# MANOVA ON PRINT ADVERTISING

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## Abstract

Print advertising is a common form of marketing communication used for the purpose of solicitation, marketing or promoting. With the presence of print ad elements, the advertisement is enhanced. The objective of the research is to determine the effect of different print ad copy elements on attitude towards product and intention to buy. Data were obtained from 100 subjects which are divided into 25 subjects per cell. Data were analyzed using simple 2x2 balanced design full factorial between subjects' multivariate analysis of variance and some necessary univariate analysis. Both competitive claim and uniqueness claim shown significant main effect on the dependent variables. The univariate tests shown significance of uniqueness claim on the likelihood on buying the product, whereas competitive claim on the liking of the product. It is concluded that the inclusion of print ad elements can affect the attitude towards product and intention to buy.

Keywords: MANOVA, print ad, SPSS, competitive claim, uniqueness claim.

## Introduction

Advertising is a form of marketing communication used to persuade audience or consumers to take or continue some action, usually with respect to a commercial offering, or political or ideological support. Any advertisement printed on paper, be it newspapers, magazines, flyers, booklets or other medias that could be considered as a portable printed medium is called print advertising.

In this research, we want to test the effects of different print ad copy elements on attitude toward product and intention to buy by using MANOVA. MANOVA, Multivariate Analysis of Variance is a type of multivariate analysis used to assess the statistical significance of differences that involves more than one independent variable in one time. The null hypothesis tested in MANOVA is the equality of vectors of means on multiple dependent variables across groups.

## Literature Review

A study was carried out by Keith P. Gennuso, *et al.* (2014) on the smokers' physical activity and weight gain one year after a successful versus unsuccessful quit attempt to examine whether smokers' physical activity is related to their weight changed following a quit attempt. Data were analysed by using *t*-tests and *chi-square* analyses. In a study conducted by FilizFatmaColakoglu, *et al.*(2014) examining the aggression levels and emphatic tendency levels of secondary school students who involve or do not involve in sports, both ANOVA and MANOVA is used to analyse the data.Aghajanihashtchintahmores (2011) investigated on the role of play in social skills and intelligence of children in three groups, kindergarden (3-5 years old), pre-school (6-7 years old), and school (8-12 years old) focusing on two factors, which is intelligence profile and social skill with data analysed by two-way MANOVA. William Flores, *et al.* (2013) explored on the effect of variations in banner ad, type of product, website context, language of advertising on Internet users' attitudes. The main goal of the study by Yu-Chen Hsieh, *et al.* (2010) was to verify different influences of the information types on advertising attention. Previous studies relevant to internet advertising focused on the form, colour, size and location, while this study

focused on how the information types and the webpage structure influenced the viewers' attention on banner advertising.

**Methodology**

Multivariate Analysis of variance (MANOVA) is a statistical test procedure for comparing multivariate (population) means of several groups. The one-way MANOVA is modelled as $\left[y_{ij}^{(1)} \quad y_{ij}^{(2)} \quad \cdots \quad y_{ij}^{(p)}\right] = \left[\mu^{(1)} \quad \mu^{(2)} \quad \cdots \quad \mu^{(p)}\right] + \left[\alpha_j^{(1)} \quad \alpha_j^{(2)} \quad \cdots \quad \alpha_j^{(p)}\right] + \left[\varepsilon_{ij}^{(1)} \quad \varepsilon_{ij}^{(2)} \quad \cdots \quad \varepsilon_{ij}^{(p)}\right]$ for p measures. $y_{ij}^{(k)}$ is the score for the subject *ij* on the dependent variable $Y_k$; $\mu^{(k)}$ and $\alpha_j^{(k)}$ are parameters for $Y_k$ (Finn, 1974).

We explored the multivariate effect and univariate effect for each MANOVA, where multivariate effect is how the independent variables have an impact on the combination of dependent variable and univariate effects is how the mean scores for each dependent variable differ across the independent variable groups. . It describes the effect of the independent variables upon the combined dependent variables.

A few assumptions have to be met to use MANOVA. All dependent variables must be distributed normally. Linear combinations of dependent variables must be distributed normally. All subsets of the variables must have a multivariate normal distribution (Statistics, L., 2013). In MANOVA, each one of dependent variables is required to have equal variances. Also, it is required in MANOVA that the covariance matrices are homogeneous. The variance shared between any two variables need to be equal across all levels of independent variable. Box's M test is used to test the hypothesis that the covariance matrices of the dependent variables are significantly different across levels of the independent variable. The assumption of MANOVA is violated when the Box's M test is significant (Zaiontz C., 2015). The subjects' scores on the dependent measures should not be influenced by or related to scores of other subjects in the condition or level. If it is suspected that the observations are lack of independence, it can be tested with an interclass correlation coefficient.

The dependent variables in MANOVA should not be too strongly correlated. When there are moderate correlations between the dependent variables, MANOVA works well. If the dependent variables are too correlated, there is not enough variance left over after the first dependent variable is fit. On the other hand, if the dependent variables are not correlated, the multivariate test will lack of power. Hence, the acceptable limits are positive correlation should not exceed $r$=0.90, while negative correlation should not exceed $r$ =-0.40(Andrew Mayers, 2013).

When we run the MANOVA analysis in SPSS, several lines of multivariate outcome are presented. Each reports different significance. The four options are: Wilks' Lambda, Hotelling's Trace, Pillai's Trace and Roy's Largest Root. Wilk's Lambda is used when the independent variable has more than two groups. It explores outcomes using a method similar to F ratios in univariate ANOVAs. The larger the dispersion between groups, the smaller the value of Wilk's Lambda, the greater the implied significance.Hotelling's Trace should be used only when the independent variables are represented by two groups. Pillai's Trace and Roy's Largest Root can be used with any number of independent variable groups. Pillai's Trace is most probably the most powerful option when the samples are equal in size. Roy's largest Root used similar calculations as Pillai's Trace, but it focused on the first factor in the analysis. The best measure to be used is the one most immune to the violations of the assumptions underlying MANOVA yet maintains the greatest power (Mayers, 2013).

When the MANOVA null hypothesis is rejected, we look into the main effect and interaction effect by using univariate tests, ANOVA. Analysis of Variance (ANOVA) is used to analyse the differences between group means and their associated procedures, such as variation among and between groups. In ANOVA, the null hypothesis is that all groups are random samples of the same population, implying that the treatments have the same effect on the samples. There are three assumptions to be satisfied for ANOVA test. The observations are obtained independently and randomly from the populations. The population at each factor level is (approximately) following normal distribution and these normal populations have a common variance, $\sigma^2$.

**Findings and Discussion**

Correlations were found to meet the acceptable limits for MANOVA. Box's M test was used to test for the equality of variance-covariance matrices and was found that the assumptions were satisfied. From Table 1, the multivariate outcome showed no interaction effect, however response measures were found to be significantly dependent on the uniqueness and competitive claim. Univariate tests were run since the MANOVA null hypothesis is rejected. Homogeneity of between group variance for all dependent variables was found using Levene's test. ANOVA tests in Table 2 shown that uniqueness claim only effect the likelihood of buying the product while competitive claim effect 'How much do you like this product?' and 'I like this product'. The interaction effect in the univariate test shows that all the response measure are significantly dependent on the inclusion of both claims.

| Effect | | Sig. |
|---|---|---|
| Intercept | Pillai's Trace | .000 |
| | Wilks' Lambda | .000 |
| | Hotelling's Trace | .000 |
| | Roy's Largest Root | .000 |
| Uniqueness | Pillai's Trace | .001 |
| | Wilks' Lambda | .001 |
| | Hotelling's Trace | .001 |
| | Roy's Largest Root | .001 |
| Competitive | Pillai's Trace | .014 |
| | Wilks' Lambda | .014 |
| | Hotelling's Trace | .014 |
| | Roy's Largest Root | .014 |
| Uniqueness * Competitive | Pillai's Trace | .150 |
| | Wilks' Lambda | .150 |
| | Hotelling's Trace | .150 |
| | Roy's Largest Root | .150 |

**Table 1**: Multivariate tests result.

| Source | Dependent Variable | Sig. |
|---|---|---|
| Corrected Model | Y1 | .016 |
| | Y2 | .025 |
| | Y3 | .025 |
| | Y4 | .002 |
| Intercept | Y1 | .000 |
| | Y2 | .000 |
| | Y3 | .000 |
| | Y4 | .000 |
| Uniqueness | Y1 | .963 |
| | Y2 | .885 |
| | Y3 | .148 |
| | Y4 | .001 |
| Competitive | Y1 | .017 |
| | Y2 | .032 |
| | Y3 | .201 |
| | Y4 | .877 |
| Uniqueness * Competitive | Y1 | .030 |
| | Y2 | .027 |
| | Y3 | .016 |
| | Y4 | .034 |

**Table 2:** Univariate Test Result

## Conclusion

Our main objective is to test the effects of different print ad elements on the attitude toward the product and intention to buy. The multivariate tests showed that the response measures were significantly dependent on both the claims at significance level $\alpha$=0.05. This shows that the claims have an effect on the measures implying the addition of the claims gives positive result on the attitude towards the product and intention to buy. From the univariate test, the experimental effects that are significant at level $\alpha$=0.05 are Y4, 'What is the likelihood you would buy this product?', for uniqueness claim and Y1, 'I like this product', and Y2, 'I would buy this product', for competitive claim. Hence, we conclude that both the claims had effects on the attitude towards the product and intention to buy.

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