

The Impact of Sequential Thinking in the Construction Design Process.

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ABSTRACT

An element of poor value in construction may be attributed to thinking-styles and approaches of members of the design team. One aspect of this could relate to the problems associated with the sequential communication processes and iterative procedures that occur during the design phase.

There are several ways in which the sequential nature of communications may impact upon the design process, and similarly, the Value Management process itself.

This paper examines the impact that information sequence may have upon the decision making that occurs during the Construction Design Process.

INTRODUCTION

There are many possible causes of poor value in construction which are created during the design process and it is probable that those of us involved in the Construction Industry have witnessed numerous examples of such in our careers. Indeed, the development of Value Management within Construction owes a great deal to the existence of these causes of poor value, for without them, an optimal value state would be inherent in all design!

The list of possible poor value factors that may have a negative impact during design could incorporate: limitations on design time forcing error or incompleteness; outdated specifications; poor communications between client and designer; poor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 & 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 is both intriguing and relevant to the Value Manager.

METHODOLOGY

A literature review was carried out to establish the potential impact of information sequence on belief updating in the context of architectural design. This included the consideration of previous research into;

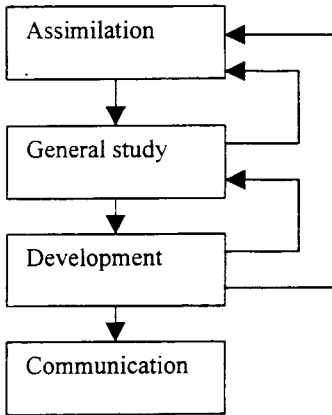
- i) the design process and design thinking

- ii) the effects of sequential information on belief updating

The confluence of this research has allowed the identification of opportunity within the design process, whereby the order effect phenomenon may impact upon decision making. This has promoted the development of a methodology which will be used to practically test for order effects in future research.

THE DESIGN PROCESS IN PRACTICE

To identify the possible effects of sequential information on the design process it is necessary to have an understanding of how architects design. There are theoretical models that attempt to describe design as a logical and systematic process. For example, the Architect's Handbook of Practice Management (1991) describes the design process as having four phases: understanding – information gathering / assimilation; general study – investigating the problem and possible solutions; development – development of a solution; communication – communicating solutions to clients.



The RIBA plan of work map of the design process (Lawson 1990).

This map indicates the iterative process of design; for example, it suggests that work carried out in the development phase may demand further investigation (a return to the general study phase) and possibly additional information (a return to the assimilation phase). However, this map is not particularly helpful in describing the thought processes that occur during design or how architectural decisions are made and implemented in practice. Nor does it indicate moments of 'inspiration' which may cut across the entire design process.

To understand the processes that architects use when designing buildings it is helpful to consider some of the research that has occurred since this subject gained attention in the 1960's. With reference to Lawson (1990) and his review of previous research into the design process, we note the following findings;

- i) Architects generally adopt a solution based strategy rather than problem based strategy in attempting to solve design problems (Lawson 1972)
- ii) Architects explore design problems by attempting solutions (Eastman 1970)
- iii) Analysis and synthesis are not discrete aspects of the design process (Akin 1986) / Design and briefing may occur simultaneously (Darke 1978)
- iv) Architects use a simple idea, generated early in the process, (the 'primary generator') to make the design problem more manageable (Darke 1978 and Rowe 1987)
- v) Designers like to retain early design ideas and will defend them strongly. Early ideas may have a long-term effect on the end solution. (Rowe 1987)

Further evidence supporting the above views is contained in the research report prepared by Mackinder and Marvin (1982) following their investigation into 'Design Decision Making in Architectural Practice'. This research project, involving the study of 12 live design projects, in 6 different architectural practices, found that: '...In nearly all case studies the initial concept formed the general basis of the final design', and that '...Time scales rarely allow the exploration of alternative concepts'. The report highlights that subsequent to conception of the design - which is based on little data - some design modification did occur upon the receipt of further information or the discovery of new design problems but 'in none of the case studies was the overall form of the building changed'. Further, the report states that;

'...All designers concerned appeared to begin their designs with a fairly clear idea of what they were going to do in terms of plan layout, form and construction. We were surprised that designs proceeded with remarkably little divergence from this....The research we have undertaken, on live projects, tends to amplify the view that Architects often 'conjecture a solution' (based on a certain group of values which are seen as important constraints or opportunities) and then 'compare it with the

problem'...In all the projects we examined, the designers concerned tended to develop a broad outline of the type of building they considered appropriate in response to their clients' initial briefing, and their own reaction to the site conditions. ... This part of the design is normally carried out very quickly; information input tends to consist mainly of client briefing, physical site constraints, requirements of the planning authority and the architect's own experience and intuitive reaction to the site'

We may abstract and develop from this analysis of previous research the following key hypotheses: 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

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.

There has been much research relating to the possible effects of information order in belief updating which dates back to the 1920's. (Crano W D 1977). The research has focused upon the effect that the sequence of information consideration has upon opinion formation and subsequent decision making. The proposition is made that when opposed pieces of information are presented to a subject, the order in which the information is considered will 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. Whilst there is strong evidence supporting the existence of an order effect phenomenon, there has been disagreement as to the prevalence of either primacy or recency.

In the extensive work by Hogarth and Einhorn (1992), the effect that certain task variables have upon primacy or recency are considered. These variables are: 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 or after the receipt of a series of items of information). By classifying and analysing previous research accordingly, the authors concluded as follows;

'...our task analysis of order effects leads to the following conclusions: (1) response mode makes a difference in the case of Short, Simple tasks. End of Sequence induces primacy, Step by step induces recency; (2) primacy seems to obtain when tasks are Simple but Long (this is also independent of response mode); and (3) recency is associated with more complex tasks (independent of response mode)'

(It should be noted that this analysis of previous research data incorporated a limited number of previous studies that utilised complex information),

Consideration of the nature of the task variables appertaining to the information flow between client and architect at concept briefing stage could allow us to postulate the existence of either a primacy or recency effect. However, this would be reliant upon our ability to classify briefing information in accordance with the set parameters described by Hogarth and Einhorn (i.e. Simple / Short in series / End of sequence action). 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. At this stage it is considered adequate to acknowledge the existence of an order effect phenomenon and that task variables may impact upon the primacy or recency outcome.

To demonstrate the possible application of the order effect phenomenon upon the design process, consider the following hypothetical and simplified brief. - This brief is presented in two formats (see table 1), with each format containing identical 'information blocks' which are presented in different order.

'Green Scenario' order – A, B, C

'Blue Scenario' order – C, B, A

The information blocks have been considered to carry a particular design emphasis type – Form, Function or Economy. With reference to Draper 1984, the following definitions are 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'

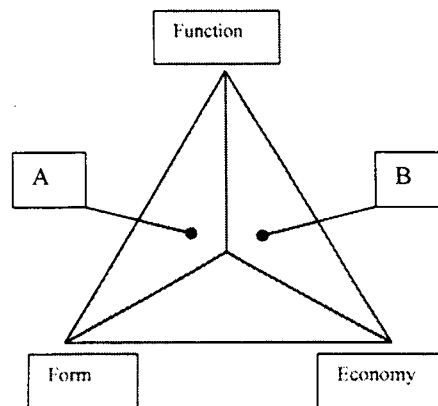
Information Block C;

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 order effect phenomenon allows us to propose that the two scenarios would elicit different judgements. With reference to the discussion above

relating to previous research - if the information type were to be classified as Short and Complex, and with an End of Sequence updating approach, it is anticipated that a primacy effect would be demonstrated. This may be reflected in a designer's interpretation of client need as indicated in the diagram below. A shift in the perceived balance of design emphasis is shown by a move in the position of the pointer - say from position A for the 'green scenario' (where the balance is weighted toward Form and Function) to position B for the 'blue scenario' (where the balance is weighted toward Function and Economy). (This is indicative since the position is dependant upon the subject's opening perception)



To facilitate the extension of this research into actual design practice, it is proposed to;

- a) validate an hypothetical concept briefing scenario in terms of its authenticity and expected interpretation
- b) collect field data from architectural designers with the use of sequentially varied briefs

It is not 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 is 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.

Table 1; Client Briefing – Information Interpretation Exercise

Scenario – ‘Green’	Scenario - ‘Blue’
<p>The following is an outline client’s brief which has been established following a series of in-house management meetings.</p>	<p>The following is an outline client’s brief which has been established following a series of in-house management meetings.</p>
<p>The company, a world leading food manufacturer, requires a new head office building in the North West of England and has purchased a two acre site adjacent to the main business district of Manchester.</p>	<p>The company, a world leading food manufacturer, requires a new head office building in the North West of England and has purchased a two acre site adjacent to the main business district of Manchester.</p>
<p>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.</p>	<p>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.</p>
<p>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.</p>	<p>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</p>
<p>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.</p>	<p>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.</p>

Note; The reader is invited to consider the above scenarios and reflect upon the possible impact the information sequence may have on his / her opinion formation regarding design emphasis.

IMPLICATIONS FOR VALUE MANAGEMENT
PRACTITIONERS

The observations and proposals stated thus far are considered to have several possible implications for the Value Management Practitioner.

Value Management Timing

The benefits of Value Management involvement prior to or at concept briefing stage are recognised by Value Managers. Rowe (1987) alerts us to 'the tenacity with which designers will cling to major design ideas and themes in the face of what, at times seem insurmountable odds'. Acceptance of the use of 'primary generators' in design practice, with the understanding that these early design decisions may govern the design development and make a major contribution to the final design, should alone give sufficient weight to the need for early Value Management. When we also consider the potential bias that may exist in the determination of the 'design generator', and one element of this bias may relate to the order effect phenomenon, there is further support for a review of the initial solution which is formed at design concept.

Since, in practice, the opportunity given to Value Management is varied, the possible impact of the order effect phenomenon will also vary. Where the first Value Management involvement follows the development of a design concept, however preliminary, the potential bias due to order effects will have occurred and thus will be something that the Value Manager must contend with.

Workshop Structure

It should be recognised that the order effect phenomenon may have some bearing upon the Value Management process. It is normal to commence a workshop with a presentation by design team members (irrespective of independent or in-house Value Management teams). The nature of this communication may resemble that used at client briefing and Value Managers should therefore be aware of its possible impact upon the early opinion formation of workshop participants which could influence future evaluation.

CRITICAL EVALUATION

Part of this paper is based upon the application of the order effect phenomenon to the design process. Since the review of previous research into order effects has not identified examples in the domain of architectural design, the need for further relevant research is apparent.

A pivotal point of the paper is that the initial design solution is produced promptly as a means of further problem solving via design development. This proposition is reliant upon previous research into the design process – some of which is now longstanding – and further work is required to confirm the currency of this design methodology which, for example, may have been influenced by the more recent publication of guidelines to Client Briefing.

CONCLUSION

This paper, which has focused upon the detailed consideration of two distinct but related areas, the design process and belief updating adjustment, has allowed the identification and exploration of the possible impact that the sequential flow of design related information may have upon design output and hence, value.

The discussion in this paper supports the case for early Value Management involvement. It does so, not by reliance on the opinion or experience of Value Managers or Quantity Surveyors - which may be perceived as containing a degree of bias - but by a reasoned argument formed from evidence produced by designers and non-construction academics. Clients may be less aware of the benefits of early Value Management involvement which does not so easily reveal cost savings which are transparent in later workshop activity (Barton 1991). This discussion should add further support to the need for Value Management at the pre or early design stage.

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.

