Exercises in R

The purpose of this set of exercises is to help you practice using R. I will provide a set of data that could realistically have come from user studies. Your job will be to transform the data into an appropriate form so that you can run the right inferential tests to help you make decisions about the data. Once you have done this, you will also practice writing sentences that clearly articulate the procedure that was undertaken.

Much of this is grunt work, but see the links from the previous worksheet to find out how to format the data properly as needed.

You can work in small groups or as a class to complete these tasks. (If it is easier, perhaps use the data only to one decimal point.)

Study 1: OS X Magnifying Taskbar

In 2002, OS X introduced a taskbar that defaults to an interaction where the icon actually expands in size. The idea is that the expanded size allows for the icons to be clicked faster.

You decide to test out this theory by having participants click on alternating targets. The independent variable is whether the targets are expanding (as in OS X), or staying the same size. You have them complete this alternating task 50 times each before you have them do the other condition. You decide to use a between-subjects design, and recruit 32 participants to complete this task. Using the data below, determine whether the expanding targets actually results in faster performance.

Participant	Static Target	Expanding Target
1	100.89876	
2	98.27522	
3	102.77773	
4	100.42039	
5	99.42488	
6	103.92898	
7	101.21053	
8	95.69733	
9	104.07195	
10	105.83715	
11	100.85767	

12	103.08823	
13	96.72939	
14	99.24429	
15	98.54360	
16	104.32236	
17		92.59521
18		100.05848
19		99.49896
20		94.88110
21		97.50323
22		101.74019
23		96.24544
24		95.25246
25		96.92449
26		95.00141
27		95.55145
28		97.15211
29		93.57841
30		97.09549
31		90.91585
32		93.84789

Ref: McGuffin, M & Balakrishnan, R. (2002). Acquisition of expanding targets). In Proceedings of CHI 2002, 57-64.

Study 2: EdgeWrite

EdgeWrite is a character-based input technique for mobile devices. It was first implemented on a PalmPilot (which uses a stylus pen) where a physical template with a square-cutout was used to restrict movement of a stylus. It provides a different kind of "graffiti", but allows people to "throw" the stylus in to the various corners. This allows text entry to happen quite quickly. (See a video here.)

To evaluate their solution, a study is conducted to compare EdgeWrite versus standard Graffiti text entry. The researchers recruited 10 participants, and this was a within-subjects design

(participants completed all tasks with each condition). The conditions were: EdgeWrite, and Graffiti. The researchers designed 3 separate sentences that needed to be completed, and each of these three sentences were written in both conditions. The collected data includes the words-per-minute as measured for each task, as well as the number of errors that were committed for each task/condition pair.

EdgeWrite Data

P	wpm1	err1	wpm2	err2	wpm3	err3
1	9.94	2	6.36	2	6.97	2
2	6.97	2	6.24	2	8.29	3
3	6.81	2	6.83	3	7.23	3
4	3.66	2	5.77	1	7.05	3
5	6.43	2	7.37	2	4.38	3
6	4.29	3	5.51	3	5.90	1
7	4.18	4	4.90	2	6.94	0
8	3.28	1	6.87	1	7.83	2
9	6.97	1	8.40	2	7.22	1
10	6.31	1	5.49	1	6.08	1

Graffiti Data

P	wpm1	err1	wpm2	err2	wpm3	err3
1	9.99	4	6.85	4	6.32	4
2	6.60	4	8.26	5	9.27	2
3	4.43	4	8.17	5	9.02	3
4	8.22	4	8.50	4	7.40	4
5	7.49	3	9.04	4	3.43	4
6	5.87	4	7.33	4	5.15	4
7	5.87	3	9.68	5	7.24	5
8	8.66	3	7.85	2	6.50	2
9	6.23	4	7.41	2	8.82	5
10	7.39	3	5.66	4	8.06	4

Ref: Wobbrock, J.O., Myers, B.A. and Kembel, J.A. (2003). EdgeWrite: A stylus-based text entry

method designed for high accuracy and stability of motion. In Proceedings of UIST 2003, 61-70.

Study 3: BubbleCursor

The bubble cursor is a target acquisition technique based on area cursors. The bubble cursor improves upon area cursors by dynamically resizing its activation area depending on the proximity of surrounding targets, such that only one target is selectable at any time. Empirical studies show that the bubble cursor significantly outperforms the point cursor, and that bubble cursor performance can be accurately modeled and predicted using Fitts' law. You can see a video of BubbleCursor, or try it out.

Since others have already demonstrated that BubbleCursor is faster, the question you are trying to answer is: do people like BubbleCursor (BC) more compared to a standard interface (S)? You allow your (10) participants to try out the interfaces, and then ask them two separate likert-style questions (scale of 1-7):

- To what extent would you like to see this on your computer (1=do not want at all; 7=would love to have it tomorrow)? (SEE)
- How easy was it to use this interaction technique (1=very difficult; 7=very easy)? (EASE)

Participant	SEE (BC)	SEE(S)	EASE(BC)	EASE(S)
1	3	7	6	5
2	4	5	4	4
3	3	8	6	5
4	5	6	4	5
5	2	6	5	6
6	4	6	7	6
7	4	5	6	5
8	5	5	5	6
9	3	4	4	5
10	3	4	4	6

Ref: Grossman, T. and Balakrishnan, R. (2005). The bubble cursor: enhancing target acquisition by dynamic resizing of the cursor's activation area. In Proceedings of CHI 2005, 281-290.

HOWTO

- Determine what the nature of this experiment is. What kind of comparison is being made?

- What is the null hypothesis?
- What will you set your alpha to be?
- What is the nature of the data?
- What kind of statistical test do you need to use?
- Is it a within or between subjects design?
- Are there multiple statistical tests that need to be run?
- Do the assumptions check out (homogeneity of variance)?
- Do you have significance? If so, report it. If not, also report this.