PSY 410 – Cognitive Psychology Lab. J.P. Toth. Fall 2013

Lab Assignment #2: Analysis of Signal Detection Data

You have two goals in this assignment. The first is to organize and format CogLab data in Excel so that it is *clearly labeled* and *easy to read*. The second is to compute **(a)** ***Hits***, ***False-Alarms (FAs)***, ***Correct-Rejections (CRs)***, and ***Misses***; and **(b)** two measures of performance based on signal-detection theory -- ***Sensitivity*** (***A'*** which is similar to d') and ***Response Bias*** (***B''$_D$***, similar to C). A third, optional goal, worth 2 extra-credit points, is to compute & interpret your sensitivity (*A'*) & and Bias (*B''$_D$*) as a function of the number of noise dots (the primary IV) in this experiment.

A. Complete the "Signal-Detection Experiment" in *CogLab* (located under "Perception")

B. Import, Organize, Label, & Format your data in Excel (see example sheets on course web page)

1. Go to "Access your account" in *CogLab* (bottom, under "Students"); log-in; select "Access account".
2. Select "Signal Detection" (in the list on the right) and then "Get your data".
3. Copy your trial-by-trial data from CogLab and paste it into the worksheet of a new Excel Workbook, starting around cell B3.
4. Label and format your trial-by-trial data:
    a. Delete the column labeled with your User ID. You should now have 4 data columns.
    b. Re-label your data columns "Trial #", "Noise Dots", "Target", & "Response".
    c. Clean up by resizing & centering your columns, bolding & underlining your labels, etc.
    d. Put a general title of your data sheet in cell A1 (e.g., "Lab 2: Signal-Detection Data"), rename the worksheet tab (by double-clicking it) "All Data", and then save your workbook (Excel file) on the desktop of your computer using the format "Lab2-*yourname*.xlsx".
5. Use Excel's *Sort* command to sort trials 1-60 by Target and then Response. First, select/highlight all the data cells associated with trials 1-60. Then go to the *Data* menu and select *Sort*. In the option box, set *Sort by* to Target (Column D) and *Z to A*; then "Add Level" and set *Then by* to Response (Column E) and *Z to A*; then press "OK". Trials 1-60 should now be blocked into 4 combinations: Present-Present, Present-Absent, Absent-Present, and Absent-Absent.

C. Compute Hits, False Alarms (FAs), Misses, & Correct Rejections (CRs) as proportions.

1. Start by putting labels for Hits, FAs, Misses, & CRs on your worksheet (e.g., in cells G3-G6).
2. Compute the relevant proportions by counting up the number of correct and incorrect responses you made for both the target present & target absent trials and dividing by 30 (the total number of each trial type). [Hint: Misses = 1 – Hits; CRs = 1 – FAs].

D. Compute A' and B''$_D$ using formulas in Excel, and answer 2 questions about your data.

1. Start by putting labels for you measures (A': & B'') on your sheet (e.g., in G8 & G9).
2. In cells H8 and H9, respectively, compute A' and B''$_D$ using the following equations:

A' = 0.5 + (((HIT-FA)*(1+HIT-FA)) / (4*HIT*(1-FA)))

[Note: A' ranges from 0 to 1.0, with .50 being chance (no sensitivity)].

B''$_D$ = ((1-HIT)*(1-FA)-(HIT*FA)) / ((1-HIT)*(1-FA)+(HIT*FA))

[Note: B''$_D$ ranges from –1.0 to +1.0 with negative values indicating a liberal response bias, positive values indicating a conservative response bias, and zero indicating no bias].

3. Interpret the A' and B''$_D$ values, writing your responses next to each value [note: you may gain insight here by comparing your values (Hit & FA, A' & B''$_D$) to those of a classmate]. **(1) How sensitive were you to the presence of a signal? (2) Were you a liberal or conservative responder?**

4. If you're not doing the extra credit, email your completed assignment to the TA by 5pm this Friday.

E. <u>Optional Extra Credit</u> (worth 2 course points & multiple knowledge points): <u>Compute A' and B''$_D$ as a function of the number of Noise Dots.</u>

1. The primary manipulation in the experiment you completed was the number of noise dots on the screen; this IV had three levels (144, 400, & 900). Before continuing, ask yourself two questions: First, how should this variable affect a person's sensitivity (i.e., their ability to discriminate between target-present & target-absent trials)? Second, how should this variable affect response bias (i.e., their likelihood of responding "present" or "absent")?

Now find out how the noise-dot variable actually affected your performance…

2. Start by copying your "All Data" work onto a new worksheet. You can do this by just copying all relevant rows & columns and pasting them onto a new worksheet; or, better, by right-clicking on the worksheet tab (at the bottom of the window), selecting *Move or Copy…,* and checking the *Create a Copy* box. Rename your new worksheet "Noise Dot Analysis".

3. Select all of the data cells and then use Excel's *Data* > *Sort* command to sort all trials by Noise Dots (*Lowest to Highest*) then Target (*Z to A*) then Response (*Z to A*). This will produce the same 4 combinations as above, but now blocked within the number of Noise Dots.

4. Calculate Hits, FAs, Misses, & CRs <u>for each level of the Noise Dots</u> (i.e., for 144, 400, & 900) making sure to change your denominators to 10.

5. Calculate A' and B''$_D$ for each level of the Noise Dots. [*Hint: You can just copy & paste your formulas (equations) from the "All Data" worksheet, as long as you paste them into the appropriate cells on the new sheet. If done right, computing all of the values should take less than a minute*].

6. Interpret your A' and B''$_D$ values. (1) Did you become more or less sensitive to the signal as the number of noise dots increased? (2) Did you your response bias change (become more liberal or conservative) as a function of the noise dots?

If you've gotten this far, great job!

7. Email your completed assignment to the TA by 5pm this Friday.