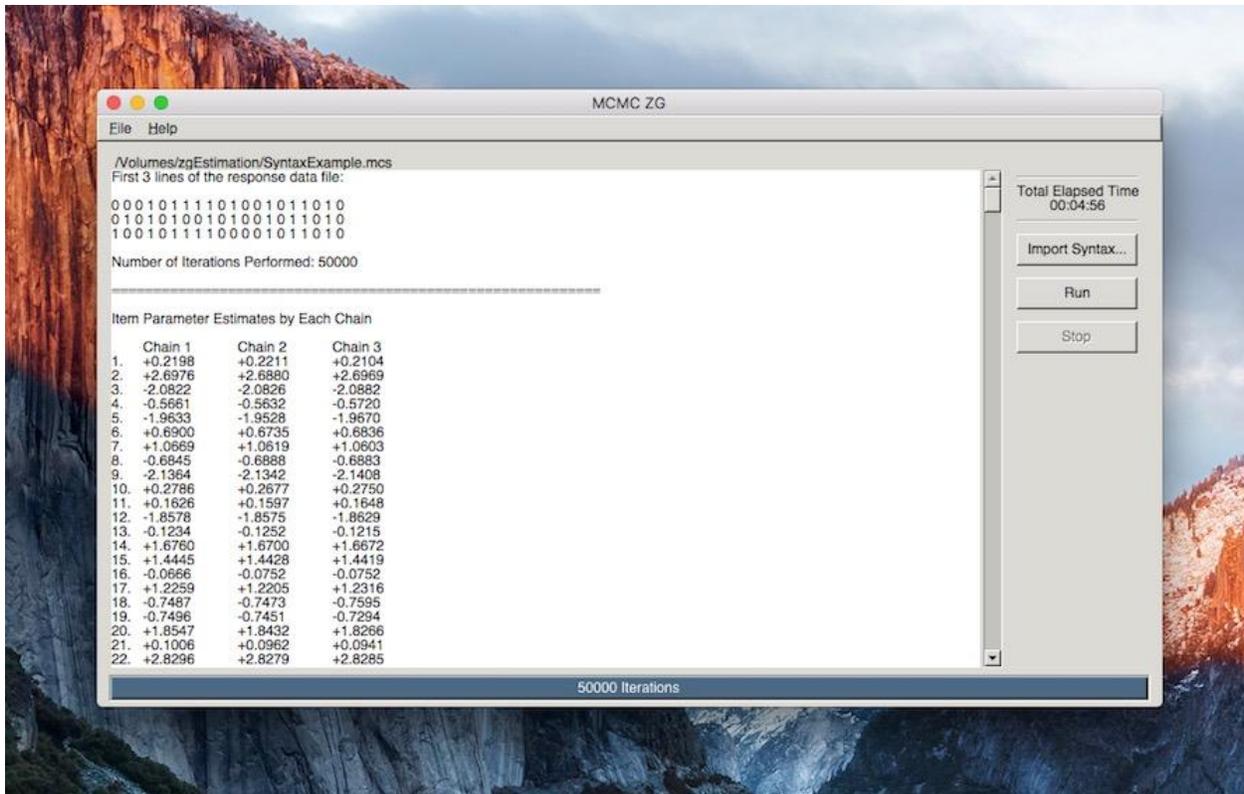


Figure 8

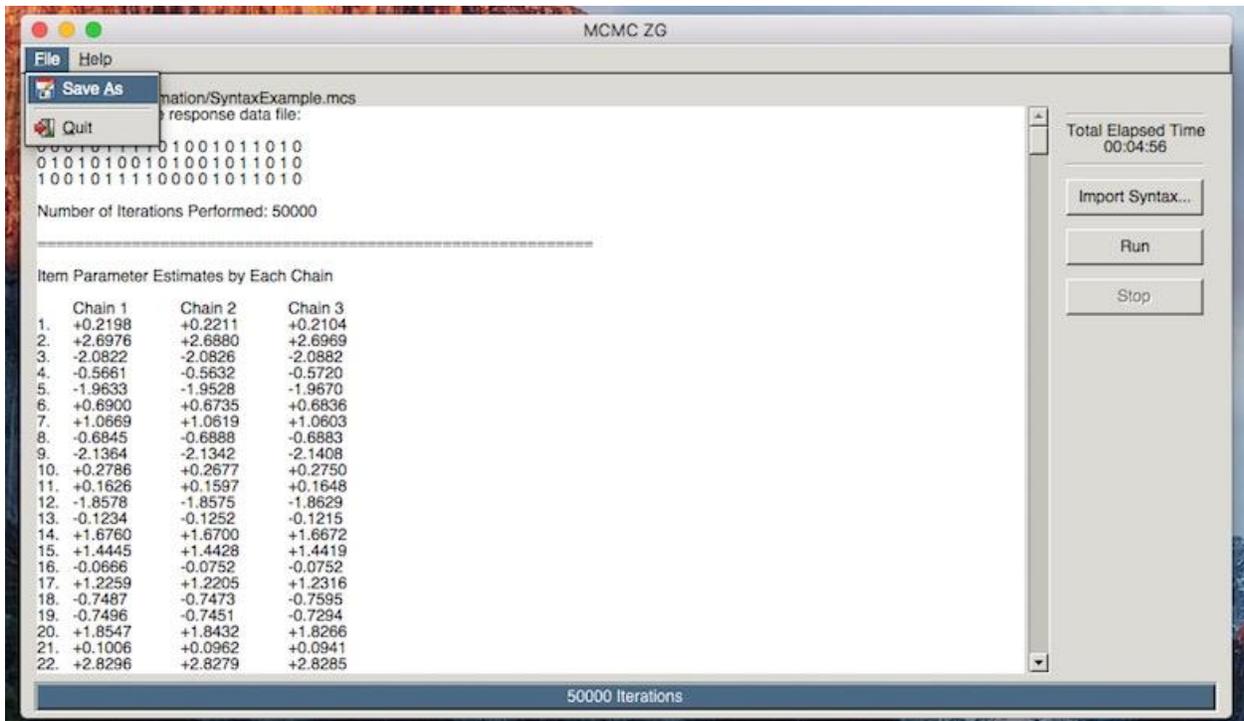


Figure 9

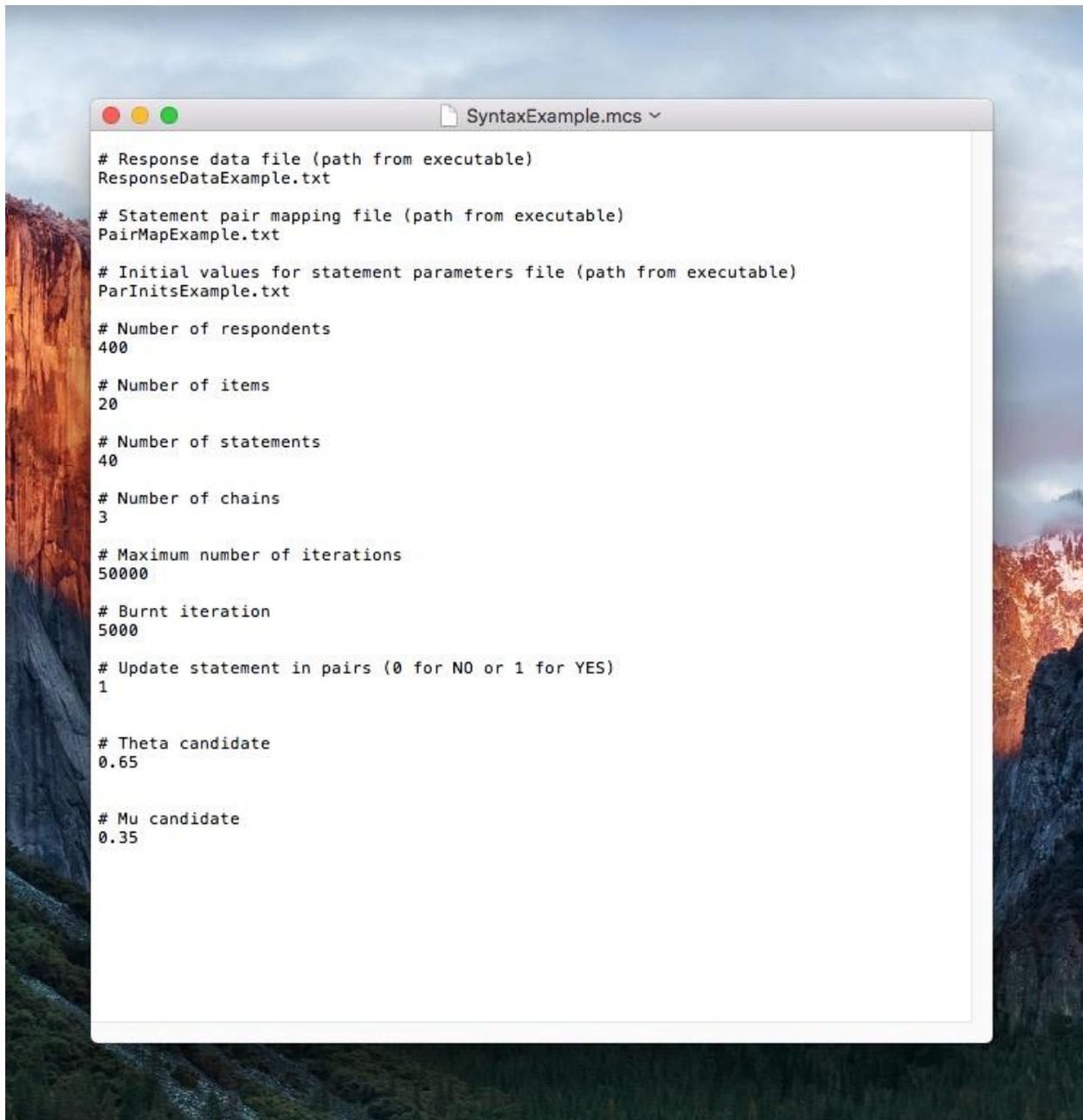
Syntax and Data Files

An exemplary syntax file named **SyntaxExample.mcs** is provided with the installation of the program. Users only need to slightly modify the syntax entries in order to run the program.

The sample syntax and its explanation are presented as follows in Figure 10.

The first three entries of the syntax file specify the name and location for the files of data, pair mapping specification, initial values. If these files are located in the installation folder, there is no need to further specify the file directory.

The 4 to 7 entries specify the numbers of respondents, items, statements, and chains, respectively, the 8 and 9 entries determine the length of the chains (typically 50,000 iterations) and burn-ins. Lastly, the standard deviation of sampling theta candidate and mu candidates can be specified. These values affect acceptance rates. The smaller the standard deviation is, the higher the acceptance rate will become.



```
# Response data file (path from executable)
ResponseDataExample.txt

# Statement pair mapping file (path from executable)
PairMapExample.txt

# Initial values for statement parameters file (path from executable)
ParInitsExample.txt

# Number of respondents
400

# Number of items
20

# Number of statements
40

# Number of chains
3

# Maximum number of iterations
50000

# Burnt iteration
5000

# Update statement in pairs (0 for NO or 1 for YES)
1

# Theta candidate
0.65

# Mu candidate
0.35
```

Figure 10

Response data can be stored in a text file, with columns are separated by a space or tab. An example of the data file (**ResponseDataExample.txt**) is provided below in Figure 11.

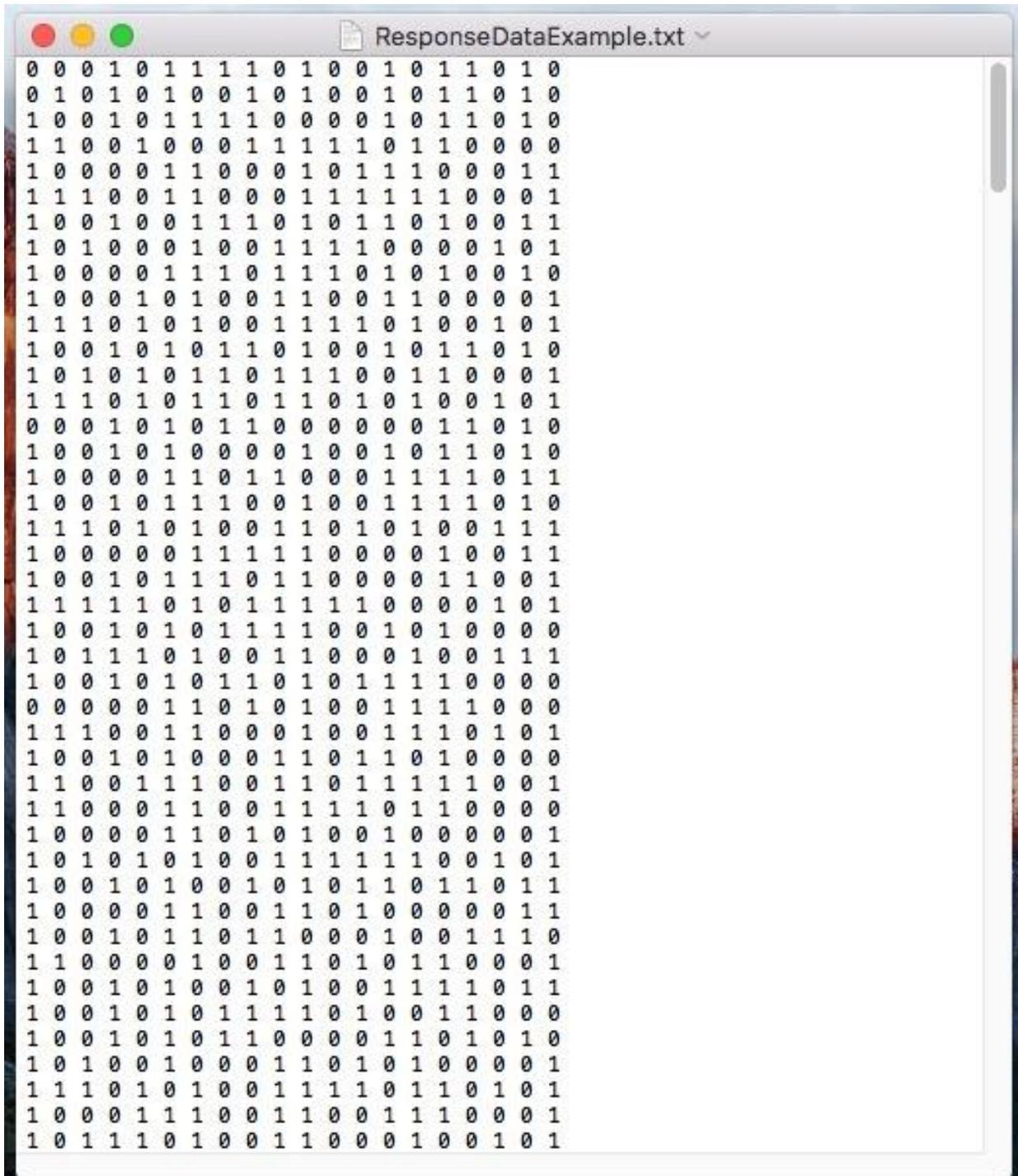


Figure 11

Output Files

The output of the program is displayed in the main window and can also be saved in a text file by clicking the **Save As** option from the File drop-down menu. The output file presents information in the following order:

- (1) First 3 files of the response data file;
- (2) Number of iterations;
- (3) Matrix of the means of item parameter (number of item parameters \times number of chains);
- (4) Matrix of the standard error of item parameter (number of item parameters \times number of chains);
- (5) Vector of the averaged means of item parameters cross chains;
- (6) Vector of the averaged standard deviation of item parameters cross chains;
- (7) Matrix of the means of person parameter (number of person parameters \times number of chains);
- (8) Matrix of the standard error of person parameter (number of person parameters \times number of chains);
- (9) Vector of the averaged means of person parameters cross chains;
- (10) Vector of the averaged standard deviation of person parameters cross chains;
- (11) Acceptance rates.

References

- Hastings, W. K. (1970). Monte Carlo sampling methods using Markov Chains and their applications. *Biometrika*, 57, 97–109.
- Metropolis, N., Rosenbluth, A. W., Rosenbluth, M. N., Teller, A. H., & Teller, E. (1953). Equations of state calculations by fast computing machines. *Journal of Chemical Physics*, 21, 1087–1092.
- Roberts, J. S., Fang, H., Cui, W., & Wang, Y. (2006). GGUM2004: A Windows-based program to estimate parameters in the generalized graded unfolding model. *Applied Psychological Measurement*, 30, 64–65.
- Wang, W., de la Torre, J., & Drasgow, F. (2014). MCMC GGUM: A New Computer Program for Estimating Unfolding IRT Models. *Applied Psychological Measurement*. doi: 10.1177/0146621614540514
- Zinnes, J. L., & Griggs, R. A. (1974). Probabilistic, multidimensional unfolding analysis. *Psychometrika*, 39, 327–350.