Power analysis

Task 1: Explain what an effect size is and how it is measured. You should include a definition, symbols, types of measurements, ranges (small, medium, large), and an example

Grissom and Kim (2014) defines effect size as the measure or a degree to which null hypothesis is wrong. This measure could be in form of a correlation, standardized difference between means, and square of correlations or simply degree to which outcome differs from what is implied by the null hypothesis (Grissom & Kim, 2014). The effect size symbol is Eta-squared (η2). According to Cumming (2013), effect size must be reported provided the test is statistically significant (Cumming, 2013). Rosenthal et al. (2000) adds that effect size tell us information that is very different from that of p-value depending on practicability and the magnitude of the said effect. In addition, how effect size (ES) is measured depend on the statistical test performed (Rosenthal, Rosnow, & Rubin, 2000).

Effect size for a t test (Cohen's d)

Cohen's d is the degree to which the two means differ. In the calculation of effect sizes, for t-tests, the assumption of normality and homogeneity of variances for the data groups is assumed (Cohen, 2013). It is calculated as:

Cohen's d = (M2 - M1)/SDpooled

Where pooled standard deviation is given by square root of average sum of variances for the two groups the SDpooled = √ ((SD12 + SD22)/2). Based on Cohen's conventional rule of thumb, the strength of the effect is dictated by the following table:

Cohen d	Effect
0.2	Small
0.5	Medium
0.8	Large

Effect size for a Chi-Square for independence (Cramer's V)

Cramer's V is an effect size (ES) measurement specific for a chi-square test of independence that has a 2 by 2 contingency table. It measures how strongly two categorical fields are associated. The Cramer's V value is between 0 and 1 and is calculated as:

V = sqrt(X2/ (N *K) where X2 is the Pearson chi-square statistic N is the total frequency for the test and K is the least cell frequency.

Cramer's V	Effect
V = 0,	No association
V = 1,	Perfect association
V <.25	Weak association
V > .75	Strong association
0.25 < V <.75	Moderate Association

Effect size for a correlation (R2)

The effect size for a correlation is the R-Square value or simply the square of the correlation coefficient (r). This is referred to as the square of determination (R2). This is the proportion of the dependent variable that is explained by the independent variable. Based on Cohen, (2013) conventional rule, the effect size strength correspond to the following table:

R2	Effect
0.1	Small
0.3	Medium
0.5	Large

Example

If the Pearson correlation coefficient between mathematical scores and hours of study is 0.7, then the effect size (R2) is 0.49(0.72). An indication that the percentage of mathematics score's variation that is explained by hours of study is 49% and the rest of the percentage is explained other factors other than hours of study.

Task 4: What are the problems with null hypothesis significance testing?

According to Kline (2013), Null Hypothesis Signficnace Testing (NHST) has several statistical issues . These issues ranges from sensitivity to sampling,sample sizes, population , level of signficnace , powor of the test ,scope , casuality and meanig of the results and unrealistic assumptions . He adds that null hypothesis is always assumed to be false which is not essentially true. (KLINE, 2013). In additon Rosenthal et al. (2013) and Cumming (2013), adds that the method encourages dichotomous thinking as opposed to estimation thinking and meta analytic thinknig (Rosenthal at al., 2000 and Cumming, 2013).

According to Cohen (2013), the biggest issue with practical significance of the test is the lack of good measures. On the other hand, the test is normally criticized for its sensitivity to sample sizes.

Other issues include lack of statistical power, high error rates and the fact that the test is mostly abused or misunderstood where some people use it as a decision making tool yet the test should be an aid or a guide to decision making (Cohen, 2013). Additionally, some researchers confuse a non -statistically significant to mean a no effect which is not the case.

Furthermore, Grissom and Kim (2014) adds that the method does not indicate strength or degree to which the results are significant. Besides, the outcome states either a significant or no significance results.

Task: You are interested in seeing whether individuals with traumatic brain injury have greater impairments in divided attention than those without. You aim to measure attention using the Color-Word score from the Stroop Test. A review of previous literature yielded an effect size of Cohen's d = .24.

• What statistical test should you be using?

The appropriate test would be an Independent t-test. This is based on the knowledge that the aim of the test is to determine equality of means (attention scores) for population of individuals with traumatic brain injury for two independent groups namely divided attention and no dividend attention group. In addition, t-test is appropriate when the true population standard deviations in the two population means are unknown as in this case. Furthermore, the dependent variable (attention scores) is measured on continuous scale while the grouping variable (divided attention) is a categorical variable measured on nominal scale (Yes and No).

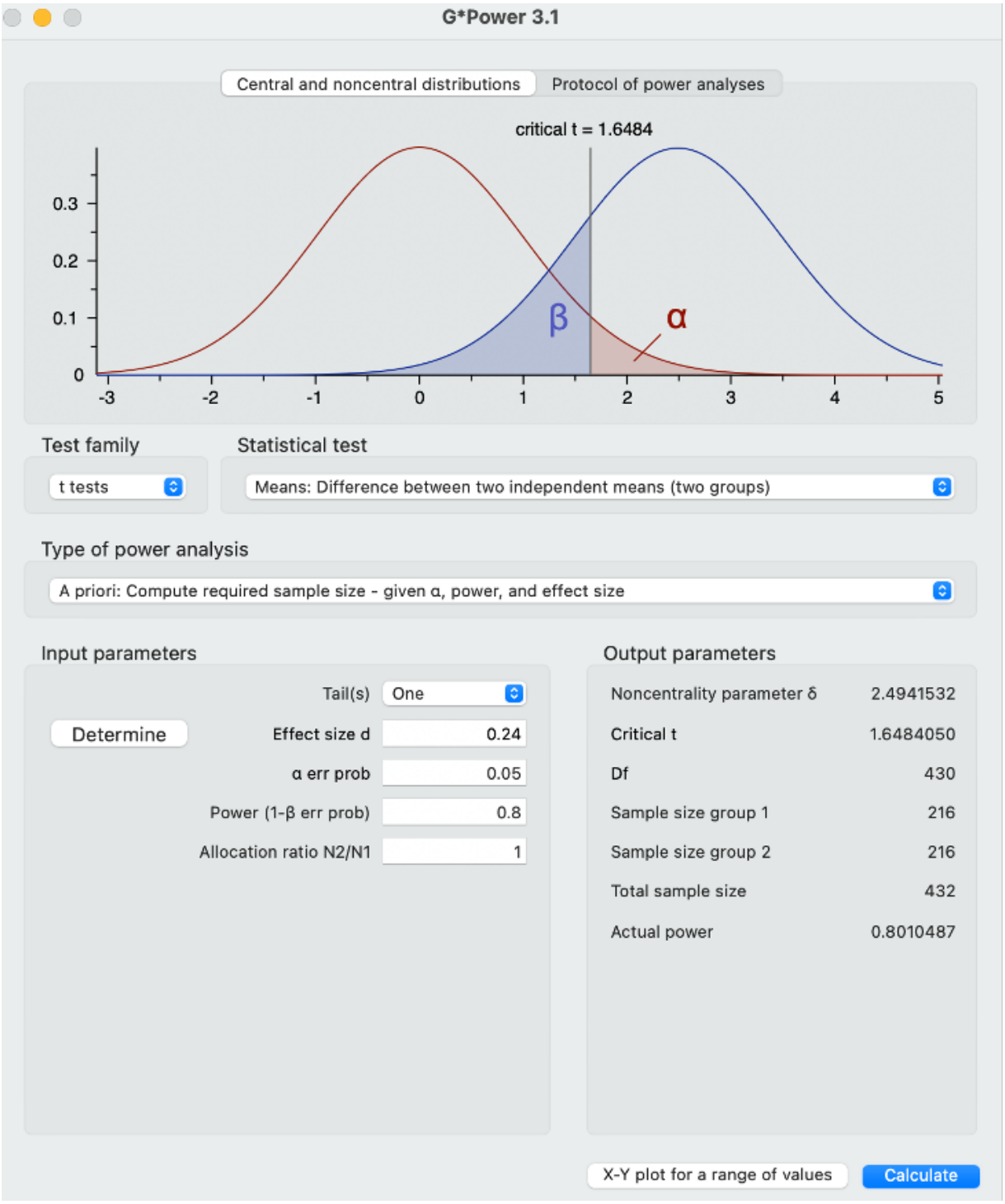
• What is your research question and what is your hypothesis?

Based on the provided information, the research question is: Do individuals with traumatic brain injury have greater impairments in divided attention than those without? From the research question, it is evident that the question has a restriction on the sign of the direction as indicated by the word greater impairment. As such, the test is right tailed. To answer the research question, the researcher formulated the following hypothesis:

H0: $\mu 1 - \mu 2 = 0$: The mean impairment for individuals with traumatic brain injury is equal for both the divided attention group and the undivided attention group.

H1: $\mu 1 - \mu 2 >= 0$: The mean impairment for individuals with traumatic brain injury is greater for the divided attention group than for the undivided attention group. The test is against an alpha level of .05.

• Explain what your G*Power result means below based on the above input



From the G*Power output table, we learn that if we would want a an independent t-test where the expected effect size d is 0.24 ,when the adopted alpha level is 0.05 and expected statistical power required to reject a false null is 0.8, then the we would need at least sample sizes of n = 216 for each group. In addition, the required critical region (right tailed) for the test would be 1.65 based on the degrees of freedom of 430 and alpha level of .05. This would imply that the test would only be statistically significant if the t-statistical value is beyond 1.65. In that case, the actual power of the test would be 0.801. (80.1%).

The Non-centrality parameter of the test would be 2.494. As Cummings (2013), puts it , the information would be inportant to the researcher as it would act as a guide based on his or her projected effect size, adopted alpha value , likely variances and available sample sizes.

References

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Ellis, P. D. (2010). The Essential Guide to Effect Sizes: Statistical Power, Meta-Analysis, and the Interpretation of Research Results. Cambridge: Cambridge University Press.

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