

THE IMPACT OF INFORMATION SEQUENCE IN THE CONSTRUCTION DOMAIN

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The decision making process that occurs during property development and construction related activities might have a significant impact upon value and therefore, client satisfaction. One key aspect of this process may be the sequence in which information is evaluated by the decision taker.

An exploratory research methodology has been developed and is used to collect empirical data in order to support the hypothesis that information sequence will impact upon the decision making process that occurs during construction design. The paper contains an analysis of data collected and an appraisal of the findings that indicate the existence of order effects within the context of the construction design process.

In addition, consideration is given to the way in which information sequence may impact upon the decision making process in several other possible areas of development and construction related application. Aspects of the development and construction process that are identified include Construction Design, Facilities Management and Risk Management.

The discussion in the paper builds upon previous work by the author (Hogg 1999) which supported the case for early intervention in the design process to mitigate against the possible negative effects on value due to the unintentional influence of the order effect.

Keywords: belief updating; client briefing; information sequence; decision making; value management

INTRODUCTION

There are many possible causes of poor value in construction which are created during the design process. The list of possible poor value factors that may have a negative impact during design could include: limitations on design time forcing error or incompleteness; outdated specifications; poor communications between client and designer; poor co-ordination of design consultants. However, at the heart of much of the cause of poor value occurring during design could be the nature of the design process itself. A review of this process from previous literature highlights the significance of communications between designers and clients. It also indicates a 'promptness' on the part of designers, in the establishment of initial design concepts, which once in existence, appear to be dominant in determining the nature of the final design.

The effect that the order of information communication may have upon the manner in which people form and update opinions ('belief updating') has been recognised for many years and related research has been applied in many areas including communications and persuasion, decision theory, economics, attitude change and jury decision making. (Hogarth and Einhorn 1992)

The idea that the order of information delivery from client to architect, or from prime consultant to design specialists may have an effect on the design of a building, or upon other areas of the construction and property domain is both intriguing and relevant.

PREVIOUS RESEARCH

This paper represents ongoing development relating to a previous publication by the author (Hogg 1999) which identified the potential impact that order effects may have upon the design process. In this previous paper, several key issues relating to the design process, belief updating mechanisms and their impact upon design, were identified. These are summarised as follows;

The design process

From a review of previous research into the practice of architectural design, the following summation, linking several key hypotheses, was made;

The initial design concept which is established upon little information is formed promptly as an heuristic approach to assist decision making in a complex task environment; the initial concept is little changed in the final design.

Belief updating mechanisms

When opposed pieces of information are presented to a subject, the order in which the information is considered may influence the resultant opinion or updated belief. If the subject forms an opinion weighted toward the early pieces of information, a primacy effect is said to occur, whilst if the subject demonstrates the greater influence of sequentially later information, a recency effect is exhibited.

Certain task variables may have an effect upon primacy or recency. These variables include: the complexity of the information; the number of items of information; the timing of the judgement (i.e. whether a belief is updated after receipt of each item of information (step by step mode SBS) or after the receipt of a series of items of information (end of sequence mode EOS). (Hogarth and Einhorn 1992).

The impact of order effects upon the construction design process

There is strong evidence as to the existence of order effects which may impact upon the design decision making process which in turn, could influence the final design and thus cause poor value.

In addition to the literature review and discussion, the paper also outlined a methodology that was proposed as a means of obtaining actual data. The basis of this was a short questionnaire that has subsequently been refined for the purposes of the investigation outlined in this paper.

METHODOLOGY

With the objective of obtaining data to support the application of the order effect phenomenon within the design process, a questionnaire survey was carried out with surveying students at the Nottingham Trent University. The students selected for the survey were from the final stage of their degree course. As such, nearly all of the subjects have had at least one year of surveying work experience (part-time students much more) and are considered to be a reliable proxy, given the constraints that exist in this initial exploratory study.

The surveys were carried out in supervised classroom conditions and necessitated an outline explanation of the process to the participating students before sight of the questionnaire, without reference to its intent.

The questionnaire was designed to reflect a hypothetical and simplified brief and was presented in two scenario formats, differentiated only by order of information;

'Green Scenario' order – Information Blocks A, B, C

'Blue Scenario' order – Information Blocks C, B, A

Subjects received only one of the questionnaires (*Green Scenario* or *Blue Scenario*) which were distributed randomly.

Each of the information blocks was designed to carry a particular design emphasis type – Form, Function or Economy. To assist subjects in completing the survey, the following definitions for these terms (Draper 1984) were used;

Form - 'what the project looks and feels like'

Function - 'how the project works for people and things'

Economy – 'maximum effect with minimum means in relating function and form'

Information Block A;

Design Emphasis Type - **Form**

'The building is to reflect the existing corporate image of the company and is to act as its Flagship headquarters within Britain. The proposed location is considered to be in an area of 'marginal quality' (the South East Boundary abuts a derelict 1950's council residential development) and consideration should be given to the long term protection of the image of the site via landscaping, security and access provision.'

Information Block B;

Design Emphasis Type - **Function**

'The company strives to be at the leading edge of technological developments and the building should therefore be able to accommodate the introduction of future innovation and an anticipated high rate of office reconfiguration. A detailed description of the present accommodation requirements of the building is outlined in a separate schedule'

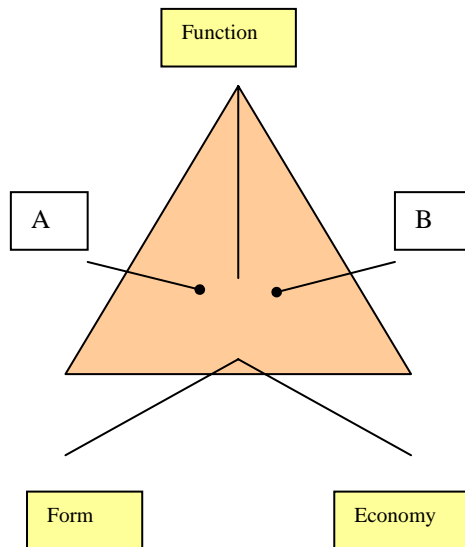
Information Block C;

Design Emphasis Type – **Economy**

'In recent months there has been considerable financial pressure on the food production industry and the sector has shown a 15% decline in profits in 1998. It is also likely that the company will make some major acquisitions in the next financial year. With this in mind, the cost of the completed building will compare favourably with other recently completed construction works carried out by the corporation and will be monitored by the group's international finance director who is resident in Chicago, USA.'

The questionnaire requested subjects to:

indicate their opinion as to the point of balance between the component elements of function, form and economy by plotting a relative location, indicating design emphasis, on a triangular grid (an example of this is shown below). Selection of position 'A' would indicate a stronger emphasis on Form and Function than Economy, whilst position 'B' would indicate a stronger emphasis on Function and Economy than Form. Although these positions would merely be indicative at the level of each individual subject (since this position is dependant upon the subject's opening perception / bias), it was considered that an aggregate position of all subject responses may support the hypothesis. (**'Design Emphasis Test'**)



provide a single word that best described their interpretation of the main emphasis of the briefing information given. Each of the words would be classified by the author as being 'Neutral' (where no design emphasis was suggested by the chosen descriptor), or demonstrating 'Form Emphasis', 'Function Emphasis' or 'Economy Emphasis' (**'Key Factor of Importance Test'**)

The survey with final year undergraduates was carried out with the assistance of 78 surveying students who were tested in small group situations (i.e. <15). The subjects included students from both quantity surveying and estate surveying disciplines and were from both sandwich / fulltime and part-time student cohorts.

RESULTS OF QUESTIONNAIRE SURVEYS

The analyses of the results of the questionnaire survey are presented in Tables 1 and 2 and Figures 1 and 2.

Design Emphasis Test

Table 1: Results of questionnaire survey showing effect of information sequence on 'design emphasis'

| Design Emphasis | Blue | | Green | | Total | |
|----------------------------------|-----------|-----|-------|-----|-------|-----|
| | N | % | N | % | N | % |
| Form/Function | 16 | 40 | 17 | 68 | 33 | 51 |
| Function/Economy | 15 | 38 | 8 | 32 | 23 | 35 |
| Form/Economy | 9 | 22 | | | 9 | 14 |
| Total | 40 | 100 | 25 | 100 | 65 | 100 |
| Significance (Chi ²) | p = 0.017 | | | | | |

Note: Analysis excludes 13 indeterminate responses

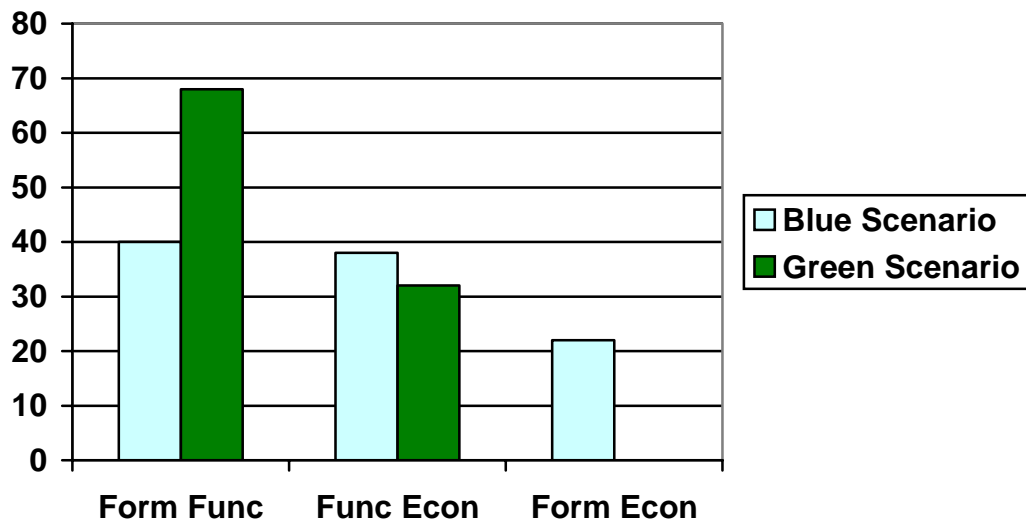


Figure 1: Bar Chart showing effect of information sequence on 'design emphasis'

Key Factor of Importance Test'

Table 2: Results of questionnaire survey showing effect of information sequence on 'key factor of importance'

| Key Factor of Importance | Blue | | Green | | Total | |
|--------------------------|-----------|-----|-------|-----|-------|-----|
| | N | % | N | % | N | % |
| Form Related | 16 | 36 | 9 | 39 | 25 | 37 |
| Function Related | 18 | 40 | 13 | 57 | 31 | 45 |
| Economy Related | 11 | 24 | 1 | 4 | 12 | 18 |
| Total | 45 | 100 | 23 | 100 | 68 | 100 |
| Sig. (Chi ²) | p = 0.108 | | | | | |

Note: Analysis excludes 10 indeterminate responses

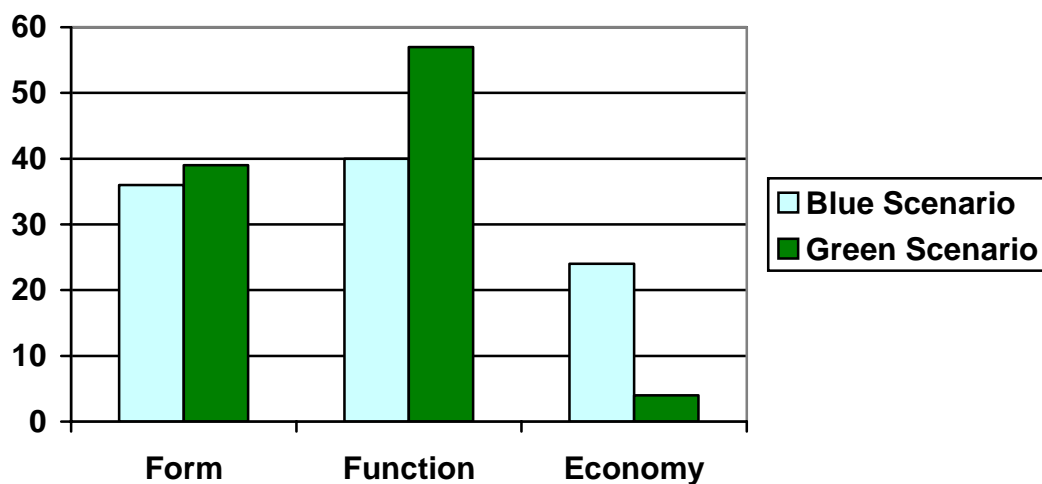


Figure 2: Bar Chart showing effect of information sequence on 'key factor of importance'

ANALYSIS OF RESULTS

Design emphasis test (Table 1)

The results relating to the green scenario questionnaire show that subjects consider that the main design emphasis lies in the *form / function* sector (68% of responses) with *function / economy* being regarded as the second preference (32% of responses) and *form / economy* the least preferred (0% of responses).

The results relating to the blue scenario questionnaire show a different pattern. The difference between *form / function* and *function / economy* is small (40% and 38% of responses respectively). As with the green scenario, *form / economy* is the least preferred, however is given a higher weighting (22% of responses).

The crosstabulation of the results from the student survey show that the difference in responses relating to the green and blue scenarios is significant ($p=0.017$).

The results of the design emphasis test suggest that the order of presentation of the information to subjects has had an effect upon the belief updating process. The information in the green scenario is given in the order *form - function - economy* and in the blue scenario *economy - function - form*. Since the results appertaining to the green scenario weight *form / function* more highly than those from the blue scenario, and likewise, the results appertaining to the blue scenario weight *form / economy* more highly than those from the green scenario, a primacy effect is suggested.

Key factor of importance test (Table 2)

The results relating to the green scenario questionnaire show that subjects consider that the key factor of importance is *function related* (57% of responses), with *form related* as the second preference (39% of responses) and *economy related* as the least preferred (4% of responses).

The results relating to the blue scenario questionnaire show that subjects consider that the key factor of importance is *function related* (40% of responses), with *form related* as the second preference (36% of responses) and *economy related* as the least preferred (24% of responses).

The results in this test show some consistency with those in the design emphasis test in that there is a trend in the overall judgements of the subjects toward *form* and *function* with *economy* being least regarded (Aggregate response: Form related - 37%; Function related - 45%; Economy related - 18%).

The crosstabulation of results of this test suggest that the order of information contained in the two questionnaire formats (Blue Scenario / Green Scenario) is significant only at $p=0.108$

DISCUSSION

The methodology for this investigation was adopted for its simplicity and transparent application to the construction design process. It has not been an aim to attempt the replication of a lengthy written brief, examples of which are used in practice. It is not considered possible to typify a full briefing process due to the vast range of client projects and situations and the use of such is considered likely to be counter productive in terms of data collection. The intention has been to demonstrate the possible impact of order effects at concept – the moment at which the designer first

forms a judgement of client need and develops the early solution. The results of this experiment are considered to achieve this. Whilst one of the tests used in the survey has produced an outcome which is significant only at 90% ('key factor of importance test' $p=0.108$), the 'design emphasis test' strongly supports the hypothesis that information sequence will impact upon the decision making process that occurs during construction design.

Although the results of this experiment are considered to have been successful in demonstrating the existence of order effects, the limitations of this research methodology (although its concept remains attractive) are recognised. Previous research into order effects has established the possible importance of a range of factors including: consistency of content; length of information; complexity of information; degree of perceived understanding at commencement of evaluation; strength of information. It is thus important to appreciate that, although the order effect phenomena is a relatively simple concept, the belief updating mechanisms and influencing factors relating to it are complex and sensitive to several task variables which have not been looked at in detail in this investigation. In order to examine further the order effect phenomena and the way it may impact upon decision making in the construction and property sectors, it is necessary to utilise a more powerful methodology.

Subsequent to the work discussed in this paper, with the objectives of introducing more control to the research methodology and widening the scope of the investigation, a further exercise is now being undertaken. In this test, the scenarios have been expanded to demonstrate the application of order effects to other facets of property and construction including issues relating to risk management, design and procurement. These experiments will closely follow the methodology outlined by Hogarth and Einhorn, (1992).

CRITICAL REVIEW

The perception by subjects of some of the criteria contained in the scenario information blocks has been tested in a further experiment and some of the results show a different interpretation to that anticipated. This exercise should have been carried out as part of the initial methodology rather than at completion of the experiment. This omission and the outcome of the subsequent investigation are brought to the attention of the reader.

The existence or otherwise of order effects which may be shown by consideration of aggregate results, does not necessarily mean that the same conclusion can be drawn for individuals. This aspect has not been considered in this research

The analysis of the data relating to the design emphasis test, is based upon the grouping of responses into one of the three sectors described by the triangular grid (see above) used for the experiment (i.e. form / function, function / economy or form economy sectors). No consideration of the exact location of each subject's indicated design emphasis point within each sector has been made. This would have allowed further analysis in terms of balance and strength of design emphasis preference, however, to infer such a level of accuracy and interpretation of the data was not considered appropriate.

For reasons of practicality, the survey has been restricted to final stage undergraduate surveying students. Notwithstanding previous comments relating to the validity of this sample for the aims of the investigation, the experiment lacks the involvement

of experienced designers. It is recognised that the perception of the information provided in the questionnaire may be viewed differently by practising architects or other experienced professionals involved in the briefing process and that their treatment of such information may differ from that by surveyors about to graduate.

Since the nature of design communication at briefing stage is acknowledged to be variable and that varying designers may perceive such information differently (e.g. 'complex' or 'simple'), further research is required in order to identify and classify information types and briefing styles.

CONCLUSION

There are several possible variables that may impact upon the design decision making process. These may include styles, approaches to design thinking, information flow, design team structure / hierarchy, programme, level of fee, status of project, ability of designer. This paper considers in detail one of these factors - the possible effects of information sequence - and in particular the impact this may have at concept design stage. The results of this investigation support the existence of order effects within the context of the construction design process.

There are many factors that may influence a designer's decision-making. These include those that are transparent from research into architectural practice (e.g. design time availability, short notice of new commissions, irregular and interrupted design progress) and those that may unconsciously sway our value judgements. Awareness of these factors will assist us in making more valid design decisions.

In connection with this research theme, the considerations thus far have related to the possible impact of order effects on the client briefing process. The principles underpinning this work (i.e. the impact of order effects in belief updating) may be applied throughout the construction and property sectors, relating to wherever decision making occurs. This acknowledgement has been reflected in the process of ongoing research.

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