

10.8: Homogeneity of Variance

Before wrapping up the coverage of independent samples t -tests, there is one other important topic to cover. Using the pooled variance to calculate the test statistic relies on an assumption known as homogeneity of variance. In statistics, an assumption is some characteristic that we assume is true about our data, and our ability to use our inferential statistics accurately and correctly relies on these assumptions being true. If these assumptions are not true, then our analyses are at best ineffective (e.g. low power to detect effects) and at worst inappropriate (e.g. too many Type I errors). A detailed coverage of assumptions is beyond the scope of this course, but it is important to know that they exist for all analyses.

For the current analysis, one important assumption is homogeneity of variance. This is fancy statistical talk for the idea that the true population variance for each group is the same and any difference in the observed sample variances is due to random chance (if this sounds eerily similar to the idea of testing the null hypothesis that the true population means are equal, that's because it is exactly the same!) This notion allows us to compute a single pooled variance that uses our easily calculated degrees of freedom. If the assumption is shown to not be true, then we have to use a very complicated formula to estimate the proper degrees of freedom. There are formal tests to assess whether or not this assumption is met, but we will not discuss them here.

Many statistical programs incorporate the test of homogeneity of variance automatically and can report the results of the analysis assuming it is true or assuming it has been violated. You can easily tell which is which by the degrees of freedom: the corrected degrees of freedom (which is used when the assumption of homogeneity of variance is violated) will have decimal places. Fortunately, the independent samples t -test is very robust to violations of this assumption (an analysis is “robust” if it works well even when its assumptions are not met), which is why we do not bother going through the tedious work of testing and estimating new degrees of freedom by hand.

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