



ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2020; 6(9): 01-04
www.allresearchjournal.com
Received: 01-07-2020
Accepted: 03-08-2020

Sourav Verma
Research Scholar, OPJS
University, Churu, Rajasthan,
India

Music treatment on patient on agitation level in early and middle stage alzheimer using: Two way analysis of variance

Sourav Verma

DOI: <https://doi.org/10.22271/allresearch.2020.v6.i9a.7048>

Abstract

Testing a New Technique but not sure how it stack up against all the alternative is very difficult as most of the options sound similar to each other so picking the best out of them is a challenge. Consider a scenario we have three music treatment to be apply on patient who are in early and middle stage Alzheimer I conduct a survey on randomly selected patients. Each Class of patient is provided with a different environment i.e. Piano interlude, Mozart, Easy listening in order to make a confident and reliable decision we need a evidence to support our approach. ANOVA is defined as a statistical measure that analyze the variance of two, three or more comparable series for determining the significance of the difference in their mean values with the help of statistical technique known as F-test. The methodology was originally developed by Sir Ronald A. Fisher, the pioneered innovator of the use and application of statistical methods in experiment design who coined the name "Analysis of variance"-ANOVA There are commonly two types of ANOVA tests for univariate analysis-One way ANOVA and Two-Way ANOVA. One way-ANOVA is used when one can interested in studying the effect of one independent variable factor on population, whereas Two-way ANOVA is used for studying the effects of two factors on population at the same time.

Keywords: Mean sum of square, degree of freedom, F-Ratio

1. Introduction

The most important and fundamental application of F-distribution is the Analysis of Variance or ANOVA. It is defined as a statistical measure that analyze the variance of two, three or more comparable series for determining the significance of the differences in their mean values with the help of statistical technique known as F-test.

In others words, technique of ANOVA is used to test the equality of three or more sample means by comparing the sample variance using F- distribution. This technique split up the variance into two parts, namely

- (a) Variance between the samples
- (b) Variance within samples

2. Characteristics of Anova

The characteristics of the analysis of variance (ANOVA) are as follows:

- i) It makes statistical analysis of variance of two, three or more samples.
- ii) It determines whether the difference in the mean values of the different samples is due to Chance, or due to any significant cause and thereby it reveals the true characteristics of the given series.
- iii) It gives the desired result by finding the appropriate variance ratio through the F-test technique.

3. Assumptions of Analysis of Variance

The analysis of variance (ANOVA) is made on the basis of some assumptions which are as follows:

- i) Each sample is drawn from the normally distributed population. If samples are large, this assumption is not required.

Corresponding Author:
Sourav Verma
Research Scholar, OPJS
University, Churu, Rajasthan,
India

- ii) The samples drawn at random for study are homogeneous and independent of each other.
- iii) There is no significant difference amongst the variance of the different universe from which the samples have been drawn.
- iv) It begins with the null hypothesis that $\mu_1 = \mu_2 = \mu_3 = \dots = \mu_k$.
- v) It is assumed that critical values of the variance ratio, (F) as estimated by the Snedecar for

Different degrees of freedom at different level of significance viz., 5% or 1% etc. holds good testing the significance of the calculated values of F-that represents the variance ratio of the Sample.

4. Technique of Analysis of Variance (Anova)

For the sake of clarity this technique be divided into two categories, namely.

- i) One-way-classification
- ii) Two-way- classification

4.1 Analysis of Variance in Two-Way Classification

In Two-way classification, the data are classified according to two factors. For example, the production of a manufacturing concern can be studied on the Basis of workers as machines. A company can analyses it's sales according to salesmen and seasons. In tow-way classification, the following procedure is adopted in the analysis of variance:

- i) Coding method can used to simplify the calculation.
- ii) Find the correction factor by using the formula:

Correction Factor (C.F.) = T^2/N

Where, T = Grand total of all the values in the all samples, N = Total number of items.

- i) Find total sum of square (TSS): It is obtained by subtracting the correction factor form the total of squared values of the sample i.e.,

$TSS = [\sum X_{12} + \sum X_{22} + \sum X_{32} + \sum X_{42} + \dots \sum X_{k2}] - T^2/N$

- ii) Find the sum of squares between columns (SSC): The totle of each column is squared and divided by the number of items in the column. The correction factor is subtracted from it and SSC is obtained i.e.,

$SSC = \sum (\sum X_c / nc)^2 - T^2/N$

Where, $\sum X_c^2$ = total of squared values in each column; nc =number of items in each column.

- iii) Find the sum of squares between rows (SSR): The total of each row is squared and divided by the number of items in respective rows. The correction factor is subtracted from the total of, thus, arrived row and SSR is obtained, i.e.,

$SSR = \sum (\sum X_{2r} / nr) - T^2/N$

Where $\sum X_{2r}^2$ = Total of squared values in each row ; nr = number of items in each row

- iv) Find The sum of squares of the residual (SSE) : The sum of the squares of the residual is obtained by deducting the SSC and SSR from TSS. Thus $SSE = TSS - SSC - SSR$

- v) Find the number of degrees of freedom by using the formula:

No. of degrees of freedom between columns =(c -1)

No. of degrees of freedom between row =(r -1)

No. of degrees of freedom for residual +(c -1) (r -1)

Total no. of degrees of freedom = N - 1 or cr-1

- vi) ANOVA Table: In a two-way classification, the analysis of variance (ANOVA) table is prepared in the following way:

Table 1: ANOVA Table (Two-way Classification)

Source of variation	Sum of square	Degrees of freedom	Mean sum of squares (MSS)	F-Ratio
Between columns	SSC	(c - 1)	$SSC / (c-1) = MSC$	$F = MSC/MSE$
Between Rows	SSR	(r - 1)	$SSR / (r-1) = MSR$	$F = MSR/MSE$
Residual	SSE	(c - 1)(r - 1)	$SSE / ((c-1) \times (r-1)) = MSE$	
Total	TSS	(N - 1)or (cr -1)		

- vii) Interpretation: The calculated value of F is compared with the table value of F and if the calculated value at a specified level of signification, the null hypothesis is rejected and concluded that the difference is significant otherwise vice versa.

5. Assumption

There some assumption to do Two Ways ANOVA or we can say that there are the condition for Two Way ANOVA

Assumption #1: Your dependent variable should be measured at the continuous level (i.e., they are interval or ratio variables).

Assumption #2: Your two independent variables should each consist of two or more categorical, independent groups.

Assumption #3: You should have the independence of observation, which means that there is no relationship between the observations in each group or between the groups themselves.

Assumption #4: There should be no significant outliers. Outliers are data points within your data that do not follow the usual pattern

Assumption #5: Your dependent variable should be approximately normally distributed for each combination of the groups of the two independent variables.

Assumption #6: There needs to be the homogeneity of variances for each combination of the groups of the two independent variables.

6. Validity of Two-Way Anova

ANOVA is based on two assumptions:

- the observations are random samples from normal distributions
- the populations have the same variance [variance = (standard deviation)²]
- observations are independent of each other

7. Two –Way Anova Practical Problem

I want examine the effect of various types of music on agitation levels in patients who are in the early and middle stages of Alzheimer’s disease. Patients were selected to participate in the study based on their stage of Alzheimer’s disease. Three forms of music were tested: Easy listening, Mozart, and piano interludes. While listening to music, agitation levels were recorded for the patients with a high score indicating a higher level of agitation. Suppose you want to determine whether the early and middle stage Alzheimer’s react to piano interlude, Mozart and Easy listening. In this example, I are interested in testing Null Hypotheses

H0D: The amount of relief does not depend on type of Alzheimer’s

H0T: The amount of relief does not depend on the piano interlude, Mozart, and Easy listening

One says the experiment has two factors (Factor Stages of Alzheimer’s, Factor various music treatment at a = 2(early and middle) and b = 3(Piano interlude, Mozart, easy listening). Thus there are ab = 3 × 2 = 6 different combinations. With each combination we have r =5 loads. r is called the number of replicates. This sums up to n = abr = 30 loads in total.

Table 2.

Groups	Piano Interlude	Mozart	Easy listening	Md
Early Stage Alzheimer’s	21	9	29	19
	24	12	26	
	22	10	30	
	18	5	24	
	20	9	26	
	Mean= 21	Mean= 9	Mean= 27	
Middle Stage Alzheimer’s	22	14	15	17
	20	18	18	
	25	11	20	
	18	9	13	
	20	13	19	
	Mean= 21	Mean= 13	Mean= 17	
Mt	21	11	12	18

- SS_{within} and df_{within}

$$SS_{within} = \sum_{i=1}^2 \sum_{j=1}^3 \sum_{k=1}^4 (y_{ijk} - \bar{y}_{ij})^2$$

$$SS_{within} = (21-21)^2 + (24-21)^2 + (22-21)^2 + (18-21)^2 + (20-21)^2 + (13-17)^2 + (19-17)^2 = 178$$

$$df_{within} = (r-1) * a * b \quad (a=2 \text{ row}, b=3 \text{ column})$$

$$(5-1) * 2 * 3 = 24$$

r = 5 in all box

$$ms_{within} = SS_{within} / DF_{within} = 178/24 = 7.4166$$

- SS_{detergent} and df_{detergent}

$$SS_{detergent} = r * b \sum_{i=1}^2 (\bar{y}_{i..} - \bar{y}_{...})^2$$

$$SS_{detergent} = 5 * 3 \{ (19-18)^2 + (17-18)^2 \} = 15 * 2 = 30$$

$$df_{detergent} = a-1 = 2-1 = 1$$

$$ms_{detergent} = SS_{detergent} / df_{detergent} = 30/1 = 30$$

- SS_{temperature} and df_{temperature}

$$SS_{temperature} = r * a \sum_{J=1}^3 (\bar{y}_{i..} - \bar{y}_{...})^2$$

$$SS_{temperature} = 5 * 2 \{ (21-18)^2 + (11-18)^2 + (22-18)^2 \} = 10 * 9 + 49 + 16 = 740$$

$$Df_{temperature} = b-1 = 3-1 = 2$$

$$MS_{temperature} = SS_{Temperature} / df_{temperature} = 740/2 = 370$$

• $SS_{interaction}$ and $df_{interaction}$

$$SS_{interaction} = r * \sum_{I=1}^2 \sum_{j=1}^3 (\square_{ij} - \square_{i..} - \square_{..j} + \square_{...})^2$$

$$SS_{interaction} = 5 * (21 - 19 - 21 + 18)^2 + (9-19-11+18)^2 + \dots + (17-17-21+18)^2$$

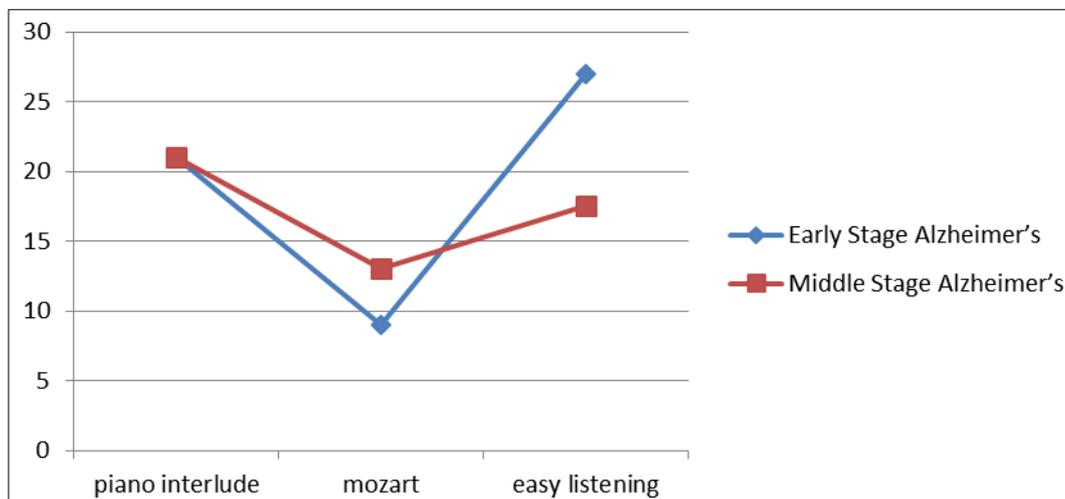
$$= 5 * 1 + 9 + 16 + 1 + 9 + 16$$

$$= 5 * 52 = 260$$

$$Df_{interaction} = (a-1) (b-1) = 1 * 2 = 2$$

$$Ms_{interaction} = SS_{interaction} / df_{interaction} = 260 / 2 = 130$$

Source	SS	df	Ms	F
Types of music	740	2	740/2 = 370	370 / 7.42 = 49.865
Degree of Alzheimer's	30	1	30/ 1 = 30	30/7.42=4.04
Music X Alzheimer'	260	2	260/2= 130	130/7.42 =17.52
Within	178	24	178/ 24 = 7.42	
Total	1208	29		



Graph 1: showing comparison of patient and music treatment

7. Result of The Experiment

The ANOVA test procedure compares the variation in observations between samples (sum of squares for groups, SSC) to the variation within samples (sum of squares for error, SSE). The ANOVA F-test rejects the null hypothesis that the mean responses are equal in all groups if SSC is large relative to SSE. The analysis of variance assumes that the observations are normally and independently distributed with the same variance for each treatment or factor level.

Without any test it is not possible to know where the significant difference lies. it seems from the graph that patient in both the early and middle stage Alzheimer's disease have less agitation while listening to Mozart, patient in the early stage of Alzheimer's disease exhibited the greater agitation while listening easy listening music and patient in the middle stages of Alzheimer's disease have greater agitation while listening to piano

The result show that there is significant main effect for type of music (F=49.86(2, 24), p<.01) but there is no significant difference in agitation level between early and middle stage of Alzheimer's disease (F-4.04(1, 24, p<.01), There is however a significant interaction effect (F=17.53(2,24), p<.01).

8. References

1. Aczel AD. Complete Business Statistics, Irwin, 1989.
2. Brown M, Forsythe A. Robust tests for the equality of variances. Journal of the American Statistical Association. 1974, 364-367.
3. Montgomery DC, Runger GC. Applied Statistics and Probability for Engineers, John Wiley & Sons, 2003.
4. Ostertagová E. Applied Statistic (in Slovak), Elfa, Košice, 2011.
5. Parra-Frutos I. The behaviour of the modified Levene's test when data are not normally distributed, Comput Stat, Springer, 2009, 671-693.
6. Stephens LJ. Advanced Statistics demystified, McGraw-Hill, 2004.
7. Taylor S. Business Statistics. www.palgrave.com