

Statistical Analysis of Variables in Heritage Buildings

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Abstract

A pilot survey was done on the experts of Heritage and renowned academicians to scale the variables found in heritage buildings in India. The analysis on these variables was done using SPSS (a statistical analysis tool) which have provided the significance level of each variable in the Heritage Buildings in India and also provided the correlation among the variables taken for analysis.

Keywords: heritage, parameters, statistical analysis, variables

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INTRODUCTION

India is a country having a very strong cultural heritage of different ages. Different regions of the country have developed buildings and complexes in their local style and character depending upon the climatic conditions and the typology of building whether it is fort, palace, kothi or a colonial bungalow. The buildings were also dependent on the regional styles and characters i.e. kothi of Awadh is different from the residential house of Kerala.

Thirty five variables which were commonly found in the heritage areas were selected for doing this study. There are still more variables which can be included from heritage buildings in India but the study was conducted on selected thirty five variables.

These variable were categorised under four broad parameters i.e. Influence, Principles, Elements and Ornamentation.^[1] Since this kind of study requires a minimum sample size of thirty (Krejcie and Morgan 1970),

therefore a pilot survey was conducted on forty professionals in the field of heritage building conservation for grading these variables on I–V scale. Freedom was given to them for suggesting some more variables and to provide suggestions if any.^[2]

The pilot survey comprises the Conservation Architects which were independently practicing in the field, the professionals working in the conservation organizations like Archaeological Survey of India (ASI), Indian National Trust for Art and Cultural Heritage (INTACH), Aga Khan Trust for Culture (AKTC), Heads of various conservation organizations like Dharohar, Heritage Restore, Conserve Heritage, Director of National Institute of Advance Studies in Architecture (NIASA) 'the education wing of Council of Architecture' and heads and faculty members of various Academic institutions like Jamia Millia Islamia New Delhi, Aligarh Muslim University, RIMT-COA Gobindgarh, Amity University Lucknow, etc.^[3,4]

DATA COLLECTION

A questionnaire was prepared and was sent to forty conservation professionals and academicians asking them to scale 35 variables selected from the heritage buildings in India on a scale of I–V, where V is the most significant and I is the least significant scale.^[5]

These thirty five variables were categorised under four broad parameters i.e.

Influence, Principles, Elements and Ornamentation for the conduct of study. For doing the analysis the elements are provided with a code which had two initial letters of parameter and two initial letters of the associated variable.

For example variable ‘Climate’ is associated with parameter ‘Influence’ therefore the code provided is INCL. In variables which had two words the first letter of both the words are taken after the two letters of parameters.

For example variable ‘Regional Architecture’ is associated with parameter ‘Influence’ therefore the code provided is INRA (Figure 1).

DATA ANALYSIS

Calculation of Mean Value

It may be define as the value which we get by dividing the total of the values of various given items in a series by the total no of items. Kothari and Garg (1985).^[6] For example: if we have the scale I to V and for variable INCL out of 40 samples 4 provides I score, 1 provides II score, 9 provided III score, 6 provides IV score and 20 provides V score.

Mean:

$$(4 \times 1 + 1 \times 2 + 9 \times 3 + 6 \times 4 + 20 \times 5) / 40 = 3.925$$

Therefore Mean for Variable INCL = 3.925 on the scale of 5.

Mean value which is also known as statistical average was calculated for all the forty variables with the help of SPSS 20 Software. This statistical average was calculated to understand the significance of each individual variable used in the heritage buildings.

The hypothesis tested is as follows:

H₀: All these variables contribute significantly for the heritage buildings in India.

H₁: All these variables do not contribute significantly for the heritage buildings in India.

Table 1 was generated after providing the above given commands to SPSS 20. It provides the mean of each variable on the scale of five, which gives the level of significance of each of the thirty five variables and places each variable according to descending order of mean.

The variable ‘Proportion’ was showing the highest score of 4.05 out of 5 and the variable ‘Exposed Brick’ was showing the lowest score of 2.80 out of 5. Rest of the variables were in between 2.8 and 4.05 on the scale of 5.

The chart below is showing the bars of response in count and response in percentage of each of the thirty five variables.

This chart explains that for each variable, what the opinion of each respondent was. For example: for the variable 1 i.e.

INCL or Climate, 20 people out of 40 respondents have said that it is the most significant variable but 4 out of 40 said that it is the least significant variable in heritage buildings in their opinion (Figures 2, 3).

Pilot Survey Questionnaire for Heritage Buildings

Name:	Designation:
Organization:	Email:

Below are the list of Variables significant in Heritage Structures and Complexes in India. Please scale these variables on a scale of I-V according to their importance in heritage buildings. Also suggest more variables which you think are significant in heritage structures.

S.No.	Parameter	Variable		*Scale the Variable				
				I	II	III	IV	V
1.	Influence	1	Climate					
2.		2	Regional Architectural					
3.		3	Typology-Fort,Palace,Mosque etc					
4.	Principles	1	Axis					
5.		2	Symmetry					
6.		3	Proportion					
7.		4	Grand Scale					
8.		5	Courtyard Planning					
9.		6	**Viewshed or Vista					
10.		7	Geometric Planning					
11.	Elements	1	Boundary Wall					
12.		2	High Plinth					
13.		3	Foundation Stone					
14.		4	Landscaping					
15.		5	Built open Relationship					
16.		6	Green Lawns					
17.		7	Stone Cladding					
18.		8	Exposed Brick					
19.		9	Arches					
20.		10	Columns					
21.		11	Eave projection and louvers					
22.		12	Brackets					
23.		13	Colonnaded Veranda					
24.		14	Parapet Wall					
25.		15	Domes					
26.		16	Chatris and Cupolas					
27.		17	Minarets					
28.	Ornamentation	1	Cornices and Corbelling					
29.		2	Monolithic Screen (Jali)					
30.		3	False Arch					
31.		4	Stone Carving					
32.		5	Pilaster					
33.		6	Inlay Work					
34.		7	Calligraphy					
35.		8	Paintings and Sculptures					

Scale the Variable: Variable are to be measured on I-V scale, where I is the least important and V is the most important.

Please put a * in the scale of Variable you select.

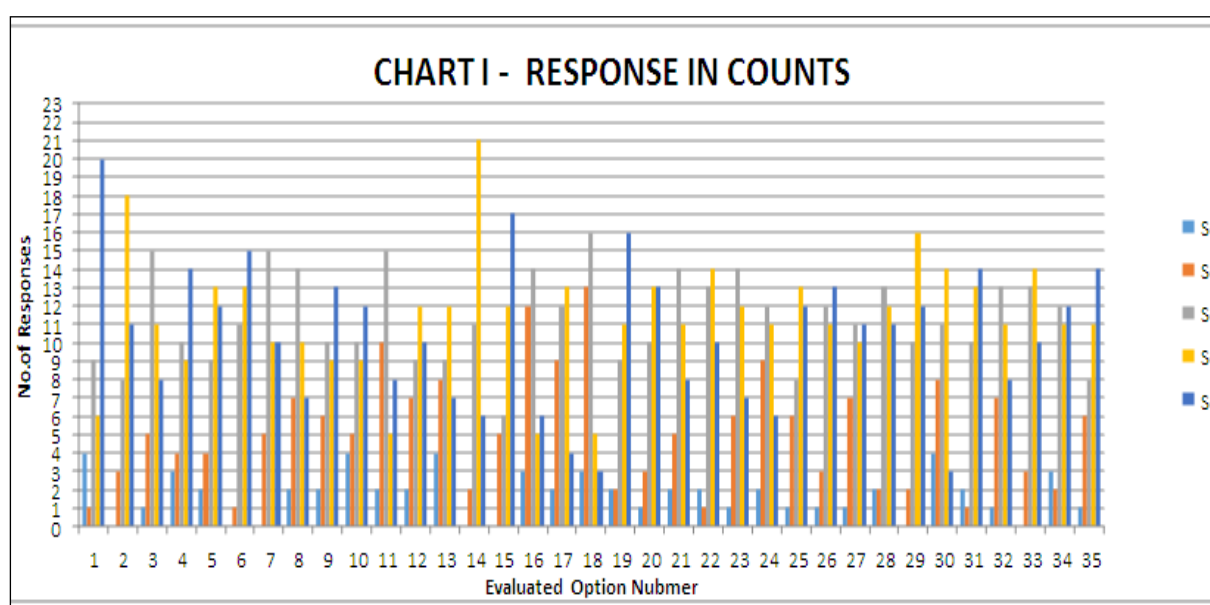
Note: Structural System is not incorporated in this Questionnaire.

****Viewshed:** View or Vista of building from the foreground.

Fig. 1. Pilot Survey Questionnaire Send to 40 Conservation Professionals.

Table 1. Descriptive Statistics Chart (Produced Through SPSS 20).

Variable	Variable code	N	Minimum	Maximum	Mean	Std. deviation
Proportion	PRPR	40	2.00	5.00	4.0500	0.87560
Built open relationship	ELBO	40	2.00	5.00	4.0250	1.04973
Monolithic screen (Jali)	ORMS	40	2.00	5.00	3.9500	0.87560
Regional Architecture	INRA	40	2.00	5.00	3.9250	0.88831
Arches	ELAR	40	1.00	5.00	3.9250	1.14102
Climate	INCL	40	1.00	5.00	3.9250	1.32795
Stone carving	ORSC	40	1.00	5.00	3.9000	1.08131
Column	ELCO	40	1.00	5.00	3.8500	1.05125
Chatris and cupolas	ELCC	40	1.00	5.00	3.8000	1.06699
Paintings and sculptures	ORPS	40	1.00	5.00	3.7750	1.16548
Landscaping	ELLS	40	2.00	5.00	3.7750	0.76753
Inlay work	ORIW	40	2.00	5.00	3.7750	0.91952
Symmetry	PRSY	40	1.00	5.00	3.7250	1.15442
Brackets	ELBR	40	1.00	5.00	3.7250	1.03744
Domes	ELDO	40	1.00	5.00	3.7250	1.13199
Cornices and corbelling	ORCC	40	1.00	5.00	3.7000	1.09075
Calligraphy	ORCA	40	1.00	5.00	3.6750	1.18511
Axis	PRAX	40	1.00	5.00	3.6750	1.26871
Grand scale	PRGS	40	2.00	5.00	3.6250	1.00480
Vista	PRVI	40	1.00	5.00	3.6250	1.23387
Minarets	ELMI	40	1.00	5.00	3.5750	1.15220
High plinth	ELHP	40	1.00	5.00	3.5250	1.19802
Geometric planning	PRGP	40	1.00	5.00	3.5000	1.32045
Typology	INTY	40	1.00	5.00	3.5000	1.03775
Colonnaded veranda	ELCV	40	1.00	5.00	3.4500	1.03651
Eave projection and louvers	ELEP	40	1.00	5.00	3.4500	1.10824
Pilaster	ORPI	40	1.00	5.00	3.4500	1.08486
Courtyard planning	PRCP	40	1.00	5.00	3.3250	1.11832
Parapet wall	ELPW	40	1.00	5.00	3.2500	1.12660
Foundation stone	ELFS	40	1.00	5.00	3.2500	1.25576
Stone carving	ELSC	40	1.00	5.00	3.2000	1.06699
Boundary wall	ELBW	40	1.00	5.00	3.1750	1.17424
False arch	ORFA	40	1.00	5.00	3.1000	1.12774
Green lawns	ELGL	40	1.00	5.00	2.9750	1.16548
Exposed brick	ELEB	40	1.00	5.00	2.8000	1.01779

**Fig. 2.** Response in Counts of the 40 Professionals for the 35 Variables Used in Heritage Buildings.

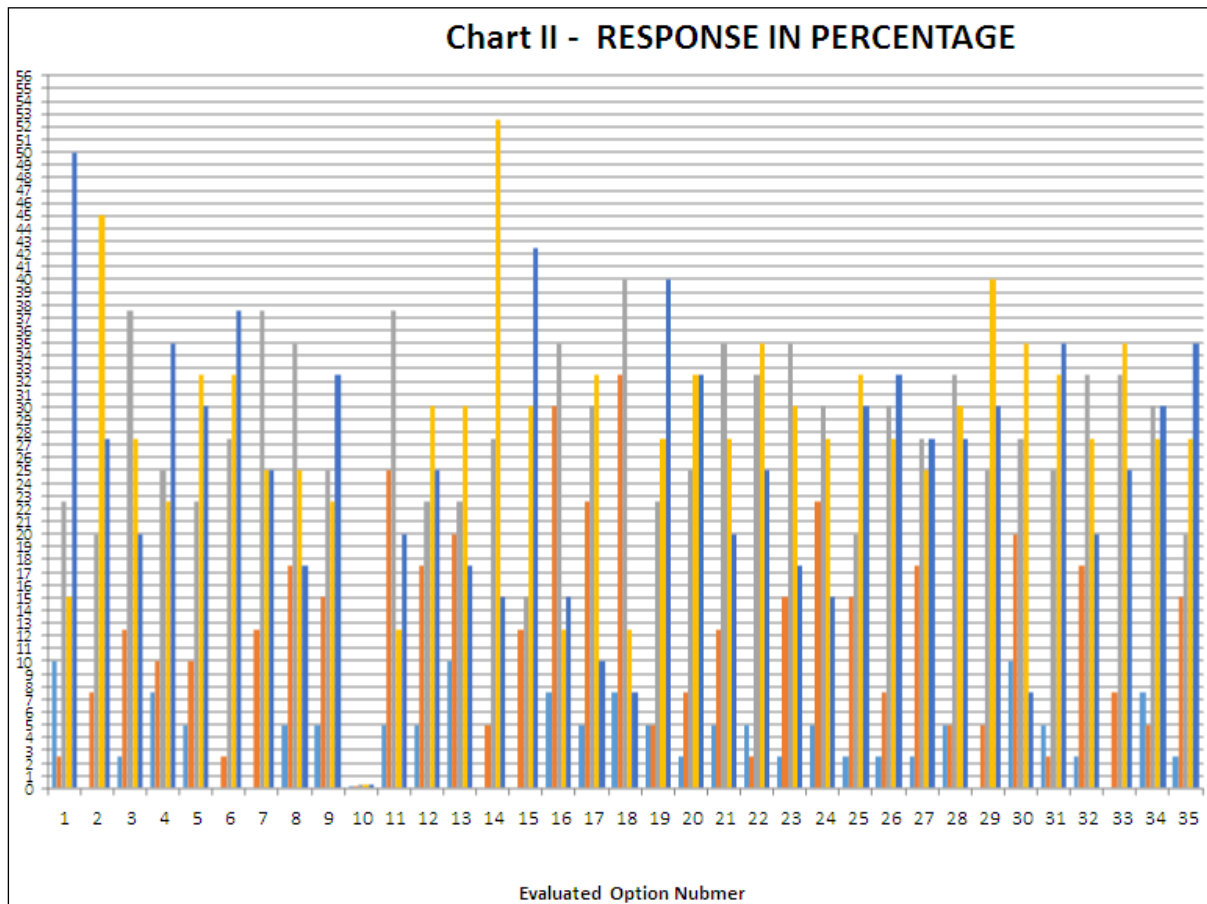


Fig. 3. Response in Percentage of the 40 Professionals for the 35 Variables Used in Heritage Buildings.

Likewise in the Chart II – Response in percentage, 50% of the respondents out of 40 accepts that the climate is the most important consideration in the designing of heritage buildings, but 10% of the respondent assumes that it is the least significant aspect in designing the heritage buildings.

The most important point which was analysed through the data provided by the forty respondents was that the mean of all the forty responses for these 35 variable was between 2.80 and 4.05 on a scale of 5. Which implies that the variables were having significance between 56 and 81%.

Since the mean of all the individual variable taken from the heritage buildings for the analysis was more than 50%. This

justifies the null hypothesis that “All these variables contribute significantly for the heritage buildings in India.”

Null hypothesis H_0 is accepted on the basis of statistical analysis carried out.

Correlation among the Parameters

The above analysis proves that all the thirty five variables are significant in the heritage buildings. But these thirty five variables are broadly categories under four parameter i.e. influence, principle, element and ornamentation. The correlation will try and analyse that ‘Are these parameters having any significant correlation among themselves’.

The coefficient of correlation ‘ r ’ is not affected by change in scale or by change in

location. It can be used to compare the relationships between two pairs of variables.

It is a unit free measure of linear relationship between two variables and takes values in $[-1, +1]$, where r is close to $+1(-1)$, there is strong positive (negative) relationship. For a significant correlation between two variables the value of significance for two tail test should always be less than 0.05 (i.e. <0.05) for 95 % significance level and 0.01(i.e. <0.01) for

99% significance level Kothari and Garg (1985).

The Pearson product movement correlation among the four parameters was also done using (SPSS 20). The following Table 2 was generated.

The hypothesis tested is as follows:

H_0 : There is no correlation between the parameters

H_1 : There is a correlation between the parameters

Table 2. Pearson Product Movement Correlation Between Parameters (Produced Through SPSS 20).

		Influence	Principle	Element	Ornament
Influence	Pearson correlation	1	0.416**	0.420**	0.279
Principle	Pearson correlation	0.416**	1	0.656**	0.526**
Element	Pearson correlation	0.420**	0.656**	1	0.800**
Ornamentation	Pearson correlation	0.279	0.526**	0.800**	1

*Sig (2-tailed) at 0.05 level of significance.

**Sig (2-tailed) at 0.01 level of significance.

Analysis

The above table shows that for parameter 'Influence' The parameter 'Principle' has value for coefficient of correlation $r = 0.416$. Since the value lies between 0 and 1, it shows that there is a positive relationship between parameter 'Influence and Principle'.

The parameter 'Principle' has Significance Value = 0.008

Which is less than 0.01 i.e. $0.008 < 0.01$ (significant correlation)

It implies that there is a strong and positive relationship between the two parameters 'Influence and Principle'.

The above table shows that for parameter 'Influence'

The parameter 'Element' has value for coefficient of correlation $r = 0.420$

Since the value lies between 0 and 1, it shows that there is a positive relationship between parameter 'Influence and Element'.

The parameter 'Element' has Significance Value = 0.007

Which is less than 0.01 i.e. $0.007 < 0.01$ (significant correlation)

It implies that there is a strong and positive relationship between the two parameters 'Influence and Element'.

The above table shows that for parameter 'Influence'

The parameter 'Ornamentation' has value for coefficient of correlation $r = 0.279$

Since the value lies between 0 and 1, it shows that there is a positive relationship between parameter 'Influence and Ornamentation'.

The parameter 'Ornamentation' has Significance Value = 0.081

Which is greater than 0.01 i.e. $0.081 > 0.01$ (nonsignificant correlation)

It implies that there is a positive relationship between the two parameters 'Influence and Ornamentation' but it is not significant'.

The above table shows that for parameter 'Principle'

The parameter 'Element' has value for coefficient of correlation $r = 0.656$

Since the value lies between 0 and 1, it shows that there is a positive relationship between parameter 'Principle and Element'.

The parameter 'Element' has Significance Value = 0.000

Which is less than 0.01 i.e. $0.000 > 0.01$ (Highly significant correlation)

It implies that there is a positive and highly significant relationship between the two parameters 'Principle and Element'.

The above table shows that for parameter 'Element'

The parameter 'Ornamentation' has value for coefficient of correlation $r = 0.562$

Since the value lies between 0 and 1, it shows that there is a positive relationship between parameter 'Element and Orientation'.

The parameter 'Ornamentation' has Significance Value = 0.000

Which is less than 0.01 i.e. $0.000 > 0.01$ (highly significant correlation)

It implies that there is a positive and highly significant relationship between the two parameters 'Element and Ornamentation'.

RESULT

The above analysis explains that there is a highly significant correlation among the three Parameters out of four taken for analysis i.e. principle, element and ornamentation.

The result also explains that there is a strong correlation of Influence with Principle and Element but there is no significant correlation between Influence and Ornamentation.

Null Hypothesis H_0 is rejected on the basis of statistical analysis carried out.

CONCLUSION

The above two analysis on the variables selected from the heritage buildings proves that all the thirty five elements taken for the analysis are significant in Indian heritage buildings but all the parameters under which they are categorised are not significantly correlated with each other.

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