Instructor’s notes for Stick-Slip Faulting and Earthquakes CogSketch geoscience worksheet

This worksheet uses the sketch-understanding program with built-in tutor: CogSketch. Therefore, students, instructors, and/or institution computer labs need to download the program from here: <http://www.qrg.northwestern.edu/software/cogsketch/> There are many introductory geoscience worksheets that have been developed using this program. Each worksheet has a background image and instructions for a sketching task. At any point during the worksheet, students can request feedback from the worksheet tutor and their sketch is compared to the solution sketch. The built-in tutor identifies any discrepancies and reports pre-written feedback to help the student correct their sketch until they are done with the activity. Once worksheets are emailed to the instructor, worksheets can be batch graded and easily evaluated. This program allows instructors to assign sketching activities that require very little time commitment. Instead, the built-in tutor provides feedback whenever the student requests, without the presence of the instructor.

This worksheet teaches students about stick-slip faulting and how earthquakes can be created in this environment. Students complete two tasks during this activity. In the first task, students trace the sticking point on two strike slip faults: a schematic of a bend in a strike-slip fault and an image of a bend in the San Andreas Fault. For each one, a student is looking for the portion of the fault trace where the fault blocks are moving towards each other, rather than past each other. For the second task, students build a stress over time graph to show how stress builds up when a fault is locked, until it reaches a threshold where fast fault slip occurs with a release of energy (earthquake). To build the graph, students should draw a positively sloping linear line during each build up phase. This line should extend from 0 stress to the fault strength threshold line. At each fault slip event (numbered events), the stress should drop to zero and then start building up towards the fault strength line again. This is repeated until the fourth slip event (drop to 0). Lastly, students move Earthquake symbols onto the graph to show where an earthquake occurs during the stick-slip process (i.e. when the line reaches the fault strength threshold line during each slip event). Therefore, each graph should show a repetition of build-up stress, drop to 0 stress, repeat; with Earthquake symbols positioned when the line reaches the fault strength line. After the sketching activity, students complete 3 multiple-choice questions on the worksheet concepts. We hope this activity helps students understand how earthquakes can be generated, and how stress plays into earthquakes and faulting by sketching out the process.

Students should be encouraged to use the worksheet tutor throughout completing the activity. We have prompted them in the instructions, but further reinforcement may help encourage its use. If an instructor is noticing a problem with the worksheet and wants to change something (the wording in the instructions or feedback, or the ink tolerance), they may alter the worksheet using the worksheet property editor. You can learn more about this property editor in the user manual, included when you download the program. Basic instructions for instructors, students, and grading worksheets are below. For further assistance with program problems in CogSketch, one can contact the Northwestern QRG group from the download page. For further assistance regarding this specific worksheet, please contact the worksheet author, Bridget Garnier, bridget.garnier@gmail.com

Starting Here for Instructors:

1. Download and install CogSketch (<http://www.qrg.northwestern.edu/software/cogsketch/>). Download the worksheet.
2. Open the program and complete the Worksheet Basic Tutorial to understand how to use CogSketch.
3. Click Open Worksheet and find the Earth’s Interior worksheet. \*I highly recommend testing the worksheet so you are very familiar with it and that it works for you.
4. Since this is an unlocked worksheet, the instructor will need to set a password to prevent students from finding the solution sketch. Once the worksheet is opened, click Edit -> Worksheet Property Editor -> Click the Security tab -> enter the password, click Apply, and save worksheet. The worksheet is now password protected and can be distributed to students. The same steps can be used to change the password
5. If an instructor wishes to make any changes to the worksheet, click Edit -> Worksheet Property Editor. This is the authoring interface and all changes can be made here. More information about the Worksheet Property Editor can be found in the user manua,l which is included when you download the CogSketch program.

Instruction to give to students:

1. Download and install CogSketh (<http://www.qrg.northwestern.edu/software/cogsketch/>). Download the worksheet.
2. Open the program and complete the Worksheet Basic Tutorial to understand how to use CogSketch.
3. Click Open Worksheet and find the Earth’s Interior worksheet. Save As with a new file name.
4. Use the sidebar at the right to find tabs for the problem, feedback, and questions. Read the instructions in the Problem tab to complete the tasks. Click the Feedback tab and click Update to receive feedback on your sketch. The Properties tab is used to define/label glyphs. Lastly, the Questions tab contains the multiple-choice questions for the end of the activity.
5. Once the worksheet is completed, save the worksheet and email it to your instructor.

To grade worksheets:

1. Put all completed worksheet files in the same folder. Can only be worksheets of the same type (e.g. all Earth’s Interior worksheets)
2. Open CogSketch and click Gradebook
3. Click New Class and enter information
4. Double click on the class and click on New student. Enter the information for all students in the course
5. Click New Assignment, and enter information
6. Double click on Assignment and click on Add Sketches. Find folder of sketches and highlight all sketches you want graded, click Open.
7. Select the student who completed the worksheet and Click Ok.
8. Upload an additional worksheet that has the solution sketch using the same Add Sketches button. The blank worksheet works just fine. After clicking open, check the box that says “Solution Sketch?” and click Ok.
9. Click Grade worksheets and enter the worksheet password. Worksheets will be graded and scores will be updated in the Gradebook. Each worksheet can be opened by double clicking on the worksheet in the gradebook.