Homework 3

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1. First, we want to know whether the Gray reference colors (collapsed across all background colors together; hint: subset the datatable in Matlab) had brightness matches different than what we would expect from the actual luminance of the patch (Luminance Ratio = 1). **Which statistical test would you choose and why? Run this test** in Matlab and **write-up the results** including the important statistical output (see class slides for examples of appropriate write-up format). Second, answer the same question, but about the Blue reference colors. Provide **plots** for these results.

Solution: -For this analysis I have used one -sample test, because only one sample is given to do the statistical analysis. The unknown sample is gray and luminance ratio is 1 i.e., known sample. Thus, to calculate the difference between gray matches and Luminance ratio One sample test is used.

One-sample-test output:
There was no difference in the luminance ratio between gray matches (M=1.022, SE = .0133) and what we expected evaluation based on luminance (ratio=1) alone , t(41) = 1.67, 95%CI = [.99, 1.05], p = .103, d = .26. The plot is shown is figure 1.
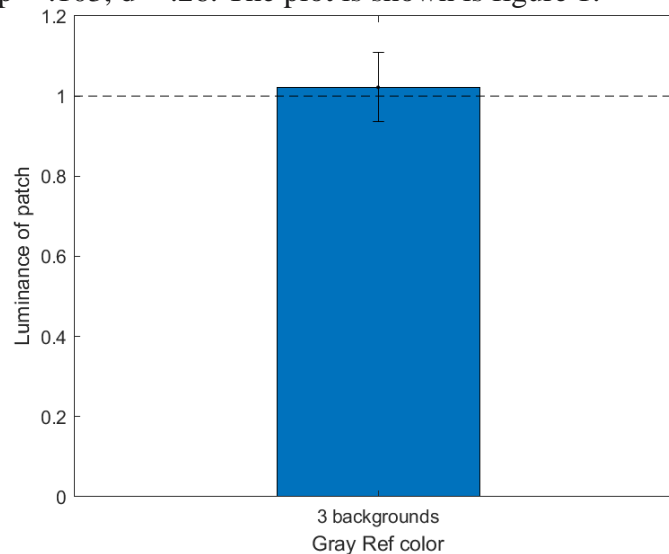

Figure 1: T-test for color grey

The analysis is now for color blue, and it is second sample color on the file. The results for one sample t test for color blue is as follows:

There is difference in the luminance ratio between blue matches (M=2.61, SE =) and what we would expect based on luminance alone (1), t(41) = 1.67, 95%CI = [2.20, 3.01],

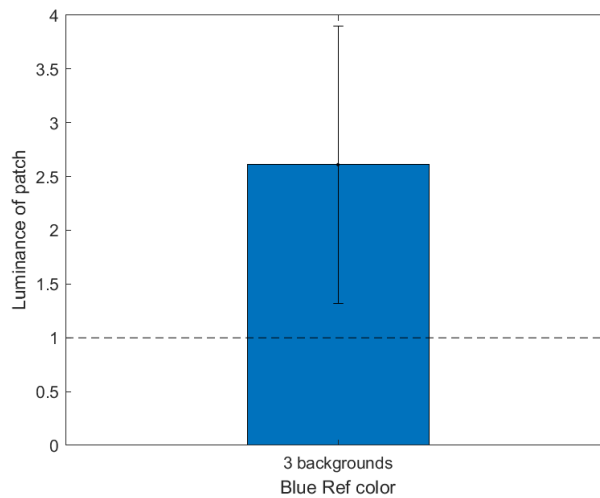p = 5.17, d = 1.2. The plot is shown in figure 2.

Figure 2: T-test for color blue

2. Next, we want to know whether the Blue ref colors (collapsed across all BG colors) had brightness matches different than the Magenta ref colors (collapsed across all BG colors). **Which statistical test would you choose and why? Run this test** in Matlab and provide an appropriate **write-up the results**. Now answer the same question, but about comparing the Blue vs. Red ref colors. Provide **plots** for these results.

Solution: For the paired comparison and to find out the difference between blue ref colors-brightness matches with magenta ref colors (collapsed across all BG colors) I have used the Pair statistical test analysis. The compared plots are shown in figure 3. Both the samples blue ref color and magenta color are unknown samples. For this test, data was used to compare 2 groups to each other. Therefore, we can say that Paired sample test is correct method to calculate the difference.

We observe that there was no much statistical difference (h=0) between blue ref colors (across all BG colors) brightness matches
(M1=2.61, SE1=0.19) than the magenta ref colors brightness matches (M2=2.91, SE2=0.20) and what we would expect based on both the colors is, t (41) = -1.9, 95%CI = [-0.62, 0.011], p = 0.058 , d = -0.30
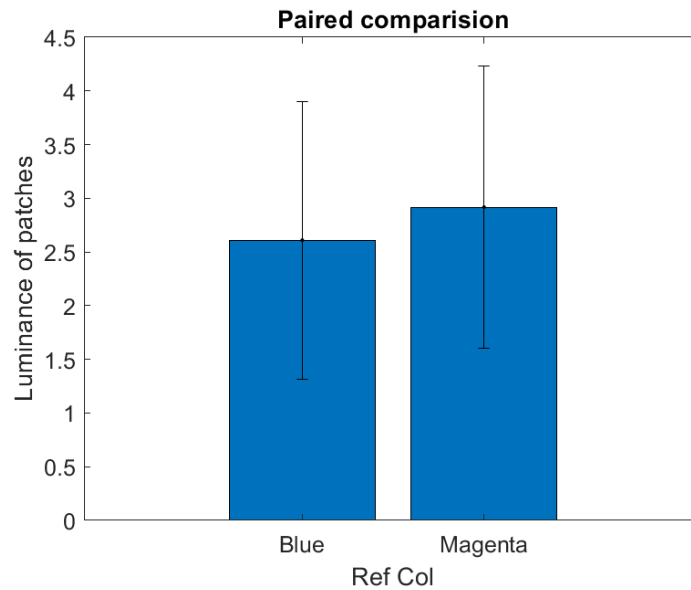
Figure 3. Paired comparison of blue and magenta brightness

Now the paired comparison and to find out the difference between blue ref colors- brightness matches with red ref colors analysis is performed. The compared plots are shown in figure 4.

In this comparison we observe that there is statistical difference (h=1) between blue ref colors (across all BG colors) brightness matches
(M1=2.61 , SE1= 0.1993) than the red ref colors brightness matches
(M2= 3.42 , SE2= 0.239)
and what we would expect based on both the colors is, t (41) = -5.31,
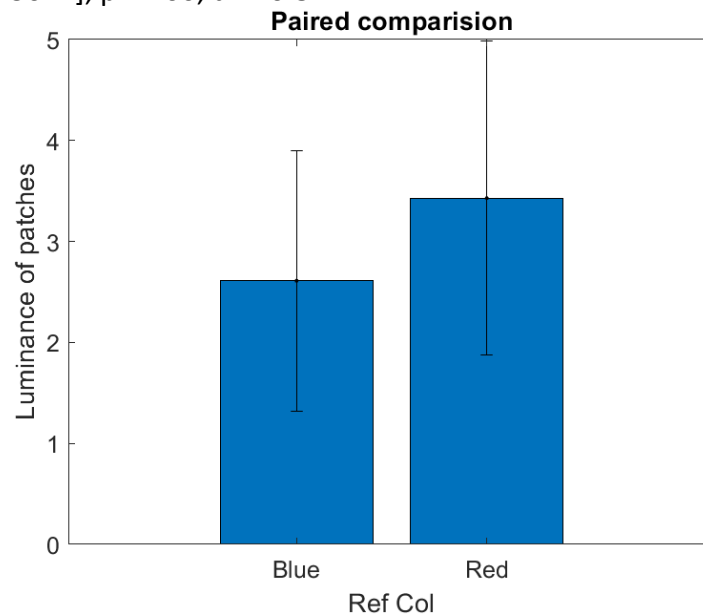95%CI = [-1.1302, -0.5077], p =4.06, d = -0.82

Figure 4. Paired comparison of blue and red brightness

3. Finally, we want to simultaneously compare the influence of the different backgrounds (1-3), the influence of the different reference colors (1-8), and their interaction, on brightness matches. For this question, run a factorial ANOVA using **anovan** in Matlab. You should get a main effect (ME) of BG color, a ME of ref color, and an interaction term (BGcol*REFcol). **Write-up and interpret** both main effects and the interaction term (just from the statistics from the ANOVA table, which should look like this):

Solution:

Analysis of Variance

Source	Sum Sq.	d.f.	Mean Sq.	F	Prob>F
BGcol	12.356	2	6.1781	5.83	0.0033
REFcol	230.273	7	32.8961	31.02	0
BGcol*REFcol	11.283	14	0.806	0.76	0.7122
Error	330.824	312	1.0603		
Total	584.736	335			

The effect of three black, white, and gray background colors i.e., BGcolor, F (2, 312) = 5.83, p =0.003. The main effect of all 8 Reference colors from gray to red Reference colors, F (7,312) = 31.02, p =0. Both the background and reference colors are significant individual (p,0.5). However, the interaction of both background colors and reference colors is noticeable. That means the interaction with each other, BGcol*Reference (3*8) interaction, F (14, 312) = 0.76, p =0.7122 (p>0.5) are not significant. As both BG and Ref don't have any effect on each other.

4. Use the **multcompare** function with the ouput from this **anovan.** Your code should be able to produce one interactive figure comparing each of the 3 BGcols together, and a separate interactive figure comparing the 8 REFcols togethers. Using these figures and the output p-values, answer the following questions (you only need to report p-values here): Which of the background colors are significantly different from each other? Which reference colors are significantly different than the Gray reference color? Is the Blue reference color significantly different than either the Magenta or Red reference color? Is the Magenta reference color significantly different than the Red reference color?

Solution:
- The background, BFCol1 (white; p=0.025) and BGCol3(gray; p=0.025) are significantly different from each other.
- The gray reference color is significantly different than 2 (blue; p=0.), 4(green; p=o.028), 6(magenta; p=00), and 8(red; p=00).
- The Blue reference color significantly different than red reference color, 8(Red; p=0.8), 6(magenta; p=0.065).
- No magenta ref color is not significantly different than red ref colors. 8(Red; p=0).

Click on the group you want to test

The population marginal means of groups BGcol=1 and BGcol=3 are significantly differ

Click on the group you want to test

4 groups have population marginal means significantly different from REFcol=1