

Computational Exercise 2.2 – Simulating the Evolution and Stability of the G-matrix

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The goal of this exercise is to become familiar with a G-matrix simulation program, its strengths, and its limitations. For this Exercise you will work in a small group (3 or 4 people), to choose and test a hypothesis, produce a short graphical summary of your results, and – finally – present that summary to the class as a whole.

Begin by downloading the Simulator to your desktop. First, create a handy folder where you can store the outputs you will generate for this exercise. If you haven't already downloaded the simulator = Home Version, you can do so by going to

<http://www.bio.tamu.edu/index.php/gvolving/>.

Click the **G-matrix Home Version** link to download a zip file with the executable and a pdf of Instructions.

The program should run on any machine running Windows 98, Vista, 7, 8, and 10 but it will not run on any other operating system. It will run on Macs and Linux using Wine.

The basic idea of the Simulator is to show the parameters of a two trait G-matrix generation-by-generation for a specified set of conditions of mutation, drift, and selection. By doing numerous runs, you can determine the stability of the G-matrix under a particular set of conditions. Alternatively, by doing extensive series of runs, you can identify how the G-matrix evolves in response to various conditions. Because of time constraints, our Exercise will concentrate on G-matrix stability rather than on G-matrix evolution.

1. **Become familiar with the Simulator.-** Read through and follow the 'G-matrix Simulator Home Version Instructions' to become familiar with the Simulator. In particular, at Step 4, produce and save text output. The use of such output will be a central part of our Exercise today. At Step 6, examine your output and focus on the column labeled 'dGangle', which is called ~G-angle' on the Instructions. We will use these values to characterize the stability of the G-matrix. What are these values?
2. **Decide on a question to explore with your group.-** We suggest that you choose one of the following questions, because their exploration will be practical within our time constraint. We would like to cover all of these questions, so please decide on your top 2 or 3 choices. Our people will talk to your people.
 - a. What effect does population size have on G-matrix stability (with and without mutational correlations and correlational selection)?
 - b. Do mutational correlations and correlational selection interact to affect G-matrix stability?
 - c. What effect does a moving optimum have on G-matrix size and stability (with and without mutational and selectional correlations)?

- d. What happens to G-matrix stability when selection intensities or mutational variances differ for the two traits?
 - e. What is the “flying kite” effect, what causes it, and why is it important?
 - f. Compared to steady movement of the optimum, how does adding some stochasticity in the optimum affect G-matrix size and stability?
 - g. What effect does episodic peak movement have on G-matrix stability and size, relative to steady peak movement?
3. **Decide on the kinds of runs that will answer your question.-** Because of limited time, it will probably not be possible to implement a full experimental design. Instead, choose a few parameter combinations that allow a quick test of the hypothesis.
 4. **Produce one or two graphics to illustrate your group presentation.-** For example, you might produce graphs of a few sample runs. You could produce those graphs by screen capture or by plotting values in your text output.
 5. **Quickly produce and practice a 5 minute presentation.-** One person in your group should be the presenter, so begin by choosing that person.